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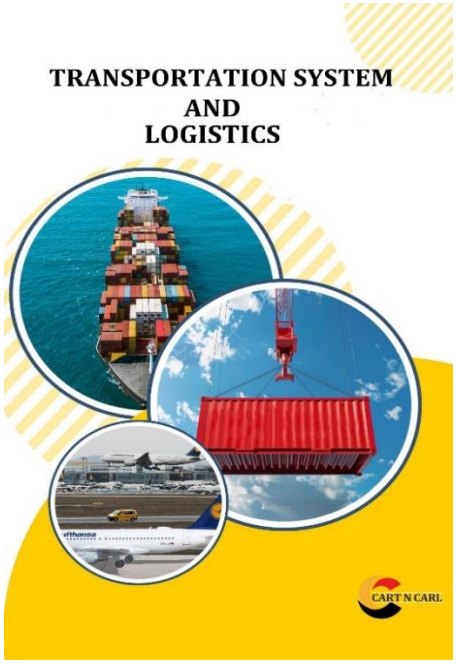

Adoption of Emerging Technologies for Operational Efficiency in the Logistics Management of the Nigerian Navy

Abstract

This study assessed the adoption of emerging technologies for operational efficiency in logistics management within the Nigerian Navy (NN). A total population of 720 personnel was identified across the NN, NAF and NA, with a sample size of 394 derived using Taro Yamane's formula. Out of 387 valid responses analysed, 81.4% were male, while 18.6% were female. Findings revealed high acceptance of emerging technologies for logistics enhancement. Specifically, 64.1% strongly agreed that technological adoption enhances ship availability, while 25.1% agreed, indicating 89.2% positive perception. Regarding Artificial Intelligence and Robotics Centre contribution to logistics, 27.1% strongly agreed and 36.2% agreed, totalling 63.3%. Additionally, 64.6% acknowledged Google Grant's potential to advance AI adoption, and 68.5% affirmed the Brain Gain Initiative as crucial for technology-driven logistics improvements. Although progress is evident, challenges persist, including limited training exposure, infrastructural gaps, and weak integration frameworks. The study concludes that emerging technologies significantly improve logistics operations but require structured implementation. Strengthening capacity-building, digital infrastructure, and policy alignment is recommended to optimize operational readiness and fleet performance within the NN.

Keywords : Emerging Technologies, Operational Efficiency, Nigerian Navy, Logistics Management, Artificial Intelligence

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Introduction

The primary purpose of every nation is the protection of national interests and the wellbeing of the people, which includes safeguarding the territorial integrity through naval operations. Over the years, these responsibilities have been significantly influenced by technological advancements, which have improved naval capabilities in various ways. For instance, the integration of surveillance systems, satellite communications, Autonomous Underwater Vehicles (AUVs), Unmanned Surface Vehicles (USVs), Hypersonic Weapons, Advanced Propulsion Systems and cyber defence mechanisms have revolutionised naval operations. These technological advancements provide real-time intelligence, enhance communication capabilities and offer more efficient logistical support, all of which contribute to a more effective maritime defence strategy (Naval Research Laboratory, 2020). The success of naval operations relies heavily on the integration of these emerging technologies and advanced logistics management.

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As technological advancements continue to evolved rapidly, navies around the world are compelled to adopt and integrate these innovations to enhance their operational capabilities and maintain technological superiority. Adopting these technologies such as autonomous systems, Artificial Intelligence (AI) and advanced communication systems are not optional but a strategic necessity to counter maritime threats and maintain a competitive edge in an increasingly complex maritime environment. Similarly, logistics management which is the backbone of naval operations, has experienced significant advancements through the integration of these emerging technologies. Modern logistics systems utilise data analytics, predictive maintenance and automated supply chain management to ensure that naval forces are well-equipped and operationally ready at all times. Effective logistics management guarantees the timely availability of resources thereby enhances the sustainability of naval missions, and optimizes the use of naval assets (South African Naval Operations Report, 2020).

The Nigerian Navy continues to face critical challenges in logistics management, which significantly undermine its ability to support an expanding and technologically advanced fleet. Despite ongoing efforts to enhance naval capabilities, traditional logistics approaches have proven outdated and inadequate, resulting in delayed maintenance, reduced operational readiness, and excessive dependence on foreign technologies and service providers. These limitations have escalated the costs of maintaining naval platforms and have hindered the Navy's capacity to respond swiftly and efficiently to maritime threats. Poor logistics management has manifested in several forms, including fragmented coordination mechanisms, underutilization of modern technologies, and a persistent skills gap among technical personnel. Although emerging technologies such as Artificial Intelligence (AI), predictive maintenance systems, and digital supply chain tools offer promising solutions, their integration into the NN's logistics framework remains minimal, unstructured, and poorly documented. These inefficiencies point to a deeper systemic issue in how the NN manages its logistics ecosystem.

In August 2023, the Chief of the Naval Staff (CNS), Vice Admiral Emmanuel Ogalla, underscored the need for the NN to leverage AI and emerging technologies to improve platform maintenance and logistics operations. However, challenges such as inadequate funding, limited infrastructure, and lack of technical expertise continue to stall meaningful progress. A notable example is that, as of 2023, only 25% of the NN's technical personnel had received training in emerging technologies a critical gap that compromises effective logistics planning and execution (NN Report, 2023). Financial constraints also persist. Despite a reported 15% increase in the NN's 2023 budget, the funds remain insufficient to support the acquisition, deployment, and maintenance of advanced logistics systems. The consequences of this funding gap on logistics performance both in the short and long term remain poorly examined in existing literature. Although technologies such as RMAC (Remote Monitoring and Control) and Falcon Eye have been introduced, the extent to which these systems have been effectively integrated into the logistics process is unclear. There is limited research on how these platforms interact with core logistics operations, including supply chain coordination, inventory management, and maintenance scheduling. This lack of interoperability and strategic alignment contributes to continued inefficiencies in logistics management, even in the presence of technological advancements. Therefore, the study examines the adoption of emerging technologies for operational efficiency in the logistics management of the Nigerian navy.

Method and Materials

Study Area (Historical Background of the Nigerian Navy)

The origins of the Nigerian Navy (NN) can be traced back to the Marine Department of the Royal Navy, established in 1887 as a quasi-military organization. This department handled responsibilities that today are divided among the Nigerian Ports Authority (NPA), the Nigerian Inland Waterways Authority (NIWA) and the NN. During World War I (1914–1918), elements of the Marine Department participated in military operations against German forces in Cameroon. However, the colonial administration at the time did not see the need to establish a formal navy, believing that naval protection for Nigeria fell under the purview of the Royal Navy. They considered the Marine Department adequate to secure the ports and coastal areas while providing harbour services for Royal Navy ships patrolling West Africa. This arrangement persisted until the end of World War II in 1945. After the war, the colonial administration prioritized port-related duties for the Marine Department, leading to the proposal to establish the NPA.

Research Design and Study Population

The cross-sectional survey research method was adopted in carrying out the study. Cross-sectional survey research is a specific type of field study that involves the collection of data from a sample of elements drawn from a well-defined population through the use of a questionnaire (Visser et al., 2002). The population of this study comprises personnel directly involved in logistics management across all operational commands of the Nigerian Navy (NN), as well as selected formations within the Nigerian Army (NA) and Nigerian Air Force (NAF). These include logistics officers, fleet maintenance staff, inventory managers, supply chain specialists, and command-level decision-makers. The study also covers relevant administrative and technical personnel responsible for the adoption and implementation of emerging technologies within the logistics system of the Armed Forces of Nigeria (AFN).

Sample and Sampling Technique

Based on preliminary field reconnaissance and consultation with relevant authorities, the estimated total population across the selected units is approximately 720 personnel. This includes: Nigerian Navy (WNC, ENC, CNC) about 450 personnel, Air Force Mobility Command, Yenagoa with about 120 personnel and 6 Division Nigerian Army, Port Harcourt with 150 personnel. The Taro Yamane formula was used to calculate the sample size for the study, applying a degree of accuracy of 95 percent with an error margin of 5 percent and a population of 720, resulting in a sample size of 394.

Data Collection and Analysis

The primary tool for quantitative data collection was a structured questionnaire. This instrument was carefully designed to gather relevant information from respondents across the Nigerian Army, Nigerian Navy and Nigerian Air Force. It aimed to capture their individual and institutional experiences, perceptions, and suggestions regarding logistics practices, particularly in relation to the adoption and integration of emerging technologies in logistics management operations. The questionnaire adopted for the study made use of closed-ended format. The retrieved questionnaires were coded and subjected to Statistical Package for the Social Sciences (SPSS) for proper analysis. The questionnaire coding was done with MS Excel before being transferred to the Data entry of SPSS. The data were analysed using descriptive statistics such as frequency counts, percentage, mean and charts. The use of such statistics allows the researcher to present the evidence of the study in a way that can be understandable and makes conclusion concerning the variables of study.

Result and Discussion

Socio-Demographic Details of the Respondents

The data presented in Table 1 reveals that 81.4% of the respondents were male, while 18.6% were female. The largest proportion of respondents (22.0%) were Sub-Lieutenants, followed by Lieutenants (20.7%) and Lieutenant Commanders (19.4%) which account for over 60% of the respondents, highlighting the involvement of junior and mid-level officers in logistics management in the NN. The representation of higher-ranking officers, such as Rear Admirals (1.3%) and Commodores (2.6%) provided strategic insights into policy formulation and high-level decision-making regarding the adoption of emerging technologies. Captains and Commanders, comprising 5.2% and 12.9% of the respondents played a key role in providing operational perspectives of integrating emerging technologies into logistics operations. The "Other" category, making up 16.0% of the respondents, included personnel from specialised roles involved in logistics management. The largest proportion of respondents (24.5%) had 5–10 years of service, representing a group with moderate experience who are likely deeply involved in implementing and adapting to new technologies. Those with 11–15 years of service (22.0%) and 16–20 years (19.4%) also constituted a significant portion, reflecting a blend of operational expertise and strategic insights. Respondents with less than five years of service (15.5%) provided perspectives from newer personnel who may bring fresh ideas and adaptability to technological advancements, though they might have limited first-hand experience with traditional logistics systems. The 18.6% of respondents with more than 20 years of service represented highly experienced personnel, offering historical context on the evolution of logistics management in the NN and insights into long-standing challenges and successes. The WNC comprised 20.7% of the respondents, while the ENC closely followed with 18.1%. The CNC represented 16.8%, and the Naval Training Command accounted for 12.9%. Additionally, the Logistics Command contributed 15.5% of the respondents, and the Naval Doctrine Command constituted 16.0%. The operational personnel comprised 31.0% of the respondents, while Logistics Staff accounted for 24.5%.

Respondents from the Technical/Engineering division represented 22.0%, and Administrative Staff made up 22.5%. This distribution demonstrates a balanced representation of personnel across various roles within the Navy, providing diverse perspectives on the study's objectives.

Table 1: Socio-Demographic Details of the Respondents

Variables	Frequency (387)	Percentage (%)
Gender		
Male	315	81.4
Female	72	18.6
Rank		
Rear Admiral	5	1.3
Commodore	10	2.6
Captain	20	5.2
Commander	50	12.9
Lieutenant Commander	75	19.4
Lieutenant	80	20.7
Sub-Lieutenant	85	22.0
Other (Specified)	62	16.0
Years of Service		
Less than 5 years	60	15.5
5-10 years	95	24.5
11-15 years	85	22.0
16-20 years	75	19.4
More than 20 years	72	18.6
Command		
Western Naval Command	80	20.7
Eastern Naval Command	70	18.1
Central Naval Command	65	16.8
Naval Training Command	50	12.9
Logistics Command	60	15.5
Naval Doctrine Command	62	16.0
Position		
Operational Personnel	120	31.0
Logistics Staff Personnel	95	24.5
Technical/Engineering	85	22.0
Administrative Staff	87	22.5

Emerging Technologies for Operational Efficiency

From Table 2, the survey results indicate that a majority (64.1%) of respondents strongly agree that emerging technologies significantly enhance ship availability in logistics management, while an additional 25.1% agree. This overwhelming support underscores the positive impact of technological adoption on operational effectiveness. However, 7% of respondents remained neutral, and 3.8% expressed disagreement, possibly reflecting reservations or limited awareness of the role of these technologies. The data indicates that 63.3% of respondents (SA and A combined) recognised the centre's potential to enhance the NN's logistics operations, particularly in ship maintenance, inventory management, and predictive analytics. From the survey results, a significant 64.6% of respondents (combining those who strongly agreed and agreed) acknowledged the potential of the Google Grant to promote the adoption of AI technologies in the NN's logistics management. The survey results show that 68.5% of respondents (combining those who strongly agreed and agreed) recognize the Brain Gain Initiative as a valuable contributor to promoting emerging technologies in NN logistics management.

Table 2: Respondents' Perception of Emerging Technologies in Logistic Management

Variable	Frequency (387)	Percentage (%)
Perception of Emerging Technologies in Enhance Ship Availability		
Strongly Agree (SA)	248	64.1
Agree (A)	97	25.1
Neutral (N)	27	7.0
Disagree (D)	10	2.6
Strongly Disagree (SD)	5	1.2
Perception of the Artificial Intelligence and Robotics Centre's Contribution to Logistics Management		
Strongly Agree (SA)	105	27.1
Agree (A)	140	36.2
Neutral (N)	70	18.1
Disagree (D)	50	12.9
Strongly Disagree (SD)	22	5.7
Perception of Google Grant for AI Development Contribution to Logistics Management		
Strongly Agree (SA)	115	29.7
Agree (A)	135	34.9
Neutral (N)	72	18.6
Disagree (D)	45	11.6
Strongly Disagree (SD)	20	5.2
Perception of the Brain Gain Initiative's Contribution to Logistics Management		
Strongly Agree (SA)	120	31.0
Agree (A)	145	37.5
Neutral (N)	70	18.1
Disagree (D)	40	10.3
Strongly Disagree (SD)	12	3.1

The findings of this study reveal that the Nigerian Navy (NN) has made commendable strides in adopting emerging technologies to enhance logistics management, including predictive maintenance tools, equipment standardization, and AI-driven solutions. However, these efforts remain constrained by inadequate infrastructure, limited training, and the absence of a coherent technological integration policy. These findings are strongly corroborated by the existing literature. For instance, the study's observation that predictive maintenance tools led to a 15% improvement in fleet availability between 2020 and 2024 is consistent with Ogunleye (2020), who emphasized the role of predictive analytics in reducing ship downtime and optimizing maintenance schedules. This aligns with Parker (2023) and Adetunji (2023), both of whom highlighted how automation and AI are reshaping naval logistics by improving efficiency and decision-making. Furthermore, Christian (2022) underscored the importance of indigenous technological development for sustainable defence transformation, reinforcing the study's recommendation for stronger domestic capacity in technology adoption.

The study also shows that while NN has achieved some success in fleet modernisation such as the acquisition of Agusta Westland 109 helicopters and construction of indigenous patrol vessels it still lags behind in areas like digital inventory systems. This supports Kayode et al. (2022), who assert that adoption of 21st-century technologies significantly reduces logistical delays and enhances mission performance. Similarly, Dike (2019) and Nwosu (2021) highlighted the operational inefficiencies resulting from lack of automation and poor system interoperability challenges echoed in the NN's ongoing logistics delays, where 25% of disruptions are still linked to inventory issues.

Conclusion

The findings of this study demonstrate that the Nigerian Navy is gradually transitioning towards digitally enhanced logistics management, with notable progress in the adoption of emerging technologies such as predictive maintenance systems, digital inventory platforms, artificial intelligence applications and automation-based solution architecture. These advancements have begun to reshape fleet support processes by improving maintenance planning, reducing operational delays and enhancing real-time decision-making. Personnel perception and institutional responsiveness also indicate a growing recognition of technology as a strategic driver for improved logistics efficiency.

However, despite these advancements, adoption remains fragmented and lacks a unified integration framework. Challenges such as inadequate technical capacity, inconsistent infrastructure development, limited research collaboration and weak technology-policy alignment continue to slow the pace of transformation. The study therefore concludes that while the Nigerian Navy is moving in the right direction technologically, operational efficiency in logistics management can only be fully realised when emerging technologies are mainstreamed into standard naval procedures and supported with sustainable training, funding and development structures. Overall, the research affirms that emerging technologies hold significant potential for enhancing logistics operations, but their success depends on deliberate institutional strengthening, holistic integration and long-term implementation commitment.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Credit Authorship Contribution Statement

Akpabi, I. L.: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Visualisation, Project administration, Writing - original draft, Review & Editing. **Wizor, C. H.**: Supervision, Methodology, Validation, Formal analysis, Data curation, Visualisation.

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