British Journal of Library and Information Management
ISSN: 2997-3163
Volume 5, Issue 2, 2025 (pp. 1-18)
www.abjournals.org

ARTIFICIAL INTELLIGENCE ADOPTION AND OPERATIONAL EFFICIENCY OF INTERNATIONAL SHIPPING COMPANIES IN SOUTH-WEST NIGERIA

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Cite this article:

Ifekanandu Chukwudi Christian (2025), Artificial Intelligence Adoption and Operational Efficiency of International Shipping Companies in South-West Nigeria. British Journal of Library and Information Management 5(2), 1-18. DOI: 10.52589/BJLIM-EK1JK3BL

Manuscript History

Received: 25 Aug 2025

Accepted: 6 Oct 2025

Published: 9 Oct 2025

ABSTRACT: *This study examined artificial intelligence adoption and operational efficiency of international shipping companies in South-West Nigeria. The study adopted the correlational research design, the quantitative research approach and the positivist research philosophy. The population of this study comprised 12 international shipping companies registered with the Nigerian Shipping Council in the South-West Geopolitical Zone of Nigeria. The census sampling technique was adopted where all the population was used as the sample size for the study. The unit of analysis consisted of managers of international shipping companies in South-West Nigeria. Data were collected from the respondents using a structured questionnaire. The data collected were analyzed statistically while the Pearson Product Moment Correlation Coefficient (PPMCC) and the SPSS version 24 were used to test the hypotheses. The findings revealed that machine learning adoption has a significant relationship with cost efficiency and time efficiency of international shipping companies in South-West Nigeria. Robotic adoption was also found to have a significant relationship with cost efficiency and time efficiency of international shipping companies in South-West Nigeria. The study equally revealed that predictive analytic adoption was significantly related to cost efficiency and time efficiency of international shipping companies in South-West Nigeria. From the findings, it was concluded that the adoption of AI technologies, such as machine learning, robotics and predictive analytics, significantly enhance operational efficiency of international shipping companies in South-West Nigeria. Based on the findings and conclusion, it was recommended that shipping companies in Nigeria should adopt AI technologies, such as machine learning, robotics and predictive analytics, as it would enhance their operational efficiency.*

KEYWORDS: Artificial intelligence, machine learning, robotics, predictive analytics, operational efficiency, cost efficiency and time efficiency.

Article DOI: 10.52589/BJLIM-EK1JK3BL
DOI URL: https://doi.org/10.52589/BJLIM-EK1JK3BL

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INTRODUCTION

In an organization where a huge sum of money is invested in logistics operations, improving operational efficiency is of utmost priority to logistics managers. Operational efficiency is the ability of a company to deliver products to customers in a timely and cost-effective manner (Kazaara et al., 2024). It demonstrates how a company uses fewer resources, such as time, costs and labour, to deliver the right quality and quantity of products to customers. Hao (2024) stated that a company can be said to have achieved operational efficiency if it is able to cut down its operational costs, minimize waste and time, and increase its revenue. Companies in the logistics industry seek to achieve operational efficiency but several challenges hindere the smooth and efficient operations of these companies. Some of the challenges facing logistics companies include vehicle routing issues, inaccurate weather forecasting, inaccurate traffic forecasting, inability to identify reliable carriers, unnecessary disruptions, delay in the delivery of goods, safety concerns, sustainability issue, as well as difficulties in responding and resolving customer complaints quickly (Aldoghan & Sundram, 2023). These logistics challenges have constituted a huge obstacle to operational efficiency. However, logistics companies can address these challenges and achieve operational efficiency if they adopt Artificial Intelligence (AI) in their logistics operations.

Artificial Intelligence (AI) refers to machines which are programmed to think, learn and act like human beings (Amit et al., 2022). It is the integration of human intelligence into machines so that these machines can perform a given task like human beings. These intelligent machines or systems can recognize speech, translate language, make predictions, recommend actions, make decisions, and perform other tasks just the way human beings do. The emergence of AI has created huge opportunities for shipping companies to improve their logistics operations. It has transformed the way in which logistics operations are managed in shipping companies. AI is adopted in different areas of logistics operations, such as transportation management, inventory management, demand forecasting, route and shipment planning, as well as the forecasting of weather conditions (Ifekanandu et al., 2023). In the area of transportation, for example, AI technologies can be used to optimize transport routes, predict transit times, identify the most reliable carrier, and spot alternative routes to prevent transport disruptions and delays. In warehousing operations, AI-powered robots can be used to navigate aisles and restock shelves with precision. In the area of demand forecasting, AI-powered predictive analytics can be used to identify products with high frequency of customer returns and provide feedback to correct mismatch between the product and intended market.

Adopting AI in logistics operations can help to improve the operational efficiency of shipping companies. According to Khatri et al. (2018), AI technologies, such as machine learning, robotics, predictive analytics and data analytics, work together to streamline and improve logistics operations. By optimizing routes using AI algorithms, shipping companies can reduce fuel consumption during transit, move products quickly and meet delivery deadlines (Hemalatha & Kumari, 2020). Using internal and external data, AI-powered algorithms can help managers to make more accurate forecasts and predictions of weather conditions, traffic patterns and potential work disruption, as well as recommend actions to be taken to address various situations (Catherine et al., 2023). AI-powered chatbots can be used to handle customer inquiries, analyze their complaints and provide feedback to logistics teams. AI technologies are trained to learn more about previously executed orders and users' preferences, thereby helping shipping companies to reduce the need for manual intervention and improve operational efficiency. It is against this backdrop that this study examines the relationship

Article DOI: 10.52589/BJLIM-EK1JK3BL
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between logistics AI adoption and operational efficiency of international shipping companies in South-West Nigeria.

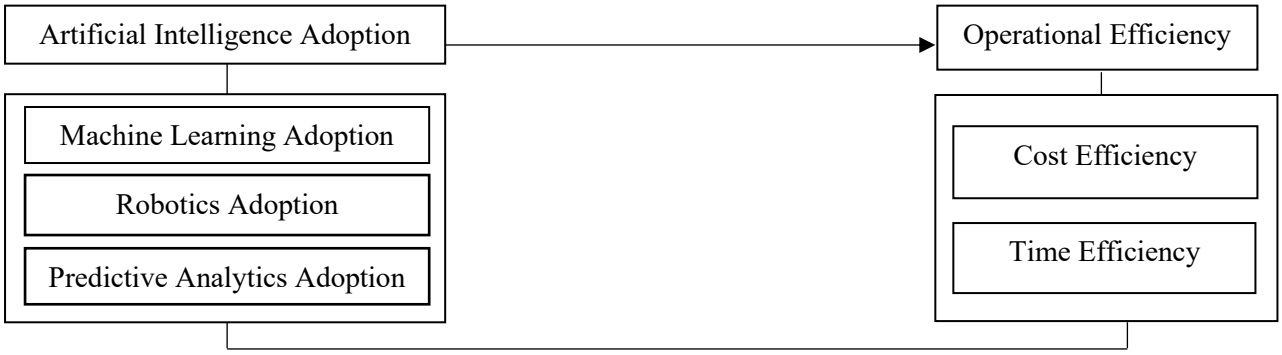
Statement of the Problem

Improving operational efficiency has been a difficult task for some companies in the logistics industry in Nigeria. A close observation shows that many shipping companies are experiencing operational challenges characterized by unnecessary disruptions, high operational costs and delay in the delivery of goods to their destinations. Several efforts have been made by these companies to improve their operational efficiency. However, despite the efforts made by these companies to improve their operational efficiency, the problem of high costs and delay in the delivery of goods still persists. The inefficiency of these companies over the years could be attributed to their inability to adopt modern technology, such as AI in their logistics operations, as they continue to utilize human beings to perform tasks that could be performed more efficiently using AI technologies. Several studies (e.g., Khatri et al., 2018; Hemalatha & Kumari, 2020; Catherine et al., 2023; Ojo, 2024) have examined the application of AI in business operations and its potentials in improving organizational efficiency. However, none of these studies specifically focused on AI adoption in logistics operations and its relationship with the operational efficiency of shipping companies in South-West Nigeria. This presents a gap in literature which this study is mapped out to fill from the Nigerian context.

CONCEPTUAL FRAMEWORK

The conceptual framework of artificial intelligence adoption and operational efficiency is shown in Figure 1 below:

Fig. 1: Conceptual framework of artificial intelligence adoption and operational efficiency of shipping companies in South-West Nigeria



Source: *Author's Conceptualization*

Article DOI: 10.52589/BJLIM-EK1JK3BL
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Aim and Objectives of the Study

The study is aimed at exploring the relationship between artificial intelligence adoption and operational efficiency of shipping companies in South-West Nigeria. The specific objectives of the study are to:

1. determine the relationship between machine learning adoption and cost efficiency of shipping companies in South-West Nigeria;
2. ascertain the relationship between machine learning adoption and time efficiency of shipping companies in South-West Nigeria;
3. discover the relationship between robotics adoption and cost efficiency of shipping companies in South-West Nigeria;
4. determine the relationship between robotics adoption and time efficiency of shipping companies in South-West Nigeria.
5. ascertain the relationship between predictive analytics adoption and cost efficiency of shipping companies in South-West Nigeria;
6. explore the relationship between predictive analytics adoption and time efficiency of shipping companies in South-West Nigeria.

Research Questions

The following research questions were answered in this study:

1. What is the relationship between machine learning adoption and cost efficiency of shipping companies in South-West Nigeria?
2. To what extent does machine learning adoption relate to time efficiency of shipping companies in South-West Nigeria?
3. What is the relationship between robotics adoption and cost efficiency of shipping companies in South-West Nigeria?
4. To what extent does robotics adoption relate to time efficiency of shipping companies in South-West Nigeria?
5. What is the relationship between predictive analytics adoption and cost efficiency of shipping companies in South-West Nigeria?
6. To what extent does predictive analytics adoption relate to time efficiency of shipping companies in South-West Nigeria?

Research Hypotheses

The following hypotheses guided this study:

Ho_1: There is no significant relationship between machine learning adoption and cost efficiency of shipping companies in South-West Nigeria.

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H_{O2}: There is no significant relationship between machine learning adoption and time efficiency of shipping companies in South-West Nigeria.

H_{O3}: There is no significant relationship between robotics adoption and cost efficiency of shipping companies in South-West Nigeria.

H_{O4}: There is no significant relationship between robotics adoption and time efficiency of shipping companies in South-West Nigeria.

H_{O5}: There is no significant relationship between predictive analytics adoption and cost efficiency of shipping companies in South-West Nigeria.

H_{O6}: There is no significant relationship between predictive analytics adoption and time efficiency of shipping companies in South-West Nigeria.

REVIEW OF RELATED LITERATURE

Concept of Artificial Intelligence

Artificial intelligence (AI) is a machine or system that is capable of performing tasks via algorithms or automation without any form of human intervention (Mhlanga, 2021). It is a field of computer science that creates intelligent machines that perform tasks just like human beings. These machines can learn by themselves, interpret information, assemble facts and make predictions based on this information. Examples of artificial intelligence (AI) tools include task automation, machine learning, chatbots (hi-tech personality), robot, blockchain technology, cutting-edge AI-powered technology, cloud computing, predictive analytics, MasterCard and Big Data, amongst others (Guo & Polak, 2021).

With these AI technologies, companies can effectively manage their business operations via algorithms and automation, make prediction and forecast, analyze risks, monitor and control activities, and as well reduce costs (Ojo, 2024). Many companies are using AI-powered software to improve their transportation efficiency. They use AI to analyze weather and traffic patterns to determine the most fuel-efficient transport routes and avoid unnecessary costs and delay (Hao, 2024). A survey conducted by McKinsey & Company, as reported in Davenport and Ronanki (2018), revealed that shipping companies that are early adopters of AI-powered software lower their logistics costs by 15% than their lagging competitors, while their inventory levels recorded a significant 35% improvement.

Dimensions of Artificial Intelligence

Artificial intelligence (AI) takes various forms, all of which aimed at improving business operations. However, the dimensions of artificial intelligence considered in this study are machine learning, robotics and predictive analytics.

Machine Learning

According to Mhlanga (2021), machine learning is a subset of AI that trains data using algorithms to obtain results. This algorithm is a set of rules and instructions that serves as a guide for AI's analysis and decision making. By using various methods, including deep

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learning, machine learning can find patterns in data and power natural language processing (Cui et al., 2016). Machine learning takes a large language approach to solve operational problems much faster and complete (Amit et al., 2022). A good number of logistics companies are using machine learning in their logistics operations. Uber Freight Limited is a typical example of companies that use machine learning in logistics operations. Uber Freight uses machine learning to address the issue of vehicle routing and determine the most optimized and efficient route for delivering goods to different locations (Agarwall et al., 2022). Some trucks waste time and fuel due to lack of route optimization, thereby causing large amounts of carbon emission to the environment during transit (Kazaara et al., 2024). By adopting machine learning algorithms, companies can optimize routes for their truck drivers and reduce between 10% to 15% amounts of carbon emission during transit (Ifekanandu et al., 2023). Also, the use of machine learning algorithms enables companies to arrive at accurate truck pricing, thereby eliminating all frictions, guessing, and back-and-front attempts to estimate the price of trucking (Tah, 2024).

Robotics

AI-powered robots can automate routine tasks and perform complex tasks with precision. By adopting AI-powered robots and task automation, companies can reduce manual errors and human workers can focus more on strategic or value-added activities that will ultimately increase organizational productivity (Haenlein & Kaplan, 2019). Mhlanga (2021) stated that AI-driven robots are transforming business operations by taking automation to a greater level. With AI-driven robots, companies can optimize their workflows, reduce downtime, increase efficiency and improve the quantity and quality of their outputs (Guo & Polak, 2021). Unlike the previous generations of robots that perform simple repetitive tasks based on pre-programmed instructions, AI-driven robots leverage computer vision, machine learning and advanced sensors to handle complex and adaptive tasks (Ahmad et al, 2021). These AI-driven robotic systems analyze data continuously to make decisions concerning production workflows, process optimization and quality control. In warehousing operations, AI-powered robots can be used to navigate aisles and restock shelves with precision.

AI-Predictive Analytics

AI predictive analytics use other AI technologies such as machine learning to identify patterns in current data and utilize these patterns to predict trends and forecast future outcomes (Zhou et al., 2021). These AI predictive analytics models are trained on how to use historical data collected from various sources to make predictions. AI predictive analytics can be used by companies to translate raw data into actionable insights (Judijanto et al., 2024). Ifekanandu and Asagba (2025) opined that companies can use AI-predictive analytics to optimize their supply chain, forecast demands, identify bottlenecks and ensure timely arrival of materials and goods at their destination. AI-predictive analytics can also be used to perform data analysis in any company using historical data, make future predictions, and personalized recommendations or suggestions (Tah, 2024). AI-predictive analytics can be used by shipping companies to increase their operational efficiency by analyzing data, reducing manual workload, and effectively allocating resources to activities (Ndubuisi-Okolo et al, 2025). FedEx is a typical example of shipping companies that use AI-predictive analytics to identify the most efficient routes for their drivers (Kazaara et al., 2024). By identifying the most efficient routes, FedEx was able to reduce its travel costs, increase the volume of shipment, and minimize time. DHL is another example of logistics companies that invest millions of Dollars in integrating predictive

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analytics into their logistics operations, and this has helped the company to adapt its operations to real-time demand (Davenport & Ronanki, 2018).

Concept of Operational Efficiency

Operational efficiency is the optimization of business processes and resources for the purpose of reducing operating costs while maintaining or improving productivity (Gomstyn & Jonka, 2023). Gill et al. (2014) stated that operational efficiency occurs when business operations go smoothly and multiple processes are streamlined or optimized to reduce costs, waste, and time while profitability is sustained. Operational efficiency is crucial to revenue growth as it enables companies to deliver quality products and services at lower prices while maintaining or increasing profitability (Ifekanandu & Asagba, 2025). Companies need to determine their operational efficiency so that they can know whether their business operation is going smoothly and efficiently. For example, if a company's operating costs are declining while revenue stream is increasing, it means that the company has attained operational efficiency (Judijanto et al., 2024). Hao (2024) stated that improving operational efficiency enables companies to make progress on key performance areas and accomplish business goals, such as profitability growth and greater sustainability.

Measures of Operational Efficiency

Operational efficiency can be measured using various indicators. In this study, operational efficiency is measured using cost efficiency and time efficiency.

Cost Efficiency

Cost efficiency is the process whereby a company tends to spend less amount of money in business operations by changing or optimizing the work processes to reduce costs (Judijanto et al., 2024). It means delivering products or services using fewer resources without compromising on quality. Cost efficiency is one of the key objectives of business organizations as it enables organizations to increase their profit margin and competitiveness (Agarwall et al., 2022). Cost efficiency helps companies to maximize profitability by optimizing business processes and reducing waste (Kazaara et al., 2024). A more cost-efficient organization is more profitable and competitive than a less cost-efficient organization.

Time Efficiency

Time efficiency refers to the completion of tasks and activities within the shortest possible time without compromising on quality (Aldoghan & Sundram, 2023). It involves optimizing processes, prioritizing tasks and avoiding unnecessary distractions and disruptions to accomplish more within a given timeframe. Time efficiency demonstrates how an individual or organization completes tasks quickly and resourcefully. It is all about getting things done without wasting time and effort (Ifekanandu & Asagba, 2025). Gill et al. (2024) stated that speed and resourcefulness are the critical elements of time efficiency. Time efficiency allows organizations to achieve exceptional results in a shorter period of time and become competitive in their industry (Ojo, 2024). It helps organizations to meet deadlines and retain their customers. Being time efficient is crucial for businesses in modern societies as every customer values timely delivery of goods and services (Ndubuisi-Okolo et al., 2025). When a company is able to deliver goods and services in a shorter period of time, customers will develop a high

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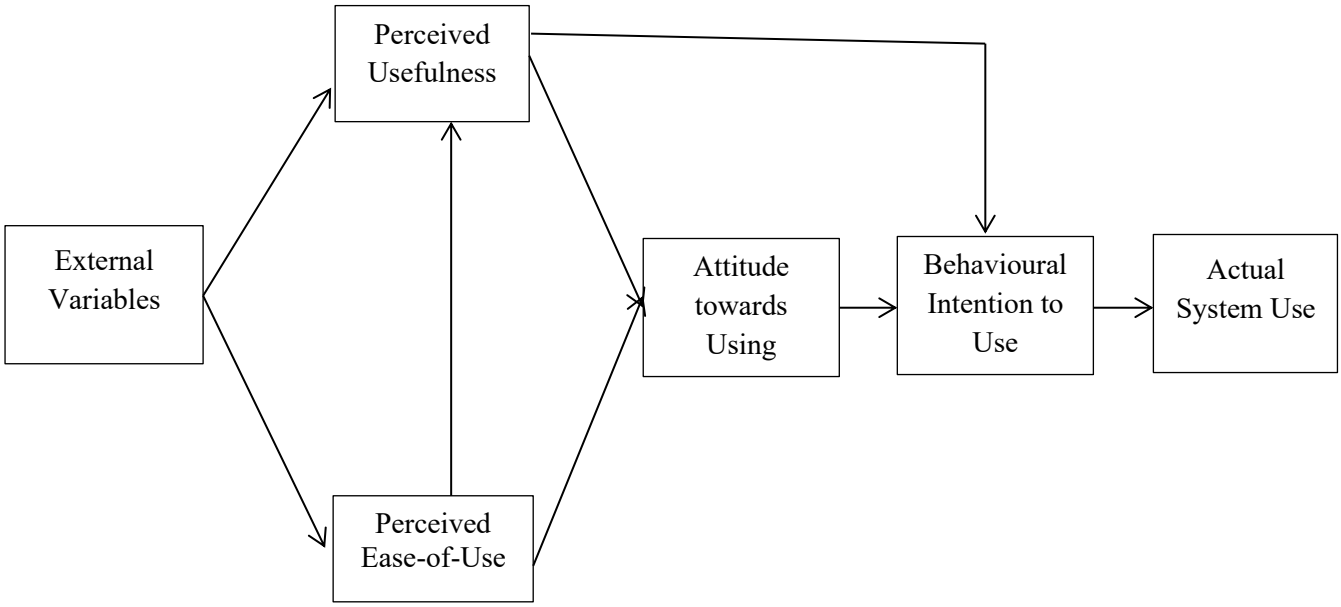
degree of trust in the organization to deliver similar performance in the future and remain loyal to its services.

Theoretical Review

This study applied the technology acceptance model (TAM) which was developed in 1986 by Fred Davis. This model explains how technology is accepted and used by modern organizations. The model provides a number of factors that influence societal acceptance and use of modern technology. According to the model, perceived usefulness and perceived ease-of-use are the two factors that influence societal acceptance and use of modern technology. Davis explained that perceived usefulness is the extent to which an organization believes that using this technology would improve their business operations, while perceived ease-of-use connotes the degree to which an organization believes that the adoption of the technology would require less effort. The technology acceptance model (TAM) is shown in Figure 1 below:



Source: *Adapted from Davis (1986)*

According to the model, external variables, such as perceived usefulness and ease-of-use, makes everyone, including organizations, to develop an attitude towards using technology, and this eventually leads to behavioural intention to use it and finally the actual system use. However, actual usage may not be a direct consequence of such attitudes and intention; it can influence an organization's decision to use technology. Relating this model to this study, it can be argued that the model is relevant in explaining why artificial intelligence (AI) is accepted and used by international shipping companies in Nigeria. The model shows that perceived usefulness and ease-of-use are the most important factors that influence the decision of international shipping companies to use AI, such as machine learning, robotics and predictive analytics technology, in their logistics operations. These companies believe that using these AI technologies would require less effort and improve operational efficiency.

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Empirical Review

Some related empirical studies have been conducted on AI adoption and operational efficiency of companies. For instance, Hao (2024) examined the relationship between artificial intelligence and operational efficiency of Chinese manufacturing firms. The study adopted the descriptive survey research design where a structured questionnaire was used to elicit data from ICT managers of 100 Chinese manufacturing firms in the textile industry. The data collected were analysed using descriptive statistics, Pearson correlation and regression analysis. The findings revealed that artificial intelligence has a positive and significant relationship with the operational efficiency of textile manufacturing firms in China.

Kazaara et al. (2024) investigated the impact of artificial intelligence on organizational efficiency and productivity. Their study adopted quantitative and qualitative research approaches, where structured questionnaires and in-depth interviews were used to collect data from 384 respondents comprising executives, managers, AI project leaders and employees in selected organizations that implement AI technologies in Kampala Metropolitan district of Uganda. The quantitative data were analysed using descriptive statistics, correlations, and regression analysis while the qualitative data were analysed using thematic analysis. The findings revealed that the adoption of AI technologies significantly improves operational efficiency, reduces process execution time, minimizes error rates, and enhances resource utilization efficiency.

Onyeoghani et al. (2022) empirically explored the relationship between artificial intelligence and organizational productivity. The study employed the qualitative research approach where online interviews were used to collect data from ten staff of selected companies that adopt AI technologies. The qualitative data collected were analyzed statistically using thematic analysis. The findings revealed that companies that adopt AI technologies have greater levels of productivity. The study revealed that AI software can perform routine functions accurately without getting tired and that the software is far better than human efforts.

Ifekanandu et al. (2023) carried out a study to determine the relationship between artificial intelligence adoption and marketing performance of quoted manufacturing firms in Nigeria. Their study adopted the positivism research philosophy and the correlational research design. Data were collected from 206 managers of quoted manufacturing firms using a structured questionnaire while descriptive statistics, Spearman Rank Order Correlation Coefficient and the SPSS version 23.0 were used for data analysis. The findings revealed that AI technologies have a significant relationship with sales growth and market share growth of quoted manufacturing firms in Nigeria. The study concluded that AI adoption significantly relates to the marketing performance of quoted manufacturing firms in Nigeria.

Kassa and Ketema (2025) examined the impact of artificial intelligence on organizational performance. Their study adopted the descriptive survey research design and utilized the quantitative research approach where data were collected from 172 employees through an online survey using Kobo Toolbox. The data and model were analyzed using PLS-SEM in SMART PLS 4.1.03. The findings revealed that artificial intelligence has a significant relationship with organizational performance. The study also revealed that employee productivity significantly mediates the relationship between artificial intelligence and organizational performance.

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Hidayat et al. (2024) carried out a study to determine the impact of artificial intelligence (AI) on business organizations in India. The researchers adopted the qualitative research approach where a semi-structured interview was used to collect data from managers in ICT firms. The data collected were analyzed using systematic content analysis, and the findings revealed that AI technology is applied by ICT firms in financial selection-making strategies, predictive analysis, data security and adoption of risk.

From the empirical literature reviewed, it was observed that a good number of studies have been conducted on AI adoption and operational efficiency but none of these studies focused on international shipping companies in Nigeria. Most of the studies conducted on AI adoption and operational efficiency were carried out in Chinese textile manufacturing firms and selected AI-driven organizations in Uganda, while studies that examined the relationship between AI adoption and operational efficiency of international shipping companies in Nigeria are lacking. This research gap is expected to be filled in this study.

METHODOLOGY

This study is a correlational research that utilizes the quantitative research approach and the positivism research philosophy. The population of this study comprised 12 international shipping companies that are duly registered with the Nigerian Shipping Council, South-West Zone of Nigeria. The census sampling technique was adopted in this study where all the population was used as the sample size for the study. The unit of analysis consisted of managers of the 12 international shipping companies in the South-West Geopolitical Zone of Nigeria. The managers include branch managers, IT managers, logistics managers, operational managers, transportation managers, warehouse managers, innovation managers and safety managers of the companies. A sample of 96 managers was selected purposively from the 12 international shipping companies on the ratio of 8 managers per company. Data were collected from the respondents using a structured questionnaire which was designed on a 4-point rating scale, such as, Strongly Agree, Agree, Disagree and Strongly Disagree. The questionnaire was validated using content analysis and its reliability was determined using the Cronbach Alpha method. After testing the validity and reliability of the research instrument, 96 copies of the questionnaire were administered to the respondents (managers) and 82 copies were collected from them, which represents 86% collection rate. The data collected were presented and analyzed statistically while the hypotheses were tested using Pearson Product Moment Correlation Coefficient (PPMCC). The correlation analysis was performed with the aid of the SPSS 24.0 version.

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British Journal of Library and Information Management
ISSN: 2997-3163
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www.abjournals.org

RESULTS AND DISCUSSION

The results of the correlation analysis carried out on the study variables were presented and analyzed in this section. The data collected on artificial intelligence adoption (machine learning, robotic and predictive analytics) were correlated with those obtained on operational efficiency (cost efficiency and time efficiency) using the SPSS software program version 24. The results of the correlation analysis are presented in the tables below:

Table 1: Result of correlation analysis between machine learning adoption and cost efficiency of international shipping companies

			Machine Learning Adoption	Cost Efficiency
Pearson (r)	Machine Learning Adoption	Correlation Coefficient	1.000	.626**
		Sig. (2 tailed)	.	.001
		N	82	82
	Cost Efficiency	Correlation Coefficient	.626**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)

*Correlation is significant at 0.05 levels (2 tailed)

Source: *SPSS-Generated Output*

Table 1 shows the result of the correlation analysis between machine learning adoption and cost efficiency of international shipping companies in South-West Nigeria. The result indicates that machine learning adoption is strongly and positively correlated to cost efficiency of international shipping companies (r = .626**) and this correlation is statistically significant at 0.01 level. As a result of this, we then reject the null hypothesis (Ho_1) and accept the alternate hypothesis, which states that there is a significant relationship between machine learning adoption and cost efficiency of international shipping companies in South-West Nigeria.

Table 2: Result of correlation analysis between machine learning adoption and time efficiency of international shipping companies

			Machine Learning Adoption	Time Efficiency
Pearson (r)	Machine Learning Adoption	Correlation Coefficient	1.000	.881**
		Sig. (2 tailed)	.	.001
		N	82	82
	Time Efficiency	Correlation Coefficient	.881**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)

*Correlation is significant at 0.05 levels (2 tailed)

Source*: SPSS-Generated Output*

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Table 2 presents the result of the correlation analysis between machine learning adoption and time efficiency of international shipping companies in South-West Nigeria. The result shows a very strong and positive correlation between machine learning adoption and time efficiency of international shipping companies (r = .881**) and this correlation is significant at 0.01 level. Based on this result, the null hypothesis (Ho_2) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between machine learning adoption and time efficiency of international shipping companies in South-West Nigeria.

Table 3: Result of correlation analysis between robotic adoption and cost efficiency of international shipping companies

			Robotic Adoption	Cost Efficiency
Pearson (r)	Robotic Adoption	Correlation Coefficient	1.000	.849**
		Sig. (2 tailed)	.	.001
		N	82	82
	Cost Efficiency	Correlation Coefficient	.849**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: *SPSS-Generated Output*

Table 3 contains the result of the correlation analysis between robotic adoption and cost efficiency of international shipping companies in South-West Nigeria. The result indicates that robotic adoption has a very strong and positive correlation with cost efficiency of international shipping companies (r = .849**) and this correlation is significant at 0.01 level. Consequently, the null hypothesis (Ho_3) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between robotic adoption and cost efficiency of international shipping companies in South-West Nigeria.

Table 4: Result of correlation analysis between robotic adoption and time efficiency of international shipping companies

			Robotic Adoption	Time Efficiency
Pearson (r)	Robotic Adoption	Correlation Coefficient	1.000	.804**
		Sig. (2 tailed)	.	.001
		N	82	82
	Time Efficiency	Correlation Coefficient	.804**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: *SPSS-Generated Output*

Table 4 shows the result of the correlation analysis between robotic adoption and time efficiency of international shipping companies in South-West Nigeria. The result indicates a very strong and positive correlation between robotic adoption and time efficiency of

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international shipping companies (r = .804**) and this correlation is statistically significant at 0.01 level. As a result of this, we then reject the null hypothesis (Ho_4) and accept the alternate hypothesis, which states that there is a significant relationship between robotic adoption and time efficiency of international shipping companies in South-West Nigeria.

Table 5: Result of correlation analysis between predictive analytics adoption and cost efficiency of shipping companies

			Predictive Analysis Adoption	Cost Efficiency
Pearson (r)	Predictive Analysis Adoption	Correlation Coefficient	1.000	.563**
		Sig. (2 tailed)	.	.001
		N	82	82
	Cost Efficiency	Correlation Coefficient	.563**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: *SPSS-Generated Output*

Table 5 depicts the result of the correlation analysis between predictive analytics adoption and cost efficiency of international shipping companies in South-West Nigeria. The result shows that predictive analytics adoption is moderately and positively correlated to cost efficiency of international shipping companies (r = .563**) and this correlation is statistically significant at 0.01 level. Consequently, the null hypothesis (Ho_5) is rejected and the alternate hypothesis is accepted. This means that there is a significant relationship between predictive analytics adoption and cost efficiency of international shipping companies in South-West Nigeria.

Table 6: Result of correlation analysis between predictive analytics adoption and time efficiency of shipping companies

			Predictive Analysis Adoption	Time Efficiency
Pearson (r)	Predictive Analysis Adoption	Correlation Coefficient	1.000	.512**
		Sig. (2 tailed)	.	.001
		N	82	82
	Time Efficiency	Correlation Coefficient	.512**	1.000
		Sig. (2 tailed)	.001	.
		N	82	82

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: *SPSS-Generated Output*

Table 6 presents the result of the correlation analysis between predictive analytics adoption and time efficiency of international shipping companies in South-West Nigeria. The result indicates

Article DOI: 10.52589/BJLIM-EK1JK3BL
DOI URL: https://doi.org/10.52589/BJLIM-EK1JK3BL

a moderate and positive correlation between predictive analytics adoption and time efficiency of international shipping companies (r = .512**) and this correlation is significant at 0.01 level. As a result of this, we then reject the null hypothesis (Ho_6) and accept the alternate hypothesis, which states that there is a significant relationship between predictive analytics adoption and time efficiency of international shipping companies in South-West Nigeria.

DISCUSSION OF FINDINGS

This study discovered a significant relationship between machine learning adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding was obtained from the result of the correlation analysis carried out on the two variables in Table 1. The result revealed that machine learning adoption is strongly and positively correlated to cost efficiency of international shipping companies (r = .626**) and this correlation is statistically significant at 0.01 level. As a result of this, we then rejected the null hypothesis (Ho_1) and accepted the alternate hypothesis which states that there is a significant relationship between machine learning adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding is supported by Agarwall et al. (2022) and Hao (2024) as both studies revealed that the adoption of machine learning in business operations enable companies to minimize costs and improve their overall efficiency.

This study also found a significant relationship between machine learning adoption and time efficiency of international shipping companies in South-West Nigeria. This finding emerged from the result of the correlation analysis carried out on the two variables in Table 2. The result showed a very strong and positive correlation between machine learning adoption and time efficiency of international shipping companies (r = .881**) and this correlation is significant at 0.01 level. Based on this result, the null hypothesis (Ho_2) was rejected and the alternate hypothesis was accepted. This means that there is a significant relationship between machine learning adoption and time efficiency of international shipping companies in South-West Nigeria. This finding is consistent with the research conducted by Amit et al. (2022), who noted that machine learning utilization allows companies to perform tasks in a timely manner. Hemalatha and Kumari (2020) also agreed with this finding as they revealed that companies that adopt machine learning in their logistics operations are likely to improve their time efficiency and retain their customers.

This study reported a significant relationship between robotic adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding was derived from the result of the correlation analysis carried out on the two variables in Table 3. The result revealed that robotic adoption has a very strong and positive correlation with cost efficiency of international shipping companies (r = .849**) and this correlation is significant at 0.01 level. Consequently, the null hypothesis (Ho_3) was rejected and the alternate hypothesis was accepted. This means that there is a significant relationship between robotic adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding is supported by Khatri et al. (2018), Tah (2024), and Kazaara et al. (2024) as their studies revealed that the use of robots in logistics operations helps companies to avoid huge costs associated with remunerating human workers.

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This study found a significant relationship between robotic adoption and time efficiency of international shipping companies in South-West Nigeria. This finding emanated from the result of the correlation analysis carried out on the two variables in Table 4. The result showed a very strong and positive correlation between robotic adoption and time efficiency of international shipping companies (r = .804**) and this correlation is statistically significant at 0.01 level. As a result of this, we then rejected the null hypothesis (Ho_4) and accepted the alternate hypothesis, which states that there is significant relationship between robotic adoption and time efficiency of international shipping companies in South-West Nigeria. This finding is in line with the research conducted by Catherine et al. (2023) and Judijanto et al. (2024) as both studies reported that robot utilization in logistics operations significantly improves time efficiency of companies.

This study discovered a significant relationship between predictive analytics adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding was derived from the result of the correlation analysis carried out on the two variables in Table 5. The result revealed that predictive analytics adoption is moderately and positively correlated to cost efficiency of international shipping companies (r = .563**) and this correlation is statistically significant at 0.01 level. Consequently, the null hypothesis (Ho_5) was rejected and the alternate hypothesis was accepted. This means that there is a significant relationship between predictive analytics adoption and cost efficiency of international shipping companies in South-West Nigeria. This finding is supported by Onyeoghani et al. (2022), Zhou et al. (2021), and Agarwall et al. (2022) as their studies revealed that predictive analytics enable companies to minimize costs and improve their performance.

Finally, it was reported that predictive analytics adoption has a significant relationship with time efficiency of international shipping companies in South-West Nigeria. This finding was emanated from the result of the correlation analysis carried out on the two variables in Table 6. The result showed a moderate and positive correlation between predictive analytics adoption and time efficiency of international shipping companies (r = .512**) and this correlation is significant at 0.01 level. As a result of this, we then rejected the null hypothesis (Ho_6) and accepted the alternate hypothesis, which states that there is a significant relationship between predictive analytics adoption and time efficiency of international shipping companies in South-West Nigeria. This finding is consistent with the research conducted by Davenport and Ronanki (2018), Hemalatha and Kumari (2020), and Hao (2024) as their studies revealed that the use of predictive analytics technology in operational management significantly saves time and enhances operational efficiency.

CONCLUSION

Given the increasing rate of technological advancement and its application in the business world, it becomes imperative for shipping companies to adopt artificial intelligence in their logistics operations in order to improve their operational efficiency. The empirical results of this study have proven that machine learning adoption is a significant predictor of cost efficiency and time efficiency of international shipping companies in South-West Nigeria. Robotic adoption was also found to be a significant predictor of cost efficiency and time efficiency of international shipping companies in South-West Nigeria. The study equally revealed that predictive analytic adoption was significantly related to cost efficiency and time

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efficiency of international shipping companies in South-West Nigeria. From the findings, it was concluded that the adoption AI technologies, such as machine learning, robotics and predictive analytics, significantly enhance operational efficiency of international shipping companies in South-West Nigeria.

RECOMMENDATIONS

The following recommendations are provided for the study:

1. Indigenous shipping companies in Nigeria, particularly those that are yet to embrace AI-driven solutions in their logistics operations, should take a cue from their global counterpart and adopt these software solutions as it would enhance their operational efficiency.

2. Shipping companies in Nigeria should adopt machine learning algorithms in their logistics operations as this AI-driven solution has the capability to reduce manual error, minimize costs and improve time efficiency.

3. Shipping companies in Nigeria, particularly those that perform repetitive tasks, should adopt AI-driven robotic solutions to automate their repetitive tasks and processes for improved operational efficiency.

4. Shipping companies in Nigeria should adopt predictive analytic technology in business analysis and utilize the personalized recommendations provided by the machine as this would not only enhance effective decision making but would also improve operational efficiency.

5. Finally, it is recommended that shipping companies in Nigeria should watch out for the latest AI-driven solutions, particularly those that are developed for business operations as any latest invention may render the existing solution obsolete in this fast changing environment.

REFERENCES

Agarwall, H., Das, C.P., Swain, R.K. (2022). Does artificial intelligence influence the operational performance of companies? A paper presented at the Conference: 2nd International Conference on Sustainability and Equity. Kalinga Institute of Industrial Technology, India.

Ahmad, T., Zhang, D., Huang, C., Zhang, H., Dai, N., Song, Y. et al. (2021). Artificial intelligence in sustainable energy industry: Status-quo, challenges and opportunities. *Journal of Cleaner Production*, *289,* 125834.

Aldoghan, M. A. & Sundram, V.P.K. (2023). Organization operational efficiency and innovativeness: Exploring the role of employees' task-based training, operational task commitment, operational engagement, and supervisor support. Retrieved from: https://www.reserachgate.net/

Article DOI: 10.52589/BJLIM-EK1JK3BL
DOI URL: https://doi.org/10.52589/BJLIM-EK1JK3BL

Amit, Y., Kamal, L. & Payal, V. (2022). An investigation of skill requirements in artificial intelligence and machine learning job advertisements. *Industry and Higher Education, 36*(1), 63–73.

Catherine, P., Wong, A. W. & Lin, Z. (2023). Artificial intelligence as a boundary-crossing object for employee engagement and performance. *Journal of Retailing and Consumer Services, 7*(3), 1-9.

Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, *34*, 133-141.

Gill, A., Manjeet, S. & Mathur, N. A. (2014). The impact of operational efficiency on the future performance of Indian manufacturing firms. *International Journal of Economics and Finance, 6* (10), 249-259. DOI:10.5539/ijef.v6n10p259.

Gomstyn, A. & Jonka, A. (2023). Operational efficiency. International Business Machine (IBM). Retrieved from: https://www.ibm.com.think/topics/operational-efficiieny.

Guo, H., & Polak, P. (2021). Artificial intelligence and financial technology FinTech: How AI is being used under the pandemic in 2020. In The Fourth Industrial Revolution: Implementation of Artificial Intelligence for Growing Business Success (pp. 169-186). Springer, Cham.

Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: Artificial intelligence's past, present, and future. *California Management Review*, *61*(4), 5-14.

Hao, C. (2024). Artificial intelligence and operational efficiency of Chinese manufacturing firms. *Sustainability, 23*, 34218.

Hemalatha, A., & Kumari, P.B. (2020). A study on impact of artificial intelligence on organisational effectiveness. *Sambodhi UGC Care Journal, 43* (4), 55-60. https://ssrn.com/abstract=3897494.

Ifekanandu, C.C., Ezirim, A.C. & Asemota, K.U. (2023). Artificial intelligence adoption and marketing performance of quoted manufacturing firms in Nigeria. *International Journal of Innovative Science and Research Technology, 8*(8), 1194-1207. DOI: https://doi.org/10.5281/zenodo.8305002.

Ifekanandu, C. C., & Asagba, S. (2025). Supply chain innovation and operational efficiency of food and beverage manufacturing firms in South-South Nigeria. *Journal of Advanced Research and Multidisciplinary Studies, 5*(2), 46-62. DOI: 10.52589/JARMS-A8Z9HNJL.

Judijanto, L., Adnan, A.Z., Pranajasakti, G., Vandika, Y. & Astutik, W.S. (2024). Use of artificial intelligence in operational efficiency and strategic business management. *West Science Information System and Technology, 2* (3), 365-373.

Kazaara, A.G., Nelson, K. & Kazaara, A.I. (2024). Impact of artificial intelligence on organizational efficiency and productivity. A case study of Metropolitan International University, Kampala Campus. *International Journal of Academic Multidisciplinary Research, 8* (8), 254-260.

Khatri, S., Ramani, J., Pandey, D.K., Penkar, D. & Vashisht, A. (2018). Artificial intelligence: A tool for organizational productivity. *Journal of Emerging Technologies and Innovative Research, 5* (10), 1-5.

Mhlanga, D. (2021). Artificial intelligence in industry 4.0, and its impact on poverty, innovation, infrastructure development, and the sustainable development goals: Lessons from emerging economies? *Sustainability*, *13*(11), 5788.

Ndubuisi-Okolo, P.U., Eneh, O.M. & Anyahara, I.O. (2025). The impact of artificial intelligence on sustainability and operational efficiency of small and medium scale

Article DOI: 10.52589/BJLIM-EK1JK3BL
DOI URL: https://doi.org/10.52589/BJLIM-EK1JK3BL

businesses in South-East, Nigeria. *European Journal of Research and Reflection in Management Sciences, 13* (1), 1-13.

Ojo, E.O. (2024). Artificial intelligence skills and job performance of office managers in public organizations. *Journal of the Management Sciences, 61* (9), 297-310.

Onyeoghani, I.M., Okohmire, I.F. & Meshach, I. (2022). Artificial intelligence and organizational business productivity: A qualitative study. *Lapai International Journal of Management and Social Sciences, 14* (1), 98-110.

Tah, E.N. (2024). Effects of artificial intelligence adoption on organizational success, productivity, and efficiency. Ph.D Thesis, School of Computing Faculty of Middle Georgia State University, Macon, Georgia.

Zhou, Y., Liao, S., & Li, Y. (2021). *Artificial intelligence, big data, and innovation: An empirical investigation in Chinese high-tech industries*. *Sustainability, 13* (2), 696-708.

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