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Evaluation Of The Impact Of Sustainable Logistics System On The Growth Of Maritime Companies In Delta State

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Abstract
This study examined the impact of sustainable logistics systems on the growth of maritime companies in Delta State. It focused on the extent to which maritime companies in Delta State have adopted sustainable logistics systems in their operations; the effect of sustainable logistics systems on the operational efficiency of maritime companies; the influence of sustainable logistics systems on the cost-effectiveness and financial growth of maritime companies; the impact of sustainable logistics systems on the competitive advantage and market relevance of maritime companies and the challenges hindering the effective adoption of sustainable logistics systems among maritime companies in Delta State. To achieve the objectives of this study, six (6) research questions were raised and three (3) hypotheses were formulated. The study adopted descriptive survey design with a population of 145 employees with a sample size of 106, determined using the Taro Yamane (1967) formula. Descriptive statistics (simple percentage and mean) were used to answer the research questions while the hypotheses were tested using Multiple Regression in SPSS at a significant level of 0.05.
The findings of the study showed that sustainable logistics systems have a significant effect on the operational efficiency of maritime companies in Delta State (0.030); sustainable logistics systems significantly influence cost-effectiveness and financial growth of maritime companies in Delta State (0.018); sustainable logistics systems have a significant impact on the competitive advantage and market relevance of maritime companies in Delta State (0.001). It was further showed that technological innovation within sustainable logistics systems improves service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies. More so, Sustainable logistics practices influence environmental compliance and regulatory performance by enabling maritime companies to actively implements sustainable logistics practices, environmental considerations integration and the use of modern logistics technologies. Furthermore, the challenges face by maritime companies in implementing sustainable logistics systems include: high implementation costs, Lack of adequate infrastructure and lack sufficient technical skills to use sustainable logistics systems effectively. It was concluded that sustainable logistics systems have a significant impact on the growth of maritime companies. It was recommended among others that Stakeholders should prioritise regular training programs to ensure all users can effectively operate sustainable logistics systems and adapt to technological upgrades

Keywords: *Sustainable Logistics, Maritime Companies, Growth, Logistics Systems, Supply Chain*

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I. Introduction

The maritime sector plays an indispensable role in the economic and industrial development of nations, particularly those with extensive coastlines and waterways such as Nigeria. Maritime activities—including shipping, port operations, marine logistics, and freight handling—form the backbone of international trade and domestic waterborne transportation. In Nigeria, over 80% of import and export activities depend on maritime transport, making the maritime industry a critical component of national economic performance. Within this broader sector, maritime companies operating in Delta State constitute a significant hub for logistics activities due to the region's strategic coastal location, its proximity to key ports, and its access to major inland waterways feeding commercial and industrial centres across the country. These companies facilitate the movement of goods, equipment, and personnel across various maritime corridors, thereby supporting industries such as oil and gas, manufacturing, construction, and agricultural exports.

As globalization expands trade networks and the demand for efficient transport systems grows, the concept of sustainable logistics systems has gained prominence as a strategic requirement rather than a mere operational choice. Sustainable logistics refers to the integration of environmentally responsible, economically viable, and socially inclusive practices into logistics operations. It encompasses the use of cleaner technologies,

optimized transport routes, energy-efficient vessels, digital tracking systems, reduced carbon emissions, recycling initiatives, and transparent supply chain practices. In modern maritime operations, sustainability is no longer optional because global supply chains increasingly demand greener operations, improved compliance with international regulations, and enhanced operational efficiency. Maritime companies are therefore under pressure to adopt sustainable logistics frameworks to remain competitive, improve service quality, reduce operational risks, and align with emerging environmental standards such as the International Maritime Organization's (IMO) directives on emission reduction.

Delta State, home to several maritime support companies, jetties, dry docks, logistics contractors, and marine service providers, operates in an environment characterized by high industrial activity, energy-intensive operations, and extensive resource utilization. This makes the integration of sustainable logistics systems particularly crucial. Maritime companies in the region frequently handle cargo movement, crew transfer, offshore support, warehousing, vessel maintenance, and supply chain coordination for multinational corporations and local businesses. These operations require substantial fuel consumption, generate emissions, and often interact with ecologically sensitive areas such as the Niger Delta waterways. Consequently, sustainability concerns—ranging from carbon footprints to waste management, energy efficiency, safety standards, and effective transport planning—are central to ensuring long-term operational viability.(Popescu et al., 2024)

However, despite the recognized importance of sustainable logistics, many maritime companies in Nigeria continue to operate with conventional logistics models characterized by inefficiencies such as frequent delays, high fuel consumption, poor route optimization, low adoption of digital technologies, and limited investment in green infrastructure. These challenges are more pronounced in Delta State, where environmental degradation, infrastructural constraints, rising energy costs, and inconsistent policy enforcement further complicate logistics operations. As a result, maritime companies struggle with reduced profitability, low service reliability, operational downtime, safety hazards, and declining competitiveness in an evolving global maritime environment.

Furthermore, a growing number of international partners and regulatory bodies now require sustainable operational practices as a prerequisite for business collaboration. Maritime firms that fall short of these expectations risk losing business opportunities and facing reputational damage. Sustainable logistics systems therefore represent an essential pathway not only for environmental stewardship but also for business growth, operational continuity, and improved corporate performance (Dovbischuk, I. 2021). For maritime companies in Delta State, the adoption of sustainable logistics systems could create opportunities to reduce operational costs, streamline cargo handling, improve turnaround time, strengthen stakeholder relations, and meet global environmental standards while expanding their market influence.

In recent years, researchers and policymakers have increasingly emphasized sustainability as a pillar for maritime sector transformation. Studies highlight that sustainable logistics practices—such as the use of renewable energy sources, digital supply chain monitoring platforms, eco-friendly vessels, and advanced warehousing technologies—can dramatically improve the efficiency and growth potential of maritime companies. Yet, despite these emerging insights, there remains a significant gap in the empirical examination of how sustainable logistics systems directly influence the growth of maritime companies, especially within the context of Delta State. Given the region's unique socio-economic and ecological conditions, understanding this relationship is vital for designing policies and operational strategies tailored to the needs of maritime operators.

Despite the strategic importance of the maritime sector to Nigeria's economy, particularly within Delta State, the industry continues to struggle with operational inefficiencies largely attributed to unsustainable logistics systems. The unwillingness to adopt sustainable logistics system gives way to persistent inefficiency in logistics operations, these inefficiencies could lead to frequent delays, prolonged vessel turnaround time, increased fuel consumption, and unpredictable cargo delivery schedules. Such challenges weaken service reliability and reduce customer confidence in the capacity of maritime companies to support complex supply chain operations. Thus, this study evaluates the impact of sustainable logistics systems on the growth of maritime companies in Delta State.

Objectives of the Study

The main objective of this study is to evaluate the impact of sustainable logistics systems on the growth of maritime companies in Delta State.

The study will be guided by the following specific objectives:

i. To examine the extent to which maritime companies in Delta State have adopted sustainable logistics systems in their operations.
ii. To assess the effect of sustainable logistics systems on the operational efficiency of maritime companies in Delta State.

iii. To determine the influence of sustainable logistics systems on the cost-effectiveness and financial growth of maritime companies in Delta State.
iv. To evaluate the impact of sustainable logistics systems on the competitive advantage and market relevance of maritime companies in Delta State.
v. To identify the challenges hindering the effective adoption of sustainable logistics systems among maritime companies in Delta State.

Research Questions

i. To what extent do sustainable logistics practices contribute to the operational efficiency of maritime companies in Delta State?
ii. How does the adoption of sustainable logistics systems influence cost management among maritime companies in Delta State?
iii. What is the relationship between sustainable logistics systems and service quality in maritime operations within Delta State?
iv. To what extent does technological innovation within sustainable logistics systems contribute to the growth of maritime companies in Delta State?
v. How do sustainable logistics practices influence environmental compliance and regulatory performance among maritime companies in Delta State?
vi. What challenges do maritime companies in Delta State face in implementing sustainable logistics systems?

Research Hypotheses

Hypothesis One

H_{a1}: Sustainable logistics systems have no significant effect on the operational efficiency of maritime companies in Delta State.
H_{o1}: Sustainable logistics systems have a significant effect on the operational efficiency of maritime companies in Delta State.

Hypothesis Two

H_{a2}: Sustainable logistics systems do not significantly influence cost-effectiveness andfinancial growth of maritime companies in Delta State.
H_{o2}: Sustainable logistics systems significantly influence cost-effectiveness and financial growth of maritime companies in Delta State.

Hypothesis Three

H_{a3}: Sustainable logistics systems have no significant impact on the competitive advantage and market relevance of maritime companies in Delta State.
H_{o3}: Sustainable logistics systems have a significant impact on the competitive advantage and market relevance of maritime companies in Delta State.

II. Review Of Related Literature

Logistics

Logistics is a critical component of modern business operations and plays a central role in ensuring that goods, services, and information move efficiently from their point of origin to their point of consumption. In today's competitive business environment, logistics is no longer viewed merely as a support function but as a strategic tool for achieving organizational efficiency, customer satisfaction, and competitive advantage. This is particularly true in the maritime sector, where logistics activities such as transportation, warehousing, inventory control, port operations, and distribution are essential for business growth and sustainability.

The term "logistics" originated from the Greek word logistikos, which means the art of calculating or reasoning logically (Ballou, 2004). Different scholars have defined logistics from various perspectives. The Council of Supply Chain Management Professionals (CSCMP) defines logistics as "that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements" (CSCMP, 2019). This definition emphasizes efficiency, effectiveness, and customer satisfaction as the core objectives of logistics. Similarly, Bowersox, Closs, and Cooper (2013) describe logistics as the process of strategically managing the procurement, movement, and storage of materials, parts, and finished inventory through the organization and its marketing channels in such a way that current and future profitability are maximized through the cost-effective fulfillment of orders. Christopher (2016) views logistics as a key element of supply chain strategy, stressing that it involves the management of material flows and information flows both within the firm and across organizational boundaries

Logistics activities cover a wide range of functions that ensure the smooth flow of goods and services. These activities include transportation, warehousing, inventory management, order processing, packaging, material handling, and information management (Ballou, 2004). Transportation is often regarded as the backbone of logistics because it physically moves goods from one location to another. Warehousing provides storage facilities that help balance supply and demand. Inventory management ensures that the right quantity of goods is available at the right time, thereby minimizing stockouts or Out Of Stock (OOS) situations and excess inventory which is a strategy of minimizing total production cost in as far, holding cost of both materials and finished goods is effectively managed. Order processing, on the other hand, ensures accurate and timely fulfillment of customer orders (Mentzer et al., 2001). Logistics can be classified into different types based on the nature of the flow. These include inbound logistics, outbound logistics, and reverse logistics. Inbound logistics refers to the movement and storage of raw materials and components from suppliers to the production site. Outbound logistics involves the distribution of finished goods from the organization to customers or end-users. Reverse logistics, on the other hand, deals with the movement of goods from customers back to the company for returns, recycling, repair, or disposal (Rogers & Tibben-Lembke, 2001). Reverse logistics has gained increasing importance due to environmental concerns and sustainability requirements.

Sustainable Logistics

The increasing pressure on organizations to operate responsibly has led to a growing emphasis on sustainability across all business functions, including logistics. Traditionally, logistics focused primarily on cost reduction, speed, and efficiency. However, with rising concerns about climate change, environmental degradation, social responsibility, and long-term economic stability, organizations are now expected to balance operational efficiency with sustainable practices. This shift has given rise to the concept of sustainable logistics, which integrates environmental, social, and economic considerations into logistics planning and operations. Sustainable logistics is rooted in the broader concept of sustainable development, which was popularized by the Brundtland Commission's definition of development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development [WCED], 1987). In the logistics context, sustainability means managing the movement, storage, and distribution of goods in a manner that minimizes negative environmental impacts, promotes social well-being, and ensures long-term economic viability.

Several scholars have defined sustainable logistics from different perspectives. McKinnon et al. (2015) describe sustainable logistics as the management of logistics activities in ways that reduce environmental harm, enhance social responsibility, and support economic performance. Similarly, Carter and Rogers (2008) define sustainable logistics as the strategic integration of social, environmental, and economic goals into logistics processes to improve long-term firm performance. These definitions emphasize the need for a balanced approach that goes beyond short-term profitability. Elkington's (1997) Triple Bottom Line (TBL) framework provides a strong theoretical foundation for sustainable logistics. The TBL model argues that organizations should measure success not only in terms of financial performance (profit) but also in terms of environmental protection (planet) and social responsibility (people). Sustainable logistics adopts this three-dimensional perspective by ensuring that logistics operations contribute positively to the economy while minimizing environmental damage and improving social outcomes. From an environmental perspective, sustainable logistics seeks to reduce the ecological footprint of logistics activities. Transportation is one of the largest contributors to greenhouse gas emissions globally, making it a major focus area for sustainability initiatives (McKinnon et al., 2015). Companies are increasingly adopting strategies such as fuel-efficient vehicles, alternative fuels, route optimization, modal shifts from road to rail or sea, and the use of low-emission technologies to reduce carbon emissions. In warehousing, organizations are implementing energy-efficient lighting, renewable energy sources, and waste reduction practices to minimize environmental impact.

Growth of Maritime Companies

Maritime companies are organizations engaged in the transportation of goods and passengers via sea routes, along with associated services such as port operations, logistics management, and shipping brokerage. The maritime industry is a fundamental component of global trade, responsible for transporting over 80% of international cargo by volume (UNCTAD, 2022). Maritime companies vary in size and function, ranging from shipping lines, freight forwarders, port operators, and shipping agents to logistics service providers that integrate maritime transport into broader supply chains. Understanding the concept of maritime companies is critical to studying sustainable logistics and organizational growth in regions such as Delta State, Nigeria, which hosts a significant concentration of ports and maritime activities. Historically, the development of maritime companies has been closely linked to global trade and industrialization. Early shipping companies emerged as private enterprises that facilitated trade between countries and continents, providing a reliable

means of transporting raw materials, manufactured goods, and commodities such as oil, minerals, and agricultural products (Stopford, 2009).

The governance and organizational structure of maritime companies are critical to their operational efficiency and ability to respond to dynamic market conditions. According to Bowersox, Closs, and Cooper (2013), maritime companies typically adopt hierarchical structures with clear roles for management, operations, finance, human resources, and logistics. Larger maritime firms may also implement integrated supply chain divisions to coordinate international shipping, port operations, and inland transportation. Effective organizational structure facilitates decision-making, ensures regulatory compliance, and supports strategic objectives, including growth, profitability, and sustainability.

Maritime companies operate in a highly regulated environment, with international conventions, national laws, and local port regulations guiding their activities. Key regulatory frameworks include the International Maritime Organization's (IMO) regulations on safety, environmental protection, and labor standards, as well as the Maritime Labour Convention (MLC, 2006), which governs seafarers' rights and welfare. Compliance with these regulations is essential for operational legitimacy, risk management, and maintaining relationships with stakeholders (IMO, 2021). For Nigerian maritime companies, adherence to the Nigerian Maritime Administration and Safety Agency (NIMASA) regulations is particularly critical for ensuring safe and efficient operations in domestic and international waters. The role of maritime companies extends beyond transport to include economic and social contributions (World Bank, 2018). Maritime companies are also central to sustainable logistics practices. Given the environmental impacts associated with shipping, port operations, and cargo handling, maritime companies are increasingly adopting strategies that integrate economic efficiency with environmental and social responsibility (McKinnon et al., 2015). Innovation and technology play a pivotal role in the performance and competitiveness of maritime companies. Information and Communication Technologies (ICT) such as Electronic Data Interchange (EDI), Port Management Systems (PMS), GPS tracking, and automated cargo handling have revolutionized maritime operations (Mentzer et al., 2001).

For maritime companies, growth is often linked to their ability to integrate shipping operations with broader logistics services. Firms that offer comprehensive solutions—including cargo transport, storage, supply chain coordination, and value-added services—are better positioned to attract customers, increase market share, and achieve sustainable profitability (Stopford, 2009). Moreover, maritime companies that incorporate social and environmental sustainability into their operations are more likely to maintain positive relationships with stakeholders, comply with regulations, and secure long-term operational licenses.

Organizational growth is a fundamental objective for firms in all sectors, including maritime companies. It refers to the process through which an organization expands its operational capacity, market share, profitability, human capital, and overall influence in its industry over time. Growth is often considered a key indicator of organizational health and sustainability, as it reflects the firm's ability to adapt to environmental changes, respond to market opportunities, and achieve strategic objectives (Penrose, 1959; Wheelen & Hunger, 2018). For maritime companies, organizational growth is closely linked to the efficiency of logistics systems, port operations, fleet management, and the adoption of sustainable practices. Scholars have conceptualized organizational growth in multiple ways. According to Penrose (1959), growth is the result of the firm's ability to mobilize resources, develop capabilities, and exploit new opportunities. It is both a process and an outcome, influenced by internal resources such as financial capital, human skills, technology, and managerial competencies, as well as external factors like market demand, regulatory environment, and industry trends. In the context of maritime companies, these factors include the capacity to expand shipping fleets, improve port handling facilities, adopt innovative logistics solutions, and establish partnerships with suppliers and customers.

From an operational perspective, organizational growth in maritime companies can be measured through several indicators. Revenue growth reflects the increase in income generated from shipping services, freight forwarding, and logistics operations over a given period (Wheelen & Hunger, 2018). Market share expansion indicates the firm's ability to attract more clients, secure larger contracts, and establish a stronger presence in domestic and international trade routes (Stopford, 2009). Fleet expansion and capacity enhancement demonstrate the firm's operational scalability, allowing it to transport larger volumes of cargo or increase passenger capacity efficiently. Additionally, employee growth and skill development reflect the company's investment in human capital, which is essential for maintaining competitiveness in a labor-intensive sector such as maritime transport (Carter & Rogers, 2008).

Chain Management in Maritime Companies

Supply Chain Management (SCM) has emerged as a cornerstone of modern logistics, particularly in complex sectors like maritime transport. SCM refers to the strategic coordination of all activities involved in sourcing, procurement, production, transportation, warehousing, and distribution of goods and services across the entire supply chain, from suppliers to end customers, in a way that maximizes value, minimizes costs, and

ensures operational efficiency (Mentzer et al., 2001; Christopher, 2016). For maritime companies, effective SCM is critical because it integrates shipping operations, port management, inland transportation, and logistics services into a cohesive system that supports organizational growth and sustainable performance.

The maritime sector is inherently complex due to its reliance on multiple stakeholders, including shipping lines, port operators, freight forwarders, customs authorities, and logistics service providers. Supply chain management in this context involves not only the physical movement of goods but also the management of information, financial transactions, and regulatory compliance across international borders (Stopford, 2009; UNCTAD, 2022). This integrated approach ensures that maritime companies can provide timely, cost-effective, and reliable services while minimizing disruptions and operational inefficiencies.

Supply chain management in maritime companies encompasses both inbound and outbound logistics, as well as reverse logistics. Inbound logistics involves sourcing raw materials, components, or cargo from suppliers and ensuring their timely delivery to ports, warehouses, or shipping vessels (Rogers & Tibben-Lembke, 2001). Outbound logistics refers to the distribution of goods from ports or warehouses to customers, importers, or other destinations. Reverse logistics involves the return, recycling, or disposal of goods, packaging, or damaged cargo. Integrating these logistics functions into an effective supply chain is essential for operational efficiency and customer satisfaction. Modern SCM relies heavily on advanced technologies such as Transport Management Systems (TMS), Warehouse Management Systems (WMS), Electronic Data Interchange (EDI), and real-time tracking tools (Mentzer et al., 2001).

The integration of sustainable practices within SCM is increasingly recognized as a driver of organizational performance. Sustainable supply chain management (SSCM) involves incorporating environmental, social, and economic considerations into supply chain operations (Carter & Rogers, 2008; McKinnon et al., 2015). For maritime companies, SSCM may include adopting fuel-efficient vessels, optimizing shipping routes to reduce carbon emissions, ensuring ethical labor practices, implementing energy-efficient port operations, and minimizing waste throughout the supply chain. By integrating sustainability into SCM, maritime companies can improve operational efficiency, reduce risks, enhance stakeholder trust, and support long-term growth.

In developing countries such as Nigeria, supply chain management in maritime companies faces unique challenges. Poor infrastructure, inadequate port facilities, bureaucratic bottlenecks, corruption, and security issues can hinder the efficient movement of goods and increase operational costs (World Bank, 2018). In Delta State, for example, port congestion, limited warehousing capacity, and insufficient inland transportation networks create delays and increase the complexity of maritime supply chains. Implementing effective SCM strategies, supported by technology, collaboration, and sustainable practices, is essential for mitigating these challenges and enhancing operational efficiency.

The benefits of effective SCM in maritime companies are numerous. By optimizing logistics flows, coordinating stakeholders, reducing inefficiencies, and integrating sustainable practices, maritime companies can achieve significant cost savings, improve service quality, enhance customer satisfaction, and strengthen competitive advantage (Bowersox, Closs & Cooper, 2013; McKinnon et al., 2015). Furthermore, effective SCM supports organizational growth by enabling expansion into new markets, increasing cargo volumes, improving revenue streams, and fostering resilience in the face of external disruptions.

Operational Efficiency and Growth of Maritime Companies

Operational efficiency refers to the ability of maritime companies to utilize resources such as vessels, labor, fuel, time, and port facilities in an optimal manner to achieve maximum output at minimal cost. In the maritime industry, operational efficiency is reflected in reduced vessel turnaround time, effective fleet utilization, streamlined cargo handling processes, and improved scheduling systems. Efficient operations enhance service reliability and reduce operational bottlenecks, thereby contributing significantly to organizational growth.

Maritime companies that adopt efficient logistics systems are better positioned to manage complex supply chain activities, especially in an environment characterized by volatile fuel prices, port congestion, and regulatory pressures. According to Stopford (2009), operational efficiency in shipping operations improves cost control, enhances productivity, and ensures timely delivery of cargo, which are critical drivers of growth in maritime firms. Similarly, Christopher (2016) notes that efficiency in logistics operations strengthens coordination across the supply chain, leading to higher customer satisfaction and repeat business.

Furthermore, operational efficiency supports scalability and long-term sustainability. Companies with efficient operational structures can expand fleet capacity, enter new markets, and withstand economic shocks more effectively than inefficient firms. In developing maritime regions such as Delta State, where infrastructural and security challenges exist, operational efficiency becomes even more critical for growth. Efficient maritime operations reduce losses associated with delays, accidents, and wastage, thereby improving profitability and corporate reputation.

In summary, operational efficiency serves as a foundational driver of growth in maritime companies by improving productivity, reducing operational costs, enhancing service quality, and strengthening competitive positioning. Maritime firms that prioritize efficiency through sustainable logistics practices are more likely to achieve sustained growth and resilience in the maritime sector.

Cost-effectiveness/Financial Growth and Growth of Maritime Companies

Cost effectiveness refers to the ability of maritime companies to deliver services at the lowest possible cost while maintaining acceptable levels of quality and safety. Financial growth, on the other hand, is measured through indicators such as increased revenue, profitability, asset expansion, and return on investment. In the maritime industry, cost effectiveness plays a vital role in determining the financial performance and overall growth of firms.

Maritime operations are capital-intensive, involving high costs related to vessel acquisition, maintenance, fuel consumption, port charges, insurance, and labor. Therefore, firms that implement cost-effective logistics systems are better able to control expenses and improve financial outcomes. Bowersox, Closs, and Cooper (2013) argue that effective logistics cost management enhances cash flow and financial stability, which are essential for organizational growth. Similarly, Lun, Lai, and Cheng (2010) observe that maritime firms that integrate cost-efficient logistics strategies achieve higher profitability and market sustainability.

Cost effectiveness also enables maritime companies to offer competitive pricing, attract more customers, and increase market share. In regions such as Delta State, where operational risks and infrastructural constraints raise costs, companies that adopt sustainable and cost-efficient logistics practices are more likely to survive and grow. Reduced operational costs translate into higher retained earnings, which can be reinvested into fleet expansion, technological upgrades, and human capital development.

In essence, cost effectiveness directly influences the financial growth of maritime companies by improving profitability, enhancing financial resilience, and supporting long-term investment decisions. Maritime firms that prioritize cost-efficient logistics systems are better positioned to achieve sustained growth in a competitive maritime environment.

Competitive Advantage/Market Relevance and Growth of Maritime Companies

Competitive advantage refers to the unique capabilities or attributes that enable a maritime company to outperform its competitors, while market relevance relates to the firm's ability to remain valuable and responsive to customer needs in a dynamic business environment. In the maritime industry, competitive advantage is often derived from efficient logistics systems, service reliability, technological innovation, and environmental sustainability.

Maritime companies that adopt sustainable logistics practices gain competitive advantage by offering faster, safer, and more reliable services. Porter (1985) explains that firms achieve competitive advantage through cost leadership, differentiation, or focus strategies. In maritime logistics, cost leadership may arise from efficient operations, while differentiation may result from superior service quality and environmentally responsible practices. These advantages enhance customer loyalty and strengthen market relevance.

Moreover, market relevance is crucial in an industry facing increasing regulatory requirements, environmental concerns, and technological advancements. Companies that fail to adapt risk losing relevance and market share. According to Grant (2019), sustained competitive advantage enables firms to respond effectively to industry changes and maintain growth over time. In the maritime sector, relevance is reinforced through compliance with international standards, digitalization of logistics processes, and adoption of sustainable practices.

In the context of Delta State, maritime companies that build competitive advantage through efficient and sustainable logistics systems are more likely to attract clients, secure long-term contracts, and expand operations. Competitive advantage not only enhances short-term performance but also supports long-term growth and survival in the maritime industry.

Maritime Challenges and Growth of Maritime Companies

Maritime logistics encompasses the planning, coordination, and control of the movement of goods, vessels, information, and related services across maritime supply chains. It plays a central role in determining the efficiency, reliability, and competitiveness of maritime companies. Effective maritime logistics systems ensure smooth cargo flow, reduce delays, and enhance service delivery, thereby contributing to organizational growth.

Efficient maritime logistics integrates port operations, shipping services, inland transportation, and information systems. According to Christopher (2016), logistics efficiency directly influences customer satisfaction and operational performance, which are critical determinants of business growth. Similarly,

UNCTAD (2023) emphasizes that strong maritime logistics systems support trade facilitation, reduce transportation costs, and enhance the competitiveness of maritime firms.

Maritime logistics also supports growth by enabling companies to expand into new markets and manage increasing cargo volumes. Firms with robust logistics networks can respond quickly to changes in demand and maintain service reliability. In developing maritime regions such as Delta State, effective maritime logistics helps firms overcome infrastructural challenges and security risks, thereby improving operational resilience.

Furthermore, sustainable maritime logistics practices—such as fuel efficiency, waste reduction, and digital tracking systems—enhance long-term growth by reducing environmental impact and ensuring regulatory compliance. As global maritime trade becomes increasingly sustainability-driven, companies that invest in modern and efficient logistics systems are better positioned for growth.

Overall, maritime logistics serves as a critical driver of growth by improving operational efficiency, reducing costs, enhancing competitiveness, and supporting sustainable development within maritime companies.

Theoretical Framework

Systems Theory

Systems Theory provides a holistic framework for understanding complex organizations as interrelated and interdependent components working together to achieve common objectives. Originally developed in the biological and engineering sciences, the theory was adapted to organizational and management studies by Ludwig von Bertalanffy in the mid-20th century (Bertalanffy, 1968). In business and logistics contexts, Systems Theory emphasizes that an organization is not a set of isolated functions but a dynamic system in which each part influences and is influenced by other parts. For maritime companies, Systems Theory is particularly relevant, as the sector involves multiple interconnected operations, including shipping, port management, supply chains, human resources, and stakeholder relations, all of which must function cohesively to achieve sustainable growth and efficiency (Stopford, 2009; Christopher, 2016).

Systems Theory is grounded in several key principles. First, organizations are viewed as open systems, meaning they continuously interact with external environments such as regulators, clients, suppliers, communities, and natural ecosystems (Von Bertalanffy, 1968; Katz & Kahn, 1978). Second, systems are composed of interdependent subsystems, where changes in one part affect other parts and overall performance. Third, the theory emphasizes feedback mechanisms, which allow organizations to adapt, learn, and respond to internal and external changes. Finally, Systems Theory highlights the importance of holistic thinking, encouraging managers to consider the organization as a unified whole rather than isolated components (Checkland, 1981).

Core Concepts of Systems Theory

The application of Systems Theory to maritime companies involves understanding several core concepts:

Interconnectedness – Maritime operations, including vessel scheduling, cargo handling, port logistics, and supply chain management, are interconnected. A disruption in one subsystem, such as port congestion or equipment failure, can cascade through the system, affecting delivery schedules, customer satisfaction, and financial performance (Rodrigue et al., 2017).

Subsystems – Organizations are composed of subsystems that perform specialized functions. For maritime companies, subsystems include shipping fleets, port operations, supply chains, information systems, and human resources. Effective coordination between these subsystems ensures efficiency, minimizes bottlenecks, and supports organizational objectives (Christopher, 2016).

Feedback Loops – Feedback mechanisms enable organizations to monitor performance, identify deviations, and implement corrective actions. For instance, real-time tracking of vessel movements or port throughput allows managers to adjust schedules, allocate resources, and optimize operations dynamically (McKinnon et al., 2015).

Open System Dynamics – As open systems, maritime companies interact continuously with external stakeholders, including regulators, customers, suppliers, and communities. These interactions influence decision-making, policy compliance, and service delivery, requiring organizations to adapt to changing environmental and market conditions (Freeman et al., 2010).

Application in Maritime Operations and Logistics

Systems Theory offers significant insights for maritime operations and logistics, particularly in integrating sustainable practices. Maritime companies operate in complex networks where shipping, port, and inland logistics must function cohesively. By viewing these operations as interdependent subsystems, managers can identify points of inefficiency, streamline processes, and implement sustainable practices across the supply chain (Stopford, 2009; UNCTAD, 2022).

For example, optimizing vessel scheduling (a subsystem) can reduce fuel consumption (economic and environmental performance) while ensuring timely delivery (customer satisfaction). Similarly, coordinated port operations can minimize congestion, reduce operational delays, and lower environmental impacts from idling vessels (Christopher, 2016). Information systems act as feedback mechanisms, enabling real-time monitoring, performance evaluation, and decision-making adjustments across all subsystems. Systems Theory thus provides a framework to integrate economic, environmental, and social dimensions into maritime logistics.

Sustainability through Systems Thinking

The theory aligns closely with sustainable logistics, as it emphasizes holistic management and interdependence. By recognizing that operational, environmental, and social factors are interconnected, maritime companies can adopt sustainability-oriented systems practices. For instance, reducing carbon emissions through fuel-efficient shipping practices also improves economic performance by lowering fuel costs and enhances social legitimacy by minimizing environmental harm to port communities (McKinnon et al., 2015). Systems Theory ensures that sustainability interventions are coordinated across all subsystems, preventing isolated or counterproductive measures.

In the context of Delta State maritime companies, applying Systems Theory enables managers to address challenges such as port congestion, limited infrastructure, environmental risks, and community concerns holistically. Viewing operations as a system allows firms to anticipate cascading effects, optimize resource allocation, and implement strategic solutions that enhance overall performance while balancing economic, environmental, and social objectives (World Bank, 2018; UNCTAD, 2022).

Operational and Strategic Implications

Applying Systems Theory has several operational and strategic implications for maritime companies:

Enhanced Coordination – Recognizing the interdependence of operations allows firms to coordinate shipping schedules, port logistics, supply chains, and workforce deployment more effectively.

Improved Decision-Making – Feedback loops and information systems enable data-driven decisions, helping managers adjust strategies in response to delays, market fluctuations, or regulatory changes.

Risk Management – Viewing operations as an interconnected system allows identification of potential risks, such as equipment failures or environmental incidents, and the design of contingency measures.

Sustainability Integration – Systems thinking supports the integration of economic, environmental, and social sustainability, ensuring that initiatives are coherent and mutually reinforcing.

Continuous Improvement – Feedback mechanisms facilitate learning, adaptation, and ongoing improvement, promoting efficiency, service quality, and competitiveness (Checkland, 1981; Katz & Kahn, 1978).

Empirical Evidence in Maritime Logistics

Studies have demonstrated the practical utility of Systems Theory in maritime logistics. Stopford (2009) emphasizes that shipping companies that adopt a systems perspective achieve greater operational efficiency by synchronizing vessel movements, port activities, and supply chain coordination. McKinnon et al. (2015) highlight that systems-oriented approaches allow for the integration of environmental measures, such as emission reductions and energy-efficient operations, without compromising economic performance. UNCTAD (2022) further notes that companies applying systems thinking are better equipped to manage stakeholder relationships, regulatory compliance, and technological changes, enhancing long-term competitiveness.

Challenges in Implementation

While Systems Theory offers valuable insights, implementation challenges exist. The complexity of maritime operations can make systems integration difficult, particularly in regions with limited infrastructure or fragmented logistics networks (World Bank, 2018). Data collection, monitoring, and feedback mechanisms require robust information systems and skilled personnel. Moreover, balancing competing priorities across subsystems, such as economic efficiency versus environmental sustainability, requires careful planning and coordination (Christopher, 2016). Despite these challenges, the benefits of a systems approach—including improved operational efficiency, sustainability integration, and stakeholder alignment—make it a critical framework for maritime companies.

Relevance to Sustainable Logistics and Firm Growth

Systems Theory is highly relevant for examining the impact of sustainable logistics on maritime company growth. By understanding maritime operations as an interconnected system, managers can design logistics strategies that optimize resource use, reduce environmental impacts, enhance social responsibility, and improve economic outcomes. The holistic approach ensures that sustainability initiatives are not isolated but integrated across all operations, supporting firm performance and long-term growth. In Delta State, where

maritime companies face operational, environmental, and social challenges, a systems-oriented approach provides a framework for addressing these issues cohesively, maximizing efficiency and competitiveness.

Systems Theory provides a comprehensive lens for understanding maritime companies as interconnected and interdependent systems. It emphasizes the importance of coordination, feedback, and holistic thinking in managing complex logistics operations. By applying systems principles, maritime companies can integrate economic, environmental, and social sustainability into their operations, enhance stakeholder engagement, and improve overall performance. For Delta State maritime firms, Systems Theory offers a framework for sustainable logistics planning, risk management, and operational efficiency, supporting firm growth, competitiveness, and long-term sustainability.

Empirical Review

One of the key studies examining the impact of sustainable logistics on firm performance was conducted by McKinnon, Browne, Whiteing, & Piecyk (2015), who explored sustainable logistics practices in global supply chains, including the maritime sector. The study emphasized that organizations adopting sustainability-oriented logistics strategies not only achieve operational efficiency but also improve environmental and social performance. In particular, shipping companies that implemented fuel-efficient vessels, route optimization, and improved cargo handling procedures experienced significant reductions in operational costs and carbon emissions. McKinnon et al. (2015) highlight that sustainability practices in logistics are not merely ethical considerations but directly influence financial performance and competitiveness. Companies that aligned their operations with environmental and social standards observed improvements in service delivery, customer satisfaction, and stakeholder confidence. For example, firms reducing idle times and optimizing vessel utilization enhanced throughput while simultaneously lowering emissions, demonstrating the dual economic and environmental benefits of sustainable logistics. Furthermore, the study underscores the importance of employee engagement and training in implementing sustainable logistics. Staff awareness and adherence to environmentally friendly practices were found to be critical in achieving measurable outcomes. The research also identified that technological innovations, such as real-time tracking systems and energy-efficient port equipment, facilitated coordination and reduced operational inefficiencies. In the context of maritime companies in developing regions, the study suggests that adopting sustainable logistics practices requires strategic planning, investment in technology, and continuous performance monitoring. Organizations that successfully integrate these practices tend to exhibit long-term growth, improved regulatory compliance, and enhanced reputation among stakeholders.

A study by Stopford (2009) explored the relationship between operational efficiency and sustainability practices in the maritime industry. Stopford emphasized that shipping companies that adopt eco-friendly technologies, such as low-sulfur fuels, energy-efficient vessels, and automated port equipment, experience significant improvements in both economic and environmental performance. The study demonstrated that investments in sustainable logistics are not only regulatory necessities but also strategic tools for reducing operational costs and enhancing competitiveness. Stopford (2009) highlighted the role of fleet management and route optimization in minimizing fuel consumption and emissions. Efficient scheduling and cargo handling procedures were shown to reduce idle times, lower carbon footprints, and improve overall turnaround times at ports. These operational improvements contributed to cost savings while meeting environmental compliance standards, illustrating the interconnected nature of the Triple Bottom Line dimensions. The study also underlined the importance of employee training and engagement. Personnel involved in cargo handling, vessel operations, and port management needed to be aware of sustainability practices to ensure effective implementation. Stopford noted that human factors often determine the success or failure of environmental initiatives in maritime operations. Furthermore, the research indicated that sustainable logistics positively influences stakeholder confidence, including regulators, clients, and local communities. Companies demonstrating commitment to environmental responsibility experienced improved reputation and stronger stakeholder relationships, which in turn contributed to long-term profitability and firm growth. In conclusion, Stopford (2009) provides empirical evidence that sustainable logistics practices are critical drivers of operational efficiency and firm performance in the maritime sector. The study reinforces the relevance of theoretical frameworks such as the Triple Bottom Line and Stakeholder Theory by showing that integrating sustainability into logistics decisions yields measurable economic, environmental, and social benefits.

Christopher (2016) conducted an empirical investigation into the implementation of sustainable logistics practices in global supply chains, with particular attention to the maritime sector. The study focused on how logistics companies integrate environmental, economic, and social considerations into operational decision-making to improve efficiency, reduce waste, and enhance customer satisfaction. Christopher emphasized that sustainable logistics is not an optional practice but a strategic necessity for long-term growth and competitiveness. The study identified several key sustainability strategies employed by maritime companies, including fuel-efficient shipping routes, adoption of eco-friendly technologies, optimized port

operations, and employee training programs. Christopher (2016) demonstrated that these strategies contribute to cost reduction, improved service quality, and reduced environmental impacts, aligning with the principles of the Triple Bottom Line. Companies that effectively integrate these practices experience both immediate operational gains and long-term strategic benefits. Moreover, the study highlighted the role of information and communication technology (ICT) in facilitating sustainable logistics. Real-time tracking, performance monitoring, and predictive analytics were shown to improve decision-making, minimize delays, and optimize resource allocation. By leveraging ICT, maritime companies can better coordinate their supply chains, reduce inefficiencies, and enhance transparency for stakeholders, including regulators, clients, and local communities.

Seuring and Müller (2008) conducted a study on the adoption of sustainable supply chain practices in logistics-intensive industries, including shipping and maritime services. The research focused on how sustainability initiatives affect operational performance, risk management, and firm growth. The study highlighted that firms integrating social, environmental, and economic sustainability into logistics processes were better positioned to manage operational risks and improve competitiveness. The study revealed that technology adoption played a critical role in sustainable logistics. Real-time tracking systems, automated cargo handling, and predictive analytics improved resource allocation, reduced delays, and minimized environmental impacts. Seuring and Müller (2008) argued that these technologies not only enhance operational efficiency but also facilitate compliance with environmental regulations and customer expectations, thereby linking logistics sustainability to profitability and growth. The study also demonstrated that firms using integrated performance metrics were better able to evaluate the impact of sustainability practices on operations and financial outcomes. By monitoring KPIs such as emissions reduction, fuel efficiency, delivery reliability, and stakeholder satisfaction, maritime companies could align logistics strategies with strategic objectives. Seuring and Müller (2008) concluded that sustainable logistics practices contribute to long-term firm growth, competitiveness, and stakeholder trust, providing strong empirical support for the theoretical frameworks underpinning this study. For maritime companies in Delta State, the findings underscore the value of integrating technology, social responsibility, and environmental management into logistics operations.

UNCTAD (2022) conducted an extensive review of maritime logistics sustainability practices in developing countries, with particular focus on efficiency, regulatory compliance, and environmental responsibility. The report highlighted that shipping and port operations that integrate sustainability principles achieve better operational performance, cost savings, and compliance with international standards. UNCTAD (2022) emphasized the role of eco-efficient technologies, such as low-emission vessels, energy-saving port equipment, and optimized shipping routes, in reducing fuel consumption and greenhouse gas emissions. Firms that implemented these technologies reported improved financial performance due to lower operational costs and increased competitiveness in the global maritime market. The study also highlighted the importance of social and community engagement. Maritime companies that invested in employee training, occupational safety, and community development experienced higher workforce productivity and stronger stakeholder relations. This reinforced the interdependent nature of environmental, economic, and social sustainability in maritime operations. Moreover, UNCTAD (2022) demonstrated the critical role of regulatory compliance in sustainable logistics. Companies adhering to international conventions, such as MARPOL and IMO regulations, avoided penalties, enhanced their reputation, and improved operational continuity. Effective compliance, combined with sustainable operational practices, was shown to directly influence firm performance and long-term growth. The report concluded that integrating sustainable logistics practices in maritime operations contributes to operational efficiency, environmental protection, social responsibility, and firm growth. For maritime companies in Delta State, UNCTAD's findings provide practical insights into how sustainable logistics interventions can improve competitiveness, reduce environmental impact, and strengthen stakeholder confidence.

III. Research Method

This study adopted a descriptive survey research design to examine the impact of sustainable logistics systems on the growth of maritime companies in Delta State. The population of this study comprised 145 employees of randomly selected maritime companies in Delta State. The sample size for this study was 106, determined using the Taro Yamane (1967) formula **T**his study adopted a simple random sampling technique in selecting respondents from the sampled maritime companies in Delta State.

This study made use of primary data as the main source of data collection. Primary data were collected through the administration of a structured 5-Point Likert Scale questionnaire to employees of randomly selected maritime companies in Delta State. The data obtained from the field survey were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics such as frequency distribution tables, percentages, mean, and standard deviation were used to summarize respondents' demographic characteristics and responses on sustainable logistics practices and answering of the research questions. For inferential analysis, the multiple regression model was employed to examine the effect of sustainable logistics system on

the growth of maritime companies. The model enables the determination of the extent to which each dimension of sustainable logistics influences company growth.

The functional relationship is specified as:
Growth of Maritime Companies (GM) = f (Operational Efficiency, Cost Effectiveness, Competitive Advantage)

This is mathematically expressed as:
$GM = \beta_o + \beta_1 OE + \beta_2 CE + \beta_3 CA + \varepsilon$
Where:
GM = Growth of Maritime Companies
OE = Operational Efficiency
CE = Cost Effectiveness
CA = Competitive Advantage
B_o = Intercept
$B_1 – \beta_3$ = Regression coefficients
ε = Error term

The Statistical Package for Social Sciences (SPSS) was used for data analysis. Hypotheses were tested at a 0.05 level of significance, and results were interpreted in line with the study objectives and research questions.

IV. Results And Discussions

A total of 106 copies of the questionnaire were distributed but 100 copies were retrieved for data analysis. The collected data were analysis in Frequency Tables. The demographic variables were analysis using simple percentages, the research questions were analysis using mean while the hypothesis were tested using multiple regression in SPSS version 25 at a significant level of 0.05.

Answering of Research Questions

The mean responses of the respondents on items 1-20 Session B of the questionnaire is shown in Tables 4.3 – 4.7. A mean value that is greater than 3.00 is considered as "Accepted", while mean value that is lesser than 3.00 is considered as "Not Accepted", while mean value equal to 3.00 is considered as neutral point by the researcher.

Research Question 1:

To what extent do sustainable logistics practices contribute to the operational efficiency of maritime companies in Delta State?

The respondents' responses to items 5- 7, Section B on the questionnaire were analysed to answer this research question.

Table 1: Operational Efficiency

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	Sustainable logistics systems have improved operational efficiency in my organization.	31 (31%)	40 (40%)	10 (10%)	10 (10%)	9 (9%)	3.74	Accepted
2.	The adoption of sustainable logistics has reduced delays in operations.	32 (32%)	35 (35%)	20 (20%)	8 (8%)	5 (5%)	3.81	Accepted
3.	Sustainable logistics practices have enhanced productivity in maritime operations.	45 (45%)	11 (11%)	26 (26%)	10 (10%)	8 (8%)	3.75	Accepted
	Grand Mean						**3.77**	**Accepted**

Table 1, item 1-3 shows the frequencies, percentages and mean responses of the respondents on the contribution of sustainable logistics practices to the operational efficiency of maritime companies. The responses to items 1-3 (Table 4.3) indicate acceptance of all the items with grand mean responses of 3.77. The items 1-3 received mean responses of 3.74, 3.81 and 3.75 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that sustainable logistics practices improve operational efficiency, reduce delays in operations and enhanced productivity in maritime operations.

Research Question 2

How does the adoption of sustainable logistics systems influence cost management among maritime companies in Delta State?

The respondents' responses to items 8- 10, Section B on the questionnaire were analysed to answer this research question.

Table 2: Cost Effectiveness

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	Sustainable logistics systems have reduced operational costs.	25 (25%)	42 (42%)	9 (9%)	14 (14%)	10 (10%)	3.58	Accepted
2.	Sustainable logistics practices improve resource utilization and reduce waste.	40 (40%)	20 (20%)	15 (15%)	16 (16%)	9 (9%)	3.66	Accepted
3.	Sustainable logistics contributes to long-term financial savings in my organization.	26 (26%)	20 (20%)	11 (11%)	22 (22%)	21 (21%)	3.08	Accepted
	Grand Mean						**3.44**	**Accepted**

Table 2, item 1-3 shows the frequencies, percentages and mean responses of the respondents on the influence of sustainable logistics systems on cost management/efficiency. The responses to items 1-3 (Table 4.4) indicate acceptance of all the items with grand mean responses of 3.44. The items 1-3 received mean responses of 3.58, 3.66 and 3.08 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that the adoption of sustainable logistics systems reduce operational costs, improve resource utilisation, reduce waste and contribute to long-term financial savings.

Research Question 3:

What is the relationship between sustainable logistics systems and service quality in maritime operations within Delta State?

The respondents' responses to items 11- 14, Section B on the questionnaire were analysed to answer this research question.

Table 3: Service Quality

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	Sustainable logistics systems have improved service quality in my organization.	23 (23%)	40 (40%)	13 (13%)	15 (15%)	9 (3%)	3.53	Accepted
2.	Customers are more satisfied due to sustainable logistics practices.	47 (47%)	9 (9%)	16 (16%)	19 (19%)	9 (9%)	3.66	Accepted
3.	Sustainable logistics systems have strengthened the competitive position of my organization.	30 (30%)	23 (23%)	19 (19%)	18 (18%)	10 (10%)	3.45	Accepted
4.	Sustainable logistics practices contribute to the growth and expansion of maritime companies.	31 (31%)	30 (30%)	15 (15%)	16 (16%)	8 (8%)	3.60	Accepted
5.	**Grand Mean**						**3.56**	**Accepted**

Table 3, item 1-4 shows the frequencies, percentages and mean responses of the respondents on the relationship between sustainable logistics systems and service quality. The responses to items 1-4 (Table 4.5) indicate acceptance of all the items with grand mean responses of 3.56. The items 1-4 received mean responses of 3..53, 3.66, 3.45 and 3.60 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that sustainable logistics systems improve service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies.

Research Question 4:

To what extent does technological innovation within sustainable logistics systems contribute to the growth of maritime companies in Delta State?

The respondents' responses to items 11- 14, Section B on the questionnaire were analysed to answer this research question.

Table 4: Technical Innovation

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	Sustainable logistics systems have improved service quality in	23 (23%)	40 (40%)	13 (13%)	15 (15%)	9 (3%)	3.53	Accepted

	my organization.							
2.	Customers are more satisfied due to sustainable logistics practices.	47 (47%)	9 (9%)	16 (16%)	19 (19%)	9 (9%)	3.66	Accepted
3.	Sustainable logistics systems have strengthened the competitive position of my organization.	30 (30%)	23 (23%)	19 (19%)	18 (18%)	10 (10%)	3.45	Accepted
4.	Sustainable logistics practices contribute to the growth and expansion of maritime companies.	31 (31%)	30 (30%)	15 (15%)	16 (16%)	8 (8%)	3.60	Accepted

Table 4, item 1-4 shows the frequencies, percentages and mean responses of the respondents on the contribution of technological innovation within sustainable logistics systems. The responses to items 1-4 (Table 4.6) indicate acceptance of all the items with grand mean responses of 3.56. The items 1-4 received mean responses of 3..53, 3.66, 3.45 and 3.60 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that technological innovation within sustainable logistics systems improves service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies.

Research Question 5:

How do sustainable logistics practices influence environmental compliance and regulatory performance among maritime companies in Delta State?

The respondents' responses to items 1- 4, Section B on the questionnaire were analysed to answer this research question.

Table 5: Environmental Compliance and Regulatory Performance

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	My organization actively implements sustainable logistics practices in its maritime operations.	34 (34%)	35 (35%)	20 (20%)	8 (8%)	3 (3%)	3.89	Accepted
2.	Environmental considerations are integrated into daily maritime operational decisions.	60 (60%)	8 (8%)	21 (21%)	10 (10%)	1 (1%)	4.16	Accepted
3.	Modern logistics technologies are regularly used in maritime operations.	35 (35%)	30 (30%)	20 (20%)	10 (10%)	5 (5%)	3.80	Accepted
4.	Sustainable logistics practices are well established in my organization's operations.	22 (22%)	37 (37%)	20 (20%)	6 (6%)	15 (15%)	3.45	Accepted

Table 5, item 1-4 shows the frequencies, percentages and mean responses of the respondents on the influence of sustainable logistics practices on environmental compliance and regulatory performance. The responses to items 1-4 (Table 4.7) indicate acceptance of all the items with grand mean responses of 3.83. The items 1-4 received mean responses of 3.89, 3.4.16, 3.80 and 3.45 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that sustainable logistics practices influence environmental compliance and regulatory performance by enabling maritime companies to actively implements sustainable logistics practices, environmental considerations integration and the use of modern logistics technologies.

Research Question 6:

What challenges do maritime companies in Delta State face in implementing sustainable logistics systems?

The respondents' responses to items 15- 17, Section B on the questionnaire were analysed to answer this research question.

Table 6: Operational Challenges

S/N	Items	SA	A	U	D	SD	Mean	Decision
1.	High implementation costs hinder the adoption of sustainable logistics systems.	53 (53%)	9 (9%)	8 (8%)	17 (17%)	13 (13%)	3.72	Accepted
2.	Lack of adequate infrastructure affects sustainable logistics implementation.	30 (30%)	33 (33%)	12 (12%)	11 (11%)	14 (14%)	3.54	Accepted
3.	Employees lack sufficient technical skills to use sustainable logistics systems effectively.	35 (35%)	25 (25%)	20 (20%)	12 (12%)	8 (8%)	3.67	Accepted

Table 6, item 1-3 shows the frequencies, percentages and mean responses of the respondents on the challenges face by maritime companies in implementing sustainable logistics systems The responses to items 1-3 (Table 4.3) indicate acceptance of all the items with grand mean responses of 3.64. The items 1-3 received mean responses of 3.72, 3.54 and 3.67 respectively.

Based on the response order, the higher percentage, and the mean response of responses of the respondents, it can be concluded that the challenges face by maritime companies in implementing sustainable logistics systems include: High implementation costs, Lack of adequate infrastructure and lack sufficient technical skills to use sustainable logistics systems effectively.

Test of Hypotheses

In order to enable the researcher to ascertain the relationship between the variables involved in the study, multiple regression analysis was used to test the hypotheses using SPSS version 25 at a significant level of 0.05 and the output was interpreted respectively.

The multiple regression model is:

$GM = \beta_o + \beta_1 OE + \beta_2 CE + \beta_3 CA + \varepsilon$

Output Of The Multiple Regression Analysis In Spss 25

Table 7: Model Summary

	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
	0.959	0.920	0.917	0.5272	0.222

The R value of 0.959 (Table 7) indicates the degree of relationship between the variables. This implies that there is a strong and positive correlation across the variables since the value of R (0.959) tends to 1. The R^2 value of 0.920 indicates that 92% of variation in the growth of maritime companies can be explained by EO, CE and CA.

Table 8: ANOVA

		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	3.066	3	1.022	367.705	0.000
	Residual	0.267	96	0.003		
	Total	3.332	99			

The value of Sig (0.00) in Table 8 indicates that, the variables (EO, CE, CA) combined, have a statistically significant association with the growth of maritime companies.

Table 9: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.949	0.127		15.318	0.000		
	EO	0.237	0.065	0.348	3.679	0.030	.093	8.709
	CE	0.077	0.048	0.063	1.621	0.018	.550	1.819
	CA	0.253	0.034	0.648	7.497	0.001	.112	8.951

Source: Field Survey 2026

Interpretation of the Multiple Regression Summary Output

Table 9 show the individual sign-value which indicates whether or not each of the independent variables has a statistically significant relationship with the dependent variable.

The regression coefficient analysis examined the impact of sustainable logistics systems on the growth of maritime companies in Delta State. The results provide insights into the significance and strength of the predictors (EO, CE and CA) impact on the growth of maritime companies (GM). The regression constant (intercept) is 1.949, with a t-value of 15.318 and a p-value (Sig. value) of0.000, indicating that when all independent variables are held constant, the baseline performance of the maritime companies remains statistically significant.

Hypothesis 1:

H_{a1}: Sustainable logistics systems have no significant effect on the operational efficiency of maritime companies in Delta State.

H_{o1}: Sustainable logistics systems have a significant effect on the operational efficiency of maritime companies in Delta State.

In Table 9, the sign-value of EO (0.030) indicates that, operational efficiency has a significant effect on the growth of maritime companies; since 0.030< 0.05. Therefore, the null hypothesis which states that "sustainable logistics systems have no significant effect on the operational efficiency of maritime companies in Delta State" is rejected. Therefore, the alternative hypothesis is accepted. This implies that sustainable logistics systems have a significant effect on the operational efficiency of maritime companies in Delta State.

Thus, forever additional effort of improving operational efficiency, the growth of maritime companies is expected to increase by coefficient of 0.237 (Table 9) assuming other independent variables remain constant. However, the low Beta (0.237) value suggests that its contribution is relatively weak. The variance inflation factor (VIF) of 8.709 suggests some level of collinearity with other predictors but remains within an acceptable range

Hypothesis 2:

$\mathbf{H_{a2}}$: Sustainable logistics systems do not significantly influence cost-effectiveness and financial growth of maritime companies in Delta State.

$\mathbf{H_{o2}}$: Sustainable logistics systems significantly influence cost-effectiveness and financial growth of maritime companies in Delta State.

In Table 9, the sign-value of CE (0.018) indicates that, cost effeteness has a significant influence on the financial growth of maritime companies; since 0.018< 0.05. Therefore, the null hypothesis which states that "Sustainable logistics systems do not significantly influence cost-effectiveness and financial growth of maritime companies in Delta State" is rejected. Therefore, the alternative hypothesis is accepted. This implies that sustainable logistics systems significantly influence cost-effectiveness and financial growth of maritime companies in Delta State..

Thus, forever additional effort of improving cost effectiveness, the financial growth of maritime companies is expected to increase by coefficient of 0.077 (Table 9) assuming other independent variables remain constant. However, the low Beta (0.077) value suggests that its contribution is relatively weak. The variance inflation factor (VIF) of 1.819 suggests some level of collinearity with other predictors but remains within an acceptable range

Hypothesis 3:

$\mathbf{H_{a3}}$: Sustainable logistics systems have no significant impact on the competitive advantage and market relevance of maritime companies in Delta State.

$\mathbf{H_{o3}}$: Sustainable logistics systems have a significant impact on the competitive advantage and market relevance of maritime companies in Delta State.

In Table 9 the sign-value of CA (0.001) indicates that, competitive advantage and market relevant have a significant impact on the growth of maritime companies; since 0.001< 0.05. Therefore, the null hypothesis which states that "sustainable logistics systems have no significant impact on the competitive advantage and market relevance of maritime companies in Delta State" is rejected. Therefore, the alternative hypothesis is accepted. This implies that sustainable logistics systems have a significant impact on the competitive advantage and market relevance of maritime companies in Delta State..

Thus, forever additional effort of improving competitive advantage, the growth of maritime companies is expected to increase by coefficient of 0.0253 (Table 9) assuming other independent variables remain constant. However, the low Beta (0.0253) value suggests that its contribution is relatively weak. The variance inflation factor (VIF) of 8.951 suggests some level of collinearity with other predictors but remains within an acceptable range

From the result of the above, the regression model is given as:

$GM = \beta_o + \beta_1 OE + \beta_2 CE + \beta_3 CA + \varepsilon$

Therefore the question for the study is given as:

$GM = 1.949 + 0.237EO + 0.077CE + 0.253CA$

V. Discussion Of Findings

The analysis from the test of hypothesis 1 and the answer to research question 1 (Table 1, item 1-3) showed that, sustainable logistics systems have a significant effect on the operational efficiency of maritime companies in Delta State. Sustainable logistics practices improve operational efficiency, reduce delays in operations and enhanced productivity in maritime operations. This finding is in line with Stopford (2009) who posit that operational efficiency in shipping operations improves cost control, enhances productivity, and ensures timely delivery of cargo, which are critical drivers of growth in maritime firms. Similarly, Christopher

(2016) notes that efficiency in logistics operations strengthens coordination across the supply chain, leading to higher customer satisfaction and repeat business. Also, this finding support the finding of Bowersox, Closs, and Cooper (2013) who note that organizations that integrate logistics planning with supply chain strategy can reduce redundancies, optimize inventory, and improve delivery performance, which collectively lead to cost savings and enhanced profitability. Similarly, Mentzer et al. (2001) emphasise that sustainable logistics systems enables organizations to align procurement, transportation, warehousing, and distribution activities to achieve economies of scale, minimize waste, and improve return on investment. They further stated that operational efficiency supports scalability and long-term sustainability. Companies with efficient operational structures can expand fleet capacity, enter new markets, and withstand economic shocks more effectively than inefficient firms.

The analysis from the test of hypothesis 2 and the answer to research question 2 (Table 2, item 1-3) showed that sustainable logistics systems significantly influence cost-effectiveness and financial growth of maritime companies in Delta State. Sustainable logistics systems reduce operational costs, improve resource utilisation, reduce waste and contribute to long-term financial savings. This finding agrees with Bowersox et al. (2013) who argue that effective logistics cost management enhances cash flow and financial stability, which are essential for organizational growth. Similarly, Lun, Lai, and Cheng (2010) observe that maritime firms that integrate cost-efficient logistics strategies achieve higher profitability and market sustainability.

The analysis from the test of hypothesis 3 and the answer to research question 3 (Table 3, item 1-5) showed that sustainable logistics systems have a significant impact on the competitive advantage and market relevance of maritime companies in Delta State. Sustainable logistics systems improve service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies. This finding support the finding of Grant (2019) who ascertains that sustained competitive advantage enables firms to respond effectively to industry changes and maintain growth over time. Similarly, Christopher (2016) said that sustainable logistics aid revenue generation in order to maintain a competitive advantage and secure long-term organizational growth.

Also, technological innovation within sustainable logistics systems improves service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies. This finding agrees with Christopher (2016), who is of the view that sustainable logistics enhance economic sustainability by balancing operational costs, resource utilization, investment in innovative technologies.

More so, Sustainable logistics practices influence environmental compliance and regulatory performance by enabling maritime companies to actively implements sustainable logistics practices, environmental considerations integration and the use of modern logistics technologies. This finding support McKinnon et al. (2015) who describe sustainable logistics as the management of logistics activities in ways that reduce environmental harm, enhance social responsibility, and support economic performance.

Furthermore, the challenges face by maritime companies in implementing sustainable logistics systems include: high implementation costs, Lack of adequate infrastructure and lack sufficient technical skills to use sustainable logistics systems effectively. This finding support Mitchell et al. (1997) and Savit & Weber (2006) who are of the view that, in maritime operations, high operational costs may limit the ability to invest in community development, employee welfare, or green technologies. Additionally, monitoring and evaluating stakeholder satisfaction can be complex, requiring robust information systems and performance metrics.

VI. Conclusion

Base on the findings of the study, it can be concluded that sustainable logistics systems have a significant impact on the growth of maritime companies. Sustainable logistics practices improve operational efficiency, reduce delays in operations and enhanced productivity in maritime operations. It influences cost effectiveness and financial growth of maritime companies, reduce operational costs, improve resource utilisation, reduce waste and contribute to long-term financial savings. Sustainable logistics systems improve service quality, enable customers' satisfaction, strengthen competitive position, growth and expansion of maritime companies. Also, sustainable logistics practices influence environmental compliance and regulatory performance by enabling maritime companies to actively implements sustainable logistics practices, environmental considerations integration and the use of modern logistics technologies. Though, the challenges face by maritime companies in implementing sustainable logistics systems include: high implementation costs, Lack of adequate infrastructure and lack sufficient technical skills to use sustainable logistics systems effectively.

VII. Recommendations

Based on the findings of this study, the following recommendations were made:

1. Stakeholders should prioritise regular training programs to ensure all users can effectively operate sustainable logistics systems and adapt to technological upgrades

2. System maintenance and periodic updates should be institutionalized to preserve system integrity and improve user confidence.
3. Stakeholder engagement initiatives should be fostered to enhance trust and collaboration, ensuring that sustainable logistics systems are addressed technically.
4. Government and maritime regulators should adopt policy incentives to encourage innovation and private investment.

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