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IMPACT OF PORT INFRASTRUCTURE AND LOGISTICS EFFICIENCY ON ECONOMIC GROWTH IN NIGERIA: THE NIGERIAN PORT AUTHORITY EXPERIENCE 2006 – 2022

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Abstract: Ports play crucial roles in facilitating international trade by serving as key gateways for imports and exports. Understanding how the quality of port infrastructure and logistics efficiency influences economic growth was the aim this study. Therefore this study, investigates the impact of port infrastructure and logistics efficiency on economic growth in Nigeria: The Nigerian Port Authority Experience from 2006 to 2022. The study is based on the quantitative method of secondary data collection. An ex - post-facto research design was adopted to achieve the objectives of the study. The study draws its data from the annual reports of the Nigerian Port Authority and Central Bank of Nigeria Statistical Bulletin with a focus on information in the post-concession era from 2006 to 2022 for a period of 16 years. The ARDL Bound Test approach was adopted to estimate the relationship between the variables. The study findings show that both quality of port infrastructure (QPI) and logistics efficiency (CTR) have insignificant relationships with economic growth in both the short-run and long-run. Specifically, the test of Hypothesis One showed that the quality of port infrastructure exhibited an insignificant negative relationship with economic growth, as indicated by the β coefficients of -2996.500 (short-run) and -110071.1 (long-run) with p-values of 0.4602 and 0.7904, respectively. Similarly, the test of Hypothesis Two showed that logistic efficiency, measured by cargo throughput (CTR), demonstrated an insignificant positive relationship with economic growth. Based on these findings, the study recommends that the government should increase investment in port infrastructure, including the development and maintenance of berths, quays, storage facilities, and cargo-handling equipment to stimulate economic growth. Finally, advanced technologies should be adopted in port operations, including automated cargo-handling processes, real-time tracking systems, and data analytics. Technological advancements can significantly improve efficiency, reduce processing times, and enhance overall logistic operations.

Keywords: Port Infrastructure, Logistics Efficiency, Gross Registered Tonnage, Vessel Traffic, Economic Growth

1.0 Introduction

In the present era of globalization, the role of port infrastructure quality and logistic efficiency systems on economic growth and development has become increasingly noticeable in recent times due to its functions that revolve around the channel of production, by enabling the flow of goods, services, and values from the point of production to consumption. The significance of port infrastructure quality and logistics systems in enabling sufficient growth and development in emerging economies has been acknowledged. Logistics is the process of managing and organizing the flow of information from the raw material (which is meant to be converted into a consumable good) to the point of consumption of the good or service. This is achieved through efficient storage and inventory management systems.

According to Adeyemo (2015), Nigeria's logistic system is too inadequate to support sustainable growth. Victor (2015) points out that when a manufacturer's supply chain experiences delays in receiving key commodities, inefficiencies in the logistics system might result in the loss of those materials. Furthermore, ineffective logistic performance impacts both ultimate consumers and manufacturers, leading to a loss of profit when necessary materials are delayed. According to Hausman, Lee, and Subramanian (2012), developed nations with well-developed port infrastructure and logistical systems have a higher chance of exporting to overseas markets and drawing foreign direct investment, whereas emerging economies continue to lag behind.

Numerous previous studies have attempted to establish a connection between port infrastructure, logistics systems, and economic growth, particularly in developing economies. However, scholars have neglected to consider the impact of logistic efficiency on economic growth through the interaction of Nigeria's infrastructure and various modes of transportation. In this era of globalization, it is necessary to investigate the effects of airways, rivers, and other logistical methods on the economic progress of developing nations such as Nigeria. Furthermore, the direction of causality between port infrastructure and logistics efficiency on economic growth was overlooked in previous studies. This therefore justifies the need for this study to examine the effects of ports infrastructure on economic growth and logistics efficiency on economic growth, and shed additional insight into the inconclusive debate on the direction of causality between logistics efficiency and economic growth in Nigeria.

In an attempt to evaluate the impact of port infrastructure quality on economic growth and development, Oriaku et al. (2011) stated that ports are significant points of entry and departure for international trade and are believed to be the most crucial link in the transportation chain for the advancement of both domestic and global trade. He continued by saying that the Tincan Island Port complex was established in 1977 and put into service to lessen the strain that large imports were placing on Apapa Port. The concept of new ports being created and expanded because of the oil boom of 1977–1979 encouraged the Federal Government to construct more ports, including the Ocean Terminal at Onne, River State; the New Sapele and Warri Port Complex; and the Calabar Port Complex. Therefore, it is against this background that this study aims to determine the impact of port infrastructure quality and logistics efficiency on economic growth in Nigeria: The Nigerian Port Authority Experience from 2006 to 2022.

Purpose of the study

The purpose of this study is to investigate the impact of port infrastructure and logistics efficiency on economic growth in Nigeria. However, the study-specific objectives are as follows:

i. Determine the relationship between port infrastructure and economic growth in Nigeria.
ii. To ascertain the relationship between logistic efficiency and economic growth in Nigeria.

Research Hypotheses

The following null hypotheses were developed for the study.

$H0_1$: There is no significant relationship between port infrastructure and economic growth in Nigeria.

$H0_2$: There is no significant relationship between logistic efficiency and economic growth in Nigeria.

2.0 REVIEW OF THE RELATED LITERATURE

This section reviews the literature relevant to the problem under investigation. The review also includes empirical investigations in the field, emphasizing the research problems that the studies examined, the theories that were developed and tested, and the conclusions and limitations of those studies. The idea was to critically evaluate the study data to identify any gaps in the literature and to provide support for the paper's conclusions.

2.1 Conceptual Review

Port Infrastructure

Port infrastructure refers to the physical facilities, equipment, and structures developed to facilitate the handling, storage, and transportation of goods and passengers through seaports. Ports are vital hubs in the global transportation systems that facilitate the transfer of products between nations and regions by linking maritime and land transit. For marine trade to be effective and seamless, port infrastructure is necessary. Vanelslander (2014) defines port infrastructure as the facilities and infrastructure that provide port services related to transportation, such as ship mooring berths, quay walls, jetties, floating pontoon ramps in tidal areas, internal basins, land reclamation, backfills, and alternative fuel infrastructure, as well as facilities for collecting waste from ships and cargo residues.

The neoclassical economic perspective of transport infrastructures put forth by Lakshmanan (2011) serves as the foundation for the methodology used to calculate the economic impact of port infrastructure quality. Our presumption is that port infrastructure investments are exogenous, meaning that they raise the port's quality index (QPI). The logistics performance (LP) of a nation would be enhanced by better QPI (such as contemporary technology and equipment) (that is, greater reliability, less damage, capacity to track and trace shipments, timeliness of delivery, etc.). A country's domestic and international accessibility would rise with improved QPI and LP, opening up new business prospects outside the country. The amount of money a nation trades internationally overall (also known as seaborne trade) is one way to measure how well those prospects are realized. Gains from trade can be characterised by improved labor supply, expanded production, diffusion of innovation, competitive pressures, economic restructuring, etc., leading to total factor productivity and GDP growth (Lakshmanan, 2011).

According to Lakshmanan (2011), freight costs can be decreased and logistical capabilities can be enhanced by investing in transportation facilities. The contribution of port infrastructure and liner shipping connectivity (LSC) to Caribbean freight rates was calculated by Wilmsmeier and Hoffmann (2008). They discovered that an increase of one standard deviation in LSC corresponds to a projected decrease in freight rates of USD 287, and an increase of one standard deviation in port infrastructure for an importing nation corresponds to an expected decrease in freight rates of USD 225. Furthermore, after adjusting for distance, availability of liner services, type of product, and insurance costs, Sánchez et al. (2003) discovered that freight costs are lower in efficient ports. Additionally, a 12% decrease in shipping costs is anticipated with a port efficiency gain from the 25th to 75th percentile (Clark et al., 2004). Quality of infrastructure and transport costs is vital for export-led economic growth (Limao and Venables, 2001). Therefore, it follows that efficient ports function better logistically and have higher-quality infrastructure than inefficient ports. Furthermore, one of the main factors influencing FDI into a nation is an effective port infrastructure with improved logistical capabilities (Panayides et al., 2015).

Conversely, ineffective ports hinder economic growth by reducing both domestic and foreign trade (Clark et al., 2004).

Quality Port Infrastructure as a Proxy of Port Infrastructure

The quality of port infrastructure refers to the overall condition, capabilities, and efficiency of the physical facilities and equipment in a port. It encompasses a range of factors that contribute to the effectiveness and competitiveness of the port in facilitating the movement of goods and vessels. Baştuğ, Haralambides, Esmer, and Eminoğlu (2022) assert that a port's competitiveness and capacity to draw shipping lines and cargo traffic are greatly influenced by the port infrastructure. Ports that make infrastructure improvements and maintenance investments are better equipped to manage rising trade volumes and support local economic growth (Erie, 2004). Meeting the changing needs of international trade and logistics requires regular evaluation and improvement of port infrastructure.

Logistics Efficiency

Logistics efficiency refers to the effectiveness and productivity of the processes involved in the planning, implementation, and control of the movement and storage of goods, services, and information within a supply chain. It is an essential component of supply chain management and helps guarantee that goods are delivered at the most affordable price to the appropriate location on schedule. According to Tseng, Yue, and Taylor (2005), logistics currently has a significant impact on the economies of most developing nations. It does so by influencing many different areas, including supply chain management, industry and products, transportation networks, storage systems, information and communication devices, packaging services, and services imports and exports. According to Hayaloglu (2015), logistics actively contributes to the current development of trade as a significant component. As a result, the growth of the logistics industry is important for both overall national and corporate growth. Investments in logistics also alter how nations operate as a whole.

According to Bensassi et al. (2015), the relative dearth of analyses that directly determine the quantitative assessment of this sector's impact on international trade can be explained by the absence of a widely recognized definition of the logistics business, both nationally and regionally. The majority of research that has already been done only looks at specific components of the supply chain's effects on global trade (Akopova et al., 2017; Bondarenko et al., 2017). Logistics, according to Sharipbekova and Raimbekov (2018), is the management and movement of resources, information, and items between the point of production and consumption. Logistics, according to Sevgi and Tezcan (2017), is the process of moving goods and commodities into and out of a business. The World Bank (2015) used the performance of six assessment indicators—customs, logistics competence, infrastructure, international shipping, tracking, tracing, and timeliness—to define logistics efficiency.

The key components of logistic efficiency include:

Transportation: Efficient transportation involves selecting the most cost-effective and timely modes of transportation for goods. This includes considerations of routes, carriers, and transportation methods.

Warehousing and Inventory Management: Effective management of warehouses and inventory helps reduce holding costs, minimize stock outs, and ensure that products are readily available when needed.

Order Processing: Streamlining order processing procedures helps reduce lead times and improve overall responsiveness to customer demands.

Information Flow: Timely and accurate information sharing is crucial for coordinating activities within the supply chain. This includes real-time tracking of shipments, inventory levels, and order status.

Technology Integration: The use of technology, such as warehouse management systems (WMS), transportation management systems (TMS), and other digital tools, can enhance logistics efficiency by automating processes and providing real-time visibility into the supply chain.
Collaboration and Communication: Effective communication and collaboration among different stakeholders in the supply chain, including suppliers, manufacturers, distributors, and retailers, are essential for smooth operations.
Improving logistic efficiency can lead to cost savings, faster delivery times, better customer satisfaction, and a competitive advantage for businesses. Continuous monitoring, analysis, and optimization of logistics processes are crucial for achieving and maintaining high levels of efficiency in a dynamic business environment.

Cargo Throughput as a Proxy of Logistics Efficiency

Cargo throughput refers to the total volume or quantity of goods and merchandise that passes through a specific transportation node, such as a port, airport, railway station, or other logistics hubs, within a given period. Seifegha, Ndalu, and Okene (2023) defined cargo throughput as the total amount of cargo handled by a port in a given amount of time. This is also known as port throughput, which is an important metric for assessing port performance. The volume of cargo that a specific infrastructure or transportation system can handle is measured by its cargo throughput (Lam, Ng, Seabrooke, & Hui, 2004). Cargo throughput is a quantitative evaluation of the effectiveness and capacity utilization of logistics and transportation systems. It is commonly stated in terms of weight (tonnage) or volume (cubic meters). To evaluate the effectiveness of these nodes and comprehend their function in promoting trade and commerce, cargo throughput measurement is crucial (Bichou & Grey, 2004).

Key points related to cargo throughput include the following:

Ports: In the context of ports, cargo throughput represents the total tonnage of goods handled by the port facilities. This includes imports, exports, and transshipment activities.
Airports: For airports, cargo throughput refers to the total volume of airfreight passing through the airport, including both domestic and international shipments.
Railways: In the case of railways, cargo throughput measures the total tonnage of goods transported over a specific rail network during a given period.
Logistics Hubs: Cargo throughput can also be used to measure the efficiency of logistics hubs or distribution centers, reflecting the total volume of goods processed within these facilities.
High cargo throughput is generally considered a positive indicator, suggesting that the transportation infrastructure is effectively handling a significant volume of goods. However, it is important to consider other factors such as processing speed, reliability, and overall logistics system performance in conjunction with throughput to assess the efficiency of the entire supply chain. According to Netteboom and Rodrigue (2008), efficient cargo throughput is essential for promoting trade, economic expansion, and the seamless operation of supply networks. To increase the effectiveness of transportation and logistics systems, stakeholders can identify areas for improvement and make well-informed decisions by tracking and analyzing cargo throughput data (Ha, Yang, & Lam, 2019).

Economic Growth

Economic growth refers to the increase in the value of goods and services produced by an economy over time. It is commonly measured as the percentage change in the gross domestic product (GDP) of a country. GDP is

the total market value of all final goods and services produced within a country during a specific period. The actual gross domestic product (GDP) changes as a percentage from year to year and is commonly used to gage economic growth, according to Seifegha, Ndalu, and Okene (2023). An important measure of a country's economic development and health is its rate of economic growth. In general, it denotes raising the standard of life for the populace and increasing the productive potential of an economy (Friedman, 2017). According to Onyimadu (2015), economic growth is defined as the rise in income per capital growth rate. One of the main benefits of economic growth is that it clarifies the resources that a society has accessible as well as the share that is allotted to each person in their quest to fulfill their utilitarian preferences.

Increased productivity, population expansion, technical developments, capital and infrastructure investments, and supportive government policies are some factors driving economic growth. Zhuang, Gunatilake, Niimi, Khan, Jiang, Hasan, and Huang (2009) proposed that poverty reduction, creation of job opportunities, and financing of public services necessitate consistent economic growth. It is vital to remember, though, that while economic growth is an essential component of development, policymakers must also take into account other factors such as income inequality, environmental sustainability, and human well-being in general.

For most people, improvements in the quality of life, access to education, and availability of basic health care are necessary conditions for economic growth (Belshaw & Livingstone, 2002). The meaning of the term "development" becomes more apparent when one has a deeper comprehension of the concept of "economic growth." Economic growth is the gradual rise in a nation's actual production per person, according to economists. The most practical technique for calculating production is to use the gross national product (GNP), while alternative measures can also be utilized. This implies that economic development is measured by the growth in a nation's per capita GNP. Economic growth is described as a sustained expansion of production capabilities as measured by an increase in real GDP over time (Chow, & Li, 2002).

As demonstrated by the economies of Hong Kong, South Korea, Taiwan, and other Asian nations, persistently strong economic growth may transform a developing nation into an affluent one (Bade & Parkin, 2002). Malizia and Feser (2000) assert that growth and development are complementary since one facilitates the others. These are frequently alternate cycles that occur sequentially. While "growth" refers to a rise in output, "systemic transition" refers to a change in law or technology. The economy benefits from growth, but advancements must result in a more equitable distribution of wealth and income. Overall, expansion and progress lead to an increased variety of economic choices.

Gross Registered Tonnage as a Control Variable

Gross registered tonnage (GRT) is a measure of the total internal volume of a ship, including all enclosed spaces, expressed in "tons." A unit of measurement used in maritime shipping to quantify the size or carrying capacity of a vessel. Despite the term "tonnage," it does not directly represent the weight of the ship. The full volume of a ship, including the crew quarters, engine rooms, cargo holds, and other areas, is considered when calculating gross registered tons (Kaukiainen, 1995). It is employed for administrative and regulatory tasks such as determining taxes, levies, and safety requirements. According to Lewis (1992), the GRT offers a standard measurement that facilitates ship size and capacity comparison and classification. It's important to remember that there is another unit of measurement for tons, known as deadweight tons (DWT), which denote the overall weight that a ship is capable of carrying, including ballast, fuel, cargo, and other goods. According to Branch, (2012), deadweight tonnage is more relevant to the commercial operation of a vessel, whereas gross registered tonnage is more focused on regulatory and administrative aspects.

Vessel Traffic as the Second Control Variable

Vessel traffic refers to the movement and navigation of ships or boats in a particular area, such as ports, harbors, waterways, or open seas. It includes all forms of maritime transportation, such as fishing boats, passenger ships, cargo ships, and other type of watercraft. Effective vessel traffic management is essential for preserving marine efficiency, safety, and lawfulness. To avoid collisions, maintain navigational safety, and promote the efficient operation of marine activities, a variety of organization, authorities, and technology are involved in managing and monitoring vessel traffic, according to Robards, Silber, Adams, Arroyo, Lorenzini, Schwehr, and Amos (2016).

Some key aspects of vessel traffic include the following:

Vessel Traffic Services (VTS): Many busy maritime areas have VTS that provide real-time monitoring and communication to assist vessels in navigating safely. VTS operators use radar, automatic identification system (AIS), and other technologies to track and manage vessel movements.

Navigation and Routing: Proper planning and coordination of vessel routes help avoid congestion, optimize traffic flow, and reduce the risk of accidents. Authorities may establish designated shipping lanes and traffic separation schemes to guide vessels safely through certain areas.

Regulatory Measures: Authorities may implement regulations and rules to govern vessel traffic in specific regions. These regulations can include speed limits, anchoring restrictions, and entry/exit protocols for ports.

Communication Systems: Effective communication is essential for vessel traffic management. Ships use VHF (Very High Frequency) radios, AIS, and other communication tools to exchange information with other vessels and relevant authorities.

Traffic Control Centers: Some regions with heavy vessel traffic have control centers that monitor and manage maritime activities. These centers collaborate with the VTS, coast guards, and other authorities to ensure the safety and efficiency of vessel movements.

Efficient vessel traffic management is particularly important in busy waterways and ports where multiple vessels operate simultaneously. It helps prevent accidents, ensures compliance with regulations, and contributes to the overall safety and sustainability of maritime transportation.

2.2 Theoretical foundation

This study is anchored on the modified neoclassical growth theory, which is referred to as the endogenous growth theory. This is because the theory posits that investments in human capital, infrastructure, and technological progress can contribute to sustained economic growth, which underpins the objectives of this study.

Endogenous Growth Theory

The Endogenous growth theory was primarily developed by economist Paul Romer. He introduced the theory in the late 1980s as an alternative to traditional neoclassical growth models, which focused on factors such as capital accumulation and technological progress as external drivers of economic growth. According to Romer's Endogenous Growth Theory, the economic system itself can explain economic growth. This theory places special emphasis on the contribution of human capital, knowledge, and innovation to long-term economic progress. The field of economics has greatly benefited from Paul Romer's groundbreaking work on endogenous growth theory, according to Chandra (2022), especially in understanding the causes of long-term economic growth and the function of laws that support innovation, education, and R&D.

The theory suggests that sustainable economic growth can be achieved through investments in infrastructure, human capital, and technological advancements. Enhancements to port infrastructure and the effectiveness of

logistics can be considered components of larger physical capital expenditures (Ho & Ho, 2006). Long-term economic growth is linked to endogenous growth theory. According to this theory, a nation's growth is facilitated by internal forces, especially those that control the incentives and chances for the creation of technological knowledge (Dosi, 1997). One could characterize it as a global economic ideology that functions within a closed system. However, the modified neoclassical growth model assumes that exogenous forces (technology, capital, expert advice, and government policies) and endogenous variables (government policies) boost economic growth (Gomulka, 2006).

2.3 Empirical Review

Edih, Nyanayon, and Agboro (2023) studied port operation's efficiency and revenue generation in global maritime trade: implications for national growth and development in Nigeria. The study employed correlation and multiple regression analyses to test the hypothesis that port operation's efficiency does not have a positive and significant effect on revenue generation in Nigeria. A cross-sectional research design and structured questionnaires were deployed in the study, and a simple random sampling technique was used to select a sample size of 200 respondents. The results revealed that efficient port operations affect revenue generation and national development. The study suggested that modern port's technologies (ICTs) be deployed to enhance operations in the ports and that manpower should be trained at regular intervals to understand modern logistics management techniques in the ports.

Raji, Solanke, and Saheed (2021) examined maritime logistics factors on Nigeria's gross domestic product (GDP) in terms of vessel movement and cargo throughput. Expo-facto research design was used in the study, and the results revealed that Nigeria's GDP had a positive but weak relationship between bulk cargo (r 5 0.16) and cargo throughput (r 5 0.29) costs and was, inversely related to container vessel (r 5 0.33) and Roro vessel (r 5 0.13) costs. Their combined contribution to GDP growth amounted to 29.1%. To increase cost efficiency, the government is advised to augment cargo handling infrastructure at seaports

Diaz (2021) examined transport infrastructure quality and logistics performance in exports. This study measures the effects of common transport-freight modals and logistics performance on the exports of goods in 29 developing economies based on micro fixed-effects panel data for the period 2012–2018. The endogenous model proved a positive relationship with countries' outward orientation, highlighting the importance of transport infrastructure and logistics resources. The results revealed that the quality of roads and ports significantly contributes to higher exports in developing economies. However, the quality of airport infrastructure and logistics has a harmful effect. Notably, the level of logistics services is a detrimental factor impacting the export of goods in developing economies. These results may adversely impact the potential contributions of other transport assets based on intermodal transport functionality and global market participation. Therefore, governments should prioritize developing innovative policies and integration strategies with the private sector to improve the performance of logistics providers and fully utilize current transportation assets, particularly airports.

Agbede and Faseesin (2021) investigated the effect of logistic efficiency on economic growth in Nigeria from 1981 to 2018. The study employed the dynamic ordinary least squares (DOLS) technique with the use of time series data sourced from the Central Bank of Nigeria Statistical Bulletin and Word Bank Development Indicator 2018. The findings showed that 1% rise in airway output; logistic efficiency and trade openness have a significant positive contribution of about 0.69%, 9.13% and 1% increase in economic growth in Nigeria, respectively, - while the study revealed a negative significant effect between waterway output and economic growth in Nigeria, which is attributed to piracy and underestimated of waterway output in Nigeria. The study

concludes that logistic efficiency, airway output, and trade openness stimulate economic growth in Nigeria, whereas waterway output depresses it. Therefore, the study recommends policies to stimulate domestic and foreign investors in the logistic sector and put measures in place to reduce piracy and underestimation of waterway output in Nigeria to minimum level.

Ikpechukwu, Olowolagba, and Olisa (2020) conducted a study on the appraisal of shipping trade influence on economic growth in Nigeria and adopted a co-integration regression method to analyze the following variables: shipping trade, external reserves, and external debts. It was observed that there was a statistically significant relationship between GDP and external reserves with p-value 0.019 and shipping trade with a p-value 0.000. Shipping trade and external reserves contribution to GDP were at 1 and 5% levels of significance, respectively, while external debts showed a negative impact on GDP at 5% level of significance with a long-run variance of co-integration regressions. It was suggested that the government should upgrade port facilities and encourage exportable goods.

Osadume and University (2020) conducted a study on port revenue performance and economic growth that hinged on Neoclassical Growth Theory. It employed ordinary least square regression and Engle_Granger Co-integration to analyze the secondary time series data used in the study. The results indicated that total revenue to gross registered tonnage had an impact on economic growth.

3.0 Methodology

This study empirically examines the impact of port infrastructure and logistics efficiency on economic growth in Nigeria using the quality of port infrastructure (QPI) to measure the state of port infrastructure and cargo throughput as a proxy for logistics efficiency, while the gross domestic product (GDP) serves as the measure of economic growth. An ex - post-facto research design was adopted to achieve the objectives of the study. This study draws its data from the annual reports of the Nigerian Port Authority and Central Bank of Nigeria Statistical Bulletin with a focus on information in the post-concession era, i.e., from 2006 to 2022 (CBN, 2022) (NPA, 2022). The ARDL Bound Test approach was adopted in estimating the relationship between the variables.

The model specification is as follows:

GDP = f (QPI, GRT, ST) ---------- (Model 1).

GDP = f (CTr, GRT, ST) ----------(Model 2)

Where

GDP = Gross Domestic Product

QPI = Quality of Port Infrastructure

GRT = Gross Registered Tonnage

ST = vessel traffic

CTR = Ship Traffic, also known as cargo throughput

4.0 Results and Discussion

Table 1: Descriptive Statistics

	GDP	QPI	CRT	GRT	ST
Mean	61430.13	2.928235	73188653	1.51E+08	4660.588
Median	67152.79	2.8	74910284	1.48E+08	4721
Maximum	72393.67	3.55	99015400	1.91E+08	5369

Minimum	40703.68	2.5	49173324	1.21E+08	3972
Std. Dev.	10742.15	0.290909	11985210	21299123	490.5721
Skewness	-0.726901	0.781627	-0.14592	0.459144	0.047811
Kurtosis	2.092806	2.713233	3.148255	2.007388	1.625251
Jarque-Bera	2.080049	1.78925	0.075898	1.295211	1.34518
Probability	0.353446	0.408761	0.962762	0.523297	0.510385
Observations	17	17	17	17	17

Source: Computation by a Researcher Using Eviews 12.0

Table 1 shows that the mean, median, and standard deviation reveal an even spread and variation for the series. The mean, median, maximum, minimum, and standard deviation show a positive and healthy trend. The Jarque_Bera probability values of GDP, QPI, CRT, GRT and ST are 2.08, 1.78, 0.07, 1.29, and 1.34, respectively. These values are higher than 0.05, indicating that they are normally distributed.

Table 2: Correlation analysis

	GDP	**QPI**	**CRT**	**GRT**	**ST**
GDP	1.00				
QPI	-0.08	1.00			
CRT	0.79	-0.03	1.00		
GRT	-0.38	0.65	-0.27	1.00	
ST	-0.42	0.80	-0.29	0.49	1.00

Source: Computation by a Researcher Using Eviews 12.0

Table 2 shows that QPI and GDP are negatively correlated, whereas CRT and GDP are positively correlated.

Table 3: Bounds Test Results

Variable	Model Specification	F-Statistic	5% Upper critical value	Decision
Port Infrastructure	**GDP = f (QPI, GRT, ST)**	4.64	4.36	Reject H0
Logistics Efficiency	**GDP = f (CTR, GRT, ST)**	5.16	4.36	Reject H0

Source: Computation by a Researcher Using Eviews 12.0

All F-statistic values in Table 3 are above the upper critical value of 5%. Hence, the null hypothesis of no long-term relationship was rejected. These results confirm that there is co-integration among the variables in all models. The evidence of a co-integration relationship among the variables in the models is also depicted by the error correction terms (ECT), as the results in Table 4 show that all error correction terms are negative and statistically significant.

Table 4: ARDL-ECM results

	ECT	**p-values**
Model 1	-0.027	0.0005
Model 2	-0.105	0.0003

Source: Computation by a Researcher Using E -views 12.0
Model 1: Quality of Port Infrastructure function {**GDP = f (QPI, GRT, ST)}**
Model 2: Logistics efficiency function {GDP **= f (CTR, GRT, ST)}**

Table 5: Model Diagnostic Tests

	Model 1	**Model 2**
	p-values	**p-values**
Breusch-Godfrey Serial Correlation LM Test	0.4511	0.3150
Breusch_Pagan_Godfrey Tests for Heteroskedasticity	0.8952	0.2343

Since the p-values of each of the two models in Table 5 are considerably in excess of 0.05 (ie, 0.4511> 0.05; 0.8952 > 0.05; 0.3150 > 0.05; 0.2343 > 0.05), we conclude that there is no statistical evidence of serial correlation and heteroskedasticity in the models.

Figure 1: CUSUM of squares for Model 1

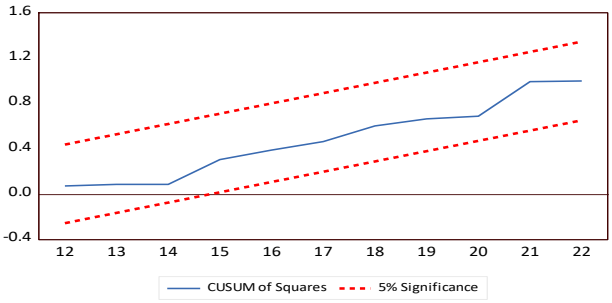

Figure 2: CUSUM of squares for Model 2

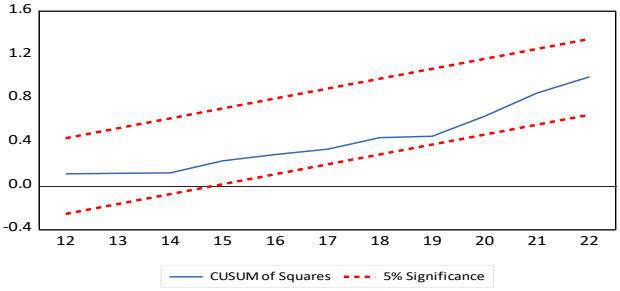

Figure 1 and Figure 2 show that the Cusum of Squares Test lines are between the five percent (5%) lines, which indicate the stability of the residuals.

Test of Hypothesis One

H0$_1$: There is no significant relationship between port infrastructure and economic growth in Nigeria.

Decision Criteria: If - *p-value < 0.05*, then variable is significant: Reject H_0

P-value > 0.05, then the variable is not significant: Accept H_0

Table 6: Effects of Port Infrastructure Quality on Economic Growth in Nigeria.

		Variable	**B**	**P-value**	**Conclusion**	**Decision**
Model 1	**Shortrun**	QPI	-2996.500	0.4602	Insignificant	**Accept H01**

	Longrun	QPI	-110071.1	0.7904	Insignificant	**Accept H01**

Source: Computation by a Researcher using E-Views 12

Table 6 shows that the quality of port infrastructure (QPI) has a β coefficient of -2996.500 and p-value of 0.4602. This indicates that quality of port infrastructure (QPI) has an insignificant negative relationship with economic growth in the short-run. Similarly, in the ARDL long-run regression in Table 6 shows that QPI has a β coefficient of -110071.1 and a p-value of 0.7904. This indicates that the quality of port infrastructure (QPI) has an insignificant negative relationship with economic growth in the long_run.

Test of Hypothesis Two

$H0_2$: There is no significant relationship between logistic efficiency and economic growth in Nigeria.

Decision Criteria: If, ----- *p-value < 0.05*, then the variable is significant: Reject H_0

p-value > 0.05, then variable is not significant: Accept H_0

Table 7: Effects of Logistics Efficiency on Economic Growth in Nigeria

		Variable	**B**	**P-value**	**Conclusion**	**Decision**
Model 2	**Shortrun**	CTR	4.700895	0.2637	Insignificant	**Accept H01**
	Longrun	CTR	0.0000448	0.1579	Insignificant	**Accept H01**

Source: Computation by a Researcher using E-Views 12

A review of Table 7 shows that logistics efficiency measured by cargo throughput (CTR) has a β coefficient of 4.7000895 and a p-value of 0.2637 in the short run. This indicates that logistics efficiency measured by cargo throughput (CTR) has an insignificant positive relationship with economic growth in the short_run. Similarly, the ARDL long-run regression in Table 7 shows that logistics efficiency measured by cargo throughput (CTR) has a β coefficient of 0.0000448 and p-value of 0.1579. This indicates that logistic efficiency measured by cargo throughput (CTR) has an insignificant positive relationship with long – term economic growth.

5.0 Discussion of the Findings

This study examined the impact of port infrastructure and logistics efficiency on economic growth in Nigeria in the post-concession period using a time series dataset from 2006 to 2022. The dependent variable economic growth was measured by gross domestic product (GDP), while port infrastructure (QPI) and logistics efficiency proxied by quality of port infrastructure and cargo throughput (CTR) served as the independent variables. We used two control variables; gross registered tonnage (GRT) and vessel traffic (ST). The analysis revealed that both quality of port infrastructure (QPI) and logistics efficiency (CTR) have insignificant relationships with economic growth in both the short-run and long-run. Specifically, the test of Hypothesis One showed that the quality of port infrastructure exhibited an insignificant negative relationship with economic growth, as indicated by the β coefficients of -2996.500 (short-run) and -110071.1 (long-run) with p-values of 0.4602 and 0.7904, respectively. Similarly, the test of Hypothesis Two showed that logistic efficiency, measured by cargo throughput (CTR), demonstrated an insignificant positive relationship with economic growth. The β coefficients of 4.7000895 (short-run) and 0.0000448 (long-run) with p-values of 0.2637 and 0.1579, respectively, suggest that the impact of logistics efficiency on economic growth is not statistically significant. This finding is in agreement with the study of Diaz (2021), who examined transport infrastructure quality and logistics performance in exports. This study measures the effects of common transport-freight modals and

logistics performance on the exports of goods in 29 developing economies based on micro fixed-effects panel data for the period 2012–2018. The results revealed that the quality of roads and ports significantly contributes to higher exports in developing economies. However, the quality of airport infrastructure and logistics has a harmful effect. Notably, the level of logistics services is a detrimental factor impacting the export of goods in developing economies.

6.0 Conclusion and Recommendations

In conclusion, the study does not find statistically significant evidence to support the hypothesis that there is a significant relationship between port infrastructure (QPI) or logistics efficiency (CTR) and economic growth in Nigeria. Both variables, quality of port infrastructure and logistics efficiency, were observed to be insignificant contributors to economic growth in the specified time frames. The study therefore recommends that:

i. The government should increase investment in port infrastructure, including the development and maintenance of berths, quays, storage facilities, and cargo-handling equipment to stimulate economic growth.

ii. The adoption of advanced technologies in port operations, including automated cargo-handling processes, real-time tracking systems, and data analytics, is required; Technological advancements can significantly improve efficiency, reduce processing times, and enhance overall logistic operations.

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