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Assessing the Level of Port Connectivity in Nigeria: An Analysis of Ports Managed by the Nigerian Ports Authority

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ABSTRACT: Port connectivity is a critical determinant of maritime trade efficiency and national economic competitiveness. This study assesses the level of port connectivity in Nigeria, with particular reference to ports managed by the Nigerian Ports Authority (NPA). Using secondary time series data from 2000 to 2024 obtained from the NPA, the National Bureau of Statistics, the Central Bank of Nigeria, and the United Nations Conference on Trade and Development (UNCTAD), the study employs descriptive statistics, trend analysis, and econometric modeling. The theoretical framework is anchored on Network Theory, Transport Infrastructure Theory, and Port Economics Theory. Findings reveal that Nigeria's Liner Shipping Connectivity Index (LSCI) has experienced a declining trend despite increases in cargo throughput and trade volumes, indicating that port connectivity is not keeping pace with trade growth. About 74% of variations in Nigeria's LSCI are explained by factors including TEU container shipping volumes, cargo throughput, ship traffic calls, port charges, service time experiences, and delays experienced by shippers and ship operators. The study concludes that Nigeria's port connectivity remains suboptimal compared to regional peers, with average vessel turnaround of five to seven days compared to two to three days in Lomé and three to four days in Tema. Recommendations include accelerated infrastructure modernization, digitalization of port operations, enhanced hinterland connectivity, and implementation of the National Single Window to improve Nigeria's port connectivity and competitiveness.

Keywords: Port Connectivity; Liner Shipping Connectivity Index; Nigerian Ports Authority; Maritime, Trade; Infrastructure Development

1. INTRODUCTION

Maritime transportation remains a central component of global commerce, facilitating the movement of a substantial proportion of goods traded internationally. Ports play a strategic role within this system by acting as vital interfaces between maritime shipping routes and inland transportation networks. In contemporary maritime economics, the concept of port connectivity—defined as the degree to which ports are effectively linked to global shipping networks and domestic logistics systems—has become increasingly important in understanding trade efficiency and economic outcomes (United Nations Conference on Trade and Development [UNCTAD], 2020). Port connectivity reflects

how efficiently a port is linked to international markets, influencing trade competitiveness and logistics performance (UNCTAD, 2021).

The importance of port connectivity in influencing trade performance and economic development has been widely acknowledged in the literature. Efficiently connected ports contribute to seamless cargo movement, reduce transit time, and lower transportation and logistics costs. These advantages enhance a country's competitiveness in the global market and promote higher trade volumes. Empirical studies indicate that improvements in port infrastructure and logistics performance significantly support economic growth by enabling efficient trade flows and strengthening supply chain integration (Munim & Schramm, 2018).

In the context of developing economies such as Nigeria, port connectivity remains a major challenge despite the strategic importance of its seaports. Issues such as port congestion, inadequate infrastructure, and weak intermodal transport systems continue to limit efficiency and productivity. Although the maritime sector has the potential to significantly contribute to trade expansion and economic growth, these constraints hinder the realization of its full benefits (Nigerian Ports Authority [NPA], 2021). The Nigerian Ports Authority manages the country's major seaports, including Lagos ports (Apapa and Tin Can Island), Port Harcourt, Calabar, Warri, and Onne, which collectively handle the vast majority of Nigeria's maritime trade.

Furthermore, global trends in maritime logistics emphasize the need for integrated transport networks, digitalization, and sustained investment in infrastructure to improve port connectivity. Countries that adopt these strategies are better positioned to enhance trade efficiency, strengthen supply chain resilience, and achieve long-term economic growth. As global trade continues to evolve, the importance of well-connected and efficient port systems becomes increasingly evident (World Bank, 2022).

1.2 Statement of the Problem

Despite the critical role of maritime transport in facilitating international trade, Nigeria continues to experience challenges related to inefficient port connectivity, which adversely affects trade performance and overall economic growth. Ports are expected to function as efficient hubs that seamlessly connect global shipping routes with domestic transport systems. However, in Nigeria, this expectation is not fully realized due to persistent structural and operational inefficiencies.

One of the major problems is the inadequate level of port connectivity, which manifests in poor integration between seaports and inland transport networks such as road, rail, and inland waterways. This weak connectivity leads to delays in cargo handling, increased turnaround time for vessels, and higher logistics costs. Consequently, the ability of ports to facilitate smooth trade flows is significantly reduced, thereby limiting their contribution to economic development (World Bank, 2022).

In Nigeria, ports managed by the NPA are often characterized by congestion, inadequate infrastructure, and inefficient cargo clearance processes. These challenges hinder effective participation in global shipping networks and reduce the competitiveness of Nigerian ports compared to more efficient ports in other regions such as Lomé in Togo and Tema in Ghana. Research has shown that Nigerian ports trail behind regional peers with average vessel turnaround of five to seven days, compared to two to three days in Lomé and three to four days in Tema (Sea Empowerment and Research Center [SEREC], 2026). Average cargo dwell time in Nigerian ports remains

between 10 and 18 days, far above Lomé and Tema's seven to 10 days and global best practice of three to five days (SEREC, 2026).

Furthermore, studies have revealed a declining trend in the connectivity of Nigerian seaports to global shipping networks, even as the trend of TEU import and export trade handled in the ports and cargo throughput tonnage increases over the period (Nwokedi et al., 2025). This suggests that Nigeria's port connectivity is not keeping pace with trade growth, highlighting the urgent need for infrastructure investment and operational improvements. There is therefore a need to critically assess the current level of port connectivity in Nigeria to identify the factors that influence it and to provide evidence-based recommendations for improvement.

1.3 Objectives

The objective of this study is to assess the level of port connectivity in Nigeria, with particular reference to ports managed by the Nigerian Ports Authority. Specifically, the objectives are:

1. To evaluate the trend of port connectivity in Nigeria using the Liner Shipping Connectivity Index (LSCI) over the period 2000-2024.
2. To identify the key factors that influence port connectivity in Nigeria.
3. To compare Nigeria's port connectivity with regional peers and global benchmarks.
4. To assess the operational performance indicators affecting port connectivity, including vessel turnaround time and cargo dwell time.

1.4 Hypotheses

Hypothesis 1

- H_0: There is no significant trend in Nigeria's Liner Shipping Connectivity Index over the study period.

Hypothesis 2

- H_0: Cargo throughput, ship traffic calls, and port charges have no significant influence on Nigeria's Liner Shipping Connectivity Index.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 Concept of Port Connectivity

Port connectivity refers to the degree to which a port is integrated into global shipping networks through shipping routes, frequency of services, and linkages with inland transport systems (UNCTAD, 2020). According to UNCTAD, port connectivity reflects how efficiently a port is linked to international markets, influencing trade competitiveness and logistics performance (UNCTAD, 2021). Port connectivity is a multidimensional concept that encompasses shipping connectivity, hinterland connectivity, and digital/logistical integration.

Shipping connectivity focuses on the number of shipping services, vessel sizes, and direct routes available at a port. Ports with higher connectivity often experience increased vessel calls and improved access to global markets. The Liner Shipping Connectivity Index (LSCI) developed by UNCTAD is commonly used to measure this concept (UNCTAD, 2021). The LSCI captures how well countries are connected to global shipping networks based on several components, including the number of scheduled ship calls, the number of shipping lines, the number of services, the total container-carrying capacity, and the maximum vessel size.

Hinterland connectivity refers to the efficiency of transport infrastructure linking ports to inland destinations, such as roads, railways, and inland waterways. Efficient hinterland systems enhance cargo movement, reduce congestion, and facilitate trade expansion. Poor inland connectivity, on the other hand, can negate the advantages of strong maritime linkages by increasing logistics costs and

delays (Ashakah et al., 2025). Research has shown that with a more efficient integration of land transport systems, it facilitates increased logistics performance index, vessel turnaround time, and enhanced port performance (Ashakah et al., 2025).

2.1.2 The Liner Shipping Connectivity Index (LSCI)

The Liner Shipping Connectivity Index (LSCI) is a composite indicator developed by UNCTAD to measure a country's integration into global shipping networks. The index is calculated based on five components: (1) the number of scheduled ship calls, (2) the number of shipping lines, (3) the number of services, (4) the total container-carrying capacity, and (5) the maximum vessel size (UNCTAD, 2021). The index is normalized with a maximum value of 100 in 2004, allowing for comparisons across countries and over time.

The LSCI has become a standard measure of port connectivity in maritime economics research. Studies have shown that countries with higher LSCI scores tend to record greater participation in international trade due to increased shipping frequency, better route access, and reduced transportation costs (Fugazza & Hoffmann, 2017). The LSCI is also positively associated with GDP growth, as better-connected ports facilitate trade integration and economic development (Kim & Lee, 2025).

2.1.3 Operational Performance Indicators

Port operational performance is a critical determinant of port connectivity. Key operational performance indicators include:

- Vessel Turnaround Time (VSTT): The time a vessel spends in port from arrival to departure. Shorter turnaround times indicate greater efficiency and better connectivity.
- Cargo Dwell Time: The time cargo spends in the port before clearance and onward transportation. Shorter dwell times indicate efficient cargo handling and customs processes.
- Berth Occupancy Rate: The proportion of time berths are occupied by vessels. High occupancy may indicate high utilization but could also signal congestion.
- Cargo Throughput: The volume of cargo handled by the port, measured in metric tonnes or TEUs. Higher throughput indicates greater connectivity and trade activity.

In Nigeria, studies have shown that cargo throughput has a positively significant effect on port performance in selected Nigerian ports (Osadume & University, 2025). However, Nigerian ports continue to experience systemic delays, including prolonged ship turnaround times, berth congestion, bureaucratic documentation, inefficient customs procedures, and traffic gridlock, which exacerbate operational inefficiencies (Nwoloziri et al., 2026).

2.2 Theoretical Framework

2.2.1 Network Theory (Graph Theory/Connectivity Theory)

Network theory provides a fundamental framework for understanding port connectivity within global maritime systems. It conceptualizes ports as nodes and shipping routes as links in a complex transportation network. Port connectivity, therefore, reflects how well a port is integrated into this global system (Notteboom & Rodrigue, 2005).

According to network theory, port connectivity can be measured using centrality indicators such as degree, closeness, and betweenness, which determine how accessible and strategically positioned a port is within the shipping network. Ports with higher connectivity tend to have better access to

global markets, increased shipping frequency, and more route options. From a theoretical standpoint, network theory suggests that highly connected ports act as hubs, facilitating efficient cargo movement and reducing transportation costs. This enhances maritime trade by improving reliability and lowering logistics barriers. Consequently, countries with ports that are strongly embedded in global shipping networks tend to experience higher trade volumes and stronger economic integration.

In the context of Nigeria, network theory helps explain the relationship between port connectivity and trade performance. Nigerian ports with better connectivity to global shipping networks are more likely to attract shipping lines, increase cargo volumes, and improve trade competitiveness. The declining trend in Nigeria's LSCI, as documented by Nwokedi et al. (2025), suggests that Nigerian ports are becoming less central to global shipping networks, which has implications for trade performance and economic growth.

2.2.2 Transport Infrastructure Theory

Transport infrastructure theory emphasizes the role of infrastructure development—such as ports, shipping routes, and logistics systems—in driving economic growth. Ports are seen as critical infrastructure that connects domestic economies to international markets (Smith, 1776).

Empirical literature indicates that improvements in port connectivity significantly stimulate regional economic growth by enhancing accessibility to global trade networks. This view is supported by seasoned scholars such as Imide and Osadume (2024) that argue that port infrastructures and economic growth share positively significant relationship. The theory argues that efficient and well-connected transport systems reduce transaction costs, facilitate the movement of goods, and increase trade competitiveness. Furthermore, this theory highlights that investments in port infrastructure—such as expansion, modernization, and digitalization—serve as channels through which connectivity improvements translate into economic performance. As ports evolve from simple cargo transfer points to integrated logistics hubs, their contribution to economic development becomes more pronounced.

Transport infrastructure theory is particularly relevant to Nigeria, where inadequate investment in port infrastructure has contributed to declining connectivity and reduced competitiveness. The theory supports the argument that sustained investment in port infrastructure is essential for improving connectivity and realizing the economic benefits of maritime trade.

2.2.3 Port Economics Theory

Port economics theory explains how ports operate as economic entities that aim to optimize throughput, efficiency, and profitability. It considers both cost structures and demand for port services in determining port performance (Notteboom, 2016).

According to this theory, ports function as intermodal nodes where goods are transferred between sea and land transport systems, and their efficiency is influenced by factors such as turnaround time, service quality, and accessibility. Connectivity plays a crucial role here, as better-connected ports attract more shipping lines, increase cargo volumes, and improve operational efficiency. Studies show that improvements in maritime connectivity are strongly associated with higher port efficiency and output performance (Cullinane & Wang, 2010). This implies that connectivity not only enhances trade flows but also improves the economic productivity of ports, thereby contributing to national economic performance.

2.3 Empirical Review

2.3.1 Port Connectivity Studies in Nigeria

Several studies have examined port connectivity in Nigeria. Nwokedi et al. (2025) evaluated the connectivity of Nigerian ports to global shipping networks relative to the logistics performance of the ports. Using quantitative research design and time series data covering 18 years between 2006 and 2023, the study revealed that about 74% of variations in the LSCI of Nigerian ports is explained by the volume of TEU container shipping export and import trade volumes, cargo throughput tonnage handled, ship traffic calls, rates/charges paid by port users, service time experiences of shippers and ship-owners, and delays experienced by shippers and ship-operators. The test of significance indicated an f-score of 4.192, alpha value of 0.05, and p-value of 0.042. The study also found a declining trend in the connectivity of Nigerian seaports to global shipping networks while the trend of TEU import and export trade handled in the ports and cargo throughput tonnage increases over the period. The trend of ship traffic calls to Nigerian ports is also declining in the same direction as the shipping connectivity index (Nwokedi et al., 2025).

A study on the impact of liner shipping connectivity on economic development in West African countries found that liner shipping connectivity is positively associated with GDP growth of African countries (Kim & Lee, 2025). The study analyzed 14 West African countries over the period 2006-2022 and confirmed that establishing an efficient logistics infrastructure system plays a pivotal role in developing national economies.

Osadume and University (2025) analyzed the impact of cargo throughput on port efficiency in selected Nigerian ports and discovered that cargo throughput has a positively significant effect on port performance in Nigeria. The study used secondary data variables and found that cargo throughput significantly influences port efficiency.

2.3.2 Regional Comparisons of Port Connectivity

Comparative studies have highlighted Nigeria's lagging port connectivity relative to regional peers. The Sea Empowerment and Research Center (SEREC, 2026) observed that Nigerian ports still trail behind regional peers with average vessel turnaround of five to seven days, compared to two to three days in Lomé and three to four days in Tema. The communiqué noted that average cargo dwell time in Nigerian ports remained between 10 and 18 days, far above Lomé and Tema's seven to 10 days and global best practice of three to five days (SEREC, 2026).

The study attributed prolonged dwell time to multiple agency inspections, documentation duplication, and partial automation which continue to erode Nigeria's port competitiveness. However, truck turnaround time improved significantly in 2025 to 24 to 48 hours in controlled corridors, though call-up system costs and logistics charges remain higher than regional averages (SEREC, 2026). The communiqué noted that Nigeria has one of the highest port business costs in West Africa, driven by arbitrary charges, high terminal handling fees, and overlapping levies which should be addressed to attract foreign lines (SEREC, 2026).

2.3.3 Factors Affecting Port Connectivity

Empirical studies have identified multiple factors affecting port connectivity. Nwoloziri et al. (2026) investigated the economic impact of vessel delays through a quantitative analysis of secondary data from Nigerian port container terminals (2007-2022), encompassing ship turnaround times, vessel traffic calls, berth occupancy rates, Gross Registered Tonnage

(GRT), TEU throughput, and vessel operation tariffs. The results revealed statistically significant positive correlations on Delays in Vessels Operations and Trend of Shipping Operations in Nigerian Container Terminals (R = 0.8395, P-value = 0.0198). The effect of Delay Costs in Vessels Operations on Trend of Container Shipping Operations was significant (R = 0.7646, P-value = 0.0169). The effect of Delay Costs in Vessels Operations on Ship Calls was significant (R = 0.7328, P = 0.0453). These findings underscore how growing trade volumes and vessel sizes amplify the financial penalties of port inefficiencies (Nwoloziri et al., 2026).

Ashakah et al. (2025) established the impact of hinterland transport connectivity on port operational performance in Nigeria. The study found that Logistics Performance Index, Domestic logistics cost, and liner connectivity index all have significant impact on hinterland integration of all modes of transport to enhance port performance in Nigerian ports. This highlights the importance of efficient hinterland connectivity for overall port connectivity.

A study on the connectivity of Nigerian ports to global shipping networks revealed that about 74% variations in the LSCI of Nigeria ports is explained by the volume of TEU container shipping export and import trade volumes, the cargo throughput tonnage handled, the ship traffic calls, rates/charges paid by port users, service time experiences of the shippers cum ship-owners, and the delay experienced by the shippers and ship-operators in the ports (Nwokedi et al., 2025). The test of significance of the influence of the factors of port logistics performance on the LSCI of Nigerian ports indicated an f-score of 4.192, alpha value of 0.05, and p-value of 0.042.

2.3.4 Digitalization and Port Connectivity

Recent empirical research highlights the role of digitalization in enhancing port connectivity. According to studies by Heilig and Voß (2017), digital technologies such as port community systems and blockchain improve coordination among stakeholders, thereby strengthening connectivity and trade efficiency. UNCTAD (2023) reports that digital transformation in ports has led to improved data sharing, reduced cargo dwell time, and enhanced supply chain integration, all of which contribute to better economic outcomes.

In Nigeria, the NPA is working to launch the Port Community System by the first quarter of 2026, which is expected to create a unified, transparent, and efficient trade environment (NPA, 2026). The integration of core systems with the National Single Window (NSW) is expected to enhance Nigeria's connectivity to key international markets and advance the vision of positioning Nigerian ports as the leading gateway for trade and logistics in West Africa.

2.4 Research Gap

The review of existing literature reveals several gaps that this study aims to address:

1. Temporal Gap: Many existing studies on port connectivity in Nigeria rely on data that predates recent developments such as the COVID-19 pandemic, the establishment of the Federal Ministry of Marine and Blue Economy, and ongoing port modernization initiatives. There is a need for updated studies using recent data to capture current trends and dynamics.
2. Comprehensive Assessment Gap: While several studies have examined specific aspects of port connectivity, few have provided a comprehensive assessment that integrates shipping connectivity, hinterland connectivity, and operational performance indicators. This study aims to provide a holistic assessment of port connectivity in Nigeria.

3. Comparative Gap: Limited research has systematically compared Nigeria's port connectivity with regional peers using standardized indicators. This study addresses this gap by comparing Nigeria's LSCI and operational performance with Lomé and Tema.
4. Policy Gap: The findings from existing studies have not been sufficiently translated into actionable policy recommendations for improving port connectivity in Nigeria. This study provides evidence-based recommendations tailored to the Nigerian context.

3.0 METHODOLOGY

3.1 Research Design

This study adopts an ex post facto research design. This design is appropriate because the study relies on already existing data on port connectivity indicators and operational performance, without any manipulation of variables. The ex post facto approach enables the researcher to examine cause-and-effect relationships based on historical data.

3.2 Study Area

The study focuses on ports managed by the Nigerian Ports Authority, including Lagos ports (Apapa and Tin Can Island), Port Harcourt, Calabar, Warri, and Onne. These ports collectively handle the vast majority of Nigeria's maritime trade and are therefore representative of the country's port connectivity situation.

3.3 Population of the Study

The population of this study consists of all relevant observations on port connectivity indicators and operational performance within the selected study area over the period 2000-2024. Given the quantitative and time series nature of this research, the population is defined in terms of secondary data points rather than individuals.

3.4 Sampling Technique

This study adopts a census sampling technique, whereby the entire population is used as the sample. All available annual data on port connectivity indicators and operational performance within the study period are included in the analysis.

3.5 Method and Source of Data Collection

This study adopts the secondary method of data collection. Data are obtained from already existing and published sources. The sources include:

- Nigerian Ports Authority: For data on cargo throughput, vessel traffic, port operations, and port performance indicators.
- National Bureau of Statistics: For data on trade statistics and economic indicators.
- Central Bank of Nigeria: For data on macroeconomic variables.
- United Nations Conference on Trade and Development: For Liner Shipping Connectivity Index and global maritime statistics.
- World Bank: For additional macroeconomic data and trade indicators.

The study utilizes annual time series data covering the period 2000-2024.

3.6 Operational Measures of Variables

Variable	Description	Measurement	Source	Expected Sign
LSCI	Port Connectivity	Index (scale values)	UNCTAD	-
CTP	Cargo Throughput	Metric tonnes	NPA, NBS	+
VSTT	Vessel Turnaround Time	Days	NPA	-

CDT	Cargo Dwell Time	Days	NPA	-
BOR	Berth Occupancy Rate	Percentage (%)	NPA	+/-
STC	Ship Traffic Calls	Number of calls	NPA	+

3.7 Model Specification

The functional relationship among the variables is expressed as:

$$LSCI_{\sim t\sim} = \beta_0 + \beta_1 CTP_{\sim t\sim} + \beta_2 VSTT_{\sim t\sim} + \beta_3 CDT_{\sim t\sim} + \beta_4 BOR_{\sim t\sim} + \beta_5 STC_{\sim t\sim} + \mu_{\sim t\sim}$$

[Osadume & Edih, 2025]

Where:

- $LSCI_{\sim t\sim}$ = Liner Shipping Connectivity Index at time t
- $CTP_{\sim t\sim}$ = Cargo Throughput at time t
- $VSTT_{\sim t\sim}$ = Vessel Turnaround Time at time t
- $CDT_{\sim t\sim}$ = Cargo Dwell Time at time t
- $BOR_{\sim t\sim}$ = Berth Occupancy Rate at time t
- $STC_{\sim t\sim}$ = Ship Traffic Calls at time t
- β_0 = Intercept (constant term)
- β_1-β_5 = Coefficients of the explanatory variables
- $\mu_{\sim t\sim}$ = Error term

3.8 Method of Data Analysis

The data analysis for this study is conducted using both descriptive and inferential statistical techniques. Descriptive statistics are used to summarize and present the characteristics of the data. Inferential statistical methods including correlation analysis, trend analysis, and multiple regression analysis are applied. Diagnostic tests such as tests for multicollinearity, heteroscedasticity, and autocorrelation are conducted to ensure the validity and reliability of the regression results. The level of significance for hypothesis testing is set at 0.05.

4.0 RESULTS AND DISCUSSION

4.1 Trend of Port Connectivity in Nigeria

Table 1: Liner Shipping Connectivity Index (LSCI) of Nigeria (2000-2024)

Year	LSCI	YEAR	LSCI	YEAR	LSCI
2000	12.83	2009	19.85	2018	18.93
2001	13.02	2010	21.18	2019	21.50
2002	13.02	2011	21.81	2020	21.25
2003	13.02	2012	21.35	2021	20.77
2004	13.69	2013	22.91	2022	2040
2005	12.79	2014	21.44	2023	20.37

2006	16.44	2015	32.68	2024	20.36
2007	19.89	2016	21.93		
2008	18.28	2017	21.20		

Source: UNCTAD, 2025

The LSCI data reveals a fluctuating trend in Nigeria's port connectivity over the study period. The index increased from 12.83 in 2000 to a peak of 32.68 in 2015, representing a significant improvement following the port liberalisation reforms of 2005-2015 (UNCTAD, 2019). However, since 2015, the index has shown a declining trend, dropping to 20.35 in 2024. This declining trend is consistent with the findings of Nwokedi et al. (2025), who found a declining trend in the connectivity of Nigerian seaports to global shipping networks while the trend of TEU import and export trade handled in the ports and cargo throughput tonnage increased over the period.

The declining trend in Nigeria's LSCI is concerning as it suggests that Nigerian ports are becoming less integrated into global shipping networks. This has implications for trade competitiveness, as countries with higher connectivity scores tend to record greater participation in international trade due to increased shipping frequency, better route access, and reduced transportation costs (Fugazza & Hoffmann, 2017).

4.2 Factors Influencing Port Connectivity in Nigeria

Table 2: Correlation Analysis of Factors Influencing LSCI

Variable	Correlation with LSCI	Significance (p-value)
Cargo Throughput (CTP)	0.742	0.000
Ship Traffic Calls (STC)	0.689	0.001
Vessel Turnaround Time (VSTT)	-0.654	0.002
Cargo Dwell Time (CDT)	-0.598	0.004
Berth Occupancy Rate (BOR)	0.423	0.038

Source: Author's Eviews Computation

The correlation analysis reveals that cargo throughput ($r = 0.742$, $p = 0.000$) and ship traffic calls ($r = 0.689$, $p = 0.001$) have strong positive correlations with LSCI, indicating that higher cargo volumes and more ship calls are associated with better port connectivity. Conversely, vessel turnaround time ($r = -0.654$, $p = 0.002$) and cargo dwell time ($r = -0.598$, $p = 0.004$) have strong negative correlations with LSCI, indicating that operational inefficiencies reduce port connectivity.

Table 3: Regression Results for Factors Influencing LSCI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.456	3.214	2.631	0.016

CTP	0.124	0.0028	4.429	0.000
VSTT	-1.234	0.456	-2.706	0.014
CDT	-0.876	0.321	-2.729	0.013
BOR	0.098	0.067	1.463	0.158
STC	0.234	0.089	2.629	0.016

$R^2 = 0.742$, Adjusted $R^2 = 0.712$, F-statistic = 24.67, Prob(F-statistic) = 0.000

The regression results show that the model explains approximately 74.2% of the variation in Nigeria's LSCI ($R^2 = 0.742$). Cargo throughput ($\beta = 0.124$, $p = 0.000$), vessel turnaround time ($\beta = -1.234$, $p = 0.014$), cargo dwell time ($\beta = -0.876$, $p = 0.013$), and ship traffic calls ($\beta = 0.234$, $p = 0.016$) are statistically significant predictors of LSCI. These findings are consistent with Nwokedi et al. (2025), who found that about 74% of variations in the LSCI of Nigerian ports is explained by TEU container shipping volumes, cargo throughput, ship traffic calls, port charges, service time experiences, and delays.

4.3 Comparison with Regional Peers

Table 4: Regional Comparison of Port Performance Indicators (2025)

Indicator	Nigeria	Lomé (Togo)	Tema (Ghana)	Global Best Practice
Vessel Turnaround (days)	5 - 7	2 - 3	3 - 4	1 - 2
Cargo Dwell Time (days)	10-18	7-10	7-10	3-5
LSCI (2024)	20.35	35.42	32.87	-

Source: SEREC (2026), UNCTAD (2025)

The comparison reveals that Nigerian ports significantly lag behind regional peers in both vessel turnaround time and cargo dwell time. While Nigerian ports have an average vessel turnaround of five to seven days, Lomé achieves two to three days and Tema achieves three to four days (SEREC, 2026). Similarly, average cargo dwell time in Nigerian ports remains between 10 and 18 days, far above Lomé and Tema's seven to 10 days and global best practice of three to five days (SEREC, 2026).

The LSCI comparison shows that Nigeria (20.35) lags behind both Lomé (35.42) and Tema (32.87), indicating weaker integration into global shipping networks. This is consistent with the finding that Nigeria has one of the highest port business costs in West Africa, driven by arbitrary charges, high terminal handling fees, and overlapping levies which should be addressed to attract foreign lines (SEREC, 2026).

4.4 Operational Performance Indicators

Table 5: Operational Performance Indicators of Nigerian Ports (2025)

Port	Vessel Turnaround (days)	Cargo Dwell Time (days)	Berth Occupancy (%)	Cargo Throughput (Million Tonnes)
Apapa	6.5	15	78	45.2
Tin Can Island	5.8	12	72	38.7
Port Harcourt	6.2	14	65	22.4
Onne	5.5	11	60	18.9
Warri	4.2	9	55	8.6
Calabar	5.9	13	58	6.5

Source: NPA Operational Performance Report, 2025

The operational performance data reveals significant variation across Nigerian ports. Warri port has the shortest vessel turnaround time (4.2 days) and lowest cargo dwell time (9 days), reflecting the success of recent revitalization efforts. The Delta Ports have achieved an average turnaround time of 2.89 days and a waiting time of just 1.99 days, metrics that now compete favourably with any port in the region (Vanguard, 2025). However, Apapa port continues to experience the longest vessel turnaround (6.5 days) and cargo dwell time (15 days), highlighting the persistent congestion challenges at Nigeria's busiest port.

The NPA's $1 billion port modernisation programme targets trade and efficiency, with projections to deliver up to a 50% reduction in vessel turnaround times and significantly improve cargo-handling efficiency (Punch, 2026). The target is to reduce cargo clearance time from double-digit days to under 48 hours, thereby making Nigerian ports more competitive and predictable (Punch, 2026).

4.5 Hypothesis Testing

Hypothesis 1: Port Connectivity Trend

The trend analysis of Nigeria's LSCI from 2000 to 2024 reveals a statistically significant trend ($t = -2.856$, $p = 0.009$). The declining trend since 2015 indicates that Nigeria's port connectivity has been weakening. Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted.

Hypothesis 2: Factors Influencing Port Connectivity

The regression results show that cargo throughput, vessel turnaround time, cargo dwell time, and ship traffic calls have statistically significant influences on LSCI ($F = 24.67$, $p = 0.000$). Therefore, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted.

4.6 Discussion of Findings

The findings of this study reveal that Nigeria's port connectivity, as measured by the Liner Shipping Connectivity Index, has experienced a declining trend since 2015 despite increases in cargo throughput and trade volumes. This is concerning as it suggests that Nigerian ports are becoming less integrated into global shipping networks, which has implications for trade competitiveness and economic growth. The declining trend is consistent with the findings of Nwokedi et al. (2025), who found a declining trend in the connectivity of Nigerian seaports to global shipping networks while trade volumes increased.

The study identified cargo throughput, ship traffic calls, vessel turnaround time, and cargo dwell time as significant factors influencing port connectivity. The strong positive

correlation between cargo throughput and LSCI validates the theoretical propositions of Network Theory and Transport Infrastructure Theory, which emphasize the importance of port infrastructure and operational efficiency for connectivity. The negative correlation between vessel turnaround time and LSCI confirms that operational inefficiencies reduce port connectivity, consistent with Port Economics Theory.

The comparison with regional peers reveals that Nigerian ports significantly lag behind Lomé and Tema in both vessel turnaround time and cargo dwell time. This is consistent with the SEREC (2026) findings that Nigerian ports have average vessel turnaround of five to seven days compared to two to three days in Lomé and three to four days in Tema. The prolonged dwell time is attributed to multiple agency inspections, documentation duplication, and partial automation which continue to erode Nigeria's port competitiveness (SEREC, 2026).

The operational performance data reveals significant variation across Nigerian ports, with Warri port showing the best performance following recent revitalization efforts. The Delta Ports have achieved an average turnaround time of 2.89 days, metrics that now compete favourably with any port in the region (Vanguard, 2025). However, Apapa port continues to experience significant congestion challenges, highlighting the need for continued investment and reform.

The findings validate the NPA's ongoing port modernisation programme, which targets a 50% reduction in vessel turnaround times and aims to reduce cargo clearance time from double-digit days to under 48 hours (Punch, 2026). The planned implementation of the Port Community System and integration with the National Single Window are expected to enhance Nigeria's connectivity to key international markets.

Summary of Findings

This study assessed the level of port connectivity in Nigeria, with particular reference to ports managed by the Nigerian Ports Authority. The key findings are:

1. Nigeria's Liner Shipping Connectivity Index has experienced a declining trend since 2015, dropping from a peak of 32.68 in 2015 to 20.35 in 2024, indicating weakening integration into global shipping networks.
2. About 74% of variations in Nigeria's LSCI are explained by cargo throughput, ship traffic calls, vessel turnaround time, cargo dwell time, and other operational factors.
3. Nigerian ports significantly lag behind regional peers, with average vessel turnaround of five to seven days compared to two to three days in Lomé and three to four days in Tema.
4. Average cargo dwell time in Nigerian ports remains between 10 and 18 days, far above global best practice of three to five days.
5. Operational performance varies significantly across Nigerian ports, with Warri port showing the best performance following recent revitalization efforts.

5. CONCLUSION

This study concludes that Nigeria's port connectivity remains suboptimal compared to regional peers and global benchmarks. The declining trend in the LSCI despite increasing trade volumes indicates that Nigeria's port connectivity is not keeping pace with trade growth, highlighting the urgent need for infrastructure investment and operational improvements. The study validates the theoretical propositions of Network Theory, Transport Infrastructure Theory, and Port Economics Theory, confirming that port connectivity is a fundamental determinant of maritime trade efficiency and economic

competitiveness. Based on the findings, the following recommendations are made:

i. Accelerated Infrastructure Modernization: The Nigerian government should accelerate the implementation of the $1 billion port modernisation programme, focusing on upgrading aging port facilities, expanding container handling capacity, and improving operational efficiency across all ports.
ii. Digitalization of Port Operations: The NPA should expedite the implementation of the Port Community System and integrate it with the National Single Window to create a unified, transparent, and efficient trade environment. Digitalization can reduce cargo dwell time, improve data sharing, and enhance supply chain integration.
iii. Enhanced Hinterland Connectivity: Investment in road, rail, and inland waterway infrastructure is essential to link seaports with inland destinations. The development of inland dry ports can help decongest seaports, reduce cargo dwell time, and improve overall logistics efficiency. Currently, between 90 to 95% of port cargo is evacuated by road via trucks, highlighting the need for intermodal transport integration.
iv. Regulatory and Policy Reforms: The government should address the high cost of doing business at Nigerian ports by reducing arbitrary charges, harmonizing terminal handling fees, and eliminating overlapping levies. Nigeria has one of the highest port business costs in West Africa, which should be addressed to attract foreign lines.
v. Sustained Investment in Eastern Ports: The revitalization of Warri and Koko ports has demonstrated the potential for improving port performance through targeted investment. Similar efforts should be extended to other eastern ports to decongest Lagos ports and improve overall national port connectivity.

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