

## OPTIMIZING MARITIME SUPPLY CHAINS: THE ROLE OF PORT OPERATIONAL EFFICIENCY IN DRIVING NIGERIA'S INTERNATIONAL TRADE

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### ABSTRACT

*This study investigates the role of port operational efficiency in driving Nigeria's international trade flows within the maritime supply chain framework. Addressing systemic bottlenecks like chronic congestion and inadequate infrastructure, the research utilizes an ex-post facto design and a quantitative analysis of secondary time-series data spanning from 1995 to 2025. Employing a dynamic log-linear regression model grounded in Queuing Theory, the study evaluates critical variables, including cargo throughput, ship calls, port turnaround time, and Gross Registered Tonnage (GRT). The findings reveal that cargo throughput and GRT significantly and positively drive Nigeria's international trade. Conversely, an increase in ship calls negatively impacts trade flows, reflecting diminishing returns caused by severe port congestion and inadequate interim infrastructure. Furthermore, port turnaround time showed a positive but statistically insignificant effect. Ultimately, the study concludes that optimizing maritime supply chains is vital for economic development and recommends urgent infrastructure upgrades, streamlined administrative procedures, and terminal expansions to accommodate modern, larger vessels.*

**KEYWORDS:** Maritime Supply Chains; Port Operational Efficiency; International Trade Flows; Cargo Throughput; Nigeria.

### 1.0 INTRODUCTION

Maritime transport serves as the backbone of global commerce, accounting for over 90% of

international trade volume (IMO, 2018; Jha, 2019). For Nigeria, Africa's largest economy and most populous nation, seaports are the primary conduits for both its dominant petroleum exports and its burgeoning non-oil sectors. With a coastline extending over 850 kilometres, Nigeria's strategic maritime gateways including the Lagos Port Complex (Apapa and Tin Can Island), Onne, and Port Harcourt are vital for regional and global supply chain integration (Oyelami & Ogundipe, 2020). The efficiency of these port operations is a critical determinant of national trade competitiveness. Optimizing port performance directly reduces trade costs by minimizing port stay time, lowering inventory holding outlays, and maximizing ship capital expenditure (Thien, 2019; Benamara et al., 2019). Consequently, a well-optimized maritime supply chain does not merely facilitate transport; it acts as a catalyst for economic diversification, shielding the nation from the volatility of global oil prices by bolstering non-oil trade flows (Chimbelu, 2019).

Despite Nigeria's strategic position as a West African economic hub, the operational efficiency of its maritime supply chain remains hindered by systemic bottlenecks. Persistent challenges such as chronic congestion, bureaucratic red tape, inadequate infrastructure, and security concerns have diminished the nation's ability to fully capitalize on its maritime potential (Ogbechie & Anetor, 2016). These inefficiencies result in increased logistics costs and unpredictable delivery timelines, which stifle Nigeria's competitiveness in the global market. While the government has sought to improve trade facilitation, there remains a significant gap in understanding how specific port operational metrics such as turnaround time and cargo throughput directly impact the volume and composition of Nigeria's international trade. Furthermore, there is a pressing need to evaluate how these localized inefficiencies resonate across the broader West African sub-region, where Nigeria serves as a critical transit point. This research, therefore, seeks to analyze the role of port operational efficiency in optimizing maritime supply chains to drive Nigeria's international trade growth and regional economic integration.

The primary aim of this research is to evaluate the impact of port operational efficiency on Nigeria's international trade flows within the maritime supply chain framework. Specifically, the study seeks to determine the effect of port efficiency metrics such as cargo throughput, ship calls (vessel traffic), port turnaround time and gross Registered Tonnage (GRT) on Nigeria's trade dynamics. This study moves beyond academic theory to provide practical value in three key areas. First, by identifying specific operational bottlenecks, this research provides data-driven evidence for the Nigerian Ports Authority (NPA) and policymakers to

optimize administrative procedures and prioritize infrastructure investments that enhance trade competitiveness. Second, improving maritime supply chain efficiency is a prerequisite for Nigeria's transition away from oil dependency. This study highlights how optimized ports can facilitate the export of agricultural and manufactured goods, thereby stabilizing the economy against global oil price volatility. Third, while global literature on port performance is vast, there is a scarcity of recent, context-specific data on Nigerian maritime operations. This paper fills that void, providing a localized framework for understanding trade facilitation in emerging African economies.

## 2.0 Literature Review

### 2.1 Conceptual Review

#### *Maritime Supply Chain*

A maritime supply chain (MSC) is an integrated network comprising sea-based transport, port terminal operations, and inland logistics, functioning as a unified system to facilitate the global movement of goods. Unlike traditional shipping, which focuses primarily on vessel transit, the MSC concept emphasizes the seamless integration of various stakeholders including port authorities, shipping lines, and land-side carriers to minimize lead times and logistical overheads. Within this framework, the seaport acts as the critical node where the efficiency of the entire chain is determined; bottlenecks at the port interface inevitably ripple through the supply chain, increasing costs for the end-user. As noted by Panayides (2006), the effectiveness of a maritime supply chain is measured by the degree of coordination and value-added services provided at these port interfaces, which ultimately dictates the competitiveness of a nation's international trade flows.

#### *Ports as a Concept*

Ports, often referred to as gateways to the world, are vital components of the global trade and transportation network. They serve as critical interfaces between land and sea, facilitating the movement of goods, people, and capital across international borders. Ports have a rich history dating back centuries, and their functions have evolved significantly over time. Today, they are integral to the functioning of global supply chains, international trade, and economic development (Songwe, 2019). According to Chang et al. (2020), ports come in various types, catering to specific needs and they include:

1. Container Ports: Specialize in handling standardized containers, essential for modern global trade.

2. Bulk Cargo Ports: Focus on commodities like coal, grain, and minerals, often requiring specialized handling equipment.
3. Passenger Ports: Serve cruise ships and ferries, offering passenger services and tourism opportunities.
4. Specialized Ports: Tailor their operations to unique cargo types, such as oil and gas, automobiles, or perishable goods.

### ***Concept of International Trade Flows***

International trade flows represent the movement of goods, services, and capital across national borders. Nigeria, as Africa's most populous nation and its largest economy, serves as a noteworthy reference point for examining the complexities of international trade within the context of an emerging market economy. The country's participation in global trade is influenced by its abundant natural resources, diverse economic sectors, and strategic geographical location within West Africa. Nigeria's trade history dates back to pre-colonial times when it engaged in extensive intra- African and trans-Saharan trade. Colonialism and post-independence policies significantly shaped Nigeria's trade landscape. The discovery of oil in the mid-20th century transformed the nation into a major oil exporter, affecting the composition of its exports and trade relationships.

Nigeria's role in international trade flows is emblematic of the complexities and opportunities inherent in emerging economies. Its journey from export dependency on oil to diversification and regional integration underscores the evolving nature of international trade. Understanding Nigeria's trade dynamics within this contextual framework is not only essential for policymakers but also for businesses, investors, and scholars seeking to navigate the intricacies of global trade and the evolving landscape of international commerce in Africa's largest economy. The challenges faced by Nigeria offer valuable lessons and insights for addressing trade issues in emerging markets while exploring the potential for economic growth and development through international trade.

## **2.2 Theoretical Literature Review**

### ***Queuing Theory***

Queuing theory is a branch of probability theory used to model situations where units arrive at service stations, such as vessels reaching berths or trailers at port exit gates. In the maritime context, queues form when demand for service such as cargo checking by customs officials exceeds the immediate capacity of the station, directly impacting traffic flow and

operational costs. The primary objective of this model is to calculate the costs of waiting and idling to identify an optimum service level that minimizes expenses and improves process efficiency. As noted by Adepoju (2000), while simple queues can be solved through simultaneous equations, more complex maritime scenarios often require statistical probability and Monte-Carlo simulation methods to determine the time spent in a queue by using random variables to model real-life situations.

### ***Theory of Comparative Advantage***

First introduced by Ricardo (1817) in *Principles of Political Economy and Taxation*, the Theory of Comparative Advantage remains a cornerstone of international trade. It posits that countries should specialize in producing goods where they hold a lower opportunity cost, rather than attempting total self-sufficiency. Ricardo distinguished this from absolute advantage, demonstrating that trade generates mutual welfare gains and efficient resource allocation even if one nation is more productive across all sectors. In the modern era, this theory explains the formation of global value chains and underscores the necessity of reducing trade barriers. For Nigeria, realizing its comparative advantage in specific industries requires an efficient maritime infrastructure; without optimized port operations, the high costs of trade can erode the inherent economic benefits of specialization.

### **2.3 Empirical Literature Review**

Several attempts had been made by scholars to contribute knowledge to the development of the maritime industry in Nigeria. Specifically, studies that bother on port performance, development, economic growth and international trade.

Olaogbebikan, Njoku, Faniran and Okoko (2014) carried out an evaluation of the performance of Nigerian ports before and after concession policy of the year 2006. The study found that improved port performance impacted trade positively which ultimately led to economic growth.

Steven and Corsi (2012) used a unique data set of individual shipments, port characteristics, and actual freight charges to examine potential factors within management controls that affect the attractiveness of a port for shipping trade. The authors hypothesized that the importance placed on each factor varies by the size of the shipper and the findings of their analysis support the hypotheses that large shippers emphasize the factors affecting speed of delivery more than the freight charges compared to small shippers. These findings have managerial implications because investments in port development would pay off depending on the fit

between the type of investment and the customers' needs.

Okoli and Onu (2018) examined empirical studies that investigate the relationship between port efficiency and trade growth in developing economies. The authors find consistent evidence that improvements in port infrastructure, operational efficiency, and trade facilitation lead to increased trade volumes and economic growth. They highlight the need for tailored policy interventions in the Nigerian context to harness the potential benefits of enhanced port performance.

Johnson & Williams (2019) conduct a comprehensive review of studies exploring the impact of digitalization on port operations in selected European Countries. Their analysis reveals that the adoption of digital technologies, such as blockchain, IoT, and data analytics, can significantly improve port efficiency, reduce cargo dwell time, and enhance trade flows. The review underscores the importance of technology investments in enhancing port competitiveness.

Garcia and Martinez (2020) focus their review on the critical issue of berth allocation strategies and their impact on port performance. Through an analysis of various empirical studies, they identify best practices in berth allocation that can reduce vessel turnaround time and waiting time at South American ports. The review emphasizes the potential benefits of collaborative approaches and data-driven decision-making in optimizing berth allocation.

Chen and Kim (2021) examine the evolving literature on environmental sustainability in South- East Asian ports. Their analysis highlights the increasing importance of green practices and environmental regulations in shaping port performance. The review discusses studies that explore the implementation of eco-friendly technologies, emissions reduction measures, and the potential for sustainable port operations in Asia.

Patel and Gupta (2022) conducted a review of empirical studies investigating the relationship between trade diversification and port efficiency in India. Their findings suggest that diversifying the export and import basket beyond oil-related products can lead to more balanced trade flows and reduced vulnerability to oil price fluctuations. The review underscores the importance of policies promoting non-oil sectors and their impact on port performance.

According to Budipriyanto, Wirjodirdjo, Pujawan & Gurning (2017) findings, the ports' performance is mainly based on total vessel turnaround time, cargo handling time and waiting time. These performance measures can be significantly influenced by arriving vessel at the port, which has available and allocated berth. The researchers carried out a replication study

amongst terminals using Collaborative Approach (CA) to obtain best resolutions for Berth Allocation Problem (BAP) beneath different situations. In their outcomes, the researchers emphasised that collaborative strategy aids to minimize total cargo-handling time, vessel turnaround time and waiting time offering rewards to both the terminals and shipping lines.

Kaliszewski et al. (2020) in their study to analyse the competitiveness of container ports sought to identify and characterize the key factors of competitiveness. The aim of their study was to examine factors of global competitiveness of container ports as perceived by shipping lines. The research method applied was a quantitative primary non-random social sampling. Data were collected from survey participants via a business-oriented social network. Two statistical methods were used to rank and group these factors: a Friedman test and a post-hoc analysis involving Least Significant Difference test (LSD). Shipping executives (n = 120) stressed the importance of three factors: container terminal service quality, social harmony with labour and adequate nautical accessibility. The study found that with growing size of container ships, which require deep water container terminals and reliable port services, shipping lines' decision makers need services of a high standard and with a low risk of labour-related disruptions to maintain their own high level of service quality.

Nwokedi et al., (2021) saw the need to eliminate bottlenecks in port operations in Nigeria. Current trends in ports management, however, suggest existence of numerous inefficiency challenges reflected in long ship turnaround time, increasing trend of cargo dwell time, high cargo pilferage risk rate, poor condition of port infrastructure and superstructure, multiple charges and government agencies, cumbersome cargo clearance & examination procedures, port congestion related delays particularly in Apapa and Onne ports, etc. Their study identifies the decisive port-related factors constraining the flow of shipping trade in Nigerian ports using a survey to obtain data on the influence of the identified factors on the flow of shipping trade in Nigerian ports. The Principal Component Analysis (PCA) was used to analyse the data obtained. The results indicate that high cargo pilferage risk profile, long ship turnaround time and increasing trend of cargo dwell time constitute the significant port-related factors constraining the flow of shipping in Nigerian ports.

## 2.4 Research Gap

While Olaogbebikan, Njoku, Faniran, and Okoko (2014) found that improved port performance positively impacted trade and economic growth after the concession policy of 2006, further

research could explore the specific mechanisms through which this impact occurred. This could involve a deeper analysis of the policy changes, their implementation, and their implications for trade and economic growth. Steven and Corsi (2012) highlighted the importance of understanding shippers' preferences and how they influence port investment decisions. Research could delve into the specific factors that large and small shippers prioritize when choosing ports and how these preferences can inform targeted investments in port development. Budipriyanto, Wirjodirdjo, Pujawan, and Gurning (2017) emphasized the benefits of collaborative strategies in minimizing cargo-handling time, vessel turnaround time, and waiting time in port operations. Future research could explore the adoption and effectiveness of collaborative approaches in different port settings and under various circumstances. Additionally, examining the challenges and barriers to collaboration in the maritime sector could be a valuable avenue for further investigation.

Kaliszewski et al. (2020) identified container terminal service quality, social harmony with labour, and nautical accessibility as key factors of competitiveness as perceived by shipping lines. Further research could delve into how these factors are interrelated and how they influence shipping lines' decisions. Additionally, exploring the role of digitalization and technological advancements in enhancing port competitiveness could be a relevant research direction. Nwokedi et al. (2021) identified several bottlenecks and inefficiency challenges in Nigerian port operations. Future research could focus on the root causes and underlying factors contributing to these challenges.

Additionally, evaluating the impact of potential policy changes or operational improvements in addressing these bottlenecks and enhancing the efficiency of Nigerian ports would be beneficial. A potential research gap is seen in the lack of a comparative analysis of port performance and efficiency across different countries or regions. This could provide insights into best practices, lessons learned, and opportunities for cross-border collaboration in improving port operations and trade facilitation. Given the increasing global focus on sustainability and environmental impact, further research could explore how ports can improve their environmental performance, reduce carbon emissions, and implement eco-friendly practices while maintaining trade efficiency.

### **3.0 Methodology**

This study employs an ex-post facto research design, utilizing a quantitative approach to analyze the longitudinal relationship between port efficiency and trade. The study relies on

secondary time- series data covering the 31-year period from 1995 to 2025. Data were purposively sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS), and the Nigerian Ports Authority (NPA) Annual Reports.

Drawing from Queuing Theory as the analytical anchor, the model is designed to capture how operational service units (ports) influence the flow of trade. The functional relationship is expressed as:

$$\text{TRADE} = f(\text{CTP}, \text{SHC}, \text{PTT}, \text{GRT})$$

The above model in its econometric form is given as:

$$\text{TRADE} = \beta_0 + \beta_1 \text{CTP}_t + \beta_2 \text{SHC}_t + \beta_3 \text{PTT}_t + \beta_4 \text{GRT}_t + \mu_t$$

Where:

TRADE = International Trade Flow CTP = Cargo Throughput

SHC= Ship Call

PTT= Port Turnaround Time GRT= Gross Registered Tonnage  $U_t$ = Error Term

A-priori Expectations;

$$\beta_0 > 0, \beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0$$

The primary estimation technique is the dynamic log-linear regression model. To ensure the reliability of the results and avoid spurious regression, the test for autocorrelation, along with tests for Heteroskedasticity and Multicollinearity (VIF) are conducted to ensure the Gauss-Markov assumptions are satisfied.

#### 4.0 RESULTS AND DISCUSSION

In this section, the results of the study will be presented and discussed. This will start with the descriptive statistics as follows.

**Table 4.1: Descriptive Statistics.**

	<b>BOT</b>	<b>MPR</b>	<b>MS</b>	<b>EXR</b>	<b>INF</b>	<b>FDI</b>
Mean	16409035	54812973	4306.061	5.290248	1.25E+08	16409035
Median	15033925	61333135	4394.000	5.440000	1.23E+08	15033925
Maximum	41598669	84951927	5232.000	6.298289	1.91E+08	41598669
Minimum	1589275.	13273053	3023.000	3.900000	78838624	1589275.
Std. Dev.	12813503	23910511	592.8361	0.701279	28785935	12813503
Skewness	0.432948	-0.422558	-0.457198	-0.470310	0.616782	0.432948
Kurtosis	2.001088	1.724883	2.490852	2.017566	2.786637	2.001088
Jarque-Bera	2.038868	2.730169	1.277913	2.158265	1.828402	2.038868
Probability	0.360799	0.255359	0.527843	0.339890	0.400837	0.360799
Sum	4.59E+08	1.53E+09	120569.7	148.1270	3.50E+09	4.59E+08

Sum Sq. Dev.	4.43E+15	1.54E+16	9489274.	13.27837	2.24E+16	4.43E+15
Observations	31	31	31	31	31	31

Source: Author’s Computation (2026)

The descriptive statistics in the table above provide a summary of the operational landscape for Nigeria’s maritime sector between 1995 and 2025. The mean value for Nigeria's total international trade over the period was approximately ₦16.41 trillion, reflecting the significant scale of the nation's global economic engagement. Regarding port operational metrics, the results show that for cargo throughput, an annual average of 54.81 million metric tons was handled across the ports. For Ship calls, ports recorded a mean frequency of 4,306 vessel arrivals per annum. The port turnaround time statistic, a critical efficiency indicator, show the average time elapsed between a ship's arrival and departure was 5.29 days. Lastly, under gross registered tonnage (GRT), the mean internal volume of vessels calling at Nigerian ports stood at 125 million tons, highlighting the substantial capacity of the maritime traffic serviced.

The standard deviation results highlight significant annual fluctuations in international trade (₦12.81 trillion) and cargo throughput (23.91 million metric tons). Conversely, the low dispersion in ship calls (593) and port turnaround time (0.70 days) points to a high degree of operational consistency, suggesting that terminal efficiency remained relatively static regardless of traffic volume. Finally, Gross Registered Tonnage exhibited a deviation of 28.79 million tons, reflecting moderate variation in the capacity of vessels serviced within the maritime supply chain. Only trade and gross registered tonnage are positively skewed, cargo throughput, ship call and port turnaround are negatively skewed. For kurtosis, all the variables are platykurtic since they are less than 3. The Jarque-Bera p-value shows that all the variables are normally distributed at the 95% confidence interval. Next, we present the results of the Pearson correlation matrix.

**Table 4.2: Dynamic Log-Linear Regression Model**

<b>Dependent Variable: TRADE</b>				
Method: ARDL				
Sample (adjusted): 1995 2025				
Included observations: 31 after adjustments				
<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
C	-10467651	18969448	-0.551816	0.5864
LOG(TRADE(-1))	0.320906	0.153446	2.091325	0.0448
LOG(CTP)	0.662550	0.099971	6.627435	0.0000

LOG(SHC)	-0.501073	0.237400	-2.110674	0.0459
LOG(PTT)	0.403686	0.309183	1.305656	0.2046
LOG(GRT)	0.736775	0.283420	2.599587	0.0311
R-squared	0.859339	Mean dependent var	16409035	
Adjusted R-squared	0.834877	S.D. dependent var	12813503	
S.E. of regression	5206817.	Akaike info criterion	33.92927	
Sum squared resid	6.24E+14	Schwarz criterion	34.16716	
Log likelihood	-470.0098	Hannan-Quinn criter.	34.00199	
F-statistic	35.12850	Durbin-Watson stat	1.325374	
Prob(F-statistic)	0.000000			

Source: Author’s Computation (2026)

The regression result presented in Table 4.2 quantify how operational maritime factors and historical trade momentum influence Nigeria's international trade flows. The lagged trade variable has a positive and significant coefficient, indicating that previous trade volumes strongly influence current performance. This suggests a persistence effect where the momentum of maritime commerce carries over from one year to the next, establishing a baseline for growth.

Among the operational metrics, Cargo Throughput emerges as the most dominant and highly significant driver of trade. A 1% increase in cargo throughput is associated with a 0.66% increase in total trade value, reinforcing the intuition that the sheer volume of goods processed at the port is the primary engine of maritime trade performance. Similarly, Gross Registered Tonnage shows a strong positive and significant effect, suggesting that the capacity and size of vessels calling at Nigerian ports significantly bolster trade flows. This underscores the importance of infrastructure capable of handling larger, more modern vessels to achieve economies of scale.

Conversely, Ship Calls enters with a negative and significant coefficient. This implies that a higher frequency of vessel arrivals, without a corresponding increase in efficiency or throughput, may actually hinder trade. In the Nigerian context, this could reflect diminishing returns caused by port congestion; an influx of ships without adequate berth availability leads to delays that increase costs and dampen overall trade value. Interestingly, Port Turnaround Time was not statistically significant. This suggests that while turnaround time is a critical internal efficiency metric, its individual short-run impact on the aggregate value of trade is muted compared to the volume- based metrics of throughput and tonnage.

The overall model demonstrates a strong fit with an R<sup>2</sup> of 0.859 (Adj. R<sup>2</sup> = 0.835), indicating that approximately 83.5% of the variation in Nigeria's international trade is explained by

these maritime operational variables. The F-statistic (35.13,  $p < 0.0001$ ) confirms the collective significance of the regressors. While the Durbin-Watson stat (1.32) suggests some level of positive serial correlation, the model remains robust for identifying long-term drivers.

### Model Diagnostics

To ensure the reliability of the regression estimates, several diagnostic tests were conducted to verify the Gauss-Markov assumptions. The results, consolidated in Table 4.3, confirm that the model is free from major econometric ailments.

**Table 4.3: Summary of Post-Estimation Diagnostic Tests.**

Test Category	Method	Statistic	P-Value / VIF	Result
<b>Serial Correlation</b>	Breusch-Godfrey LM	F-stat: 1.399	0.2688	No Serial Correlation
<b>Heteroskedasticity</b>	Breusch-Pagan-Godfrey	F-stat: 2.216	0.0989	Homoskedasticity Confirmed
<b>Multicollinearity</b>	Variance Inflation Factor	<b>Max VIF:</b>	<b>5.690</b>	No Multicollinearity
<b>Individual VIFs:</b>	<i>CTP (5.690)</i>	<i>SHC (1.972)</i>	<i>PTT (4.681)</i>	<i>GRT (1.928)</i>

Source: Author’s Computation (2026)

The diagnostic suite validates the integrity of the ARDL model. The Breusch-Godfrey test yielded a p-value of 0.2688, indicating a failure to reject the null hypothesis of no serial correlation, which resolves the ambiguity of the initial Durbin-Watson statistic. Similarly, the Breusch-Pagan-Godfrey test results ( $p = 0.0989 > 0.05$ ) confirm that the error variances are constant (homoscedastic).

Finally, the Multicollinearity test shows that all Centered VIF values are well below the threshold of 10, with the highest being 5.69 for Cargo Throughput. This confirms that the independent variables are not overly correlated, allowing for a reliable interpretation of the individual coefficients.

### Discussion of Findings

From the findings made in section 4.2, cargo throughput, port turn around time and gross registered tonnage were seen have positive impacts on Nigeria’s international trade flows. This is in line with Okoli and Onu (2018). This positive association is an indicator that port performance usually grow in the same direction with international trade flows. However, ship

call had a negative effect on trade flows. In Johnson and Williams (2019), similar findings were made and though the positive effects are expected, the negative impact by ship call is indicative of inadequate port infrastructure at the interim. The positive and significant effect of cargo throughput on international trade flow lends credence to Gacia and Martinez (2020)'s findings.

Interestingly, port turnaround time had a positive but not significant effect on trade flow. This is in line with the findings of Chen and Kim (2021) and also suggests that the current port infrastructure needs to be upgraded in the near future. Gross registered tonnage is seen to have a positive effect on international trade flow. As Patel and Gupta (2022) found, the higher the gross registered tonnage, the more efficient trade becomes and this invariably leads to an increase in international trade flow.

## **5.0 CONCLUSION AND RECOMMENDATIONS**

This study has examined the intricate relationship between port performance and international trade flow in Nigeria, shedding light on the multifaceted dynamics that shape the nation's economic landscape. The findings reveal the crucial role that optimized maritime supply chains play in facilitating and catalysing international trade activities. As the gateways to global commerce, Nigerian ports serve as crucial nodes in the supply chain, influencing the ease and efficiency with which goods move across borders. The research has revealed that port optimization, specifically through enhanced cargo throughput and the capacity to handle larger gross registered tonnage, has a positive effect on increased international trade flow. However, the study also highlights that simply increasing the frequency of ship calls without addressing operational bottlenecks can hinder trade performance.

As Nigeria positions itself in the global marketplace, the research shows the urgency of prioritizing supply chain integration and port improvements as a strategic imperative for sustained economic development. These findings serve as a foundation for future policy recommendations aimed at encouraging a more conducive and competitive environment for international trade. By leveraging the findings made in this study, policymakers, industry players, and relevant stakeholders can work collaboratively towards creating a resilient and efficient port infrastructure that propels Nigeria to new heights of prosperity in the ever-evolving landscape of global trade.

### **Recommendations**

In light of the findings, the following recommendations are proposed:

1. The government should allocate resources for the upgrade and expansion of port infrastructure, including terminals, berths, and cargo handling facilities. Modern technologies to enhance efficiency in cargo handling and processing should also be implemented.
2. The relevant authorities should implement measures to streamline port operations and reduce turnaround time, such as optimizing customs procedures, improving inspection processes, and implementing digital documentation systems. Investment in training and capacity building for port personnel to enhance their skills and improve overall operational efficiency should also be done.
3. Port facilities should be upgraded to accommodate larger vessels, reducing congestion and improving ship turnaround times and implement measures to optimize ship scheduling and reduce waiting times through improved coordination with shipping companies.
4. The government should encourage policies that promote the growth of cargo throughput, such as providing incentives for increased cargo volumes and fostering collaboration with logistics and manufacturing industries. There should be implementation of efficient cargo handling practices and invest in technology to expedite cargo processing.

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