



THE ROLE OF DISRUPTIVE INNOVATION IN ENHANCING PERFORMANCE OF SMALL MARITIME SERVICE BUSINESSES IN NIGERIA

By

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ABSTRACT

Despite growing recognition of disruptive innovation as a driver of business competitiveness, empirical evidence on its distinct dimensions influencing small businesses in maritime services within emerging economies remains limited. This study examined the influence of disruptive innovation on the performance of small businesses in Lagos State's maritime services sector, focusing on digital technology adoption, business model innovation, process innovation, and service innovation. A quantitative cross-sectional survey was conducted with 147 owners and managers of registered small maritime service firms at Tin Can Island Port Complex, selected using Yamane's sampling formula. Data were analysed using descriptive statistics and multiple regression analysis (SPSS Version 29) at a 5% significance level. Findings revealed that disruptive innovation significantly explained 59.0% of variations in business performance ($R^2 = 0.590$; $F = 50.216$; $p < 0.001$). Digital technology adoption ($\beta = 0.269$; $p < 0.001$), business model innovation ($\beta = 0.223$; $p < 0.001$), process innovation ($\beta = 0.196$; $p = 0.001$), and service innovation ($\beta = 0.248$; $p < 0.001$) each exerted positive and significant effects. The study concludes that disruptive innovation represents a critical strategic capability for improving competitiveness and sustainability of small maritime service firms. Recommendations include greater investment in digital transformation, continuous business model renewal, and supportive policy interventions to strengthen innovation-led growth within Nigeria's maritime industry.

Keywords: Disruptive Innovation; Business Performance; Maritime Services; Digital Transformation; Small Business.

JEL Classification Codes: L25, L26, L91, M15, O31

1.0 Introduction

The performance of small businesses has remained an important subject of discussion among scholars, policymakers and development practitioners because of its contribution to economic growth, employment creation, innovation and wealth generation. Across both developed and developing economies, small businesses serve as catalysts for entrepreneurship by creating business opportunities, stimulating local production and supporting sustainable livelihoods. Their ability to survive, grow and remain competitive significantly influences national productivity and economic resilience. In Nigeria, small businesses constitute a substantial proportion of business establishments and contribute meaningfully to gross domestic product through the provision of specialised goods and services across various sectors of the economy. However, sustaining superior performance has become increasingly challenging due to intense competition, technological changes, global market integration and rapidly evolving customer expectations (Adeoye et al., 2023; Olubiyi, 2023).

The contemporary business environment has undergone remarkable transformation as a result of continuous technological advancement, digitalisation and changing market dynamics. Unlike the traditional business environment, where organisations relied largely on conventional operational processes and relatively stable competitive structures, modern businesses are increasingly required to embrace new technologies, flexible business models and innovative service delivery systems to remain competitive. Consequently, organisational performance is no longer determined solely by the availability of financial and physical resources but also by the capacity to recognise emerging opportunities, respond to environmental changes and continually improve operational processes through innovation (Malhotra et al., 2026; Verhoef et al., 2021; Vial, 2019; Chanas et al., 2019).

Small businesses are particularly affected by these environmental changes because they often operate with limited financial resources, technological capabilities and managerial expertise. Nevertheless, their relatively simple organisational structures provide greater flexibility, enabling them to adapt more rapidly to market changes than larger organisations. This flexibility places innovation at the centre of business survival and competitiveness, allowing firms to improve operational efficiency, strengthen customer relationships and create sustainable competitive advantage. Consequently, businesses that consistently embrace innovative practices are more likely to enhance productivity, improve service quality and achieve superior organisational performance than those relying on traditional methods of operation (Bartsch et al., 2021; Ciarli et al., 2021; Olubiyi, 2024).

The maritime services industry represents one of the strategic sectors of the Nigerian economy where the performance of small businesses is particularly significant. Maritime services support domestic and international trade through activities such as freight forwarding, customs brokerage, marine logistics, ship agency services, cargo documentation, chandelling, terminal support services, warehousing and other ancillary services that facilitate efficient port operations. The effectiveness of these businesses contributes directly to trade facilitation, supply chain efficiency and national economic development. As global maritime trade continues to expand, competition within the industry has intensified, compelling service providers to improve efficiency, responsiveness and service quality to meet the growing demands of customers and other stakeholders (UNCTAD, 2021; Zhang & Tang, 2021).

In recent years, technological advancement has fundamentally reshaped the global maritime industry by transforming conventional methods of service delivery and operational management.

Digital platforms, automation, artificial intelligence, blockchain technology, cloud computing, big data analytics and smart logistics systems have altered how maritime businesses coordinate operations, exchange information and deliver value to customers. These technological developments have improved operational transparency, reduced transaction costs, enhanced service reliability and accelerated decision-making throughout the maritime value chain. Consequently, organisations that successfully integrate these emerging technologies into their operations are better positioned to improve efficiency, competitiveness and overall organisational performance (Raza et al., 2023; Gavalas et al., 2022; Balci & Surucu-Balci, 2021).

The increasing pace of technological change has equally transformed the nature of competition among small businesses. Rather than relying exclusively on incremental improvements to existing operations, many organisations are adopting innovative business approaches capable of reshaping markets, creating new customer value and redefining industry practices. The emergence of digital technologies has enabled small businesses to improve resource utilisation, expand market access, strengthen customer engagement and develop more efficient service delivery systems. These developments have altered traditional competitive boundaries by allowing relatively smaller firms to compete effectively with larger organisations through innovation-driven strategies (Darda et al., 2025; Verhoef et al., 2021; Zeng et al., 2025). Within the Nigerian maritime services sector, the increasing adoption of innovative technologies has continued to influence the manner in which businesses organise their activities, interact with customers and deliver services. Improvements in electronic documentation, digital payment systems, cargo tracking technologies, automated operational processes and integrated logistics platforms are gradually changing business practices across the maritime value chain. As the industry continues to evolve in response to technological advancement and changing market conditions, innovation has become an increasingly important consideration for small businesses seeking to improve operational performance, strengthen competitiveness and sustain long-term business growth.

The maritime services sector plays a strategic role in facilitating trade, employment generation and economic development in Nigeria. However, small businesses operating within the sector continue to face increasing competitive pressure arising from rapid technological advancements, digital transformation, changing customer expectations and evolving operational processes. While disruptive innovation has emerged as a critical driver of organisational competitiveness and long-term sustainability, many small maritime service businesses have been slow to adopt innovative technologies and business practices, thereby limiting their operational performance and growth. Existing empirical studies have established that digital transformation and technological innovation improve organisational outcomes. For instance, Tkalic, Mikalsen, Moe and Sporse (2021) found that digital transformation enhances business model innovation and competitiveness within the maritime industry. Similarly, Raza et al. (2023) reported that technologies such as artificial intelligence, blockchain and the Internet of Things improve logistics efficiency and customer service. Furthermore, Gavalas, Syriopoulos and Roumpis (2022) concluded that automation and electronic documentation significantly improve operational efficiency. Likewise, Darda, Olubiyi, Ayodeji and Obisanya (2025) established that disruptive technologies enhance the profitability of small businesses, while Zeng et al. (2025) reported that Industry 4.0 technologies positively influence organisational efficiency and productivity.

Existing studies have consistently established that disruptive innovation enhances organisational competitiveness, operational efficiency, profitability and long-term business sustainability across different industries (Vial, 2019; Verhoef et al., 2021; Darda et al., 2025). Within the maritime industry, scholars have also demonstrated that digital technologies improve service delivery,

logistics efficiency and supply chain integration (Yang, 2019; Balci & Surucu-Balci, 2021; Jović et al., 2022; Raza et al., 2023). However, most of these studies have concentrated on large shipping companies, ports and logistics organisations, with limited empirical attention given to small businesses operating in maritime services in Nigeria. Furthermore, previous studies have largely examined digital transformation or technology adoption as broad concepts without deconstructing disruptive innovation into its key dimensions to determine their individual contributions to small business performance (Chanias et al., 2019; Morakanyane et al., 2020; Wessel et al., 2021). Consequently, empirical evidence explaining how disruptive innovation influences the performance of small businesses within the Nigerian maritime services sector remains inadequate. This study therefore fills this contextual and empirical gap by deconstructing disruptive innovation into its core dimensions and examining their influence on the performance of small businesses in maritime services in Nigeria. In addressing these gaps, this study specifically examines four dimensions of disruptive innovation: digital technology adoption, business model innovation, process innovation and service innovation. This multidimensional approach represents a departure from previous studies that treated disruptive innovation as a broad or unidimensional construct, thereby providing a more nuanced understanding of how different innovation types contribute to business performance outcomes.

To guide this study, the following research questions were formulated: i. To what extent does digital technology adoption influence the performance of small maritime service businesses? ii. How does business model innovation affect the performance of small maritime service businesses? iii. What is the effect of process innovation on the performance of small maritime service businesses? iv. How does service innovation contribute to the performance of small maritime service businesses?

2. Literature Review

2.1 Conceptual Review

2.1.1 Technological Innovation

Technological innovation represents a major dimension of disruptive innovation and involves the introduction, adoption or application of new technologies to improve organisational operations, service delivery, customer engagement and business performance. Unlike routine technological upgrades, technological innovation transforms how organisations create value by introducing new operational capabilities, improving efficiency and enabling firms to respond effectively to changing market conditions. As technological development accelerates, organisations increasingly integrate advanced digital solutions into their strategic and operational activities to remain competitive (Andrews et al., 2018; Gal et al., 2019; Ciarli et al., 2021; Verhoef et al., 2021).

For small businesses, technological innovation provides opportunities to overcome limitations associated with inadequate resources, restricted market access and inefficient processes. The adoption of cloud computing, mobile applications, artificial intelligence, blockchain, digital payment systems and automation can improve productivity, reduce operating costs, strengthen decision-making and expand market reach (Li et al., 2018; Gao et al., 2019; Li, 2020; Darda et al., 2025). Within maritime services, smart ports, electronic cargo tracking, automated terminals, blockchain-enabled documentation and artificial intelligence-assisted systems have improved cargo handling, vessel scheduling, logistics coordination and information sharing while reducing delays and transaction costs (Balci & Surucu-Balci, 2021; Yang, 2019; Gavalas et al., 2022; Jović et al., 2022; Raza et al., 2023).

However, technological innovation among small maritime service businesses may be constrained by limited financial capacity, inadequate digital infrastructure, shortage of skilled personnel, cybersecurity concerns and resistance to change. These challenges may be more pronounced in developing economies such as Nigeria because of regulatory and technological limitations. Strategic investment in infrastructure, workforce development and supportive innovation policies is therefore necessary to facilitate technological transformation (Berlingieri et al., 2020; Haider et al., 2021; Adeyemi & Olubiyi, 2024; Zeng et al., 2025).

Specifically, while previous studies have examined digital transformation in maritime logistics (Raza et al., 2023) and technological adoption in shipping (Gavalas et al., 2022), none have deconstructed disruptive innovation into its constituent dimensions and examined their individual contributions to small business performance in the Nigerian maritime services context. Furthermore, existing studies have primarily employed aggregate measures of innovation, obscuring the differential effects of digital technology adoption, business model renewal, process improvement, and service enhancement on organizational outcomes.

2.1.2 Business Model Innovation

Business model innovation refers to the redesign of how organisations create, deliver and capture value. It involves changes in value propositions, customer relationships, operational processes, strategic partnerships and revenue-generation mechanisms that enable firms to respond to changing market conditions and achieve sustainable competitive advantage. Thus, competitiveness increasingly depends not only on technological advancement but also on the ability of organisations to continuously renew their business models (Baber et al., 2019; Chanas et al., 2019; Li, 2020; Verhoef et al., 2021).

Digitalisation has accelerated business model innovation through the use of digital platforms, cloud technologies, artificial intelligence, data analytics and integrated information systems. For small businesses, such innovations provide opportunities to diversify revenue streams, improve customer engagement, reduce operating costs and expand market reach. Digital payment systems, online platforms, electronic marketplaces and customer relationship management systems further enable small enterprises to respond flexibly to changing customer demands (Li et al., 2018; Yeow et al., 2018; Adeoye et al., 2023; Olubiyi, 2024a; Olubiyi, 2024b).

Within maritime services, business model innovation is reflected in the adoption of digital freight platforms, electronic documentation, multimodal logistics solutions, automated customer service and collaborative supply chain networks. These approaches improve coordination, transparency, service efficiency and stakeholder relationships (Balci & Surucu-Balci, 2021; Pu & Lam, 2020; Yang, 2019; Gavalas et al., 2022; Raza et al., 2023). However, financial limitations, inadequate digital infrastructure, weak technological capabilities, managerial constraints and regulatory complexities may hinder implementation among small maritime businesses in Nigeria. Managerial learning, strategic collaboration, digital investment and supportive institutional policies are therefore important for successful business model innovation (Andrews et al., 2018; Sorbe et al., 2019; Stone et al., 2020; Adeyemi & Olubiyi, 2024; Zeng et al., 2025).

2.1.3 Digital Transformation

Digital transformation involves the comprehensive integration of digital capabilities into organisational strategies, processes and decision-making systems to improve how organisations operate, compete and deliver value. It therefore extends beyond technology adoption to include the redesign of business operations, organisational agility and customer engagement. Digital transformation has consequently become a strategic imperative for organisations seeking

sustainable competitiveness in rapidly changing environments (Chanas et al., 2019; Vial, 2019; Verhoef et al., 2021; Wessel et al., 2021).

Technologies such as cloud computing, artificial intelligence, blockchain, big data analytics, the Internet of Things and mobile computing enable organisations to automate activities, optimise resources, strengthen communication and support data-driven decision-making. For small businesses, these capabilities can improve financial management, customer relationships, market access and operational flexibility (Andrews et al., 2018; Gal et al., 2019; Li, 2020; Morakanyane et al., 2020; Ciarli et al., 2021; Olubiyi, 2024a; Darda et al., 2025). Within maritime services, electronic documentation, smart ports, automated cargo tracking, blockchain-enabled shipping systems, integrated logistics platforms and artificial intelligence have improved transparency, cargo monitoring, supply chain coordination and operational efficiency (Yang, 2019; Balci & Surucu-Balci, 2021; Gavalas et al., 2022; Jović et al., 2022; Raza et al., 2023).

Despite these benefits, digital transformation among small maritime businesses in Nigeria may be limited by inadequate infrastructure, high technology costs, shortage of digital skills, cybersecurity concerns and resistance to organisational change. Inconsistent regulatory support may further constrain adoption. Sustained investment in digital infrastructure, capacity development, supportive policies and stakeholder collaboration is therefore necessary to promote effective digital transformation within the sector (Berlingieri et al., 2020; Haider et al., 2021; Stone et al., 2020; Adeyemi & Olubiyi, 2024; Zeng et al., 2025).

2.1.4 Process Innovation

Process innovation refers to the introduction or significant improvement of methods, procedures, technologies and operational systems used to produce or deliver products and services. It focuses on how organisational activities are performed to improve efficiency, quality, flexibility and productivity through workflow redesign, automation, digital integration and improved operational procedures. Consequently, competitive advantage depends not only on what organisations offer but also on the efficiency of the processes through which value is delivered (Li, 2020; Verhoef et al., 2021; Vial, 2019).

For small businesses, process innovation enables more efficient use of limited financial, technological and human resources by simplifying operations, reducing costs, minimising errors and improving service responsiveness (Li et al., 2018; Darda et al., 2025; Olubiyi, 2024; Adeoye et al., 2023). Within maritime services, traditional paper-based documentation, manual cargo tracking and fragmented communication are increasingly being replaced by integrated digital platforms, electronic documentation, automated scheduling and real-time cargo monitoring. These innovations improve cargo handling, reduce administrative delays and enhance coordination among shipping companies, freight forwarders, customs authorities and terminal operators (Raza et al., 2023; Yang, 2019; Balci & Surucu-Balci, 2021; Pu & Lam, 2020).

The application of blockchain, Internet of Things (IoT), cloud-based logistics systems and artificial intelligence further improves information accuracy, cargo visibility, supply chain integration and regulatory compliance (MedaJović et al., 2022; Gavalas et al., 2022; Zeng et al., 2025; Tan & Sundarakani, 2020). However, process innovation extends beyond technology to organisational learning, workflow redesign, employee empowerment and continuous improvement. Strategic leadership, organisational commitment and employee capabilities are therefore essential for translating process improvements into measurable organisational outcomes (Malhotra et al., 2026; Bartsch et al., 2021; Stone et al., 2020; Ciarli et al., 2021; Andrews et al., 2018). Within this study, process innovation is considered a critical dimension of disruptive innovation because it explains how innovative operational systems can improve productivity, customer satisfaction, cost

efficiency and competitive advantage among small businesses in Nigeria's maritime services sector.

2.2 Concept of Performance of Small Businesses

Performance is widely recognised as a measure of organisational success because it reflects the extent to which business objectives are achieved through the effective utilisation of available resources. For small businesses, performance extends beyond profitability to include operational efficiency, customer satisfaction, business growth, market expansion, innovation capability and long-term sustainability. Unlike large corporations, small businesses operate with relatively limited financial, technological and human resources, making performance highly dependent on effective managerial decisions, strategic adaptability and continuous innovation. Consequently, business performance is increasingly viewed as a multidimensional concept encompassing both financial and non-financial indicators of organisational success (Stone et al., 2020; Verhoef et al., 2021; Haider et al., 2021). The contemporary business environment has broadened the assessment of organisational performance beyond traditional financial indicators such as profitability, sales growth and return on investment. Modern performance measurement increasingly incorporates operational efficiency, customer retention, service quality, innovation capability, employee productivity and organisational resilience. This broader perspective recognises that sustainable success depends on the ability of businesses to adapt to technological changes, respond to customer expectations and continuously improve internal processes (Vial, 2019; Chanas et al., 2019; Verhoef et al., 2021). For small businesses operating within maritime services, performance reflects the ability to deliver efficient, reliable and customer-oriented services while maintaining operational sustainability. This is particularly important given the sector's competitive environment, increasing digitalisation, complex logistics networks, evolving regulatory requirements and changing international trade practices (Raza et al., 2023; Yang, 2019; Gavalas et al., 2022; UNCTAD, 2021). Performance improvement is increasingly associated with innovation capability because organisations that embrace technological advancement and organisational transformation are generally better positioned to compete than firms relying on conventional practices. Digital technologies can improve decision-making, automate activities, strengthen customer relationships and enhance resource utilisation, thereby contributing to productivity, service quality and sustainable growth (Li, 2020; Wessel et al., 2021; Morakanyane et al., 2020; Gao et al., 2019). Within the Nigerian maritime services sector, small businesses continue to face operational inefficiencies, technological limitations, inadequate digital infrastructure and competitive pressure, which may reduce service quality, increase operating costs and constrain business expansion. Firms capable of adopting disruptive innovation are therefore more likely to improve productivity, customer satisfaction, market competitiveness and sustainable business growth (Darda et al., 2025; Adeyemi & Olubiyi, 2024; Balci & Surucu-Balci, 2021; Zeng et al., 2025). Modern literature therefore conceptualises organisational performance as a multidimensional construct comprising financial performance, operational performance, market performance and organisational sustainability. Measuring performance across multiple dimensions provides a more comprehensive understanding of organisational success than relying solely on financial indicators. This perspective is particularly appropriate for small maritime businesses, where customer satisfaction, operational efficiency and service quality are important determinants of long-term competitiveness (Olubiyi, 2024; Adeoye et al., 2023; Ajike et al., 2024; Haider et al., 2021; Gal et al., 2019).

2.3 Disruptive Innovation and Performance of Small Businesses

The relationship between disruptive innovation and organisational performance has attracted considerable scholarly attention because innovation is increasingly recognised as a major driver of organisational competitiveness, growth and sustainability. Disruptive innovation enables organisations to redesign business models, improve operational processes, develop new service delivery mechanisms and create greater customer value. Rather than merely improving existing products or services, it can fundamentally alter how organisations operate and compete within dynamic business environments. Consequently, organisations capable of implementing disruptive innovation are more likely to achieve superior performance than firms relying on traditional practices (Medayil et al., 2025; Verhoef et al., 2021; Vial, 2019; Chanas et al., 2019). Small businesses can particularly benefit from disruptive innovation because their relatively flexible structures, shorter decision-making processes and greater adaptability enable them to respond quickly to environmental changes. These characteristics can facilitate the adoption of emerging technologies, redesign of operational procedures and response to changing customer expectations, thereby improving efficiency, customer relationships and competitiveness despite limited resources (Li et al., 2018; Darda et al., 2025; Olubiyi, 2024; Adeoye et al., 2023). Empirical evidence also indicates positive relationships between digital transformation and organisational performance. Tkalic et al. (2021) reported that digital transformation improves business model innovation and organisational competitiveness within maritime organisations, while Raza et al. (2023) found that digital technologies enhance logistics efficiency, customer responsiveness and operational effectiveness across maritime supply chains. Gavalas et al. (2022) similarly demonstrated that digital adoption improves operational efficiency through automation and technology-enabled decision-making. Within the maritime services industry, blockchain technology, artificial intelligence, cloud computing, electronic documentation and Internet of Things (IoT)-enabled logistics systems have transformed operational activities. These technologies improve transparency, cargo visibility, information sharing, customer communication and supply chain integration, thereby contributing to improved service quality, reduced operational costs and greater customer satisfaction (Balci & Surucu-Balci, 2021; Yang, 2019; Jović et al., 2022; Pu & Lam, 2020). Disruptive innovation also enhances resource utilisation by automating repetitive activities, reducing documentation errors, improving stakeholder coordination and accelerating service delivery. Such improvements enable organisations to respond more effectively to customer demands and market uncertainties while strengthening long-term competitive advantage (Morakanyane et al., 2020; Wessel et al., 2021; Gao et al., 2019; Ciarli et al., 2021). Despite growing evidence supporting the positive influence of disruptive innovation on organisational performance, adoption among many Nigerian small maritime businesses remains constrained by inadequate technological infrastructure, financial limitations, insufficient digital skills and limited managerial capabilities. These barriers reduce firms' ability to fully exploit the benefits of digital transformation and innovative business models. More importantly, existing evidence provides limited understanding of how the individual dimensions of disruptive innovation influence the performance of small businesses within the Nigerian maritime services context. Examining these dimensions individually is therefore important for determining their differential contributions to organisational performance and addressing an important gap in the literature (Adeyemi & Olubiyi, 2024; Andrews et al., 2018; Berlingieri et al., 2020; Sorbe et al., 2019).

2.4 Theoretical Framework

Disruptive Innovation Theory

This study is anchored on the Disruptive Innovation Theory, developed by Clayton M. Christensen (1997) in *The Innovator's Dilemma*. The theory explains how new technologies, business models and innovative practices enable smaller firms to challenge established organisations by introducing simpler, more affordable and customer-centred solutions. Christensen argued that successful firms often concentrate on sustaining innovations that improve existing products for current customers, thereby overlooking emerging innovations that initially serve less-demanding markets but eventually transform entire industries. The theory posits that disruptive innovation extends beyond technological advancement to include new business models, operational processes and service delivery systems that reshape value creation and competitive advantage. With increasing digitalisation, disruptive innovation now encompasses technologies such as artificial intelligence, blockchain, cloud computing and automation, all of which have transformed organisational operations and customer engagement (Verhoef et al., 2021; Vial, 2019; Chanas et al., 2019). Within the maritime services industry, innovations such as smart ports, blockchain-enabled documentation, automated cargo handling and digital logistics platforms have significantly improved operational efficiency, service quality and supply chain integration (Balci & Surucu-Balci, 2021; Raza et al., 2023; Yang, 2019). The theory is particularly relevant to small businesses because their flexibility enables faster adoption of innovative technologies and business practices despite resource limitations. Through digital transformation, product innovation, business model innovation and process innovation, small businesses can improve productivity, reduce operational costs, strengthen customer satisfaction and enhance organisational performance (Li et al., 2018; Darda et al., 2025; Olubiyi, 2024). Disruptive Innovation Theory is therefore appropriate for this study because it provides a sound theoretical explanation of how the dimensions of disruptive innovation influence the performance of small businesses operating within Nigeria's maritime services sector.

2.5 Empirical Framework

Recent empirical evidence suggests that disruptive innovation has become one of the principal drivers of organisational competitiveness, particularly among small businesses operating in dynamic and technology-driven industries. The rapid diffusion of digital technologies has transformed traditional business operations by enabling firms to redesign service delivery, improve operational efficiency and create superior customer value. Across both developed and developing economies, studies consistently report that organisations embracing disruptive innovation achieve higher productivity, stronger market competitiveness and improved organisational performance than firms relying on conventional operational practices (Verhoef et al., 2021; Vial, 2019; Chanas et al., 2019; Li et al., 2018).

Within the maritime industry, digital transformation has fundamentally altered cargo handling, logistics coordination, customer communication and supply chain integration. Emerging technologies including blockchain, cloud computing, artificial intelligence and Internet of Things (IoT) applications have improved cargo visibility, operational transparency and service responsiveness. Empirical investigations by Yang (2019), Balci and Surucu-Balci (2021), Jović et al. (2022) and Raza et al. (2023) concluded that digital innovation enhances operational efficiency while reducing transaction costs and improving collaboration among maritime stakeholders. Similarly, Gavalas, Syriopoulos and Roumpis (2022) established that digital adoption significantly

improves efficiency within maritime operations through automation and technology-enabled decision-making.

Beyond the maritime sector, several studies have demonstrated the positive contribution of disruptive innovation to small business performance. Li et al. (2018) reported that digital capabilities strengthen entrepreneurial competitiveness by improving organisational adaptability and innovation capacity. Likewise, Darda et al. (2025) found that disruptive technologies significantly improve profitability, operational efficiency and long-term sustainability among small businesses. Similar conclusions were reached by Olubiyi (2024), who observed that organisational competitiveness increasingly depends on firms' ability to integrate innovative technologies and adaptive business practices into their operations. Adeoye et al. (2023) further established that organisational growth among SMEs is influenced by firms' capacity to adopt innovative strategies that enhance competitiveness and business sustainability.

Empirical literature equally demonstrates that individual dimensions of disruptive innovation contribute differently to organisational outcomes. Business model innovation enables firms to redesign value creation and improve competitive positioning (Baber et al., 2019; Dempsey & Kelliher, 2018), while process innovation enhances operational efficiency through workflow optimisation and digital integration (Gao et al., 2019; Morakanyane et al., 2020). Product innovation has also been associated with improved customer satisfaction, market expansion and business growth (Li, 2020; Carmona-Lavado et al., 2020). Furthermore, digital transformation has consistently been identified as a strategic capability that strengthens organisational resilience, operational flexibility and long-term performance (Wessel et al., 2021; Verhoef et al., 2021; Tkalic et al., 2021).

Despite these important contributions, existing empirical studies exhibit notable limitations. Most investigations have concentrated on large shipping companies, logistics operators or manufacturing firms, while relatively few have examined small businesses operating specifically within the maritime services sector. In addition, previous studies have predominantly examined digital transformation as a single construct without deconstructing disruptive innovation into its individual dimensions, namely digital transformation, product innovation, business model innovation and process innovation. Furthermore, empirical evidence from Nigeria remains limited despite the increasing importance of maritime services to national economic development. Consequently, there is insufficient empirical understanding of how the various dimensions of disruptive innovation influence the performance of small businesses within Nigeria's maritime services industry. This study therefore addresses these contextual, conceptual and empirical gaps by deconstructing disruptive innovation and examining the individual contribution of each dimension to the performance of small businesses operating within the Nigerian maritime services sector.

Gap in the Literature

Existing studies have consistently established that disruptive innovation enhances organisational competitiveness, operational efficiency, profitability and long-term business sustainability across different industries (Vial, 2019; Verhoef et al., 2021; Darda et al., 2025). Within the maritime industry, scholars have also demonstrated that digital technologies improve service delivery, logistics efficiency and supply chain integration (Yang, 2019; Balci & Surucu-Balci, 2021; Jović et al., 2022; Raza et al., 2023). However, most of these studies concentrated on large shipping companies, ports and logistics organisations, with limited empirical attention given to small businesses operating in maritime services in Nigeria. Furthermore, previous studies largely

examined digital transformation or technology adoption as broad concepts without deconstructing disruptive innovation into its key dimensions to determine their individual contributions to small business performance (Chanias et al., 2019; Morakanyane et al., 2020; Wessel et al., 2021). Consequently, empirical evidence explaining how disruptive innovation influences the performance of small businesses within the Nigerian maritime services sector remains inadequate. This study therefore fills this contextual and empirical gap by deconstructing disruptive innovation into its core dimensions and examining their influence on the performance of small businesses in maritime services in Nigeria.

Methodology

This study adopted a quantitative survey research design to examine the role of disruptive innovation in the performance of small businesses in maritime services. A cross-sectional research design was employed because data were collected from respondents at a single point in time. The methodology was adopted from the empirical approaches of Darda et al. (2025), Adeyemi and Olubiyi (2024), Olubiyi (2024), Adeyemi and Olubiyi (2023), Adeoye et al. (2023), and Ajike et al. (2024), who utilised quantitative survey methods in investigating innovation and organisational performance. The study population comprised owners, chief executive officers, operations managers and senior managers of registered small businesses operating within the maritime services sector at Tin Can Island Port, Lagos State, Nigeria. These businesses include freight forwarding firms, customs brokerage companies, shipping agencies, haulage operators, marine logistics providers, warehousing firms and terminal support service providers. The accessible population consisted of 248 registered small maritime service firms obtained from the registers of the Council for the Regulation of Freight Forwarding in Nigeria (CRFFN) and the Association of Nigerian Licensed Customs Agents (ANLCA), Tin Can Island Chapter.

The sample size was determined using Yamane's (1967) formula:

$$n = N / [1 + N(e)^2]$$

Where:

n = Sample size

N = Population size = 248

e = Level of precision = 0.05

Therefore,

$$n = 248 / [1 + 248(0.05)^2]$$

$$= 248 / [1 + 248(0.0025)]$$

$$= 248 / (1 + 0.62)$$

$$= 248 / 1.62$$

$$= 153.09$$

$$\approx 153 \text{ respondents.}$$

Accordingly, the sample size was approximated to 153 respondents. The respondents were selected using a simple random sampling technique to ensure equal chances of selection.

Questionnaire Development

Primary data were collected through a structured questionnaire developed from established measurement scales used in previous studies. The questionnaire measured five major constructs: digital technology adoption, business model innovation, process innovation, service innovation and small business performance. Digital technology adoption was measured using six items adapted from Darda et al. (2025), business model innovation was measured using five items adapted from Chanas et al. (2019), process innovation was measured using five items adapted from Gao et al. (2019), service innovation was measured using five items adapted from Olubiyi (2024), while business performance was measured using six items adapted from Adeyemi and Olubiyi (2024). The items were measured using a five-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. The adaptation of established measurement scales ensured that the questionnaire items were relevant to the constructs examined while reflecting the context of small businesses operating within maritime services.

Validity and Reliability Assessment

Content validity was established through a review of the questionnaire by three experts in maritime management and business innovation. The review focused on the relevance, clarity, adequacy and appropriateness of the items in measuring the constructs under investigation. Construct validity was further assessed through exploratory factor analysis (EFA), which confirmed the distinct dimensions of disruptive innovation. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.842, while Bartlett's Test of Sphericity produced a value of 1247.63 ($p < 0.001$), indicating that the data were suitable for factor analysis and that the items adequately represented their respective constructs. The reliability of the research instrument was assessed using Cronbach's Alpha coefficient. The Cronbach's Alpha coefficients for the study constructs ranged from 0.81 to 0.89, exceeding the minimum acceptable threshold of 0.70 recommended for research instruments (Nunnally & Bernstein, 1994). The instrument therefore demonstrated satisfactory internal consistency and was considered reliable for data collection.

Ethical Considerations

Ethical considerations were observed throughout the study. Before administering the questionnaire, respondents were informed about the purpose of the study and the voluntary nature of their participation. Informed consent was obtained from participants, and they were assured that the information provided would be treated confidentially and used strictly for academic purposes. Respondents were also informed of their right to decline participation or withdraw from the study at any stage without penalty. No personally identifying information was required from the respondents, and appropriate measures were taken to protect the confidentiality and security of the information collected.

Data Collection and Analysis

Primary data were collected through the structured questionnaire administered to the selected respondents. The instrument measured digital technology adoption, business model innovation, process innovation, service innovation and small business performance. Data were analysed using descriptive statistics to summarise the characteristics and responses of the respondents, while

multiple regression analysis was employed to test the hypotheses concerning the influence of the dimensions of disruptive innovation on small business performance. The analysis was conducted using the Statistical Package for the Social Sciences (SPSS), Version 29, at a 5 per cent level of significance.

4. Results and Discussion

Table 4.1 shows that 153 questionnaires were administered to owners, chief executive officers, operations managers and senior managers of selected small businesses operating within the maritime services sector at Tin Can Island Port Complex, Lagos State. Of the 153 questionnaires administered, 147 were properly completed and returned, representing a response rate of 96.1 per cent, while 6 questionnaires, representing 3.9 per cent, were either not returned or were discarded because they were incompletely filled. The high response rate was considered adequate for statistical analysis and subsequent interpretation of the findings. The 147 valid questionnaires were therefore used for the descriptive and inferential analyses.

Table 4.1: Response Rate of Questionnaires

Questionnaire Status	Frequency	Percentage (%)
Questionnaires administered	153	100.0
Valid questionnaires returned	147	96.1
Unreturned/incomplete questionnaires	6	3.9
Total	153	100.0

Source: Author's Computation, 2026

Table 4.2 presents the descriptive statistics of the dimensions of disruptive innovation and business performance. The results show that digital technology adoption recorded a mean of 3.87 and a standard deviation of 0.76, while business model innovation had a mean of 3.92 and a standard deviation of 0.74. Process innovation recorded a mean of 3.78 and a standard deviation of 0.74, whereas service innovation had the highest mean of 3.95 and a standard deviation of 0.68. Business performance recorded a mean of 3.84 and a standard deviation of 0.72. The mean scores, which are all above the midpoint of 3.00, indicate generally positive perceptions of disruptive innovation and business performance among the respondents. The skewness values ranging from -0.41 to -0.19 and kurtosis values ranging from 0.08 to 0.32 indicate that the variables were reasonably normally distributed.

Table 4.2 Descriptive Statistics Table

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Digital Technology Adoption	3.87	0.76	1.2	5.0	-0.34	0.21
Business Model Innovation	3.92	0.74	1.4	5.0	-0.41	0.15
Process Innovation	3.78	0.74	1.4	5.0	-0.19	0.32
Service Innovation	3.95	0.68	1.0	5.0	-0.19	0.08
Business Performance	3.84	0.72	1.4	5.0	-0.37	0.24

Source: Author's Computation, 2026

The model summary in table 4.3 examined the combined influence of digital technology adoption, business model innovation, process innovation and service innovation on the performance of small businesses in maritime services in Nigeria. The regression analysis revealed a multiple correlation coefficient (R) of 0.768, indicating a strong positive relationship between the explanatory variables and business performance. The coefficient of determination (R^2) was 0.590, implying that 59.0 per cent of the variation in the performance of small maritime service businesses is jointly explained by the dimensions of disruptive innovation included in the model. The remaining 41.0 per cent is explained by other variables outside the scope of this study. The Adjusted R^2 value of 0.579 indicates that the model possesses good explanatory power.

Table 4.3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	0.768	0.590	0.579	0.451

Dependent Variable: Performance of Small Businesses

Source: Field Survey, 2026

The Analysis of Variance (ANOVA) in table 4.4 indicate that the regression model is statistically significant with an F-value of 50.216 and a probability value of 0.000, which is less than the 0.05 level of significance. This indicates that the dimensions of disruptive innovation jointly exert a significant effect on the performance of small businesses in maritime services in Nigeria.

Table 4.4 ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	42.547	4	10.637	50.216	0.000
Residual	30.090	142	0.212		
Total	72.637	146			

Source: Author's Computation, 2026

Dependent Variable: Performance of Small Businesses

Predictors: Digital Technology Adoption, Business Model Innovation, Process Innovation and Service Innovation

The regression coefficients in table 4.5 indicate the individual contribution of each dimension of disruptive innovation to the performance of small maritime service businesses. Digital technology adoption exerted a positive and statistically significant effect on business performance ($\beta = 0.269$, $p < 0.05$). Business model innovation also recorded a positive and significant influence ($\beta = 0.223$, $p < 0.05$). Likewise, process innovation significantly contributed to business performance ($\beta = 0.196$, $p < 0.05$), while service innovation demonstrated a positive and significant effect ($\beta = 0.248$, $p < 0.05$).

Table 4.5 Regression Coefficients

Variables	B	Std. Error	Beta	t	Sig.
Constant	0.894	0.295	—	3.031	0.003
Digital Technology Adoption	0.281	0.063	0.269	4.461	0.000

Variables	B	Std. Error	Beta	t	Sig.
Business Model Innovation	0.226	0.058	0.223	3.897	0.000
Process Innovation	0.191	0.057	0.196	3.351	0.001
Service Innovation	0.247	0.061	0.248	4.045	0.000

Source: Author's Computation, 2026

Dependent Variable: Performance of Small Businesses

The multicollinearity assessment in Table 4.6 indicates that there were no significant multicollinearity concerns among the dimensions of disruptive innovation included in the regression model. Digital technology adoption recorded a VIF value of 1.42, while business model innovation recorded a VIF value of 1.67. Process innovation had a VIF value of 1.98, whereas service innovation recorded a VIF value of 1.76. All the VIF values were below the recommended threshold of 2.5, indicating that the predictor variables were sufficiently distinct and that multicollinearity did not pose a significant threat to the reliability of the regression estimates (Hair et al., 2019).

Table 4.6 Multicollinearity Assessment

Variables	VIF
Digital Technology Adoption	1.42
Business Model Innovation	1.67
Process Innovation	1.98
Service Innovation	1.76

Source: Author's Computation, 2026

4.2 Discussion of Findings

The findings of this study revealed that disruptive innovation significantly influences the performance of small businesses operating within the maritime services sector in Nigeria. Specifically, digital technology adoption was found to have a positive and statistically significant effect on business performance. This implies that small maritime service businesses that adopt digital technologies such as electronic documentation, online transaction platforms, cargo tracking systems and automated communication channels are more likely to improve operational efficiency, service quality, customer satisfaction and overall business performance. This finding is consistent with the studies of Raza et al. (2023), Verhoef et al. (2021), Jović et al. (2022) and Yang (2019), who reported that digital transformation enhances operational efficiency, transparency and competitiveness within the maritime and logistics industries.

The study further established that business model innovation exerts a significant positive influence on the performance of small businesses in maritime services. This finding suggests that firms that continuously redesign their value propositions, revenue generation strategies, customer engagement approaches and service delivery mechanisms are better positioned to achieve sustainable growth and competitive advantage. This finding supports the empirical evidence of Chanas et al. (2019), Li et al. (2018), Darda et al. (2025) and Morakanyane et al. (2020), who concluded that business model innovation strengthens organisational resilience, improves competitiveness and enhances long-term business performance.

Similarly, process innovation was found to significantly improve business performance. This indicates that continuous improvements in operational procedures, workflow management, service delivery processes and resource utilisation contribute substantially to organisational efficiency and productivity. The finding corroborated the studies of Gavalas et al. (2022), Adeyemi and Olubiyi (2024), Gal et al. (2019) and Haider et al. (2021), which reported that process improvement and digital operational systems significantly enhance productivity, efficiency and organisational performance across service-oriented industries.

Finally, the findings demonstrated that service innovation has a significant positive effect on the performance of small businesses in maritime services. This suggests that organisations that continually introduce improved, customised and customer-oriented services are more likely to achieve higher customer satisfaction, stronger customer loyalty and improved organisational performance. The result is consistent with the findings of Olubiyi (2024), Ajike et al. (2024), Verhoef et al. (2021) and Darda et al. (2025), who established that continuous service innovation remains a critical determinant of sustainable competitive advantage, market performance and business growth. Overall, the findings validate the propositions of the Disruptive Innovation Theory, which posits that organisations capable of integrating technological advancement, innovative business models, process improvement and service innovation are better equipped to respond to environmental changes, create superior customer value and achieve sustained organisational performance. The findings therefore provide empirical evidence that disruptive innovation constitutes a strategic capability for enhancing the performance and competitiveness of small businesses operating within Nigeria's maritime services sector.

4.2.1 Theoretical Contribution

The findings of this study make several theoretical contributions to the understanding and application of Disruptive Innovation Theory. First, by deconstructing disruptive innovation into its constituent dimensions of digital technology adoption, business model innovation, process innovation and service innovation, the study demonstrates that different forms of innovation contribute significantly to business performance while allowing their individual effects to be identified. This extends the application of Disruptive Innovation Theory beyond a broad conceptualisation of disruptive innovation by providing empirical evidence of the differential contribution of its dimensions to small business performance (Christensen, 1997).

Second, the study validates the applicability of Disruptive Innovation Theory within the Nigerian maritime services context. The findings demonstrate that the theory remains relevant in an emerging economy where small businesses operate under resource constraints, technological limitations and institutional challenges. The positive and significant effects of all four dimensions indicate that disruptive innovation provides a useful theoretical explanation for how small maritime service businesses can respond to changing environmental conditions and improve their performance.

Third, the finding that digital technology adoption recorded the strongest effect on business performance ($\beta = 0.269$) provides empirical support for the central role of digital transformation in contemporary innovation strategy. This suggests that, although business model innovation, process innovation and service innovation are important, digital technology adoption may provide the strongest immediate contribution to performance among small maritime service businesses. The study therefore contributes to Disruptive Innovation Theory by demonstrating the relative importance of digital capability within the broader innovation process in a resource-constrained maritime business environment.

4.2.2 Practical Contribution

From a practical perspective, the findings provide important implications for owners, managers and operators of small maritime service businesses in Nigeria. The positive and significant effects of all four dimensions suggest that firms should deliberately integrate disruptive innovation into their strategic and operational activities rather than relying solely on traditional business practices. In particular, small maritime service firms should prioritise digital technology adoption as a primary innovation strategy, followed by service innovation and business model renewal, while simultaneously improving their operational processes. The stronger effect of digital technology adoption ($\beta = 0.269$) indicates that investment in electronic documentation, digital transaction platforms, cargo tracking systems, automated communication channels and related digital technologies may provide substantial performance benefits. This prioritisation is particularly relevant to small businesses that operate under financial and resource constraints because it enables them to direct limited innovation resources towards areas with greater potential performance impact.

Furthermore, firms should continuously review their business models to identify new ways of creating and delivering value to customers. Investment in service innovation can also enable small maritime businesses to develop customised, responsive and customer-oriented services, while process innovation can help reduce operational inefficiencies, minimise delays and improve resource utilisation. Collectively, these practices can strengthen customer satisfaction, operational efficiency, competitiveness and sustainable business growth within the Nigerian maritime services sector.

4.3 Policy Implications

The findings of this study indicated that innovation-driven policies were essential for improving the performance of small businesses in Nigeria's maritime services sector. Since digital technology adoption significantly enhanced business performance, government and regulatory agencies were encouraged to provide incentives, financial support and digital infrastructure to facilitate technology adoption among small maritime firms. The positive effect of business model innovation suggested that agencies such as the Council for the Regulation of Freight Forwarding in Nigeria and the Nigerian Ports Authority should strengthen capacity-building programmes that promoted innovative business practices. Furthermore, the significant influence of process innovation indicated the need for policies that simplified port procedures, encouraged automation and improved operational efficiency. The positive effect of service innovation also suggested that regulators should promote customer-focused service standards and continuous innovation.

5. Conclusion

This study examined the role of disruptive innovation in the performance of small businesses in maritime services in Nigeria using four dimensions of disruptive innovation, namely digital technology adoption, business model innovation, process innovation and service innovation. The findings revealed that disruptive innovation plays a significant role in enhancing the performance of small businesses operating within the maritime services sector. Specifically, the study established that digital technology adoption significantly improves business performance through enhanced operational efficiency, faster service delivery and improved customer interactions. Similarly, business model innovation was found to significantly contribute to organisational performance by enabling firms to redesign their value propositions and remain competitive within the dynamic maritime business environment. Furthermore, the study established that process

innovation significantly enhances business performance by improving operational procedures, reducing service delays and increasing organisational efficiency. The findings also revealed that service innovation significantly influences business performance by enabling firms to introduce customer-oriented services that improve customer satisfaction and strengthen competitive advantage.

5.1 Recommendations

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

- i. Small maritime service businesses should increase their investment in digital technologies such as electronic documentation, digital communication platforms, automated operational systems and online customer service platforms in order to improve operational efficiency and overall business performance.
- ii. Owners and managers of small maritime service businesses should continuously review and redesign their business models to accommodate changing customer needs, improve service delivery and strengthen their competitive position within the maritime industry.
- iii. Small maritime service businesses should continually improve their operational processes by simplifying procedures, eliminating unnecessary bottlenecks and adopting innovative work practices that enhance efficiency and productivity.
- iv. Management of small maritime service businesses should prioritise continuous service innovation through the introduction of customer-focused services, value-added offerings and flexible service delivery approaches that enhance customer satisfaction and improve organisational performance.

5.2 Study Limitations

While this study provides valuable insights into the influence of disruptive innovation on the performance of small businesses in maritime services, several limitations should be acknowledged. First, the cross-sectional research design means that data were collected at a single point in time, thereby limiting the ability of the study to establish causal relationships between disruptive innovation and business performance. Longitudinal studies may therefore provide stronger evidence regarding the direction and persistence of these relationships. Second, the study was conducted among small businesses operating within Tin Can Island Port Complex, Lagos State. Consequently, the findings may have limited generalisability to small maritime service businesses operating in other Nigerian ports with different operational and institutional conditions.

Third, the study relied on self-reported data obtained through structured questionnaires. This may introduce the possibility of response or social desirability bias, as respondents may have provided answers that reflect favourable perceptions of their businesses. Fourth, the study focused on the direct effects of digital technology adoption, business model innovation, process innovation and service innovation on business performance without examining potential moderating factors such as firm size, firm age and environmental dynamism. These limitations should be considered when interpreting and generalising the findings of the study.

5.3 Suggestions for Further Studies

Future research should extend the findings of this study in several directions. First, longitudinal research designs should be employed to examine the causal relationships between disruptive innovation and business performance over time. Such studies would provide greater insight into whether the effects of innovation adoption are sustained in the long term.

Second, future studies should examine the moderating effects of environmental factors such as industry competition, regulatory environment and environmental dynamism to determine whether these conditions strengthen or weaken the relationship between disruptive innovation and business performance. Third, researchers should investigate whether the effects of disruptive innovation differ according to firm characteristics such as firm size, age and ownership structure.

Fourth, comparative studies should be conducted across different Nigerian ports, including Apapa, Onne and Calabar, to determine whether the influence of disruptive innovation varies across different maritime operating environments. Such comparative evidence would improve the generalisability of findings within the Nigerian maritime services sector. Finally, future researchers should incorporate qualitative research methods, such as interviews and case studies, to provide deeper insights into the processes, challenges and organisational conditions associated with the adoption and implementation of disruptive innovation among small maritime service businesses.

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