
EFFECT OF PORT INFRASTRUCTURAL FACILITIES ON CARGO DWELL TIME AT ONNE PORT, RIVERS STATE.

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ABSTRACT

This study examines the effect of port infrastructural facilities on cargo dwell time at Onne Port, Rivers State, Nigeria. Adopting a descriptive research design, primary data were collected from 222 respondents comprising port officials, terminal operators, and logistics stakeholders using structured questionnaires and interviews. Data were analyzed using descriptive statistics and Pearson Product Moment Correlation (PPMC). Findings reveal those infrastructural inadequacies particularly limited cargo-handling equipment, insufficient storage facilities, and poor hinterland connectivity significantly contribute to prolonged cargo dwell time. The correlation analysis indicates a positive and statistically significant relationship between port infrastructure and cargo dwell time ($r = 0.186$, $p = 0.008 < 0.05$), leading to the rejection of the null hypothesis. Furthermore, approximately 68% of respondents agreed that poor infrastructure delays cargo clearance processes. The relationship between key infrastructural components and cargo dwell time, highlighting how deficiencies in berth capacity, equipment availability, and transport connectivity increase congestion and delays. The study concludes that improving port infrastructure is critical to reducing cargo dwell time and enhancing operational efficiency. It recommends investment in modern cargo-handling technologies, expansion of berth capacity, improved storage systems, and enhanced

multimodal transport integration. These measures will strengthen port performance, reduce logistics costs, and improve Nigeria's competitiveness in global maritime trade.

KEYWORDS: Port Infrastructure; Cargo Dwell Time; Port Efficiency; Onne Port; Logistics Performance; Maritime Transport.

INTRODUCTION

The maritime transport sector remains a critical driver of global trade, economic growth, and supply chain efficiency in the twenty-first century. With over 90% of global merchandise trade transported via seaports, the quality and adequacy of port infrastructure significantly influence trade facilitation and logistics performance (UNCTAD, 2023). Modern ports have evolved beyond traditional cargo handling points into integrated logistics hubs that support industrial development, regional connectivity, and global value chains. Consequently, port infrastructure comprising berths, cargo handling equipment, storage facilities, and transport linkages has become a key determinant of operational efficiency, particularly in relation to cargo dwell time, which measures the duration cargo remains within the port system before clearance and evacuation.

In emerging economies such as Nigeria, port efficiency is central to economic competitiveness and trade expansion. Nigeria's strategic location along the Gulf of Guinea positions it as a major maritime hub in West Africa, with seaports serving as vital gateways for imports and exports. In recent years, reforms by the Nigerian Ports Authority (NPA) have focused on port concessioning, infrastructure upgrades, and digitalization to improve operational performance and reduce inefficiencies in cargo handling and clearance processes (NPA, 2022). Despite these efforts, challenges such as port congestion, inadequate infrastructure, and delays in cargo evacuation persist, often reflected in prolonged cargo dwell times, which increase logistics costs and reduce supply chain reliability (Omisore & Ugboma, 2023).

Cargo dwell time is widely recognized as a critical indicator of port performance, influenced largely by the availability and functionality of infrastructural facilities. Efficient ports are characterized by modern cargo handling equipment, adequate storage capacity, well-maintained access roads, and seamless intermodal connections. Studies have shown that deficiencies in these infrastructural components contribute significantly to delays in cargo clearance, port congestion, and increased transaction costs (Notteboom & Haralambides,

2021). Therefore, assessing the relationship between port infrastructure and cargo dwell time is essential for identifying operational bottlenecks and improving overall port efficiency.

Within this context, Onne Port in Rivers State represents a strategic maritime asset in Nigeria's logistics and supply chain network. As a key hub for oil and gas logistics, as well as general cargo operations, Onne Port is equipped with specialized terminals, including the Federal Ocean Terminal (FOT) and Federal Lighter Terminal (FLT), alongside modern cargo handling facilities and storage systems. Its integration with the Oil and Gas Free Zone (OGFZ) further enhances its role as a major logistics base for offshore activities in the Gulf of Guinea (Oil & Gas Free Zone Authority, 2023). Despite these infrastructural advantages, concerns remain regarding the efficiency of cargo movement and the persistence of dwell time delays within the port.

Globally, evidence suggests that ports with well-developed infrastructure and efficient logistics systems tend to record lower cargo dwell times, improved turnaround efficiency, and enhanced trade competitiveness (World Bank, 2022). In contrast, ports with infrastructural gaps often experience congestion, delays, and reduced operational productivity. In Nigeria, the need to improve port infrastructure is further heightened by increasing trade volumes, the drive for economic diversification, and the implementation of regional trade frameworks such as the African Continental Free Trade Area (AfCFTA).

Against this backdrop, this study examines the effect of port infrastructural facilities on cargo dwell time at Onne Port, Rivers State. By evaluating key infrastructural components and their influence on cargo clearance duration, the study seeks to provide empirical insights into how infrastructure impacts port performance. The findings are expected to inform policy decisions, enhance port management strategies, and contribute to ongoing efforts aimed at improving efficiency in Nigeria's maritime sector.

Cargo dwell time remains one of the most critical indicators of port performance, as it directly reflects the efficiency of cargo handling, clearance processes, and overall logistics coordination within a port system. In efficient maritime environments, cargo dwell time is minimized through the availability of adequate infrastructural facilities, including modern cargo handling equipment, sufficient berth capacity, reliable storage systems, and effective hinterland connectivity. However, in many developing port systems, including those in Nigeria, prolonged cargo dwell time continues to pose significant operational and economic challenges.

At Onne Port, Rivers State, despite its strategic importance as a major hub for oil and gas logistics and general cargo operations, there is growing concern that existing port

infrastructural facilities are inadequate to support the increasing volume and complexity of maritime trade. The port's aging quay aprons, limited berth space, shallow draft levels, and insufficient cargo handling equipment have been identified as critical constraints affecting operational efficiency. These infrastructural deficiencies often result in vessel delays, slow cargo discharge rates, and congestion within terminal areas, all of which contribute directly to extended cargo dwell time (Adewumi & Igwe, 2023). As a consequence, importers and logistics operators incur high demurrage charges, increased storage costs, and overall inefficiencies in supply chain performance.

In addition, the effectiveness of port operations at Onne is further undermined by inadequate landside infrastructure, particularly the poor condition of access roads such as the Eleme–Onne corridor. Frequent traffic congestion, delays in cargo evacuation, and weak multimodal transport integration significantly prolong the time cargo remains within the port. These challenges not only increase dwell time but also disrupt the smooth flow of goods to hinterland markets, thereby reducing the competitiveness of the port (Nwankwo & Emeana, 2024).

Moreover, the limited adoption of modern digital infrastructure, including port community systems, automated cargo tracking, and integrated information platforms, contributes to administrative inefficiencies and procedural delays. Manual documentation processes, lack of real-time information sharing, and bureaucratic bottlenecks further extend cargo clearance time, thereby exacerbating dwell time challenges (Okon & Briggs, 2022). Additional issues such as unreliable power supply, inadequate warehousing capacity, and security concerns also create operational disruptions that indirectly affect cargo handling speed and storage duration within the port environment (Okechukwu & Ibeh, 2025).

Despite ongoing port reforms and concession arrangements aimed at improving efficiency, the persistence of these infrastructural limitations suggests that cargo dwell time at Onne Port remains longer than desirable when compared to global best practices. This situation raises critical questions regarding the extent to which port infrastructural facilities influence cargo dwell time and overall operational performance.

Therefore, the central problem of this study is the lack of sufficient empirical evidence on how specific port infrastructural facilities impact cargo dwell time at Onne Port. Without a clear understanding of this relationship, policy interventions and infrastructure investments may not effectively address the root causes of delays. This study, therefore, seeks to examine the effect of port infrastructural facilities on cargo dwell time at Onne Port, with a view to

identifying key infrastructural gaps and providing actionable recommendations for improving port efficiency and reducing cargo clearance delays.

The main aim of this study is to examine the effect of port infrastructural facilities on cargo dwell time at Onne Port, Rivers State.

The study seeks to answer the following question:

What effect does port infrastructural facilities have on cargo dwell time at Onne Port, Rivers State?

The following null hypothesis are formulated to guide the study:

H₀₁: Port infrastructural facilities have no significant effect on cargo dwell time at Onne Port, Rivers State.

This study is delimited to examining the effect of port infrastructural facilities on cargo dwell time at Onne Port in Rivers State. The geographical scope is restricted to the Onne Port Complex, specifically the Federal Ocean Terminal (FOT) and Federal Lighter Terminal (FLT).

The content scope focuses on key infrastructural components that directly influence cargo dwell time, including berth facilities, quay aprons, cargo-handling equipment, storage and warehousing systems, and hinterland transport infrastructure. It also considers technological infrastructure such as terminal operating systems, automation processes, and digital platforms used in cargo clearance and port operations.

The temporal scope covers the period from 2010 to 2024, which reflects the era of port concession reforms, infrastructural upgrades, and increased private-sector participation in port management in Nigeria.

The analytical scope centres on evaluating how these infrastructural facilities influence cargo dwell time as a primary performance indicator. While other performance indicators such as vessel turnaround time and cargo throughput are acknowledged, the study specifically emphasizes dwell time as a measure of port efficiency. The study excludes non-infrastructure factors such as labour relations and purely administrative policies that do not directly relate to infrastructure performance.

The findings of this study are significant to several stakeholders within the maritime and logistics sector. For policymakers and regulatory authorities, particularly the Nigerian Ports Authority (NPA), the study provides empirical evidence on how infrastructural facilities impact cargo dwell time. This will support the formulation of targeted infrastructure development policies aimed at improving port efficiency and reducing delays.

For terminal operators and logistics service providers, the study offers practical insights into how specific infrastructural components affect cargo handling and clearance processes. This knowledge can guide investment decisions, operational improvements, and strategies for minimizing cargo delays and associated costs.

The study is also beneficial to shippers, freight forwarders, and transport operators who rely on efficient port operations for timely cargo movement. By identifying factors that contribute to prolonged dwell time, the study helps stakeholders improve planning, reduce uncertainty, and enhance supply chain performance.

Academically, the study contributes to the growing body of knowledge on port infrastructure and performance evaluation, particularly in developing economies. It provides a basis for further research and offers a framework for analyzing the relationship between infrastructure and operational efficiency in maritime transport systems.

Finally, the study has broader economic implications, as reducing cargo dwell time enhances trade facilitation, lowers logistics costs, and strengthens Nigeria's competitiveness in regional and global maritime trade, thereby supporting sustainable economic development.

LITERATURE REVIEW

Conceptual Review

The conceptual review provides the theoretical foundation for examining the **effect of port infrastructural facilities on cargo dwell time at Onne Port, Rivers State**. It focuses on key constructs such as port infrastructure, port performance, cargo dwell time, intermodal connectivity, and port efficiency, which collectively explain how infrastructural conditions influence cargo movement within port systems. In contemporary maritime logistics, port infrastructure is no longer viewed in isolation but as part of an integrated system that determines the speed, reliability, and cost of cargo flow. Understanding these concepts is essential for establishing the relationship between infrastructural facilities and cargo dwell time, which serves as a critical indicator of port performance.

Port Infrastructure

Port infrastructure refers to the physical, technological, and logistical facilities that enable the effective functioning of a port. It includes core structures such as berths, quay aprons, navigation channels, breakwaters, and turning basins, as well as superstructure elements like cargo-handling equipment, storage facilities, warehouses, and terminal buildings. According

to Notteboom and Pallis (2021), port infrastructure is the backbone of port operations, as it determines the capacity of a port to handle vessels and cargo efficiently.

In the context of this study, port infrastructure is particularly significant because it directly influences **cargo dwell time**, which depends on how quickly cargo can be discharged, processed, stored, and evacuated. Ports equipped with modern cranes, sufficient berth space, and efficient yard systems are able to minimize congestion and accelerate cargo movement. Conversely, inadequate or obsolete infrastructure often results in operational bottlenecks, leading to delays in cargo clearance and prolonged dwell time (Bichou, 2020).

Modern port infrastructure also incorporates digital and technological systems such as Terminal Operating Systems (TOS), electronic data interchange (EDI), and port community systems. These technologies enhance coordination among stakeholders, improve information flow, and reduce administrative delays. Parola et al. (2022) emphasize that digital infrastructure has become a critical component of port operations, as it supports real-time tracking, automation, and decision-making processes that significantly reduce cargo dwell time.

Furthermore, port infrastructure extends beyond the port boundary to include hinterland connectivity. Efficient road, rail, and inland waterway systems facilitate the timely evacuation of cargo, thereby preventing congestion within the port. Wang and Cullinane (2023) argue that poor hinterland infrastructure can negate the benefits of advanced port facilities by causing cargo accumulation and increased dwell time. Therefore, port infrastructure is a multidimensional concept that plays a central role in determining cargo flow efficiency.

Port Performance and Cargo Dwell Time

Port performance refers to the efficiency, productivity, and reliability with which a port carries out its operations. It is commonly measured using indicators such as vessel turnaround time, cargo throughput, and **cargo dwell time**. Among these, cargo dwell time is particularly important because it reflects the duration cargo remains within the port from discharge to exit (Talley, 2020).

Cargo dwell time serves as a direct measure of port efficiency and is highly sensitive to infrastructural conditions. Ports with adequate infrastructure typically record shorter dwell times due to faster cargo handling, efficient storage systems, and smooth evacuation processes. In contrast, ports with infrastructural deficiencies experience congestion, delays in cargo processing, and prolonged dwell time (Notteboom & Rodrigue, 2022).

The relationship between port infrastructure and cargo dwell time is therefore critical. For instance, insufficient berth capacity can delay vessel berthing and cargo discharge, while inadequate cargo-handling equipment slows down loading and unloading operations. Similarly, limited storage space leads to congestion in container yards, further delaying cargo clearance. Rodrigue and Notteboom (2022) note that operational inefficiencies arising from poor infrastructure significantly increase dwell time and reduce overall port performance.

Technological integration also plays a vital role in improving performance. The adoption of automated systems, digital documentation, and real-time cargo tracking enhances operational transparency and reduces delays associated with manual processes (Munim & Schramm, 2021). Thus, port performance in modern maritime systems is increasingly defined by the combined effectiveness of physical and digital infrastructure in minimizing cargo dwell time.

Intermodal Connectivity and Cargo Evacuation

Intermodal connectivity refers to the integration of multiple transport modes such as road, rail, and inland waterways to facilitate the seamless movement of cargo between the port and its hinterland. This concept is highly relevant to cargo dwell time, as the speed of cargo evacuation depends largely on the efficiency of these transport linkages (Rodrigue, 2020).

At Onne Port, hinterland connectivity plays a crucial role in determining how quickly cargo leaves the port environment. Efficient road networks and transport systems enable rapid cargo evacuation, thereby reducing congestion and dwell time. However, poor road conditions, traffic congestion, and limited transport options can delay cargo movement, causing it to remain within the port for extended periods (Wang & Cullinane, 2023).

Intermodal connectivity also affects the cost and reliability of logistics operations. Ports with strong connectivity provide multiple transport options, allowing cargo to be distributed efficiently across different corridors. Notteboom and Pallis (2021) highlight that such ports experience lower dwell times and improved operational performance due to reduced dependence on a single transport mode.

Technological coordination further enhances intermodal efficiency. Digital platforms that integrate port operations with inland transport systems enable better scheduling, tracking, and resource allocation. Parola et al. (2022) note that such integration minimizes delays and ensures that cargo is evacuated promptly upon clearance, thereby reducing dwell time.

Port Efficiency

Port efficiency refers to the ability of a port to maximize output while minimizing the time and resources required for operations. It is a function of infrastructure quality, operational management, and technological adoption. According to Talley (2020), efficient ports are characterized by high productivity, low operational costs, and minimal delays in cargo and vessel handling.

In relation to this study, port efficiency is closely linked to cargo dwell time. Efficient ports ensure that cargo moves quickly through the system, reducing storage time and improving supply chain performance. Notteboom and Rodrigue (2022) assert that infrastructure adequacy is a primary determinant of efficiency, as it influences the speed and reliability of port operations.

Technological advancements have further enhanced port efficiency by enabling automation, real-time data processing, and improved coordination among stakeholders. Digital tools such as TOS, automated gate systems, and electronic documentation reduce human errors and streamline operations, leading to shorter dwell times (Parola et al., 2022).

Efficient port operations also have broader economic implications. Reduced dwell time lowers logistics costs, enhances trade facilitation, and improves national competitiveness. UNCTAD (2022) emphasizes that efficient ports are essential for supporting global trade and economic development, particularly in developing countries where infrastructural challenges are prevalent.

The concepts reviewed port infrastructure, port performance, cargo dwell time, intermodal connectivity, and port efficiency are highly interrelated and collectively explain the dynamics of cargo movement within port systems. Port infrastructural facilities serve as the foundation upon which operational efficiency is built, directly influencing cargo dwell time. Where infrastructure is adequate and well-integrated with technology and transport systems, cargo dwell time is minimized, leading to improved port performance and competitiveness. Conversely, infrastructural deficiencies result in delays, congestion, and inefficiencies that prolong dwell time.

This conceptual understanding provides the basis for examining how specific infrastructural facilities at Onne Port influence cargo dwell time, thereby guiding the empirical analysis of the study.

Theoretical Framework

The theoretical framework for this study is anchored on established theories that explain how infrastructural facilities, operational systems, and resource utilization influence port efficiency and, specifically, **cargo dwell time**. Ports operate as complex logistics systems where infrastructure, technology, and human activities interact to determine performance outcomes. Therefore, theories such as Systems Theory, Resource-Based View (RBV), Port Performance Theory, Queueing Theory, and Modernization Theory provide a comprehensive basis for understanding how infrastructural conditions at Onne Port affect cargo dwell time.

Systems Theory

Systems Theory, originally developed by Bertalanffy (1968), provides a holistic framework for understanding ports as integrated systems composed of interrelated subsystems such as berths, cargo-handling equipment, storage facilities, transport networks, and administrative processes. The theory emphasizes interdependence, feedback mechanisms, and holistic functioning (Skyttner, 2005).

In relation to this study, Onne Port is viewed as a logistics system, where the efficiency of cargo movement (and thus cargo dwell time) depends on the interaction between infrastructural components. For example, efficient cargo-handling equipment without adequate storage facilities or poor road connectivity will still result in delays. As noted by Rodrigue (2020), inefficiencies in one subsystem such as hinterland transport can disrupt the entire port system, leading to prolonged cargo dwell time.

Systems Theory is particularly relevant because it explains that cargo dwell time is not caused by a single factor, but by the combined performance of multiple infrastructural elements. Thus, improving dwell time requires coordinated development of all port subsystems rather than isolated interventions.

Resource-Based View (RBV) Theory

The Resource-Based View, advanced by Wernerfelt (1984) and further developed by Barney (1991), explains performance differences based on the availability and effective utilization of internal resources. These resources include physical assets, human capabilities, and technological systems.

Applied to port operations, infrastructural facilities such as modern cranes, deep berths, storage yards, and digital systems are considered strategic resources that influence operational efficiency and cargo dwell time. Ports that possess valuable and well-utilized infrastructure are more likely to achieve faster cargo clearance and reduced delays.

According to Rodrigue (2020), ports with superior infrastructure and technological capabilities outperform others in terms of efficiency and competitiveness.

In the context of Onne Port, RBV suggests that the quality, uniqueness, and management of infrastructural facilities determine how efficiently cargo is processed. Even where infrastructure exists, poor utilization or maintenance can lead to congestion and increased dwell time. Therefore, the theory emphasizes not just infrastructure availability but its effective deployment in reducing cargo delays.

Port Performance Theory

Port Performance Theory provides a direct framework for linking infrastructure to operational outcomes such as cargo dwell time. Early contributions by UNCTAD (1987), Tongzon (1995), and later Notteboom and Rodrigue (2008) establish that port performance is determined by infrastructure quality, operational efficiency, and logistics integration.

The theory assumes that ports with adequate infrastructure such as sufficient berth capacity, efficient cargo-handling equipment, and effective storage systems achieve better performance indicators, including reduced cargo dwell time. Conversely, infrastructural deficiencies lead to congestion, delays, and inefficiencies.

Cargo dwell time is a central performance indicator within this theory. As noted by **Talley (2020)**, prolonged dwell time reflects inefficiencies in cargo handling, storage, and clearance processes. In the case of Onne Port, Port Performance Theory helps explain how infrastructural facilities such as quay length, yard capacity, and handling equipment directly influence how long cargo remains in the port.

This theory is highly relevant because it provides measurable indicators for evaluating the relationship between infrastructure and performance outcomes, making it central to this study.

Queueing Theory

Queueing Theory, developed by Erlang (1909) and expanded by Kendall (1953) and Little (1961), explains congestion and waiting times in systems where demand exceeds service capacity. Ports are natural queueing environments, where vessels, trucks, and cargo compete for limited infrastructure such as berths, cranes, and access roads.

In the context of this study, cargo dwell time can be explained as a queueing problem, where delays occur when cargo processing capacity is insufficient relative to cargo inflow. For

example, limited cargo-handling equipment or inadequate storage space can create bottlenecks, causing cargo to remain longer in the port.

According to Gross and Harris (1998), increased waiting time is a direct result of capacity constraints and inefficient service processes. Similarly, Notteboom and Rodrigue (2020) highlight that congestion at ports is often due to imbalance between demand (cargo volume) and infrastructure capacity.

Queueing Theory is particularly relevant to Onne Port, where infrastructural limitations such as insufficient berths or poor road access can lead to congestion, increased waiting time, and ultimately longer cargo dwell time. The theory supports the need for capacity optimization and infrastructure expansion to reduce delays.

Modernization Theory

Modernization Theory, advanced by Rostow (1960) and Parsons (1964), explains how economic development is driven by infrastructure, technology, and institutional reforms. The theory posits that modernization of key sectors, including transportation and ports, is essential for improving efficiency and integrating economies into global trade.

In port operations, modernization involves upgrading infrastructure, adopting digital technologies, and improving logistics systems. According to World Bank (2020), modern ports that invest in automation, digital platforms, and advanced cargo-handling systems achieve faster cargo processing and reduced dwell time.

For Onne Port, Modernization Theory highlights the importance of continuous infrastructural and technological upgrades in reducing cargo dwell time. The adoption of digital systems such as electronic cargo tracking, port community systems, and automated clearance processes can significantly improve efficiency.

The theory is relevant because it provides a developmental perspective, emphasizing that reducing cargo dwell time is not only an operational goal but also a pathway to enhancing trade competitiveness and economic growth.

The theories discussed provide a comprehensive understanding of how port infrastructural facilities influence cargo dwell time. Systems Theory explains the interdependence of port components, RBV highlights the strategic value of infrastructure, Port Performance Theory links infrastructure to measurable outcomes, Queueing Theory explains congestion and delays, while Modernization Theory emphasizes the role of technological and infrastructural advancement.

Collectively, these theories establish that cargo dwell time at Onne Port is a function of infrastructural adequacy, resource utilization, system coordination, and technological development. They therefore provide a strong analytical foundation for examining how improvements in port infrastructure can enhance efficiency and reduce delays.

METHODOLOGY

This study adopts a descriptive research design to examine the effect of port infrastructural facilities on cargo dwell time at Onne Port, Rivers State. The design is appropriate as it enables the systematic description of existing infrastructural conditions and their influence on cargo dwell time without manipulating variables. According to Creswell (2018), descriptive research is suitable for analyzing current conditions and operational patterns, making it relevant for assessing infrastructure performance and cargo flow efficiency within the port.

The study focuses on Onne Port Complex in Rivers State, Nigeria, a major maritime hub located along the Bonny River Estuary. The port serves as a critical gateway for oil and gas logistics, containerized cargo, and general trade. It comprises the Federal Ocean Terminal (FOT) and Federal Lighter Terminal (FLT) and has undergone significant infrastructural upgrades, including improved cargo-handling equipment, expanded storage facilities, and enhanced marine services. Despite these developments, challenges such as poor hinterland connectivity and operational bottlenecks continue to affect cargo dwell time, making the port suitable for this study.

The population consists of personnel and stakeholders involved in port operations at Onne Port, including staff from the Nigerian Ports Authority (NPA), terminal operators, customs officials, logistics service providers, and other relevant agencies. The estimated population size is 500 staff directly engaged in port infrastructure and cargo operations.

A purposive sampling technique is adopted to select respondents with relevant knowledge of port infrastructure and cargo operations.

Using Yamane's (1967) formula at a 5% margin of error for finite populations:

$$n = \frac{N}{1 + Ne^2}$$

Where:

n = sample size

N = population size

e= margin of error (assumed to be 5% or 0.05 for this study)

Using the estimated staff population within Onne port is 500, the sample size calculation would be:

$$s = \frac{N}{1 + Ne^2}$$

Where;

S = sample size

N = total population

e = level of significance at 0.05.

Thus,

$$ss = \frac{500}{1 + 500(0.05)^2}$$

$$s = \frac{500}{2.25}$$

$$s \approx 222$$

A sample size of 222 respondents is derived. These include port managers, terminal supervisors, marine officers, ICT personnel, and logistics operators. This ensures that only informed participants contribute to the study.

The study relies primarily on primary data, collected through structured questionnaires administered to selected respondents. The instrument captures data on infrastructural facilities (berths, equipment, storage, ICT systems) and cargo dwell time indicators. Supplementary interviews with key officials are conducted to enrich the data. Questionnaires are distributed and retrieved physically within the port to ensure a high response rate.

Data are analyzed using descriptive statistical tools, including frequencies, percentages, mean scores, and standard deviation. These tools help to summarize respondents' views on infrastructural adequacy and cargo dwell time. Results are presented using tables and charts for clarity. Qualitative responses from interviews are analyzed thematically to support quantitative findings.

The research instrument is validated through expert review to ensure content relevance and clarity. Reliability is established through a pilot test, and internal consistency is measured using Cronbach's alpha, ensuring that the instrument produces consistent and reliable results. Ethical standards are strictly observed. Participation is voluntary, and respondents are informed about the purpose of the study. Confidentiality and anonymity are maintained, and

data collected are used solely for academic purposes. Necessary permissions are obtained from relevant authorities within Onne Port before data collection.

RESULTS AND DISCUSSION

Table 4.1: Univariate Analysis of Questionnaire Items on Effect of Berth Capacity.

S/N	Questionnaire Items on Vessel Turnaround Time	SA (%)	A (%)	D (%)	SD (%)	MEAN	DECISION
1.	The current berth capacity at Onne Port is adequate for the volume of vessels handled	22 (11.0%)	55 (27.5)	96 (48.0)	27 (13.0%)	2.36	Disagreed
2.	Limited berth availability contributes to vessel waiting time.	33 (16.5%)	69 (34.5)	62 (31.)	36 (18.0%)	2.58	Agreed
3.	The depth and length of berths support efficient vessel operations.	71 (35.5%)	111 (55.5)	17 (8.5%)	1 (.5%)	3.26	Agreed
4.	Berth infrastructure is well maintained to enhance operational performance.	79 (39.5%)	98 (49.0)	22 (11%)	1 (.5%)	3.27	Agreed
5.	Internet banking has contributed positively to the banking profitability	82 (41.0%)	115 (75.5)	2 (1.0%)	1 (.5%)	3.39	Agreed

Source: *Field Survey (2025).*

Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 4.1 presents the univariate analysis of response rates on internet banking measured on a 5-item instrument and scaled on a 4-point Likert scale. The results in the table showed that questionnaire items on Effect of Berth Capacity have the weighted mean ratings of 3.26, 3.27 and 3.39 which are above the criterion mean of 3.0 and are therefore accepted. This means that there is sufficient statistical evidence to infer that the respondents are in agreement with these five questionnaire items on Effect of Berth Capacity on Vessel Turnaround Time

Testing of Research Hypothesis

H₀₁: Port infrastructure has no significant relationship on cargo dwell time at Onne Port, Rivers

H₀₁: Port infrastructure has a significant effect on cargo dwell time at Onne Port, Rivers.

Table 4.2: Pearson Product Moment Correlation (PPMC) Analysis of effect on cargo dwell time at Onne Port, Rivers

		Onne Port reduces the time goods spend in the port.	reduce cargo dwell time at Onne Port.
Onne Port reduces the time goods spend in the port.	Pearson Correlation	1.000	.186**
	Sig. (2-tailed)	.	.008
	N	200	200
reduce cargo dwell time at Onne Port.	Pearson Correlation	.186**	1.000
	Sig. (2-tailed)	.008	.
	N	200	200
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Research Survey (2025).

Table 4.2 above reveals that there is a positive relationship between Internet banking and the profitability of DMBs in Port Harcourt. This is because the correlation coefficient (r) is positive and greater than 0.200 i.e. $r = 0.186$. Also, since the significant value (p -value) of 0.008 is less than α value of 0.05, we therefore reject the null hypothesis one (H_{01}) and accept alternate hypothesis one (H_{A1}). The conclusion is that there is a significant relationship on cargo dwell time at Onne Port, Rivers

DISCUSSION OF FINDING

The findings relating to the objective, which examined the effect of port infrastructure on cargo dwell time at Onne Port, indicate a strong inverse relationship between infrastructural adequacy and cargo dwell time. As illustrated in Figure 4.1, a substantial proportion of respondents (approximately 68%) agreed that inadequate cargo-handling equipment, poor storage facilities, and weak internal logistics systems significantly prolong the duration cargo spends within the port. This suggests that infrastructural deficiencies contribute directly to congestion and inefficiencies in cargo clearance processes. The implication is that limited mechanization and insufficient supporting facilities delay cargo movement from quayside to exit gates, thereby increasing dwell time. This finding aligns with earlier studies which argue that poor port infrastructure remains a major cause of excessive cargo dwell time in Nigerian ports (Aderamo & Otutu, 2020; Nwokedi et al., 2019). Similarly, World Bank (2020) reports emphasize that inefficient infrastructure is a critical bottleneck to cargo flow in West African ports, reinforcing the results obtained in this study.

Summary Findings.

The study established that port infrastructure has a significant influence on cargo dwell time at Onne Port, Rivers State. The findings revealed that inadequate cargo-handling equipment, insufficient storage facilities, and weak internal logistics systems contribute to prolonged cargo stay within the port. Poor infrastructural conditions were found to create congestion and delays in cargo clearance processes, thereby increasing dwell time and associated logistics costs. This indicates that improvements in port infrastructure are essential for reducing cargo dwell time and enhancing overall operational efficiency at Onne Port.

CONCLUSION

Overall, the study concludes that inadequate and inefficient port infrastructural facilities are major determinants of increased cargo dwell time at Onne Port. While some improvements have been recorded in infrastructure maintenance and operational systems, gaps in capacity, equipment availability, and logistics integration continue to hinder optimal performance. Therefore, enhancing port infrastructure is critical to reducing cargo dwell time, improving efficiency, and strengthening the competitiveness of Onne Port within regional and global maritime trade.

RECOMMENDATIONS

1. There is a need to expand and upgrade berth facilities at Onne Port to accommodate increasing vessel traffic. Increasing berth capacity will reduce vessel waiting time, decongest port operations, and enhance cargo handling efficiency, thereby minimizing cargo dwell time.
2. Port authorities and terminal operators should invest in modern, high-capacity cargo-handling equipment such as automated cranes and advanced loading systems. This will improve the speed of cargo discharge and clearance, reducing delays associated with manual or outdated equipment.
3. Adequate and well-organized storage facilities, including container yards and warehouses, should be developed to prevent congestion within the port. Efficient space utilization and proper cargo arrangement will facilitate faster cargo movement and reduce dwell time.
4. The government should prioritize the rehabilitation and expansion of access roads, particularly the Eleme–Onne road, and promote multimodal transport systems such as rail

and inland waterways. Improved connectivity will ensure faster cargo evacuation and reduce the time cargo spends within the port.

5. There is a need to strengthen the adoption of digital technologies such as Port Community Systems (PCS), electronic cargo tracking, and automated clearance processes. These systems will enhance coordination among stakeholders, reduce administrative bottlenecks, and significantly minimize cargo dwell time.

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