SMART TECHNOLOGY AND SUPPLY CHAIN MANAGEMENT IN THE SHIPPING INDUSTRY: EVIDENCE FROM ONNE PORT, RIVERS STATE, NIGERIA.

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ABSTRACT This study examined the effect of Smart Technology on Supply Chain Management in the Nigerian Shipping Industry evidence from Onne port, Rivers State, Nigeria. The study specifically examined the effect of Internet of Things (IoT) on shipment visibility, the effect of Artificial Intelligence (AI) on operational efficiency, and the effect of Blockchain Technology on information sharing and transparency in the Nigerian shipping industry. A descriptive survey research design was adopted for the study. Data were collected from respondents in the Nigerian shipping and maritime sector using a structured questionnaire. The data were analyzed using descriptive and inferential statistical techniques, including regression analysis, with the aid of Statistical Package for the Social Sciences (SPSS). The findings revealed that Internet of Things has a significant impact on shipment visibility in the Nigerian shipping industry. The study also found that Artificial Intelligence has a significant impact on operational efficiency. However, Blockchain Technology was found to have no significant impact on information sharing and transparency. Based on the findings, the study recommends increased investment in digital infrastructure, human-capacity development, reliable electricity and internet services, and the development of supportive regulatory and institutional frameworks for maritime digital transformation.

Keywords: ***Smart technology, supply chain management, shipping industry, Rivers State, multiple regressions.***

1. INTRODUCTION

Globally, the adoption of smart technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), blockchain technology, big data analytics, cloud computing, and automation has significantly transformed supply chain management within the shipping industry. These technologies enable real-time

cargo tracking, predictive maintenance, automated documentation, intelligent route optimization, enhanced inventory management, and seamless communication among supply chain partners. Countries with advanced maritime systems have leveraged these technologies to improve operational efficiency, reduce turnaround time, minimize operational costs, strengthen supply chain resilience, and enhance customer satisfaction (UNCTAD, 2023).

In contrast, the adoption of smart technologies within Nigeria's shipping industry remains relatively low and uneven. Although some digital initiatives have been introduced by the Nigerian Ports Authority (NPA), the Nigerian Customs Service, and terminal operators, many shipping companies and logistics service providers continue to rely heavily on manual procedures and fragmented information systems. Consequently, inefficiencies such as delays in cargo clearance, duplication of documentation, limited cargo visibility, poor inventory control, and inadequate coordination among stakeholders continue to undermine supply chain performance (Nigerian Ports Authority, 2024).

The increasing complexity of global supply chains further compounds these challenges. The COVID-19 pandemic, geopolitical conflicts, fluctuating fuel prices, climate-related disruptions, and cybersecurity threats have exposed the vulnerability of traditional supply chain systems that lack digital integration and real-time decision-making capabilities. These developments have reinforced the need for shipping organizations to adopt smart technologies capable of improving visibility, flexibility, resilience, and responsiveness throughout the supply chain (Ivanov & Dolgui, 2020).

Several factors continue to hinder the adoption of smart technologies in Nigeria's shipping industry. These include inadequate digital infrastructure, unstable electricity supply, high cost of technology acquisition and maintenance, cybersecurity concerns, inadequate investment, shortage of skilled ICT personnel, resistance to organizational change, poor policy implementation, and weak collaboration among maritime stakeholders. The persistence of these barriers has slowed digital transformation and limited the realization of the benefits associated with smart supply chain systems.

Empirical studies on smart technology adoption have largely focused on manufacturing firms, retail organizations, healthcare systems, financial institutions, and general logistics operations. Comparatively, fewer studies have specifically examined how smart technologies influence supply chain management efficiencies within Nigeria's shipping industry. Existing studies have also concentrated on isolated technologies such as blockchain or automation without providing a comprehensive assessment of the combined effects of major smart technologies including Artificial Intelligence, the Internet of Things, blockchain technology, and big data analytics on supply chain performance. This creates a significant knowledge gap in the literature.

Furthermore, many previous studies have measured organizational performance using indicators such as profitability, productivity, or financial performance, while paying limited attention to critical supply chain management outcomes such as operational efficiency, shipment visibility, information sharing, inventory management, delivery reliability, and customer satisfaction. Consequently, there is insufficient empirical evidence to guide policymakers, port authorities, shipping companies, and logistics managers in making informed decisions regarding investments in smart technologies.

The inability of many shipping organizations in Nigeria to fully integrate smart technologies into their supply chain operations continues to result in operational inefficiencies, increased transportation costs, reduced competitiveness, customer dissatisfaction, and delays in international trade. Unless these challenges are adequately addressed, Nigeria may continue to lose its competitive advantage within the global maritime industry and experience difficulties in achieving efficient port operations and sustainable economic growth.

It is against this background that this study investigates the effect of smart technology on supply chain management in the Nigerian shipping industry. The aim this study is to examine the impact of smart technologies and maritime supply chain management efficiency in the Nigerian shipping industry. The objectives are to: examine the impact of the Internet of Things (IoT) on shipment visibility in the Nigerian shipping industry; determine the impact of Artificial Intelligence (AI) on operational efficiency in the Nigerian shipping industry; and assess the impact of blockchain technology on information sharing and transparency in the Nigerian shipping industry.

2. LITERATURE REVIEW

2.1 Conceptual framework

2.1.1 Concept of Smart Technology

Smart technology refers to the integration of advanced digital technologies, intelligent systems, and interconnected devices that enable organizations to automate processes, collect and analyze real-time data, support informed decision-making, and enhance operational efficiency. Smart technologies combine information and communication technologies (ICT), artificial intelligence, machine learning, cloud computing, big data analytics, robotics, the Internet of Things (IoT), blockchain technology, and automation to create intelligent systems capable of responding dynamically to changes in the operating environment (Schwab, 2017).

2.1.2 Concept of Supply Chain Management

Supply chain management (SCM) refers to the integrated planning, coordination, implementation, and control of activities involved in sourcing raw materials, procurement, production, inventory management, transportation, warehousing, distribution, and delivery of goods and services from suppliers to final consumers (Christopher, 2022).

Modern supply chain management extends beyond the physical movement of goods. It involves information sharing, collaboration, relationship management, financial flows, demand forecasting, risk management, and continuous performance improvement across the entire supply chain network.

2.2 Theoretical framework/models

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was developed by Davis (1989) to explain the factors that influence users' acceptance and utilization of information technologies. The model was adapted from the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975). TAM has become one of the most widely used theoretical frameworks in information systems research because of its simplicity and strong predictive power in explaining technology adoption.

According to Davis (1989), an individual's intention to use a technology is primarily influenced by two key constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived usefulness refers to the degree to which an individual believes that using a particular technology will improve job performance, productivity, and organizational effectiveness. Perceived ease of use, on the other hand, refers to the extent to which an individual believes that using a technology will require minimal effort.

The model assumes that when users perceive a technology to be useful and easy to use, they develop a positive attitude toward its adoption. This positive attitude increases their behavioural intention to use the technology, which ultimately leads to actual system usage. Conversely, technologies perceived as difficult to operate or offering limited benefits are less likely to be adopted.

Despite its strengths, TAM has been criticized for focusing primarily on users' perceptions while paying limited attention to external factors such as organizational culture, technological infrastructure, government regulations, financial resources, and environmental pressures. In developing countries such as Nigeria, these contextual factors significantly influence the adoption of smart technologies. For instance, unreliable electricity supply, inadequate ICT infrastructure, cybersecurity concerns, high implementation costs, and shortages of skilled personnel may discourage organizations from adopting digital technologies even when managers recognize their potential benefits.

The theory is therefore applicable to this study because successful implementation of smart technologies depends not only on their availability but also on the willingness of shipping organizations and their employees to embrace and utilize them effectively. Consequently, TAM provides a useful lens for examining how smart technology adoption contributes to improved operational efficiency, supply chain visibility, inventory management, information sharing, and customer satisfaction in Nigeria's shipping industry.

2.3 Empirical review

2.3.1 Internet of Things (IoT) and Shipment Visibility

Ben-Daya, Hassini, and Bahroun (2019) conducted a study to examine the role of the Internet of Things (IoT) in supply chain management. The study employed a systematic literature review of published articles on IoT applications in logistics and supply chains. The review found that IoT significantly enhances real-time shipment tracking, cargo monitoring, inventory visibility, and information sharing among supply chain partners.

Lee and Lee (2015) investigated enterprise applications of the Internet of Things in manufacturing and logistics industries. The study adopted a conceptual research design based on evidence from existing industrial applications. The findings indicated that IoT-enabled sensors and communication devices improve real-time monitoring of goods, vehicle tracking, fleet management, and operational coordination.

Verdouw, Beulens, and Van der Vorst (2016) examined the application of IoT technologies in logistics and agricultural supply chains in Europe. The study utilized multiple case studies involving organizations that had implemented IoT solutions. The findings showed that IoT enhances product traceability, warehouse visibility, inventory control, and transportation monitoring.

Rejeb, Keogh, and Treiblmaier (2022) examined the use of IoT in maritime logistics through a comprehensive review of previous empirical studies. The study found that IoT improves cargo monitoring, vessel tracking, route optimization, and communication between ports, shipping companies, and customers.

Bag, Gupta, and Kumar (2021) investigated the influence of digital technologies, including IoT, on logistics performance among manufacturing firms in India. Using a survey research design and Structural Equation Modelling (SEM), the study found that IoT significantly improves logistics coordination, inventory accuracy, transportation efficiency, and shipment tracking.

2.3.2 Empirical Review on Artificial Intelligence (AI) and Operational Efficiency

Min (2010) investigated the application of Artificial Intelligence (AI) in supply chain management. The study adopted a review of empirical evidence from logistics and manufacturing organizations. The findings showed that AI significantly improves demand forecasting, warehouse operations, transportation planning, scheduling, and operational decision-making.

Ivanov and Dolgui (2020) examined the role of Artificial Intelligence in improving supply chain resilience during operational disruptions. The study used evidence from multinational manufacturing and logistics firms and adopted a case study approach. The findings revealed that AI enables organizations to predict supply chain disruptions, optimize operational processes, and improve decision-making during emergencies.

Toorajipour, Sohrabpour, Nazarpour, Oghazi, and Fischl (2021) conducted a systematic literature review on Artificial Intelligence in supply chain management. The objective was to identify how AI contributes to supply chain performance. The review covered numerous empirical studies published in leading journals. The findings showed that AI improves procurement, inventory management, transportation planning, warehouse automation, and customer service.

Riahi, Saikouk, Gunasekaran, and Badraoui (2021) carried out a bibliometric analysis of Artificial Intelligence applications in supply chain management. The study reviewed published literature to identify emerging research trends. The findings indicated that AI enhances operational efficiency through automation, predictive analytics, intelligent decision support, and process optimization.

Baryannis, Dani, Antoniou, and Wijnand (2019) investigated the application of Artificial Intelligence in supply chain risk management. The study employed a systematic review of empirical studies involving logistics organizations. The findings revealed that AI improves operational efficiency by predicting disruptions, reducing operational risks, optimizing logistics planning, and improving organizational responsiveness.

2.3.3 Blockchain Technology and Information Sharing/Transparency

Saberi, Kouhizadeh, Sarkis, and Shen (2019) investigated the role of blockchain technology in sustainable supply chain management.. The researchers adopted a systematic literature review of published studies on blockchain applications. The findings revealed that blockchain significantly improves information sharing, product traceability, transparency, accountability, and trust among supply chain participants.

Queiroz and Wamba (2019) examined the adoption of blockchain technology in supply chain management using a survey of logistics and manufacturing firms. The study analyzed the factors influencing blockchain adoption and its operational benefits. The findings indicated that blockchain significantly improves information exchange, transaction transparency, supply chain integration, and collaboration among business partners.

Kouhizadeh, Saberi, and Sarkis (2021) conducted a systematic review on blockchain technology in logistics and supply chain management. The objective was to identify the benefits and barriers associated with blockchain implementation. The study found that blockchain improves documentation accuracy, information security, shipment traceability, transaction transparency, and communication among supply chain participants.

Min (2019) investigated blockchain technology as a tool for enhancing supply chain resilience. The study reviewed empirical evidence from logistics organizations and found that blockchain improves information sharing, product traceability, operational security, and transparency throughout the supply chain.

2.4 Research gap

The literature reviewed in this section demonstrates that smart technologies have become indispensable tools for improving supply chain management in the global shipping industry. Despite the substantial body of literature, several research gaps remain. A geographical gap exists because most empirical studies were conducted in developed countries such as the United States, the United Kingdom, Germany, China, and India, with relatively few studies focusing on Nigeria. A sectoral gap is evident because many previous studies concentrated on manufacturing, retail, healthcare, and general logistics organizations, while limited attention has been given to the shipping and maritime industry.

A conceptual gap also exists because many previous researchers examined individual smart technologies independently. Few studies have simultaneously examined the combined effects of the Internet of Things, Artificial Intelligence, and Blockchain Technology on different dimensions of supply chain management. This study addresses this gap by integrating these three smart technologies and examining their effects on shipment visibility, operational efficiency, and information sharing and transparency.

3. METHODOLOGY

This study adopted the descriptive survey research design. The design is suitable for collecting quantitative data through questionnaires and for determining the relationship between the independent and dependent variables. The study was carried out in Rivers State, Nigeria. River State is located in the South-South geopolitical zone of Nigeria. The population of the study comprised management and operational staff of the Nigerian Port Authority in Onne, Port Harcourt. River State. For the purpose of this study, the target population consists of 200 employees drawn from the Nigerian Port Authority in Onne, Port Harcourt, River State.

The sample size was determined using the Taro Yamane (1967) formula:

[n = {N}{1 + N(e)^2}]

Where:

n = Sample size

N = Population (200)

e = Level of significance (0.05)

$$n = 200 / [1 + (200 \times 0.05^2)]$$

n = 200 / [1 + 200 x 0.0025)]

n = 200 / (1+ 0.5)

n = 200 = 1+ 0.5

n = 200 = 1.5

n = 200 / 1.5

n = 133.3

n = 133 Sample size by approximation.

Furthermore, a simple random sampling technique was employed to select respondents from study population. This technique gave every member of the population an equal opportunity of being selected and minimized selection bias.

The study utilized both primary and secondary sources of data. The major instrument for data collection was a structured questionnaire designed by the researcher after reviewing relevant literature. The questionnaire consisted of two sections: Section A contains demographic information while Section B contains research variables measured using a four-point likert Scale of strongly agree, agree, disagree, and strongly disagree.

Research questions of the fourth objective was answered using descriptive statistics, including frequencies, and percentages. The hypotheses for objectives one to three were tested using the Linear Regression method at a 5% level of significance.

Model Specification:

The econometric models are:

$SCME = \beta_0 + \beta_1 IOT + \beta_2 AI + \beta_3 BLCT + e$ (1)

Where:

SCME = Supply chains management efficiency

IOT = Internet of things

AI = Artificial intelligence

BLCT = Block chains technology

e = Error term

$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0$

β_0 = Constant

$\beta_1, \beta_2, \beta_3$= Regression coefficients

4. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Distribution of subjects

Table 4. 1: Distribution of subject

Questionnaire	Responses according to categories	Total	Percentage (%)
No. returned	130	130	97.7
Not returned	3	3	2.3
Total	133	133	100

Source: Field work, 2026

From Table 4.1 one hundred and thirty-three (133) Copies questionnaires were administered to respondents and out of this number, 130 questionnaires were returned while 3 questionnaires were not returned. The total number of questionnaires returned was 130 representing 97.7 per cent while the total number of questionnaires not returned were 3, representing 2.3 per cent of the respondents who did not return their questionnaire.

4.2 Regression result

Table 4.2: Multiple regression result

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.566	.374		1.515	.131
	INTERNET OF THINGS	.175	.040	.139	4.364	.000
	BLOCK CHAIN TECHNOLOGY	.047	.034	.045	1.382	.168
	ARTIFICIAL INTELLIGENCE	.751	.034	.728	21.881	.000

a. Dependent Variable: supply chains management efficiency

Source: Researcher's computation, 2026.

From the result, internet of things (IOT) has a positive relationship with supply chains management efficiency. This means that a 1 percent increase in IOT will increase supply chain management efficiency by 0.175 percent. IOT has a significant effect on supply chain management efficiency since its probability value of 0.000 is less than the 0.05 level of significance. The result indicates that IOT has a significant positive effect on supply chain management efficiency.

Also, from the result. Artificial intelligence (AI) has a positive relationship with supply chains management efficiency. This means that a 1 percent increase in AI will increase supply chain management efficiency by 0.751 percent. AI has a significant effect on supply chain management efficiency since its probability value of 0.000 is less than the 0.05 level of significance. The result indicates that AI has a significant positive effect on supply chain management efficiency.

Furthermore, block chains technology (BCT) has a positive relationship with supply chains management efficiency. This means that a 1 percent increase in BCT will increase supply chain management efficiency by 0.047 percent. However, BCT has no significant effect on supply chain management efficiency since its probability value of 0.168 is more than the 0.05 level of significance. The result indicates that BCT has an insignificant positive effect on supply chain management efficiency.

The coefficient of determination ($R^2 = 0.637$) in table 4.3 indicates that about 63.7 percent of the variation in supply chains management efficiency is explained by the independent variables. The p-value of the F-statistic of 0.000 in table 4.4 confirms that the overall model is statistically significant.

Table 4. 3:Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.800[a]	.639	.637	.873

a. predictors: (constant), internet of things, artificial intelligence, block chain technology

Table 4.4: ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	125.640	3	41.880	35.420	.000[b]
	Residual	148.940	126	1.182		
	Total	274.580	129			

a. Dependent variable: supply chains management efficiency

b. Predictors: (constant), internet of things, artificial intelligence, block chain technology

4.3 Testing of hypotheses

From the result, it can be observed that there is a significant impact of internet of Things (IoT) on shipment visibility in the Nigerian shipping industry, thus we reject the null hypothesis which says that there is no significant impact of Internet of Things (IoT) on shipment visibility in the Nigerian shipping industry and conclude that there is a significant impact of internet of Things (IoT) on shipment visibility in the Nigerian shipping industry. From the result, it can be observed that Artificial Intelligence (AI) has a significant impact on operational efficiency in the Nigerian shipping industry. We therefore reject the null hypothesis which says that Artificial Intelligence (AI) has no significant impact on operational efficiency in the Nigerian shipping industry and conclude that Artificial Intelligence (AI) has a significant impact on operational efficiency in the Nigerian shipping industry.

From the result it can be observed that there is no significant impact of blockchain technology on information sharing and transparency in the Nigerian shipping industry. We therefore accept the null hypothesis which says that there is no impact of blockchain technology on information sharing and transparency in the Nigerian shipping industry.

4.4 Discussions of findings

4.4.1 Effect of Internet of Things on Shipment Visibility in the Nigerian Shipping Industry

The study found that Internet of Things (IoT) has a significant impact on shipment visibility in the Nigerian shipping industry. This finding implies that the use of IoT-enabled technologies such as GPS trackers, sensors, RFID devices, connected cameras and other monitoring devices contributes significantly to the ability of shipping firms to monitor the location, movement and condition of cargo in real time. IoT allows information about shipments to be collected and transmitted continuously, thereby making it easier for shipping companies and other supply chain stakeholders to know where cargo is, when it is likely to arrive and whether there are problems during transportation. This finding is consistent with the findings of Ben-Daya, Hassini and Bahroun (2019), Lee and Lee (2015), Verdouw, Beulens and Van der Vost (2016), Bag, Gupta, and Kumay (2021), etc.

The significant effect may be explained by the fact that shipment visibility is highly dependent on timely and accurate information. When IoT devices are attached to containers, vehicles or cargo, they can provide information on location, movement, temperature, humidity and other relevant conditions. This enables shipping firms to identify delays, deviations, losses and other problems more quickly and take corrective measures. In a country such as Nigeria, where maritime and logistics operations may involve multiple locations and supply chain actors, improved visibility can enhance coordination between shipping companies, freight forwarders, terminal operators, importers and other stakeholders.

4.4.2 Effect of Artificial Intelligence on Operational Efficiency in the Nigerian Shipping Industry

The study also revealed that Artificial Intelligence (AI) has a significant impact on operational efficiency in the Nigerian shipping industry. This means that the application of AI-based technologies can contribute meaningfully to faster, more accurate and more efficient maritime operations. This result corroborates the results of Min (2010), Ivanov and Dolgui (2020), Toorajipour et al (2021), Riahi et al (2021), etc. AI can support shipping operations through predictive analytics, automated decision-making, demand forecasting, route optimization, predictive maintenance, cargo-handling automation and intelligent scheduling. The significant finding therefore suggests that Nigerian shipping organisations that effectively utilize AI are more likely to improve their operational processes. This is particularly important because operational efficiency in shipping involves several interconnected activities, including vessel scheduling, cargo

handling, documentation, transportation, equipment utilisation and communication among supply chain partners.

4.4.3 Effect of Blockchain Technology on Information Sharing and Transparency

Contrary to the findings for IoT and AI, the study found that Blockchain Technology has no significant impact on information sharing and transparency in the Nigerian shipping industry. This result means that, based on the data obtained from the respondents, the current use or level of adoption of blockchain technology has not produced a statistically significant improvement in information sharing and transparency. This finding is not in line with the findings of Saberi et al (2019), Queiroz and Wamba (2019), Min (2019), etc who all stressed that Blockchain Technology has no significant impact on information sharing and transparency in the shipping industry.

This finding does not necessarily mean that blockchain technology is incapable of improving information sharing or transparency. Rather, it may indicate that blockchain technology is not yet sufficiently adopted, integrated or operationalized within the Nigerian shipping environment to produce measurable effects.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This study examined Smart Technology and Supply Chain Management in the Nigerian Shipping Industry, with particular emphasis on the effects of Internet of Things (IoT), Artificial Intelligence (AI), and Blockchain Technology, as well as the challenges limiting the effective use of smart technologies in Nigerian maritime operations. Based on the findings of the study, it is concluded that smart technology plays an important role in improving supply chain management in the Nigerian shipping industry. The study demonstrates that technologies such as IoT and AI can contribute significantly to important dimensions of maritime and supply chain performance. The significant effect of IoT on shipment visibility indicates that the adoption of connected devices and real-time tracking technologies can improve the ability of shipping organization's to monitor shipments and obtain timely information about cargo movement. Improved shipment visibility can enhance coordination among supply chain actors, reduce uncertainty and support better management of cargo throughout the transportation process.

Similarly, the significant effect of AI on operational efficiency demonstrates that intelligent technologies can contribute to more efficient shipping operations. Through data processing, prediction, automation, route optimization and decision support, AI can enable shipping organization's to improve the utilization of resources and reduce operational inefficiencies.

However, the insignificant effect of blockchain technology on information sharing and transparency indicates that the technology has not yet achieved sufficient adoption or integration to produce significant

improvements within the Nigerian shipping environment. This does not imply that blockchain lacks potential. Rather, its effectiveness may depend on the establishment of appropriate digital infrastructure, interoperability, technical capacity, regulatory frameworks and cooperation among maritime stakeholders.

5.2 Recommendations

Based on the findings of the study on Smart Technology and Supply Chain Management in the Nigerian Shipping Industry, the following recommendations are made:

i. Shipping companies should adopt and expand the use of GPS tracking systems, RFID, sensors, smart containers and other connected devices. These technologies will enable real-time monitoring of cargo location and condition, improve traceability and reduce the risk of lost or misplaced shipments.

ii. Shipping companies should deploy AI-based systems for route optimisation, vessel scheduling, demand forecasting, predictive maintenance, cargo handling and operational decision-making. This will help reduce delays, minimise errors and improve the utilisation of human and material resources.

iii. Maritime stakeholders should strengthen the adoption and integration of Blockchain Technology that allow shipping companies, ports, customs authorities, freight forwarders and other relevant actors to securely share information and documentation.

iv. Government and private-sector stakeholders should improve electricity and internet infrastructure to enhance the operation of IoT, AI, blockchain and other digital systems.

v. Shipping companies should provide regular training and capacity-building programmes in areas such as data analytics, artificial intelligence, IoT, blockchain, cybersecurity and digital supply chain management. Maritime training institutions should also incorporate emerging digital technologies into their programmes.

5.3 Limitations of the study

The study was restricted to the Nigerian shipping industry, and therefore the findings may not fully represent other sectors of the Nigerian economy. Differences in organizational structures, technological readiness and operational practices may produce different results in other industries. Again, the study relied primarily on responses obtained from respondents through a structured questionnaire. The findings therefore depend partly on the respondents' perceptions, experiences and understanding of smart technologies. There is a possibility that some respondents may have provided subjective responses or may not have had complete knowledge of the technologies being investigated.

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