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Effects of Administrative Strategy on Operational Performance of Ports in Nigeria

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Abstract- ***The research aimed to evaluate the impact of various administrative tactics on the operational performance of Nigerian ports. It identified key components of port administration policies such as infrastructure development, modernization of operations, and digitization, which served as independent variables. The dependent variable, which is operational performance, was assessed through metrics like cargo delivery efficiency, ship berthing, and vessel services. Utilizing a theoretical framework based on policy implementation theory and relative state autonomy, the study adopted a cross-sectional survey method, gathering both primary and secondary data. A structured questionnaire was employed to collect relevant primary data from a total of twenty-four participants across six Nigerian ports, yielding a response rate of 87.92% with 21 valid entries. Reliability of the research instrument was confirmed with a Cronbach Alpha score of 0.70. Key findings include: i) improved port infrastructure positively influences vessel services and cargo delivery; ii) port modernization significantly enhances reliable ship berthing and cargo efficiency; iii) while digitalization has a favorable effect on cargo delivery and ship berthing, other port services experience negligible benefits.***

Keywords: Port Administrative Strategies, Port Digitalization, Quality Port Infrastructure Development, Port Administrative Strategies, Operational Performance of Ports

I.INTRODUCTION

The agricultural, oil and gas, marine, and industrial sectors are vital to Nigeria's economy, which is the biggest in Africa. Given that much of Nigeria's commerce with other countries takes place at seaports, these facilities are vital for the country's economy. Because ports play a crucial role in transporting agricultural goods, industrial goods, crude oil, natural gas, and other critical commodities to global markets, it is necessary to analyse their administration procedures. Apapa, Tin Can Island, Onne, and Port Harcourt are some of Nigeria's most important seaports since they link the nation to international markets. The importance of a well-developed port infrastructure and logistics system in enabling developing economies to reach their full potential has been highlighted by Ndalu and Okene (2024).

The administrative strategies of ports aim to improve efficiency through the use of smart port technologies, digitalise operations, plan for future growth, collaborate with stakeholders, ensure strong governance and risk management, and adapt to changing conditions and enhance competitiveness by adopting a flexible, market-oriented approach. Strategies for port administration often focus on ways to make the port more efficient, better manage resources, and adjust to changing patterns of international commerce. Among the most common topics are smart port technologies, logistics optimisation, infrastructure improvement, and better cargo management (Onwuegbuchunam, et al., 2021). It is the exclusive responsibility of the Nigeria Ports Authority (NPA) to oversee all of Nigeria's seaports. In other words, the Port Authority is crucial to Nigeria's commerce and economic evolution. The Federal Ministry of Transport oversees the operations of the Nigeria Ports Authority, which is tasked with supplying the country's maritime industry with specialised port and harbour services. With an annual cargo handling capacity of around 35 million tonnes, the eight (8) main ports under the supervision of the Nigerian Ports Authority (Chilaka, 2022) do not include oil terminals.

In Nigeria, the Nigerian Ports Authority (NPA) leases out port operations to commercial concessionaries, with the goal of modernising and streamlining port administration. Reducing port congestion, enhancing transparency, and increasing competitiveness may be achieved through the use of digital technology, the implementation of a single window system, infrastructure improvements, human capital development, and the promotion of public-private partnerships.

According to Pyre and Briggs in Eze (2004), sufficient, well-run seaports are essential for sustained economic growth. Consequently, the Nigerian Ports Authority is established as an independent body with specific tasks. Among these responsibilities is ensuring that the country's marine sector has access to the ports and harbour services it needs and that all of the necessary people, tools, capital, and machinery are working together effectively (Okpara & Enyioko, 2023). In addition to its primary responsibilities, the Nigeria Ports Authority is also entrusted with the following tasks: (a) ensuring that the necessary quays and cargo handling facilities are provided and operated in an efficient and effective manner; providing pilotage and towage services; and providing a suitable amount of storage space. (d) Providing water and fuel to vessels at anchorage or mooring buoys on a timely basis, (e) Ensuring that vessels are repaired and maintained to work effectively and efficiently (f) Among other things, Ezekiel (2023) calls for the dredging and contract dredging of water ways to facilitate water flow and prevent floods inside and surrounding the complex.

At the national, regional, and municipal levels, seaports impact economic, social, and environmental development because of their central role in marine transportation (Pinwa, 2019). Concerns about the environment are quickly rising to the forefront of marine logistics. Businesses can only thrive in an environment where governments and other decision-makers establish port administration institutions with well-defined policy objectives. According to Xiao et al. (2022), port administration encompasses the public-private dynamics that impact port organisation on a local, national, and international scale. In various geographical and temporal combinations, it is inseparable from various systems of political, economic, and administrative organisation; it is also inseparable from distinct phases of history, cultures, and geography. In recent decades, traditional forms of seaport organisation have been challenged by extensive port upgrades. Recent changes to port administration models, such as devolution and regionalisation policies, have given the port authority more power and responsibility, allowing it to take on more responsibilities beyond just running the port (UNCTAD, 2023). Scholars, port authorities, policymakers, and decision-makers in the marine industry have all taken an interest in port administration during the last 30 years, and the idea of port governance has grown in importance, both in academia and in practice (Osadume & University, 2020). Curious in the impact of port administrative policies on operational performance of Nigerian ports, this study fills a gap in the literature by providing a complete assessment.

With the goal of filling this knowledge gap, this study reviewed the existing literature on the subject. Outdated methods of monitoring and executing port business activities are the root cause of the research problem. With respect to modernisation, digitalisation, and quality port infrastructure development, this study thoroughly evaluates the effect of port administrative strategies on operational performance of ports in Nigeria. Operational performance is measured by effective ship berthing, cargo throughput, and effective vessel services. Contributing to the region-specific body of knowledge in port administration plans, the findings are anticipated to influence operational strategies for seaports across Africa, including those in Nigeria.

Research Questions

The following research questions are posed in line with addressing the aim of this research. These are as follows:

i. What is the effect of port administrative strategies (involving quality port infrastructure development, port modernization and port digitalization) on effective vessel services in Nigeria ports?
ii. What is the effect of port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization) on efficient cargo delivery in Nigeria ports?
iii. What is the effect of port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization) on effective ship berthing in Nigeria ports?

Conceptual Framework

The emphasis of this study is on Nigerian ports and the impact of various administrative strategies on their operational efficiency. This study is primarily investigating two principal factors. The variables under consideration are port operational performance and administrative strategy. When looking at port operational performance and administrative strategy,

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port operational performance is the independent variable and administrative strategy is the criteria variable. The predictor variable is divided into three components: (i) the digitalisation of ports, (ii) the strategy for containerisation, and (iii) the enhancement of superior port infrastructure. Notteboom et al. (2022) and Ndalu and Okene (2024) have previously employed these variables; similarly, the dependent variable is transformed into three proxies or indicators of (i) efficient cargo delivery, (ii) effective ship berthing, and (iii) efficient vessel services. This research has employed these factors in alignment with Guerrero (2022) and Davis and Zhang (2023). Figure 1.1 shows the conceptual framework, and chapter two's academic discussion talks about all of these things.

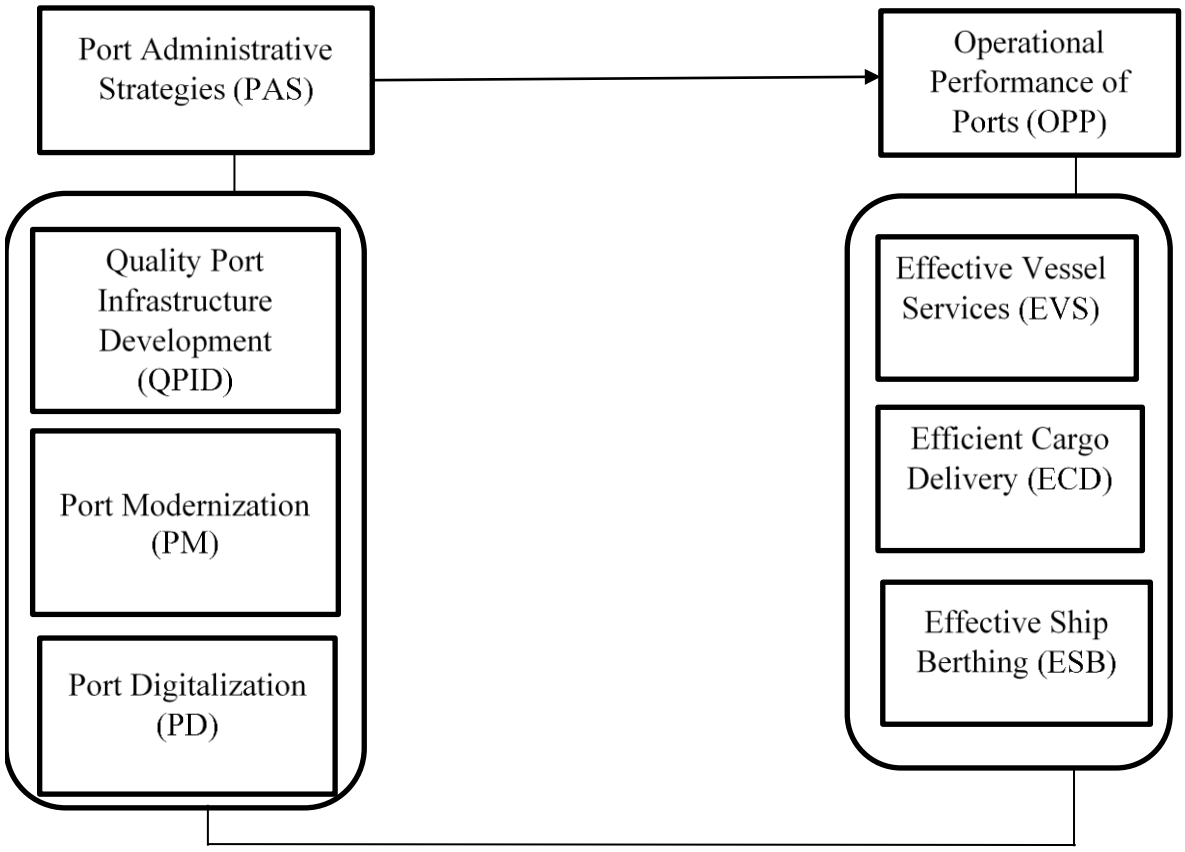

Figure 1.1 Conceptual Framework of the Effect of Port Administrative Strategies on Operational Performance of Ports in Nigeria

Sources: Ndalu and Okene (2024); Adepoju (2020); Notteboom et al. (2022); Researcher's Desk (2025).

1.6 Research Hypotheses

The following null hypotheses are stated tentatively in line with the objectives of the study:

Ho_1: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on effective vessel services in Nigeria ports.

Ho_2: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on efficient cargo delivery in Nigeria ports.

Ho_3: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on effective ship berthing in Nigeria ports.

II.LITERATURE REVIEW

Theoretical Foundation

This section delves into the hypotheses that support the study. These theories encompass a wide range of topics and approaches, including those of General

System Theory, Contingency Theory, Infrastructure-Led Development, New Public Management (NPM), Port Driving Force, and Driving Force Development.

General System Theory

Austrian philosopher and biologist Bertalaffy laid the groundwork for universal system theory in the 1940s. This theory aims to set rules that apply to all open systems (Bertalaffy, 1968). Homologies, or correspondence connections, among systems from various domains constitute the foundation of GST. We should be able to think more clearly about other systems if we understand one system (Bertalanffy 1968) madated to develop a novel approach for analysing living systems in response to the increasing complexity of the world. In his writings and in philosophy classes, Bertalanffy said that we shouldn't break systems down into their parts, but instead see them as whole, changing things. Bertalanffy (1968) posits that a system comprises a network of interdependent components. In his quest for universally applicable concepts, von Bertalanffy promotes systems thinking across all disciplines. It offers the idea of "system" as a different way of looking at things than classical science's analytical and mechanical ways of doing things. Interactions are a big part of general systems theory. In this case, general system theory looks at the Nigerian Ports Authority to find out how they manage the country's ports. It talks about how the Nigeria Ports Authority's management and administrative groups affect the environment. We can now look at how administrative law works in real-life organisations, like Nigeria's ports, based on this theory. According to the general theory of systems, any organisation that has real power in its area, like the Nigeria Ports Authority, should be able to enforce the federal government's rules on how the country's seaports are run. Because of this, the Nigeria Ports Authority is likely to fail if its policy decisions are not legally binding.

Applications of the Theory

Applying general system theory to the present study, the theory treats the many components of the Nigerian maritime infrastructure as an integrated whole, rather than isolating them. The theory provides the Nigeria Ports Authority with a framework for considering the country's seaports in relation to their external environment. According to the theory, the management of the Nigeria Ports Authority must comprehend not only their responsibility in overseeing the administration of Nigeria's seaports, but also the interconnectedness of all of the ports in the country and how their operations impact one another. In addition, it will make sure that the organization's many components (Nigerian seaports) work together smoothly to accomplish the goal set by the federal government for the management of Nigerian seaports. The idea also opens the door to studying how various authorities in Nigeria prescribe formal administrative law at the country's seaports. According to the hypothesis, the agencies in charge of the Nigerian seaports face a number of challenges while trying to carry out their jobs in an environment as hostile as the ports complex as a whole. According to David Easton, the creator of the systems concept, the ability of central players, such as the managers of the Nigeria Ports Authority or the administrative agencies of the Nigerian seaports, to carry out their responsibilities effectively and efficiently determines whether a system will survive or continue. The Nigeria Ports Authority, according to Easton, has the authority to impose federal policies on the management of Nigeria's seaports. This would mean that the federal government's goal would undoubtedly be achieved. System theory, on the other hand, stresses the need of cooperating with others in order to stay alive in a given setting.

Contingency Theory

The research utilised contingency theory as its foundation due to its elucidation of the relationship between port reform and operational performance (Bandura, 1977). Based on the empirical evidence mentioned above, it is clear that the current business environment is very unstable. As a result, organisations must adopt and execute context-specific strategies to attain their objectives, whether pertaining to performance, survival, sustainability, or other goals. Fiedler developed the contingency theory in the 1960s, which Jaja and Zeb-Obipi (2005) improved upon. According to this theory, successful managers adapt their leadership styles to fit the needs of each situation (Song & Lee, 2017). The theory identified three fundamental factors that offer a thorough elucidation of the various situations faced by managers. First, there are interactions between leaders and members. The theory looks at how much a manager's subordinates trust and depend on him. Second, there is the formalised task structure, which outlines the work that needs to be done. Third, there is the position power, which looks at how sure a

manager is about the organization's business (Freeman et al., 2010).

Because the marine sector is so complicated and has its own set of problems, we think that no one strategy can keep it running well over time, especially when it comes to how well it works with the research factors of port reform and performance. This is because a theory that works in one situation may not work in another. Things never go as planned in Nigeria, which makes things even worse (Wang & Slack, 2002). Because of corrupt leadership, the government has not been able to keep its promises to the sector, especially when it comes to financial help. As a result, a targeted strategy is needed to save the Nigerian port. This means that the Nigerian government should think about modernising the port by either partially or fully privatising it, or by making changes to the way it is owned.

Infrastructure-Led Development Theory

In 2006, Professor Pierre-Richard Agenor from the University of Manchester's Centre for Growth and Business Cycle Research proposed the concept of infrastructure-led growth through a series of discussion papers. Agenor (2010) posits that the theory's definitive iteration from February 2010 indicates that public infrastructure ought to serve as the principal growth mechanism in the long term. The inadequacy of infrastructure in most low-income countries substantiates a principal aspect of Agenor's (2010) hypothesis. Agenor (2010) discovered that only 16% of roads in sub-Saharan Africa are paved, and statistics show that less than 20% of Africans have access to electricity. Agenor (2010) presents two primary justifications to support his concept of infrastructure-led growth. There are two main reasons for this: first, there is a floor below which spending money on infrastructure doesn't help development, and second, spending money on infrastructure below that floor doesn't help development at all Network effects mean that the amount of public capital doesn't have a straight-line relationship with how well port infrastructure works. It may be possible to go from a low growth equilibrium with low productivity and savings to a high growth steady state by increasing the share of spending on infrastructure. This could be done by cutting unproductive spending or getting foreign grants, as long as the government is competent enough to make sure that public investment is efficient enough.

New Public Management (NPM) Theory

The writings of Osborne and Gaebler set the stage for what is now called New Public Management (NPM) Theory (1992). The belief that the state should take the lead includes ethical compliance, transparency, equality, fairness, accountability, prudence, participation, responsiveness to the needs of the people, and efficient use of public resources. The New Public Management school of thought wants to encourage the following traits in a performance-based, decentralised public sector: efficient, effective, and focused on giving great service; Decentralised management can help service providers get closer to customers and get feedback faster by getting rid of top-down, hierarchical management structures. The government would see its citizens as customers instead of workers if it were customer-focused (Osborne, 2006). It should put customer satisfaction ahead of red tape. Part of it is giving people choices, asking for their opinions, making it easier for them to get resources, and encouraging them to think outside the box. Governments should be entrepreneurial and put making money ahead of spending money. To keep running, it needs to focus on getting fees, enterprise savings funds, and other types of income. The government should put finding problems ahead of fixing them. The seaport can help the government make money and the economy grow if the public services it offers are up-to-date and follow best practices around the world. The government needs to stay away from the ports and the people who work there in order for all of the above to happen. After that, it must give concessionaires full control over how to run the ports in a way that is both efficient and effective. This deal is good for the government, the concessionaires, and the people as long as the concessionaires provide services that are competitive and meet international standards.

Driving Force Development Theory

The concept of port driving power (Kim et al., 2012) serves as the foundation for port development. It is connected to a method that measures and combines the information from each unit that needs to be evaluated. Using the Entropy Method gives the assessment elements more power, which makes the evaluation process easier and lets the index weight be determined objectively. The study employs the Entropy Weight to assess the index weight in the context of port development evaluation, thereby

mitigating the influence of subjective variables in determining the weight coefficient (Lee et al., 2017). Munim and Schramm (2018) said that the benefits of investing in infrastructure go beyond just saving time on travel. They showed that better goods and services will lead to more business, which will then lead to more workers. Notteboom (2015) says that regular maintenance of existing infrastructure is important for port operations because it helps them get market share and stifle competition for business opportunities. A 10% increase in cargo throughput can lead to a 6-20% increase in a country's GDP. Now we can use advanced tools to make valuation index system based on how the ports handle cargo. We can also use the structures of the port's level of growth to help us.

Conceptual Review

Port Administrative Strategy

There is always some kind of administration in every cooperative effort. When we talk about administration, we mean the actions of groups of people working together to reach common goals. UNCTAD (2023) says that good administration means leading, coordinating, and controlling a lot of people to reach a common goal. Administration is a part of every human activity, except for those that can be done by just one person. The Ports Authority The Nigerian Ports Authority takes input from around the world and sends it to the legislative branch as instructions and feedback. The Nigerian Ports Authority is a government agency that is completely owned by the Nigerian government. It reports directly to the Federal Ministry of Transport. Its duties include overseeing the country's maritime industry by providing ports and harbour services, operating quays and cargo handling facilities, providing pilotage and towage services, refuelling and watering vessels at anchorage or mooring buoys, repairing and maintaining vessels, and dredging and contract dredging of water ways. The management of seaports as the name suggests, seaports administration is in charge of overseeing seaports by an organisation that the federal government has given permission to provide the maritime sector with specific ports and harbour services. The Federal Government wants to build seaports in Nigeria, and this will help them reach their goal. Oyewole (2019) says that the Nigeria Ports Authority (NPA) is in charge of overseeing Nigeria's seaports.

The Nigeria Ports Authority (NPA) is the only group in charge of all of Nigeria's seaports. This shows how important the Port Authority is for running Nigeria's seaports. The Nigeria Ports Authority is in charge of providing specialised port and harbour services to the country's maritime industry. The Federal Ministry of Transport oversees the authority's work. The eight (8) main ports that the Nigerian Ports Authority is in charge of are now open. They can handle about 35 million tonnes of cargo each year (not including oil terminals). But SMS (Ibrahim, 2022) by using good administrative practices and focussing on operational performance, Nigeria could make its ports more efficient and competitive, which would help the economy grow and trade in the region.

The federal government can also step in to make sure that policies are in line with each other. One kind of funding that doesn't work like traditional, locally focused income streams is conditional grants. In port systems where local businesses compete fiercely with each other, central governments often use a port hierarchy, either openly or secretly, to decide which ports should get more development. This is what happened in China (Carter, 2022). Port and government officials should work together to make sure that policies are in line with each other. A wide range of stakeholders, such as businesses, marine services companies, non-profits, unions, and academics, should also be involved. As part of their long-term scenario planning, ports like Rotterdam and Vancouver have talked to these groups a lot. This is a good example for a lot of ports to follow. It's usually necessary to rethink who is a major stakeholder. This includes people like public officials, neighbourhood groups, and real estate developers (Alser et al., 2024).

Ports make things that are both public and private. Public safety, security, and a healthy environment are all examples of public goods that can't be split up or used up. Coastline protection works are needed to make port basins, on the other hand. Private goods have few economic externalities because they can be used up and shared (Liu & Guitart, 2022). There are a lot of things that affect the marine industry from the outside. These are things like rules about money, trade, and the environment. Ports need to be quick and adaptable to keep up with the market and regulatory changes that happen all the time (UNCTAD, 2023). Zaucha and Kreiner (2021) say that it is important to improve how ports are run in

order for them to stay efficient, sustainable, and competitive in the global economy. To deal with the problems of the modern marine sector and improve performance, port authorities should focus on operational efficiency, building new infrastructure, protecting the environment, and getting stakeholders involved.

Quality Port Infrastructure Development

Due in large part to the concession program that began in 2006, Nigeria's port infrastructure has improved greatly in recent years (Ezekiel, 2023). Revenue generation, cargo throughput, and ship turnaround times have all improved since the pre-concession era, when infrastructure was inefficient and unreliable. The privatisation of cargo operations was a primary goal of the concession program's inception, with the expectation that it would increase efficiency and productivity (Ibrahim, 2022). In order to promote trade and economic growth, quality port infrastructure development prioritises the creation of sustainable, dependable, and efficient port facilities. Harbours, navigation channels, berths, and logistics systems are all part of the infrastructure that must be carefully planned, built, and maintained in accordance with this approach. It takes into account things like community involvement, environmental effect, and sustainability in the long run (Ikwunze & Ihunwo, 2024).

The area where port activities happen includes everything from the port's internal infrastructure (berths, quays, docks, storage yards, etc.) to its superstructure (sheds, fuel tanks, office buildings, cranes, van carriers, transtainers, and so on). Bivbere (2019) said that it is possible to "define precisely" what is and isn't included when talking about port infrastructure. However, these facilities are necessary for the port to work. The port authority is in charge of most of the port area and some of the infrastructure that allows ships to get in and out, such as breakwaters, lights, buoys, and other things. The state or local government, on the other hand, owns and takes care of the connections to land networks and other types of maritime access, such as channels and locks (Kalgora, 2019). Traditionally, public funds have been used to build new port infrastructure. The pattern has been for the public to own and maintain the ports directly through port administrations (World Bank, 2020). The rationale for this stance has consistently been that these assets should reside in the public sector to avert the emergence of monopolies among private enterprises. Bichou and Grey (2022) assert that a global trend has emerged since the 1980s, initiated by Margaret Thatcher's Conservative government, advocating for increased private sector participation and the infusion of private capital into infrastructure development via various privatisation methods, including concessions.

Port Digitalization

Digitisation is the best way to improve port operations, and using technology is the first step towards this goal. It allows for real-time data delivery to everyone involved, which makes things more effective and efficient (Turcanu (Marcu), 2022). Ports are important places where people and goods move between land and sea, and they help the economy grow (Buiza-Camacho et al., 2016; Karli et al., 2021). The growing number of transactions shows how important it is for a country to have long-term, sustainable port management for its economy, politics, and the environment. Smart ports are one of the planned new ideas to help reach these goals (Paulauskas et al., 2021b; Turcanu (Marcu), 2022). The smart port idea came from efforts to reduce greenhouse gas emissions and environmental impact. The goal is to create a nice port environment with pollution levels that are easy to control (Liao et al., 2016; Turcanu (Marcu), 2022). Smart ports need applications that work with their features. This means that it's important to look at the ports because each one has different needs. Digital transformation efforts are new and useful, but they could fail if port stakeholders don't understand how they can help themselves or if other factors aren't taken into account (Turcanu (Marcu), 2022).

Digitalisation in the maritime sector includes building new ships that are connected to the internet, making port operations more efficient, solving traffic problems in ports, and making sure the environment is protected (Sullivan et al., 2019). Lam and Notteboom (2014) talk about some environmental problems, like pollution of water and air and how to get rid of trash. The authors examined port management systems and their utilisation to encourage the advancement of eco-friendly ports. To achieve this, a comparative and exploratory study was conducted, examining the diverse instruments available to port authorities and the operational activities performed at the ports. We looked at and compared four important ports: Rotterdam, Antwerp, Shanghai, and Singapore. The results showed that ports do a good job of following the rules when it

comes to protecting the environment. Also, European port authorities had more power to make decisions about environmental policy than the Asian ports that were looked at. Chiu et al. (2014) examined the impact of ports on the natural environment. The authors say that emissions from the intermodal transport networks that service the port also add to the effect, along with port activities and ships' calls. Researchers examined the significance and sequence of the criteria necessary for the operation of an environmentally sustainable port, utilising the first three ports in Taiwan as a case study. The paper's conclusions can help the port industry make and run ports that are better for the environment.

Port Modernization

The goal of modernising ports is to make it easier to handle containers in every way, from docking ships to moving containers around the terminal and transferring cargo. Ndalu and Okene (2024) say that one of the best ways to improve operations and cut down on delays is to optimise the layout and equipment of container yards. Another way is to improve gate processes and use technology to make things easier. The main goals of port modernisation are to improve overall logistics and lower costs. This is done by making it easier to handle, store, and move containers inside the port. This often means using automation and the latest technology to make things like storage, handling containers, and gate operations easier. Notteboom and Haralambides (2020) say that the goal is to make the port more reliable, make customers happier, and improve its performance.

These new technologies, like AI-guided autonomous ships and fully automated container terminals, are meant to make operations more efficient and reduce the chance of human error in tasks that used to require a lot of work. Many parts of the process of handling cargo in containers will soon be automated because new technologies are growing so quickly (Yang, 2022). One of the new trends in containerised goods is eco-friendly options. Some examples are biodegradable packaging, containers that run on solar power, and ships that run on LNG. Companies that do business internationally can stay creative and help the environment by using new technology and sustainable practices (Zhang et al., 2023).

Modernization of Port Infrastructures

To set the standard berth lengths for both cruise and ferry ships, models and comparisons to the sizes of cruise ships in 2009 were used (Monde et al., 2018). These days, things are very different. The area is likely to lose passenger traffic because the port can't handle liners longer than 333 meters unless it makes changes to its infrastructure and works to lengthen the berths in the city. Digitalisation processes also have an effect on processing and port services. Even with the problems caused by COVID-19, a lot of people still want to take cruises and ferries. To keep up with the growing number of passengers, a modern sea passenger port needs to make sure that it can handle passengers and cargo quickly, reliably, and efficiently. It also needs to reduce the time it takes to handle vessels and keep all of its services and departments running smoothly (Monde et al., 2018). This means we need to come up with new ways to organise processes and use digital technology. It's important to think about how things will change because digitisation is happening so quickly. As companies move to the digital economy, they need to change their development strategies, structures, and practices to meet the digital needs of their customers, meet their expectations on time, and improve their competitive position in the market for services. This includes ports, ferry companies, the services they offer, and the way they do things as a group. There are new problems with transportation-related topics because we need to speed up the social and economic effects of digital technology. As transport space themes shift towards a more "digital" future, there will be pros and cons to think about. To be able to join the global economy, make it easier for businesses to reach new markets, and make industries more global, seaports need to switch to digital management.

The functions show that the port area provides a variety of services. It is not uncommon for these services to be supplied by standalone businesses operating within the port, or even by a single business in the instance of smaller ports. The number of viable operators in a port region is diminished by the space restriction. When dealing with little ports in outlying areas, it may be necessary to employ a single operator (Bert, 2008). The port authority is the government body often in charge of activity coordination, common facility usage, safety, and overall port facility design. The function of port authorities within the port sector is addressed in the next section.

Operational Performance of Ports

Operational performance can be defined as how effectively a company runs its core activities, focusing on efficiency, productivity, quality, and timeliness in delivering goods or services, tracked through Key Performance Indicators (KPIs) like cost, output, and customer satisfaction to identify issues and drive continuous improvement for profitability and competitiveness. It assesses the effectiveness of internal processes from input to output, including supply chain, production, and customer service, ensuring seamless operation and goal achievement.

The study's findings indicate that Asian ports need to increase their inputs to improve efficiency, as they are experiencing rising returns to scale. Researchers may find it difficult to choose which DEA model to use in their study. Jang et al. (2016) employed Shannon's Entropy method to evaluate and rank the efficiency of 21 Asian ports, thereby addressing the issue. In the DEA models, the ports in question were CCR-I, BCC-I, BCC-O, CRS-SBM, and VRS-SBM. This means that ports need to be able to do their main job of "lifting up" and "putting down" cargo well for marine transportation to work well. Modern ports are complicated and different, but they all offer the same basic services: cargo, vessel, infrastructure, marketing, administration, and security. Table 2.1 shows the different types of services and the jobs that go with each one. (Was & Bos-Nehles, 2019).

Effective Vessel Services

Turnaround times have a direct effect on the economic and operational performance of port containers (Zhang & Xing, 2018). As turnaround times get longer, container performance goes down and port congestion gets worse. The most important thing for any port is to optimise throughput and, in the end, cut down on the time it takes for a ship or vessel to turn around. The two most important parts of a ship's turn-around time are the time it spends at berth and the time it spends waiting, or the time it spends in port from the time it enters the port's boundaries until it leaves (Lee, 2021). According to KTO's data for the last 2.5 years, 1999-2001, there was no waiting time, so the ships' turn-around time was the same as their service time at dock. The happiness of the shipowner, who is the port's main customer, is very important for the port's long-term health. This is why this is one of the most common ways to measure port performance around the world. The owners of ships would benefit the most from a quick turnaround time because the amount of time a ship spends in port has a big effect on how much money it makes. As a result, the profit goes up as the amount of time ships spend in ports goes up.

Effective Cargo –Delivery

A logistics hub's cargo throughput is the total amount of goods and products that pass through it in a set amount of time. This could be an airport, port, railway station, or other type of hub. Cargo throughput, or port throughput, is an important way to measure how well a port works because it shows how much cargo the port can handle in a given amount of time (Seifegha, Ndalu, and Okene, 2023). Zhang and Xing (2018) say that cargo throughput is a way to measure how much stuff a certain transportation system or infrastructure can handle. Cargo throughput is measured in weight (tonnage) or volume (cubic meters) to figure out how well transportation and logistics infrastructure is working and how much it is being used. To assess the functionality of these nodes and understand their role in facilitating trade and commerce, cargo throughput evaluation is essential (Lee, 2019). Cargo throughput is the total amount of goods that are loaded and unloaded at a port or terminal over a certain amount of time, usually a year. Compared to what was possible before the port privatisation regime, the data shows that the amount of cargo throughput and ship traffic that called at the ports of Nigeria under the post-privatization regime increased dramatically. One of the primary goals of implementing the privatisation program was to increase cargo throughput and ship traffic, and this proved to be the case after the privatisation of the Nigerian Seaports. It also revealed that, under the post-port privatisation system, such ships spent more time at berth being worked on, which went against the spirit of the policy's introduction. The amount of man-hours spent working on these ships grew in direct proportion to the number of days they were at berth.

Effective Ship Berthing

Berthing is the process of manoeuvring a ship into place next to a dock, quay, or pier so that cargo operations may begin. Precise coordination among the ship's crew, port authorities, and terminal operators is required for this crucial phase in ensuring the smooth transfer of commodities. To make sure that goods moves smoothly after it reaches the port, it is vital to understand the notion of berthing. Just

picture yourself navigating a huge ship into a tight spot without hitting any other ships or ruining the port's infrastructure. Accurate timing is just as important as competence and communication in this process. Planning the berth, carrying it out precisely, and being environmentally conscious are all components of a successful berthing strategy. Among these measures are the following: utilising cutting-edge technology for precise location and environmental modelling; optimising vessel and berth schedules to save turnaround time; and utilising safe and secure docking practices. Efficiency, cost reduction, and a safe and sustainable operation are the overarching goals. Inherently, all parties, not just the terminals, have a duty for effective ship berthing. As a byproduct of the port's logistical chain, its success is directly correlated to the strength of each link in the chain, regardless of who it pertains to. Nevertheless, it is the terminal's principal obligation to ensure the swift turnaround of boats, as there is a correlation between dwell duration and efficient ship berthing. There would be an impact on the port's recorded effective ship berthing if the vessels are late at berth. The berth occupancy rate is the percentage of available berth time that a vessel is using within a certain time period. Low berth occupancy (<50%) indicates underutilization of resources, whereas high berth occupancy (>70%) indicates congestion and a subsequent reduction in services (Oyewole, 2020).

Empirical Review

Nigeria's economy will grow if ports are well-managed and operations run more smoothly. Fighting corruption, making infrastructure better, and making operations easier are all important steps. Even though the NPA plays an important role in port development, regulation, and administration (Akani & Ndiokho, 2021; Ahmodu et al., 2021; and Ikwunze & Ihunwo, 2024), problems like traffic jams, bad infrastructure, and safety concerns still exist. Tongzon and Heng (2005) looked into the topics of promptness, effectiveness, and privatisation of ports. They use a linear regression model and principal component analysis to figure out what makes international container ports competitive. The study's results show that private companies getting involved in the port business could make it more efficient and competitive. Blonigen and Wilson (2007) studied the best ways to run a port and do business. The Gravity trade model was used to look at US imports and the costs that go along with them. The model produced estimates for different ports, goods, and times. The results showed that efficient ports greatly increase trade volumes.

Ndalu and Okene (2024) wrote a paper called "The Nigerian Port Authority Experience from 2006 to 2022" that looked at how the quality of logistics and port facilities affected Nigeria's economic growth. This study focusses on data from the post-concession period (2006–2022) and aggregates information from the Central Bank of Nigeria Statistical Bulletin and the annual reports of the Nigerian Port Authority. We used the ARDL Bound Test method to find out how the variables were connected to each other. The study's findings indicate that both short-term and long-term correlations between logistical efficiency (CTR) and economic growth are statistically insignificant. The test of Hypothesis One showed that economic growth had a very small negative effect on the quality of port infrastructure, with β coefficients of -2996.500 (short-run) and -110071.1 (long-run) and p-values of 0.4602 and 0.7904, respectively. In a similar manner, the second hypothesis test indicated that cargo throughput (CTR), an indicator of logistics efficiency, showed a weakly positive correlation with GDP growth.

Port Administrative Strategy and Effective Vessel Services in Nigeria Ports

Good port infrastructure, good management of containerisation, and good management of liquid bulk all have a direct effect on how well ships are serviced in Nigerian ports. Clark et al. (2004) analysed port efficiency, maritime transport expenses, and bilateral trade costs to the United States, utilising 300,000 annual observations of product shipments aggregated for various global ports. They discovered that port efficiency was a crucial factor in shipping costs. Improving PE from the 25th to the 75th percentile cut shipping costs by 12%. In general, their research showed that a port's (in) efficiency also raised the costs of handling and shipping. Bichou and Grey (2022) conducted a study on the management of container terminal operations, focussing on logistics and planning. The study utilised a correlational analytical tool and determined that the management of container terminal operations in logistics is significantly influenced by planning and control. Based on the above explanations, the study proposes the hypothesis: HO1: Port administrative strategies (including quality port infrastructure development, containerisation strategy, and port digitalization) do not significantly

impact the effectiveness of vessel services in Nigerian ports.

Port Administrative Strategy and Efficient Cargo Delivery in Nigeria ports

De Langen & Sharypova (2013) and Cong et al. (2020) say that most countries don't want to privatise their port authority. Instead, they will use a landlord model and give private operators concessions that last 30 years or more. Port authorities can be fully privatised, as seen in New Zealand's port (Brooks et al., 2020), partially privatised, as in Piraeus, or newly autonomous, as in Turkey's and China's ports (Notteboom et al., 2013; Da Silva & Rocha, 2012). Notteboom and Haralambides studied port management after Covid-19 in their 2020 book "Quo Vadis." The study indicates that the landlord port has a combination of public and private priorities. In this system, private companies run the port, especially when it comes to moving cargo. The port authority is in charge of the port and acts as a landlord. Ports like Rotterdam, Antwerp, New York, and Singapore (since 1997) are all examples of landlord ports. Trans (2019) says that the landlord port model is now the norm for larger and medium-sized ports.

Ndalu and Okene (2024) looked at how the effectiveness of logistics and port facilities affected Nigeria's economic growth in their study "The Nigerian Port Authority Experience from 2006 to 2022." This study focusses on data from the post-concession period (2006–2022) and aggregates information from the Central Bank of Nigeria Statistical Bulletin and the annual reports of the Nigerian Port Authority. We used the ARDL Bound Test method to find out how the variables were connected to each other.

Port Administrative Strategy and Effective Ship Berthing in Nigeria ports

The conservative port authority is mostly focused on passive and mechanical management and implementation. The port authority that is "facilitating" is actually a go-between for competing social and business goals in its quest for strategic regional relationships. The "business" port authority has many duties, including facilitating, investing, providing services, and giving advice (Kalgora et al., 2019). As an important part of port governance models, rules for competition between ports could lead to (a) a monopoly on port services, (b) a limit on the number of port service providers, or (c) a loosening of port services in general (World Bank 2019). The process for choosing port managers, harbour managers, and officers is very important and can have a big effect on the port's success. Local or national lawmakers, a technical tender, or the port community can all suggest who should be in charge (Kraemer, 2021).

Based on the preceding information, the study's working hypothesis posits that: HO3: Efficient ship berthing and the advancement of high-quality port infrastructure in Nigerian ports remain uninfluenced by port administrative strategies that incorporate containerization, digitalization, and superior port services.

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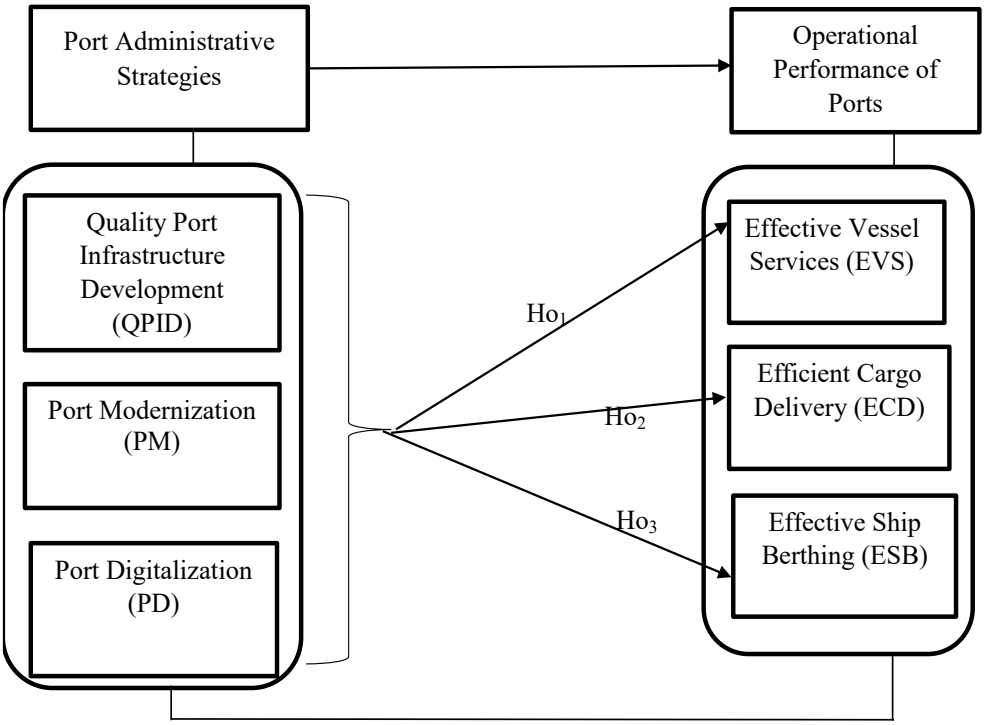

Figure 2.1 Operational Framework of the Effect of Port Administrative Strategies on Operational Performance of Ports in Nigeria

Sources: Ndalu and Okene (2024); Adepoju (2020); Notteboom et al. (2022); Researcher's Desk (2025).

III. METHODOLOGY

Research Design

The research design provides a comprehensive account of the framework, methodologies, and strategies employed to collect and analyse data for the study, aiming to ascertain the relationship between the hypothesised variables. Researchers employed a cross-sectional survey methodology in this study. Cross-sectional survey research focuses on quantitative analysis and collects data through questionnaires, interviews, or existing records. The survey method can give you a "snapshot" of a certain situation at a certain time. This study qualifies as a cross-sectional design as it encompassed only one specific time point.

Population of the Study

Scholars agree that the study's population is an all-inclusive set of organisms that share certain traits (Akujuru & Enyioko, 2018; Bai et al. 2021). Both parties also acknowledge that the term "population" refers to the whole of the entities, whether human or otherwise, that the researcher intends to examine

Sample Size and Sampling Technique

A total of 240 managers and supervisors from the six ports make up the study's target group. This research qualifies as a census as the sample size is proportional to the tiny target population. Here is how the samples are sent to the various ports: This study employed the purposive sampling approach for its sampling. The specified and well-known nature of the study's components led to the selection of this methodology. Participants in the study included port traffic managers, supervisors, dispatchers, logistics managers, supply chain supervisors, beach masters, clients service officers, warehouse supervisors, and transport supervisors/officers who were all directly involved in maritime logistics at the ports.

Methods of Data Analysis

Methods and techniques for statistical data analysis surfaced and were organised in a comprehensible way as the thesis's scope expanded. This step's responses allowed the research to be expanded,

showed certain trends, and addressed the initial questions. It also entails looking for similarities and contrasts, patterns of structure, and trends in these datasets. To assess and accomplish the research goals, this study used a variety of statistical methods, including percentages, ratios, frequency distribution, scaling, ranking, and more. However, the moderating variable was tested using stepwise regression. The magnitude of the influence of the individual and collective variables on each other was tested using regression analysis. The study's hypotheses were also tested using regression analysis. We used IBM SPSS Statistics 25, which is a statistical software for the social sciences, to do all of these analyses.

Model Specification

This study takes as its starting point the model proposed by Odiegwu and Enyioko (2022) and Chang (2020), tweaking it somewhat to account for factors like berth turnaround time and effective vessel services. The study's authors formulated economic performance metrics in terms of port management techniques (MT).

Their models are stated thus:

$EVS = ß_0 + ß_1\ QPID + ß_2\ PM + ß_3\ PD + U_t$ ----------1

$ECD = ß_0 + ß_1\ QPID + ß_2\ PM + ß_3\ PD + U_t$ ----------2

$ESB = ß_0 + ß_1\ QPID + ß_2\ PM + ß_3\ PD + U_t$ ----------3

To examine the effect port administrative strategies on effective vessel services, efficient cargo delivery and effective ship berthing, the model of the study is stated using the multivariate models' estimation as shown below:

$Y_1 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(1)

EVS = f (QPIDS, PCMS, LBMS)

Where;

EVS = Effective vessel services

QPID = Quality Port infrastructure development

PM = Port modernization

PD = Port digitalization

$Y_2 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(2)

ECD = f (QPID, PM, PD)

Where;

ECD = Efficient Cargo Delivery

QPID = Quality Port infrastructure development

PM = Port modernization

PD = Port digitalization

$Y_3 = b_o + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + b_{12}x_{12} + e$ ----------(3)

ESB = f (QPIDS, PCMS, LBMS)

Where;

ESB = Effective ship berthing

QPID = Quality Port infrastructure development

PM = Port modernization

PD = Port digitalization

Port administration strategies are an independent variable that takes economic and environmental considerations into account while aiming to improve operations, efficiency, and sustainability. Here, QPID, PM, and PD are the variables that stand in for them in terms of port infrastructure development. The dependent variable proxies are the operational performance of port indicators, which include efficient cargo delivery (ECD), Effective ship berthing (ESB), and Effective vessel services (EVS).

Statistical Model Specification

The dependent variable in this study was the operational performance of ports, which was measured using Efficient cargo delivery, Effective ship berthing, and Effective vessel services. The independent variable was port administrative strategies, which were to be defined by quality port infrastructure development, port modernizations, and port digitization. Consequently, the following is the model specification:

$Y_1 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e;$

$Y_2 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e;$

$Y_3 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e;$

Where;

Y1 is the intercept parameter; Y2 is the efficient cargo delivery parameter; Y3 is the effective ship berthing parameter; and bo is the effective vessel services parameter. Each of the independent factors x1, x2, x3, and x4 had an influence on the dependent variables b1, b2, b3, and b4 via the usage of the regression parameters. Years 1–3 e is the amount of random disturbance. Port administration tactics and performance can be influenced by these variables, even if they are not explicitly mentioned in this model. Issues such as government policy, political unrest, corruption, and environmental degradation fall into this category. Utilising interval and ratio scaling, we evaluated the impact of port administration practices on the dependent variables. To find out how much the dependent variables explained the independent variable, researchers utilised the coefficient of determination (R2). The coefficients are expected to be greater than zero if

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given the following a priori: β0 >0; β1 >0; β2 >0; β3 >0.

Table 1: Test of Reliability

Construct	No of items	Alpha(α)
Quality port infrastructure development	5	0.874
Port modernization	5	0.799
Port digitalization	5	0.887
Effective vessel services	5	0.835
Efficient cargo delivery	5	0.893
Effective ship berthing	5	0..872
Port infrastructure	5	0.836
Total		5.943
Reliability Test		0.849

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0.

IV. RESULTS

Data Presentation

The researcher conducted the field and survey exercises using both online and offline methods, distributing copies of the questionnaire to port workers via the ports' email addresses. After giving the instruments to the respondents, they had three months to answer them. After that, copies of the questionnaire were sent to the studied ports through established email contacts with the help of Monkey Survey and enumerators.

Data Analysis

The study's univariate data analysis of the dimensions of the construct that were looked at. It is highly valued to conduct an initial analysis of the study data by examining the various factors and their components. This context takes into account the data collected by the study instruments that showed the presence and size of these variables. Here are the univariate analyses for all of the operationalised variables. A 5-point Likert scale instrument was used to measure the operationalised variables. The results of this study were assessed using a 5-point Likert Scale, comprising the options: "very strongly agree" (5), "strongly agree" (4), "agree" (3), "disagree" (2), and "strongly agree" (1). Below are the means, standard deviations, variances, and answers to research questions. They were calculated using the SPSS software program window output, Version 25.0, based on this scale, which includes options, responses, and related rating points. The table on how to build good port infrastructure is the first thing the investigation looks at.

Table 2: Responses on Quality Port Infrastructure Development (QPID)

	Question Items on Quality port infrastructure development	Mean	STD
1	Quality port infrastructure development makes the maritime transport in ports to put a lot of emphasis on having a credible port administrative strategic outcome	3.010	1.969
2	Effective quality port infrastructure development influences the current contributions of effective vessel services, societal orientation and effective ship berthing in the port	4.245	0.826
3	The impact of quality port infrastructure development on port's competitive advantage is advantageous to the overall performance of seaports	4.433	0.676
4	Seaports have developed and implemented strategies, initiatives and programmes that address issues related to quality port infrastructure development questions in maritime industry	4.152	0.631

5	Adequate information is provided to predict future demand for goods, storage, port digitalization, and services related to the operational performance of ports	3.533	0.887
	Valid N listwise	211	

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0*(Appendix A)*

Table 2 shows the descriptive results from the analysed question items and gives us an idea of how the operational performance of ports is related to the quality of port infrastructure development as a part of port administration strategies. The main goal of this survey was to find out if building high-quality port infrastructure makes port maritime transport more important for getting a credible port administration strategy. Experts agree that for marine transport of ports to focus on real port management strategy outcomes, it is important to build good port infrastructure. This is shown by the mean and standard deviation ratings of 3.010±1.969. The second question asked whether or not the development of high-quality port infrastructure affects the current contributions of efficient vessel services, social orientation, and ship berthing at the port. With a mean and standard deviation score of 4.245±0.826, it can be inferred that the respondents agree that the development of high-quality port infrastructure has an effect on the current contributions of successful ship berthing, social orientation, and effective vessel services.

The third question item asked if seaports benefit from the development of high-quality port infrastructure that gives companies a competitive edge. The average and standard deviation scores of 4.433±0.676 show that the people who took part agreed that well-developed port infrastructure helps firms' competitive advantages at seaports. The mean and standard deviation scores of 4.152±0.631 indicate that, in general terms, the respondents agree that there is enough information available to predict future demand for goods, storage, port digitalisation, and services related to the operational performance of ports. This was the fourth question. The participants all agree that seaports have made and carried out plans, projects, and programs to deal with problems related to building high-quality port infrastructure in the marine sector. This is shown by the mean and standard deviation scores of 3.533±0.887.

Table 3: Responses on Port Modernization (PM)

	Question Items on Port Modernization	Mean	STD
1	Port modernization engenders administrative changes in customer and vendor compliance issues with greater emphasis on supply chain visibility and customer satisfaction in ports	4.672	0.510
2	Port modernization determines how strategies shape the approach to aims, methods and ways to enhance and improve the storage devices of seaports.	4.133	0.642
3	Port modernization activates benefit all the stakeholders connected with the management of a warehouse i.e., all the operations of movement of the products inside the warehouse and distribution centers in ports	4.200	0.997
4	A major way of achieving efficient cargo delivery is by effective ship berthing involves a combination of precise planning, skilled maneuvering, and proper use of equipment to dock a vessel safely and efficiently.	4.110	0.929
5	Port modernization provides a valuable tool for ports to temporarily store products, often for storing inventory and optimizing shipping to their customers	4.438	0.586
	Valid N listwise	211	

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0 *(Appendix B)*

The research utilised a 5-point scale from "very strongly agree" to "very strongly disagree" across five questions. First, as shown in Table 3 above, we wanted to know if port modernisation leads to changes in how the company works in order to better meet the needs of customers and vendors. We were curious if there would be a bigger focus on making the supply chain more visible and keeping customers happy. The results show that they all agree that port modernisation leads to better compliance with vendor

and customer concerns, with more attention on supply chain visibility and customer satisfaction. The mean and standard deviation of the results, 4.672±0.510, show this. The second part of the inquiry asked if strategies affect how people set goals, choose tactics, and improve the storage devices of seaports through port modernisation. The average and standard deviation scores of 4.133±0.642 show that the participants all agreed that strategies affect how people go about reaching their goals, using techniques, and improving the storage devices of seaports through port modernisation. The third question asks if everyone who works in warehouse management, which includes all the work that goes into moving things around inside the warehouse and distribution centres in ports, benefits from port modernizations activities. With a mean score of 4.200±0.997 and a standard deviation score of 0.997, it is clear that the people who answered the question strongly believe that everyone involved in warehouse management, including all operations involving the movement of goods within the warehouse and distribution centres in ports, benefits from port modernisation initiatives.

The goal of the fourth question was to find out if careful planning, expert manoeuvring, and the right use of equipment are all needed to safely and effectively dock a ship, which is an important part of getting cargo delivered on time. The responses, which had a mean and standard deviation score of 4.110±0.929, showed that careful planning, skilled manoeuvring, and the right use of equipment are all necessary for effective ship berthing. This is a big part of making sure that cargo is delivered on time. Most of the people who answered (4.438±0.586) think that modernising ports could be very helpful because it lets them store things temporarily, which is helpful for keeping track of inventory and getting shipments to customers faster.

Table 4: Responses on Port Digitalization (PD)

	Question Items on Port digitalization	Mean	STD
1	Port digitalization is the set of technical knowledge, scientifically, ordered that allows one to design and create goods and services that facilitate the adaptation to the environment and meet both their essential needs as people's wishes	4.057	0.631
2	To remain an attractive and contemporary transport option in an increasingly digital economy, the port administrative strategies industry has to create a new digital infrastructure based on data sharing among actors, facilitating visibility and predictability	4.433	0.593
3	Port digitalization is particularly required in port administrative strategies segments where shippers/operators/freight forwarders are plenty and more conscious about the time-related service-quality attributes, such as reliability, speed and port turnaround time	3.776	1.018
4	Digitalization is incorporated into the company's vision or mission statement in order to achieve port sustainability	3.724	1.153
5	Port digitalization is the process by which companies embed technologies across their businesses to drive fundamental change	4.438	0.744
	Valid N listwise 211		

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0*(Appendix A)*

Table 4 illustrates that the study considered the potential impacts of the moderating element in a marine context, specifically examining how the contextual factor of digitalization at ports influenced the relationship between administrative methods and port performance in Nigeria. Five questions were used to measure this. The first part of the question asked if the digitalization of ports is a collection of scientifically organized technological knowledge that makes it possible to make goods and services that help people adjust to their environment while also meeting their basic needs and wants. The mean and standard deviation scores of 4.057±0.631 support the respondents' views on port digitalization. This means that this is the scientifically organized body of knowledge that makes it possible to design and make goods and services that help people adapt to their surroundings and meet both their basic needs and their desires. With a mean and standard deviation score of 4.433±0.593, the participants agree that port administrative strategies need to create a new digital infrastructure that encourages data sharing among

stakeholders in order to be relevant in today's digital economy. This will make things more visible and predictable. The third question item has an average and standard deviation score of 3.7761.018. This means that ports need to be more digital in the areas of port administrative strategies where shippers, operators, and freight forwarders care a lot about service quality factors like reliability, speed, and port turnaround time.

The mean and standard deviation of the respondents' answers to the fourth question, which were 3.724±1.153, show that digitalization is part of the company's goal or ambition to achieve port sustainability. Is port digitalization the way that companies make big changes by using technology in their daily work? Question 5 is meant to answer that. The average and standard deviation scores of 4.057±0.631 show that most of the people who answered the question think that digitalization is the way that companies use technology to make big changes.

Table 5: Responses on Effective Vessel Services (EVS)

	Question Items on Effective vessel services	Mean	STD
1	Effective vessel services impact on factors that have the potential to affect the stakeholders on their performance and productivity of ports	4.848	0.373
2	Effective vessel services accentuate the factors that lead to higher increase in economic values in the ports	4.190	0.588
3	Effective vessel services are achieved in seaports after giving bundles of satisfaction to clients and customers through effective and efficient services that enhance port sustainability	4.352	0.770
4	Port effective vessel services maintain and facilitate trade, it goes without saying that such actions uphold environmental and social sustainability.	4.281	0.808
5	Effective vessel services are linked to trade facilitation measures, improve the economic advantages of supply chains and stakeholders, and thus renders its operation cost efficient in port.	4.214	0.576
	Valid N listwise	211	

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0*(Appendix E)*

Table 5 shows the descriptive data for the five-item, five-point scale that measures how well vessel services work. The results show that good vessel services make ports work better, as shown by the response distribution. The mean and standard deviation scores of 4.848±0.373 for the first question item, which asked if effective vessel services assess the economic impact of factors that could influence stakeholders' performance and productivity of ports, indicate that respondents agreed that effective vessel services do impact such factors. The second question asked if good vessel services make the things that make ports more valuable better, and the people who answered agreed with a mean and standard deviation score of 4.190±0.588. As for the third The respondents concurred that seaports deliver successful vessel services by ensuring client and consumer satisfaction through efficient and effective services that enhance port sustainability, as indicated by the mean and standard deviation scores of 4.352±0.770. The average and standard deviation scores of 4.281±0.808 for the fourth question item, which asked if effective vessel services at ports help and make trade easier, were agreed upon by the respondents. It goes without saying that these actions help the environment and society. Fifthly, we wanted to know if efficient vessel services are linked to trade facilitation measures, if they increase the economic benefits for stakeholders and the supply chain, and if they make port operations more cost-effective. The average score for the item was 4.214±0.576, which means that respondents agreed that efficient vessel services are linked to trade facilitation measures, improve the economic benefits of stakeholders and supply chains, and make port operations cost-effective.

Table 6: Responses on Efficient Cargo Delivery (ECD)

	Question Items on Efficient Cargo Delivery	Mean	STD

1	Efficient cargo delivery in ports is of paramount importance for socially sustainable ports to take action—internally and externally—to improve issues regarding employees, community, supply chain members and stakeholders.	4.338	0.709
2	Ports' actions to minimize environmental externalities are overarching and highly covered in the ports. The environmental measures and actions are adopted in maritime transport systems, which are accredited and reported in different schemes	3.933	0.872
3	Efficient cargo delivery is the contribution made by ports to support the development of the environment	4.295	0.823
4	Efficient cargo delivery uses various measures to realize relevant actions, thereby improving the welfare of employees, decreasing accidents and socially engaging and supporting the community to enhance logistics sustainability in ports	4.262	0.832
5	A major way of achieving efficient cargo delivery is by effective ship berthing involves a combination of precise planning, skilled maneuvering, and proper use of equipment to dock a vessel safely and efficiently.	4.757	0.556
	Valid N listwise	211	

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0*(Appendix F)*

Table 7 shows how well the assessed ports delivered cargo as a measure of operational performance; five questions were asked in response. The first question's results showed that socially sustainable ports must put efficient cargo delivery first in order to deal with concerns from stakeholders, employees, communities, and the supply chain, both inside and outside of the port. You can see this in the mean and standard deviation scores of 4.338±0.709. The mean and standard deviation scores of 3.933±0.872 show that people thought that port' efforts to reduce environmental externalities are thorough and well-covered in the second question item. Environmental measurements and activities are part of maritime transport systems. These are recorded and certified in different systems. The third question item had a mean and standard deviation score of 4.295±0.823, which showed that respondents agreed that ports help the environment by moving goods efficiently. The fourth question was about whether effective cargo delivery uses different methods to get the job done, which in turn makes employees happier, lowers the number of accidents, and helps the community. Efficient cargo delivery improves employee welfare, decreases accidents, engages and supports the community, and enhances logistics sustainability in ports through various measures. The mean and standard deviation score is 4.262±0.832. To safely and efficiently dock a boat, you need to use a combination of careful planning, expert navigation, and the right tools. The fifth question was trying to find out this. Safe and efficient ship berthing requires a mix of careful planning, skilled manoeuvring, and proper use of equipment. The mean and standard deviation scores of 4.757±0.556 show that this is a key factor in getting cargo delivered quickly. Table 4.9 shows the five-item, five-point scale that measures how well a vessel's services work. The results show that the way the answers are spread out shows that good vessel services improve port operational performance. The mean and standard deviation scores of 4.848±0.373 for the first question item, which asked if such services assess the economic impact of factors that could affect the performance and productivity of stakeholders in ports, show that respondents agreed that effective vessel services do have an effect on these factors. The respondents agreed that excellent vessel services improve the traits that lead to higher economic values at ports in response to the second question. Their mean and standard deviation score was 4.190±0.588. When you think about the third mean and standard deviation scores of 4.352±0.770 show that the people who answered the survey thought that providing good and efficient services to customers and consumers makes ports more sustainable, which in turn leads to successful vessel services for the ports. The fourth question asked if good vessel services at ports help trade and make it easier. The mean and standard deviation scores were 4.281±0.808, and the respondents agreed. The mean and standard deviation scores of 4.214±0.576 for the item show that people agreed that trade facilitation measures are linked to efficient vessel services, improve the economic benefits for stakeholders and supply chains, and lead to cost-effective port operations.

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Table 8: Responses Effective Ship Berthing (ESB)

	Question Items on Effective ship berthing	Mean	STD
1	Efficient ship berthing in ports is of paramount importance for socially sustainable ports to take action—internally and externally—to improve issues regarding employees, community, supply chain members and stakeholders	4.605	0.765
2	Ports' actions to minimize environmental externalities are overarching and highly covered in the ports through efficient ship berthing. The environmental measures and actions are adopted in maritime transport systems, which are accredited and reported in different schemes	4.605	0.699
3	Efficient ship berthing is the contribution made by ports to support the development of the environment	4.457	0.771
4	Successful berthing reduces waiting times, prevents damage to the ship and port structures, and ensures a smooth transition for cargo operations, which is vital for the entire supply chain	4.576	0.495
5	Efficient ship berthing is effective ship berthing involves a combination of precise planning, skilled maneuvering, and proper use of equipment to dock a vessel safely and efficiently.	3.957	1.159
	Valid N listwise	211	

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0*(Appendix G)*

Table 9 empirically displays the results of an examination of the studied ports' effective ship berthing as a measure of operational performance. Five questions were posed on this item. An efficient ship berthing system is critical for socially sustainable ports to address internal and external issues affecting stakeholders, employees, communities, and the supply chain. This was the result for the first question. Socially sustainable ports must prioritise efficient ship berthing in order to address internal and external issues pertaining to employees, community, supply chain members, and stakeholders, as evidenced by the mean and standard deviation scores of 4.605±0.765. Respondents agreed that seaports enable staff to propose a variety of suggestions for the social orientation of the port, as indicated by the 2nd question item with a mean and standard deviation score of 4.605±0.699. The third question item's mean and standard deviation scores of 4.457±0.771 suggest that the majority of respondents agree that ports contribute to environmental development through efficient cargo delivery. The fourth question aimed to determine whether, in addition to reducing waiting times, successful berthing protects the ship and port structures, and guarantees a seamless transition for cargo operations—crucial to the entire supply chain—. A successful berthing minimises waiting times, protects the ship and port structures from damage, and guarantees a seamless transition for cargo operations, all of which are crucial for the supply chain as a whole, according to the mean and standard deviation scores of 4.576±0.495. The fifth question aimed to determine if managers are aware of the significance of environmental issues confronting ports when it comes to effective ship berthing. With mean and standard deviation scores of 3.957±1.159, this is confirmed.

Statistical Test of Hypotheses and their Interpretation

We did a descriptive univariate analysis of all the field data in the previous sections using SPSS window output, version 25.0. We also used means, standard deviations, variances, and frequencies to talk about the study variables. The scatter plot that shows how different parts of port administration techniques affect operational performance metrics is also done. The scatter gramme results were helpful in figuring out how wide and strong the link was between the criteria and predictor variables. This has not only shown us the way, but it has also put us in the spotlight so that we can start testing the hypotheses in this section using inferential statistics. Since we want to test hypotheses that compare the means of two groups, and we've already looked at univariate analysis, we'll now move on to univariate test analysis. This is necessary because our study includes more than one group.

Port Administrative Strategy (Quality Port Infrastructure Development, Port Modernization, and Port Digitalization) On Effective Vessel Services in Nigeria

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Ports

Model 1: $Y_1 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ---------(1) {for testing Ho_1}

For Objective 1, Research Question 1 and Hypothesis 1 (Ho_1)}

The first hypothesis was to find out how administrative methods for ports in Nigeria, such as modernizing and digitizing ports, as well as developing high-quality port infrastructure, affect the efficiency of vessel services.

Table 10: Results of Port Administrative Strategy (PAS)) and Effective Vessel Services (EVS)

Model		Unstandardized Coefficients		Standardized Coefficients			Decision
		B	Std. Error	Beta	t	Sig.	
1	(Constant)	2.168	0.125		17.351	0.000	
	QPID	0.283	0.046	0.517	6.188	0.000	Positive and Significant
	PM	0.013	0.061	0.021	0.222	0.825	Positive and Insignificant
	PD	0.189	0.062	0.244	3.061	0.002	Positive and Significant

a. Dependent Variable: Effective Vessel Services (EVS)

b. Predictors: Quality Port Infrastructure Development, Port Modernization, and Port Digitalization

Source: Survey Data, 2025, and IBM SPSS Statistics 25 Window Output

$Y_1 = = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(1) {for testing H_{o1}}

$Y_1(EVS) = 2.168 + 0.283QPID + 0.013PM + 0.189PD + e$

t = (6.188) (0.222) (3.061)

Table 10 above shows the results of the test of the hypothesized assertions, H01. The findings from testing hypothesis 1 demonstrate that port administrative strategies, particularly the development of quality port infrastructure, exert a positive and significant influence on the effectiveness of vessel services. This is backed up by a t-value of 6.188 @ p0.000 < 0.05, which shows that improving the quality of port infrastructure has a good and important effect. The first hypothesis tested found that port administration techniques (port modernizations) had a positive but small effect on efficient vessel services, with a t-value of 0.222 @ p0.825 > 0.05. The t-value of 3.061 @ p 0.002 < 0.05 also shows that port administration techniques (port digitalization) have a big effect on effective vessel services. This supports hypothesis 1 (H1), which says that port digitalization has a positive and significant effect on effective vessel services.

From the inferential statistical analysis so far, it can be stated that:

1. Quality port infrastructure development as a predictor variable of port administrative strategies has a positive and significant effect on effective vessel services.
2. Port modernization as a predictor variable of port administrative strategies has positive and insignificant effect on effective vessel services.
3. Port digitalization as a predictor variable of port administrative strategies has a positive and insignificant effect on effective vessel services.

Port Administrative Strategy (Quality Port Infrastructure Development, Port Modernization, and Port Digitalization) On Efficient Cargo Delivery in Nigeria Ports

Model 2: $Y_2 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(2) {for testing Ho_2}

For Objective 2, Research Question 2 and Hypothesis (Ho_2)}

The first hypothesis aimed to investigate the impact of administrative policies for ports—specifically, the establishment of superior port infrastructure, the modernizations of ports, and the digitization of ports—on the efficiency of cargo transportation in Nigerian ports.

Table 11: Results of Port Administrative Strategy (PAS)) and Efficient Cargo Delivery (ECD)

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Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Decision
2	(Constant)	2.441	.141		17.347	0.000	
	QPID	0.204	.052	.368	3.955	0.000	Positive and Significant
	PM	0.235	.068	.361	3.447	0.001	Positive and Significant
	PD	-0.035	.070	-.045	-0.505	0.614	Negative and Insignificant

a. Dependent Variable: Efficient Cargo Delivery (ECD)
b. Predictors: Quality Port Infrastructure Development, Port Modernization, and Port Digitalization
Source: Survey Data, 2025, and IBM SPSS Statistics 25 Window Output

$Y_2 = = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(2) {for testing H_{o2}}
$Y_2(ECD) =$ 2.441+ 0.204QPID+0.235PM -0.035PD +e
t = (3.955) (3.447) (-0.505)

The results of the test of hypothesised assertions—H02—are shown in Table 4.13 above. A t-value of 3.955 @ p0.000 < 0.05 shows that developing high-quality port infrastructure has a positive and significant effect on effective vessel services. This is backed up by the results of testing hypothesis 2, which show that port administrative strategies, specifically developing high-quality port infrastructure, have a positive and significant effect on efficient cargo delivery. The results of the second hypothesis showed that port administration methods (port modernisation) had a small but positive effect on effective cargo delivery (t-value outcome: 3.447@ p0.001 > 0.05). The test of hypothesis 2 (Ho2) shows that port digitalisation has a negative and small effect on effective cargo delivery. This means that port administration procedures (port digitalisation) do not have a significant effect on this outcome (t-value of -0.505@ p 0.614 > 0.05). So far, the inferential statistics have led to the following conclusion:

1. Quality port infrastructure development as a predictor variable of port administrative strategies has a positive and significant effect on efficient cargo delivery.
2. Port modernization as a predictor variable of port administrative strategies has positive and significant effect on efficient cargo delivery.
3. Port digitalization as a predictor variable of port administrative strategies has a negative and insignificant effect on efficient cargo delivery.

Port Administrative Strategy (Quality Port Infrastructure Development, Port Modernization, and Port Digitalization) On Effective Ship Berthing in Nigeria Ports

Model 3: $Y_2 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(3) {for testing Ho_3}

For Objective 3, Research Question 3 and Hypothesis (Ho_3)}

Table 12: Results of Port Administrative Strategies (PAS)) and Effective Ship Berthing (ESB)

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Decision
1	(Constant)	2.282	.089		25.585	.000	
	QPID	0.221	.033	.478	6.765	0.000	Positive and Significant
	PM	0.102	.043	.188	2.366	0.019	Positive and Significant
	PD	0.136	.044	.208	3.082	0.002	Positive and Significant

a. Dependent Variable: ESB
b. Predictors: Quality Port Infrastructure Development, Port Modernization, and Port Digitalization
Source: Survey Data, 2025, and IBM SPSS Statistics 25 Window Output
$Y_3 = b_o + b_1x_1 + b_2x_2 + b_3x_3 + e$ ----------(1) {for testing H_{o3}}
$Y_1(ESB) =$ 2.282+ 0.221QPID+0.102PM + 0.136PD +e
t = (6.765) (2.366) (3.082)

Table 12 above shows the results of the test of the hypothesised assertions, H03. The t-value outcome of 6.765 @ p0.000 < 0.05 shows that quality port infrastructure development has a positive and significant effect on effective ship berthing. This means that port administrative strategies, specifically quality port infrastructure development, have a positive and significant effect on effective ship berthing. The results of Hypothesis 3 indicated that port administration measures, specifically port modernizations, exerted a positive and significant influence on successful ship berthing, evidenced by a t-value of 2.366 at p=0.019, which is less than 0.05. The test of hypothesis 3 (Ho1) shows that port digitalization has a big and positive effect on effective ship berthing. This is because port digitalization is one of the port administration measures that have a big effect on effective ship berthing (t-value of 3.082@ p 0.002 < 0.05).

From the inferential statistical analysis so far, it can be stated that:

1. Quality port infrastructure development as a predictor variable of port administrative strategies has a positive and significant effect on effective ship berthing.
2. Port modernization as a predictor variable of port administrative strategies has positive and significant effect on effective ship berthing.
3. Port digitalization as a predictor variable of port administrative strategies has a positive and significant effect on effective ship berthing.

Table 13: Summary of the Results on Test of the Research Hypotheses

Research Hypotheses	Predictor Variable Vs Measure	t - value	Sig/ Prob Value	Decision
Ho_1: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on effective vessel services in Nigeria ports.	QPID Vs EVS	6.188	0.000	Positive and Significant
	PM Vs EVS	0.222	0.825	Positive and Insignificant
	PD Vs EVS	3.061	0.002	Positive and Significant
Ho_2: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on efficient cargo delivery in Nigeria ports.	QPID Vs ECB	3.955	0.000	Positive and Significant
	PM Vs ECB	3.447	0.001	Positive and Significant
	PD Vs ECB	-0.505	0.614	Negative and Insignificant
Ho_3: Port administrative strategies (involving quality port infrastructure development, port modernization, and port digitalization have no significant effect on effective ship berthing in Nigeria ports.	QPID Vs ESB	6.765	0.000	Positive and Significant
	PM Vs ESB	2.366	0.019	Positive and Significant
	PD Vs ESB	3.082	0.002	Positive and Significant

Source: Survey Data, 2025, and SPSS Window Output, Version 25.0

Interpretations
QPID = Quality Port Infrastructure Development
PM = Port Modernization
PD = Port Digitalization
EVS = Effective Vessel Services
ECB = Efficient Cargo Delivery
ESB = Effective Ship Berthing

V. CONCLUSION

The conclusion of the research presents thorough study findings. When different port administration methods work together, they often lead to better performance. So, well-run port administration programs are likely to improve the performance of ports. In conclusion, the findings of this study demonstrate that:

1. Quality port infrastructure development has a positive and significant effect on effective vessel services (6.188 @ p0.000 < 0.05). Port modernization

has a positive but insignificant effect (0.222 @ p0.825 > 0.05), and port digitalization has a positive but insignificant effect (3.061 @ p 0.002 < 0.05).

2. The modernization of ports has a positive and significant effect on the efficient delivery of goods (3.447@ p0.001 > 0.05), while the digitalisation of ports has a negative and insignificant effect (-0.505@ p 0.614 > 0.05). Qualitative port infrastructure development has a positive and important effect on the timely delivery of goods (3.955 @ p0.000 < 0.05).

3. The modernization of ports, the development of high-quality port infrastructure (6.765 @ p0.000 < 0.05), and the digitalization of ports (2.366 @ p0.019 < 0.05) all have positive and important effects on the effective berthing of ships. Digitalization of ports (3.182 @ p 0.002 < 0.05) also has a positive and significant effect.

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