Maritime Technology and Research

https://so04.tci-thaijo.org/index.php/MTR


Research Article

# Evaluation of ship turnaround time and cargo trade delays of Nigerian ports in the post privatization regime

**Mbachu Justice C.*, Ndikom Obed B., Nze Ibeawuchi C. and Nwokedi Theophilus C.**

*Department of Maritime Management Technology, Federal University of Technology, Owerri, Nigeria*

*Corresponding author's e-mail address: justice.mbachu@futo.edu.ng*

**Article information**
Received: February 24, 2024
Revision: July 29, 2024
Accepted: August 4, 2024

**Keywords**
Maritime logistics;
Ship turnaround time;
Cargo dwell time;
Logistics performance

**Abstract**

The study evaluated the ship turnaround time and cargo trade delays of Nigerian ports in the post privatization regime. The objectives of the study were, among other things, to investigate the existence of delays in ship turnaround time (STRT) operations and processing of shipping (cargo) trade in Nigerian seaports. The study used ex-facto research design, employing secondary data sourced from different sources as explained later in the work. The Net Output Model approach for estimating value of time lost, the paired sample-test, and the log-linear multiple regression analysis methods were used to analyze the data obtained. It was found that there exists disproportionate levels of delay in ship turnaround time operations in the individual seaports of Nigeria, such that, in each of the Onne, Lagos Apapa, Warri, Rivers, and Calabar ports, the delay encountered by ship operators in shipping operations is 1.878, 5.340, 3.470, 2.810, and 2.440 days, respectively. The Nigerian port sector average delay in ship turnaround time operations is 9.20 days. The result of the study also indicated the existence of 9.00, 16.73, 14.10, 15.60, and 13.40 day delays in the processing of shipping trade in each of the Onne, Lagos Apapa, Warri, Rivers, and Calabar ports, respectively. It is recommended that Port Authorities and Terminal operators, in collaboration with the Nigerian Shippers Council, should develop delay reduction policies and strategies in the ports, in order to ensure that trade processing and ship turnaround time operations in Nigerian ports comply with the global benchmark of 1.20 days for ship turnaround time and 4.00 days for shipping trade.

## 1. Introduction

The concept of port services include the receiving, handling, unloading, and even additional shipping of clients' products once they arrive at port and come off the ship. This also encompasses the time delays experienced by ships at the ports of call in offloading their cargoes and embarking on the return legs of their voyages. Port services also provide an overview of the product at arrival and departure, providing an extra layer of protection should any products arrive damaged. The impression of being cost effective and more productive by improving port services quality has long been the concern of international bodies, including the International Association of Ports and Harbors (IAPH), the International Labor Organization (ILO), and UNCTAD (UNCTAD, 2021).

Port services are provided by a number of providers: (1) the port operator, (2) shipper third-party brokers (e.g., the freight forwarder, third-party logistics provider, and customs broker) that provide port services for shippers' cargo while in port; (3) shipping line agents, i.e., third-party

brokers that provide port services for the ships (of ship owners and lessors) while in port; (4) harbor pilots that assist a ship's master in the movement of the ship to and from the port's harbor and berth; (5) towage companies that use their tugboats for the berthing and un-berthing of ships to and from a port's wharf (or quay); and (6) government customs that clear a port's import cargo for entry into the country (Wayne et al., 2014). These time factor delays comes in diverse ways, as highlighted above, but this paper is limited to the concept of ship turnaround time and cargo trade delays in the ports, which are subsets of port service time used as parameters for measuring port efficiency.

This implies that the implementation of port logistical functions should reduce or optimize associated operational costs, port service time, and business risk, and ensure port user (consumer) satisfaction, especially with service time and cost of port usage, while improving output (revenue, throughput, etc.) to Port Authorities and Terminal Operators. These suggest that one key measure of Port Logistics performance, especially when viewed from the perspectives of port user (shipper) satisfaction, is port service time (Ndikom et al., 2017). Port service time indicates whether or not the port users face challenges of delay in processing trade through the seaports. This, in turn, can be viewed as two major components, namely:

(i) Ship Turnaround Time (STRT), which indicates the service time for ship operations and vessel waiting time experiences of ship operators in a given port. STRT provides the basis for understanding the amount of delay, or otherwise, that ship operators experience in particular ports.

(ii) Cargo Dwell Time (CDWT), which indicates the overall time of processing shipping trade from the port by shippers. Additionally, CDWT provides the basis for understanding the quantum of delay experiences of shippers in seaports.

The current study, therefore, foresees the need to investigate the port performance of Nigerian ports from the perspectives of delays in STRT and trade processing. To do this, the study identifies the central problems, aim, and objectives to be pursued by the study in subsequent sections.

From the commencement of operation of the Nigerian Ports Authority in 1956, Nigeria operated a service port model. This was fraught with a lot of challenges which informed the idea of switching over to a landlord port model or port concession. The port concession program was completed in 2006 after an international competitive bidding process. This led to the emergence of 26 terminals which were concessioned to private terminal operators on the Build, Operate, and Transfer (BOT) model. The reform brought about the ceding of cargo handling operations at the port to private terminal operators, leaving NPA as the landlord (Eniola et al., 2014). According to Ndikom (2011), the clear policy intent for this was to improve the management performance of the day-to-day running of ports, in order to enthrone efficiency, improve productivity, and ensure port user satisfaction. These were all lacking in the service port era, where the port authority performed both the administration and operation of port activities.

Available empirical studies suggest that the productivity of Nigerian ports over the years has improved, following the implementation of the 2006 port reform regime. These improvements are evident in the areas of port revenue, cargo throughput, ship traffic, and container throughput trade handled in the ports. However, the African Development Bank (2010), UNCTAD (2022), and World Bank (2023) all indicate rising port costs of shipping trade to Nigeria and other Sub-Saharan African ports as a result of elongated time of ship operations and trade processing. This represents a problem, situation, in that Nigeria has not significantly addressed the challenges of increasing port costs of shipping through Nigerian ports, associated with delays and elongated time of processing shipping trade.

High/increasing congestion, high turnaround time of ships, delays at the port, and increase in dwell time of ships and low labor productivity are a few of the challenges that are increasing in Nigerian ports (Gbolahan et al., 2021). These inefficiencies, therefore, point towards the existence of a problem situation, where the port privatization exercise has failed to improve the logistical performance of the ports, in terms of delays in STRT operations and trade processing. Moreover, there is a seeming lack of empirical studies that provides adequate knowledge and information on the

level of time delays faced by ships trading in Nigeria, as well as the quantum of time delay to which shipping trade is exposed in Nigerian ports. It is worthy to note that the global port sector STRT benchmark of 1.2 days for all ship types was used in this study. Subsequently, a global benchmark of 4 days was used for cargo trade processing.

### 1.1 Aim and objectives of the study

The aim of the study is to evaluate the STRT operations and cargo trade delays in Nigerian seaports in the post privatization regime. The specific objectives of the study are:

1) To ascertain the existence of delay in STRT operations in Nigerian seaports;

2) To assess the existence of delay in the processing of container shipping trade in Nigerian seaports.

### 1.2 Research questions

1) What is the quantum of delay in STRT operations in Nigerian seaports?

2) What amount of delay exists in the processing of container shipping trade in Nigerian seaports?

### 1.3 Hypotheses

1) There is no delay in STRT operations in Nigerian seaports.

2) There is no existence of delay in the processing of container shipping trade in Nigerian seaports.

## 2. Literature review

Several works have been carried out in this area to evaluate the port performance of Nigerian ports, with regards to delays encountered by ship owners in shipping operations and delays encountered by shippers in processing shipping trade through the ports. Many authors have tried to define the concept of "Logistics" vis-a-vis "Maritime Logistics". The Council of Supply Chain Management Professionals (CSCMP, 2010) define logistics as: "the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements". According to Nwokedi et al. (2021), maritime logistics, similar to port logistics, is an integrated concept aimed at addressing all aspects of logistics and supply chain challenges associated with maritime transportation and the delivery of goods via seaports, with focus on improving and/or maximizing efficiency of ports and maritime transport, bringing about cost-effectiveness in port operations and use, limiting time of port service delivery, improving maritime safety and security services, and improving quality of service quality, utility/customer satisfaction, etc., associated with the use of maritime transport and seaports in the delivery of consignments by shippers and freight forwarders. In modern logistical systems, ports also contain value added services like warehousing, packaging, inland connections, repairing, and assembly, which make ports (a cluster of organizations) fully become a link in supply chain (Bichou & Gray, 2004; Carbone & De Martino, 2003). According to Tuna and Arabelen (2013), "Maritime logistics is referred to as the process of planning, implementing and managing the movement of goods and information involved in the ocean carriage." Tuna and Arabelen (2013), suggests that the main issue in maritime logistics lies in the concept of integration, which has to be evident at the physical level (intermodal or multimodal), economic/strategic level (vertical integration, management structure), or organizational level (relationship based, people and process integration between organizations). Lee et al. (2012) note that, while maritime transportation focuses on the individual functions relating to sea transportation, maritime logistics focuses on the effective and efficient cargo and information flow in the scope of logistics system. Maritime logistics is not only interested in sea transportation activities like shipping, loading, and unloading, but also in value added logistics

activities like warehousing, packaging, repairing, stuffing, storage, etc. It is evident that, with the above definitions, Nigerian ports have failed to live up to expected heights. This is witnessed in the delays encountered by ship owners who call at Nigerian ports and the delays also encountered by shippers in shipping trade processing of goods. Ships spend more time in Nigerian ports than the global benchmark (of 1.2 days for container ships) for ship turnaround time (STRT), while cargoes spend more time at the ports before being cleared to leave, which does not conform to the global benchmark (of 4 days) for cargo dwell time in efficient ports. STRT is a port-related factor that influences the flow of shipping trade via ports, and is defined as the total time that a vessel spends at a port from its arrival to departure. According to Nwokedi et al. (2021), STRT is a major factor that influences port choice by ship owners and operators, as it indicates the level of efficiency of use of port superstructures and cargo handling equipment. Thus, high STRT may imply a longer period of stay in ports by vessels awaiting services, with the attendant implications on the economy and finances of the affected ship-owners and operators. Higher STRT also increases the risk of delay in delivery of shipments and cargo to the shippers' warehouses in hinterland markets, which could result in the situation of stock-out and scarcity in the domestic markets, price inflation, shutdown, etc., among other negative economic implications. Cargo dwell time (CDWT) is a port-related factor influencing the flow of shipping trade via the ports. It is the measure of the time that elapses from the time the cargo arrives in the port to the time the cargo leaves the port premises after all permits and clearances have been secured for the cargo to leave the port to the shippers' terminal and/or warehouse. There are up to 32 government agencies, including the Nigerian Customs Service, all of which cause avoidable delays in the clearing of imported goods and consignments (Nwokedi et al., 2021). These numerous agencies mostly constitute a major delay in shipping trade processing through Nigerian ports, causing cargoes to spend more time at ports than is required (Ndikom, 2011). This study is interested in determining the existence and quantum of delay of STRT operations that exists in Nigerian ports, as well as the existence and amount of delays that exists in shipping trade processing in Nigerian ports, and the best way to tackle these anomalies.

## 3. Methodology

The study employed the use of descriptive statistics, inferential statistics, and multiple linear regression models in establishing the objectives. The secondary data was obtained from the Nigerian Ports Authority (NPA) and the Nigerian Shippers Council (NSC). Also, secondary data obtained from World Bank publications on cargo global dwell time and ship global turnaround time benchmarks in ports were used to determine STRT and trade processing time delay in Nigerian ports.

### 3.1 Explanation of method

The STRT and CDWT experiences of shippers and ship-owners in each of the ports of Apapa Lagos, Calabar, Onne, Warri, and Port-Harcourt provided evidence of the average time spent in ship berths and cargo trade processing through each port. The average STRT and CDWT benchmarks operational in global ports represent the expected time standard required for shipping operations and trade processing that all efficient seaports should comply with. The time delay experiences of ship-owners in ship operations ($T_{dso}$) in each Nigerian seaport is obtained by comparing the global average ship turnaround time benchmark with the actual ship turnaround time experiences of ship-owners in each of the ports used in the study. Ship operations entail the total time spent by the ship in a port. This includes both maintenance and the time it takes to discharge and load the ship for the return leg of the journey. This makes STRT a major component considered in ship operations. Similarly, time delay experiences of ship-owners in trade/cargo processing ($T_{dtp}$) in each Nigerian seaport is obtained by comparing the global average CDWT benchmark of 4 days with the actual CDWT experiences of shippers in each of the seaports.

In this way, the delays in ship husbandry and cargo processing in the seaports will be obtained using Eqs. (1) and (2) below;

$$T_{dso} = STR_a - STR_e \quad (1)$$

$$T_{dtp} = CDT_a - CDT_e \quad (2)$$

where:
$T_{dso}$ = Time delay in ship operations in each of the ports experienced by ship-owners
$STR_a$ = Actual ship turnaround time experiences of ship-owners in each of the ports
$STR_e$ = Expected ship turnaround time or global ship turnaround time benchmark
$T_{dtp}$ = Time delay in trade processing experienced by shippers in ports
$CDT_a$= Actual cargo dwell time experiences of shippers in the ports
$CDT_e$ = expected cargo dwell time or cargo dwell time standard benchmark

### 3.2 Data description

The study used secondary data obtained from the Nigerian Ports Authority and the Nigerian Shippers Council, and the use of descriptive statistics, inferential statistics, and multiple linear regression models, in establishing the objectives. It also used secondary data obtained from World Bank publications on CDWT and STRT benchmarks in ports to determine the ship husbandry and trade processing time delay in Nigerian ports. The study used ex-post facto research design. Ex-post facto research examines the cause-and-effect relationship between an independent variable and a dependent variable. It also hypothesized how the independent variable, which is not controlled or manipulated, influences or affects the dependent variable. It also used time series historical data on the port performance of each of Onne port, Warri port, Calabar port, Lagos Apapa port, and Port-Harcourt port, in terms of STRT performances and CDWT performances of each of the ports between 2007 and 2021.

## 4. Results

In this section, the data collected from the Nigerian Ports Authority (NPA) and UNCTAD were used for the study and presented as shown in the various tables below:

**Table 1** Cargo throughput (tons), ship traffic performance, at berth (hours), and number of days ship is worked at berth in Nigerian ports in post reform era (2007 - 2021).

| Year | Cargo throughput (tons) | Ship traffic | At berth (Days) | At berth (Hours) |
|---|---|---|---|---|
| 2007 | 57,473,350 | 4,849 | 3.39 | 81.36 |
| 2008 | 64,372,749 | 4,623 | 3.58 | 85.92 |
| 2009 | 65,775,509 | 4,721 | 4.60 | 110.40 |
| 2010 | 6,744,727 | 4,881 | 4.27 | 102.48 |
| 2011 | 83,461,697 | 5,232 | 4.27 | 102.48 |
| 2012 | 77,092,625 | 4,837 | 4.04 | 96.96 |
| 2013 | 78,281,634 | 5,369 | 4.20 | 100.80 |
| 2014 | 84,951,927 | 5,333 | 4.30 | 103.20 |
| 2015 | 77,387,638 | 5,014 | 4.60 | 110.40 |

**Table 1** (continued) Cargo throughput (tons), ship traffic performance, at berth (hours), and number of days ship is worked at berth in Nigerian ports in post reform era (2007 - 2021).

| Year | Cargo throughput (tons) | Ship traffic | At berth (Days) | At berth (Hours) |
|---|---|---|---|---|
| 2016 | 70,365,036 | 4,373 | 4.10 | 98.40 |
| 2017 | 71,535,636 | 3,897 | 4.30 | 103.20 |
| 2018 | 74,677,604 | 3,878 | 4.30 | 103.20 |
| 2019 | 81,264,169 | 3,259 | 4.23 | 101.52 |
| 2020 | 80,826,672 | 4,054 | 4.10 | 98.40 |
| 2021 | 79,915,877 | 4,100 | 4.30 | 103.20 |

Source: NPA Statistical Report (2022)

**Table 1** shows data collected for each of the identified variables, which covered a period of 15 years, between 2007 and 2021, considered as the post port privatization regime in the study. The table shows a tremendous increase in the volume of cargo throughput, as well as ship traffic that called at Nigerian ports during the post port privatization regime as against what was obtainable during the pre port privatization regime, as shown in **Table 2** below.

**Table 2** Cargo throughput, ship traffic, and ship turnaround time performance of Nigerian seaports in the pre port reform era (1995 - 2005).

| Year | Cargo throughput (Tons) | Ship turnaround time prevailing in Nigerian ports | Ship traffic handled |
|---|---|---|---|
| 1995 | 13,273,053 | 6.17 | 3,023 |
| 1996 | 15,475,301 | 6.34 | 3,202 |
| 1997 | 16,582,805 | 6.71 | 3,585 |
| 1998 | 19,325,718 | 7.31 | 3,972 |
| 1999 | 22,232,936 | 6.31 | 3,762 |
| 2000 | 28,932,880 | 7.01 | 4,087 |
| 2001 | 35,940,692 | 7.91 | 4,473 |
| 2002 | 36,987,241 | 11.34 | 4,143 |
| 2003 | 39,765,945 | 7.89 | 4,315 |
| 2004 | 40,816,947 | 6.44 | 4,553 |
| 2005 | 4,495,207 | 7.40 | 4,586 |

Sources: Annual Abstract of Statistics (2016), Eniola et al. (2014).

This gives evidence to the fact that cargo throughput and ship traffic improved tremendously as a result of the privatization of Nigerian seaports, which was one of the main aims of introducing the privatization policy.

Ship turnaround time (STRT) is a measure that indicates the average time that it takes a vessel to be loaded and/or discharged, on arrival in a given seaport, until it departs the port terminal, after loading or discharging, with a global benchmark of 4 days. Based on the STRT data for container vessels, liquid bulk carriers, and dry bulk carriers, a global average STRT benchmark for all ships trading in global ports was determined, as shown in item (iv), for the post privatization regime. This data set is used in further analysis to determine the existence of delay in ship operations and husbandry in Nigerian seaports. This table is of great importance, as it is used to compare the global average

STRT for all ships trading in Nigerian seaports to ascertain the quantum of delay that actually exists in STRT operations and husbandry in those seaports.

**Table 3** Ship turnaround time (STRT) benchmark in global ports for various vessel types.

| S/N | Year | (i) Container vessels (days) | (ii) Liquid bulk carriers (days) | (iii) Dry bulk carriers (days) | (iv) Global average (days) |
|---|---|---|---|---|---|
| 1 | 2007 | 0.80 | 0.96 | 2.08 | 1.28 |
| 2 | 2008 | 0.80 | 1.00 | 2.04 | 1.28 |
| 3 | 2009 | 1.00 | 1.10 | 2.00 | 1.37 |
| 4 | 2010 | 1.00 | 0.95 | 2.01 | 1.32 |
| 5 | 2011 | 0.80 | 0.90 | 2.23 | 1.31 |
| 6 | 2012 | 0.70 | 1.20 | 2.00 | 1.30 |
| 7 | 2013 | 0.70 | 0.85 | 2.04 | 1.20 |
| 8 | 2014 | 0.80 | 0.93 | 2.05 | 1.26 |
| 9 | 2015 | 1.00 | 0.94 | 2.08 | 1.34 |
| 10 | 2016 | 0.90 | 1.00 | 2.06 | 1.32 |
| 11 | 2017 | 0.80 | 0.95 | 2.08 | 1.28 |
| 12 | 2018 | 0.70 | 0.94 | 2.05 | 1.23 |
| 13 | 2019 | 0.70 | 1.10 | 2.05 | 1.28 |
| 14 | 2020 | 0.80 | 0.96 | 2.06 | 1.27 |
| 15 | 2021 | 1.00 | 1.00 | 2.05 | 1.35 |

Source: UNCTAD Review of Maritime Transport (2011, 2017, and 2022 editions).

**Table 4** Post reform ship turnaround time (STRT) performance indicating lead-time in vessel husbandry in Nigerian ports between 2007 and 2021.

| S/N | Year | (i) Onne port STRT (days) | (ii) Lagos Apapa STRT (days) | (iii) Rivers STRT (days) | (iv) Warri STRT (days) | (v) Calabar STRT (days) | (vi) STRT average in Nigerian ports (days) |
|---|---|---|---|---|---|---|---|
| 1 | 2007 | 2.55 | 6.75 | 4.20 | 5.00 | 3.00 | 4.300 |
| 2 | 2008 | 2.76 | 5.59 | 3.20 | 6.50 | 4.01 | 4.412 |
| 3 | 2009 | 3.50 | 6.55 | 3.60 | 5.80 | 3.95 | 4.680 |
| 4 | 2010 | 3.84 | 5.38 | 2.55 | 5.36 | 3.43 | 4.112 |
| 5 | 2011 | 2.05 | 5.48 | 3.09 | 4.71 | 3.25 | 3.716 |
| 6 | 2012 | 3.50 | 7.10 | 4.19 | 3.75 | 4.84 | 4.676 |
| 7 | 2013 | 4.60 | 6.20 | 3.83 | 5.35 | 4.45 | 4.886 |
| 8 | 2014 | 3.70 | 7.90 | 5.77 | 5.90 | 5.00 | 5.654 |
| 9 | 2015 | 2.59 | 7.20 | 6.55 | 4.00 | 3.72 | 4.812 |
| 10 | 2016 | 3.39 | 7.50 | 4.05 | 3.09 | 3.45 | 4.296 |
| 11 | 2017 | 2.47 | 7.53 | 5.00 | 4.19 | 4.55 | 4.748 |
| 12 | 2018 | 3.70 | 5.30 | 3.00 | 3.15 | 3.00 | 3.630 |
| 13 | 2019 | 2.30 | 7.80 | 2.26 | 4.51 | 3.05 | 3.984 |
| 14 | 2020 | 3.10 | 5.40 | 4.80 | 5.60 | 3.20 | 4.420 |
| 15 | 2021 | 3.50 | 7.80 | 5.50 | 4.50 | 2.95 | 4.850 |

Sources: Nigeria Shippers Council (NSC) (2019) performance report; Nigerian Ports Authority (NPA), Statistical Report, various editions; UNCTAD Review of Maritime Transport (2022).

**Table 4** above shows data/records of the STRT performance of each of the ports of Onne, Lagos Apapa, Rivers, Warri, and Calabar between 2007 and 2021, considered as the post reform era in the study. The average STRT prevailing in the Nigerian port sector, for all ships trading in Nigerian ports, each year covered in the post reform era (2007 - 2021), was determined, as shown in item (vi). For each of the ports, it was noticed that an average of 4 days was spent by ships in STRT operations in Nigerian seaports. This is as against the global STRT average benchmark of global ports posited in **Table 3**. It is evident from the table that Lagos port has the highest STRT, followed by Warri Port, with Onne port having the lowest time spent by ships in its port.

**Table 5** Cargo dwell time (CDWT) performance of Nigerian seaports indicating time spent in processing seaborne trade in seaports, post port reform era (2007 - 2021).

| S/N | Year | (i) Onne port Cargo dwell time (days) | (ii) Lagos Apapa dwell time (days) | (iii) Rivers Port Dwell time (days) | (iv) Warri port dwell time (days) | (v) Calabar Dwell time (days) | (vi) Nigerian average (days) | (vii) Dwell time global average benchmark (days) |
|---|---|---|---|---|---|---|---|---|
| 1 | 2007 | 11 | 19 | 18 | 17 | 13 | 15.6 | 4 |
| 2 | 2008 | 10 | 20 | 16 | 20 | 13 | 15.8 | 4 |
| 3 | 2009 | 12 | 19 | 19 | 18 | 15 | 16.6 | 4 |
| 4 | 2010 | 13 | 20 | 20 | 21 | 18 | 18.4 | 4 |
| 5 | 2011 | 12 | 19 | 20 | 17 | 17 | 17.0 | 4 |
| 6 | 2012 | 11 | 21 | 15 | 20 | 18 | 17.0 | 4 |
| 7 | 2013 | 15 | 19 | 16 | 20 | 20 | 18.0 | 4 |
| 8 | 2014 | 14 | 22 | 18 | 21 | 19 | 18.8 | 4 |
| 9 | 2015 | 11 | 21 | 20 | 19 | 20 | 18.2 | 4 |
| 10 | 2016 | 15 | 19 | 17 | 18 | 15 | 16.8 | 4 |
| 11 | 2017 | 13 | 23 | 18 | 21 | 17 | 18.4 | 4 |
| 12 | 2018 | 15 | 21 | 20 | 20 | 18 | 18.8 | 4 |
| 13 | 2019 | 14 | 23 | 20 | 22 | 21 | 20.0 | 4 |
| 14 | 2020 | 16 | 22 | 16 | 20 | 18 | 18.4 | 4 |
| 15 | 2021 | 13 | 23 | 18 | 20 | 19 | 18.6 | 4 |

Source: Nigeria Shippers Council (NSC) (2019) performance report; Nigerian Ports Authority (NPA), Statistical Report, various editions; UNCTAD Review of Maritime Transport (2022).

CDWT is a measure that indicates the average time that it takes a shipper to process their shipping export or shipping import trade through a seaport, from the terminal operators, customs authorities, ports authority and other government agencies operating in the ports, until the trade (containerized or otherwise) is delivered away from the seaport to the consignees or shippers warehouse. The average CDWT prevailing in the Nigerian port sector, for all trades in Nigerian ports for each year covered in the post reform era (2007 - 2021), was determined as shown in item (vi) in **Table 5** above. The record/data for the CDWT benchmark for the global port sector/shipping industry is also shown in item (vii). The table shows a tremendous difference between the Nigerian average CDWT and that of global ports, which points to the existence of delay in the processing of container shipping trade in Nigerian ports.

**Table 6** Existence of delay in ship husbandry in Nigerian port sector (2007 - 2021).

| | N | Range | Minimum | Maximum | Sum | Mean |
|---|---|---|---|---|---|---|
| SHDELAYNIGERIAVERAGE | 15 | 1.99 | 2.40 | 4.39 | 47.79 | 3.1860 |
| SHDELAYONNE | 15 | 2.66 | 0.74 | 3.40 | 28.16 | 1.8776 |
| SHDELAYAPAPA | 15 | 2.58 | 4.06 | 6.64 | 80.09 | 5.3396 |
| SHDELAYWARRI | 15 | 3.45 | 1.77 | 5.22 | 52.02 | 3.4682 |
| SHDELAYRIVERS | 15 | 4.23 | 0.98 | 5.21 | 42.20 | 2.8136 |
| SHDELAYCALABAR | 15 | 2.14 | 1.60 | 3.74 | 36.46 | 2.4309 |
| Valid N (listwise) | 15 | | | | | |

**Descriptive statistics**

| | Std. Deviation |
|---|---|
| SHDELAYNIGERIAVERAGE | 0.51546 |
| SHDELAYONNE | 0.71292 |
| SHDELAYAPAPA | 0.98693 |
| SHDELAYWARRI | 1.01464 |
| SHDELAYRIVERS | 1.22399 |
| SHDELAYCALABAR | 0.71752 |
| Valid N (listwise) | |

Source: Authors' calculation.

**Table 6** above shows the result of the extent of delay in STRT operations in the five major seaports in Nigeria in the extended years of post reform from 2007 - 2021. The result of the study indicated that average delay suffered by ship operators in getting their vessels loaded or discharged in the Nigerian port sector is 3.19 days (76.56 hours) with a standard deviation of 0.5154. This implies that, following the implementation of the port reform policies in Nigeria, the Nigerian port sector still witness delays in ship husbandry as a result of increased STRT to the extent of 3.19 days (76.56 hours) on average. It also indicates that the port sector in Nigeria is still yet unable to achieve compliance with the global port sector standard ship turnaround benchmark of 1.20 days for all ship types. Thus, ship owners transiting through Nigerian seaports suffer delays of up to an average of 3.19 days (76.56 hours), which consequently increases port costs borne by the ship operators and charterers. **Table 6** also reveals the extent of delay that ship operators suffer in the individual seaports. For example, in the Onne and Lagos Apapa seaports, the average delays suffered by ship operators between 2007 - 2021 post reform period were 1.88 days (45.12 hours) and 5.34 days (128.16 hours), respectively, with respective standard deviations of 0.71292 and 0.98693. In the Warri, Rivers, and Calabar seaports, ship operators suffered average delays of 3.47 days (83.28 hours), 2.81 days (67.44 hours), and 2.43 days (58.32 hours), respectively, as a result of higher STRT in Nigerian ports in comparison to the standard global port sector benchmark. The results indicate that ship operators suffer the most (highest delays in STRT operations) delay in the Lagos Apapa ports, followed by the Warri seaport: while in the Onne seaport, ship operators and charterers suffer the least amount of delay in STRT operations. **Figure 1** below is a comparison of the amounts of delay in ship husbandry operations in individual Nigerian seaports, affecting ship operators and charterers in the post reform era.

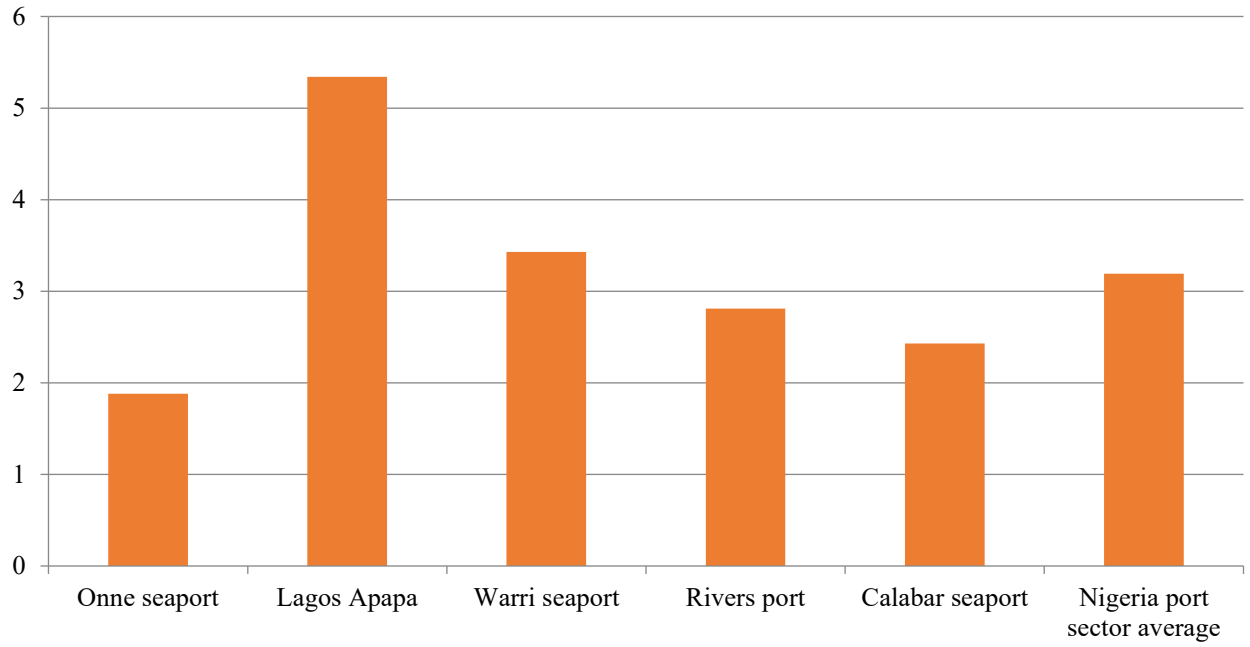


**Figure 1** Average delay (days) in ship turnaround time operations in Nigerian ports affecting ship operators and charterers.
Source: Prepared by Authors.

**Figure 1** above presents a graphical view of the extent of delay in days that ship operators and charterers face in the loading and discharge of their vessels in the individual Nigerian ports, and the local port sector average. It is important to further show by what percentages these delays differed or increased, from the global port sector STRT benchmark, as shown in **Table 7** below.

**Table 7** Percentage (differences) between delays in ship turnaround time operations in Nigerian seaports and global port sector standard benchmark indicating extent of increase in delay in Nigeria.

| Ports | Difference-increase in delay | | Difference-increased delay | |
|---|---|---|---|---|
| | Days | %difference | Hours | %difference |
| Onne port | 0.59 | 45.74 % | 14.16 | 45.74 % |
| Lagos Apapa | 4.05 | 313.82 % | 97.18 | 313.82 % |
| Warri port | 2.18 | 168.90 % | 52.32 | 168.90 % |
| Rivers Port | 1.52 | 117.80 % | 36.48 | 117.80 % |
| Calabar port | 1.14 | 88.37 % | 27.36 | 88.37 % |
| Nigerian port sector | 1.90 | 147.20 % | 45.60 | 147.30 % |
| Global port sector benchmark | 1.29 | - | 30.96 | - |

Source: Authors' calculation.

The result of the study presented in **Table 7** above indicates that, between 2007 and 2021, represented as the post concession era in the Nigerian maritime/port industry, the delays in ship turnaround time operations (loading and discharging operations, etc.,) affecting ship operators and charterers in the sector were about 147.30 % higher than the global port sector standard benchmark of 1.29 days (30.96 hours). The Nigerian port sector was about 1.90 days (45.60 hours), higher than

the global standard benchmark. The individual ports of Nigeria each have higher time delays of ship turnaround time operations than the global port sector benchmark. For example, the delay experienced by ship operators in Onne and Lagos Apapa seaport was 45.74 and 313.82 %, respectively, higher than the global port sector standard ship turnaround time benchmark. Warri seaport, Rivers port, and Calabar port had respective significant delays of 168.90, 117.80, and 88.37 %; higher than the global port sector benchmark. **Figure 2** below shows the ranking of the Nigerian seaports in increasing order of delays in ship turnaround time operations, affecting ship operators and charterers in the Nigerian shipping industry.

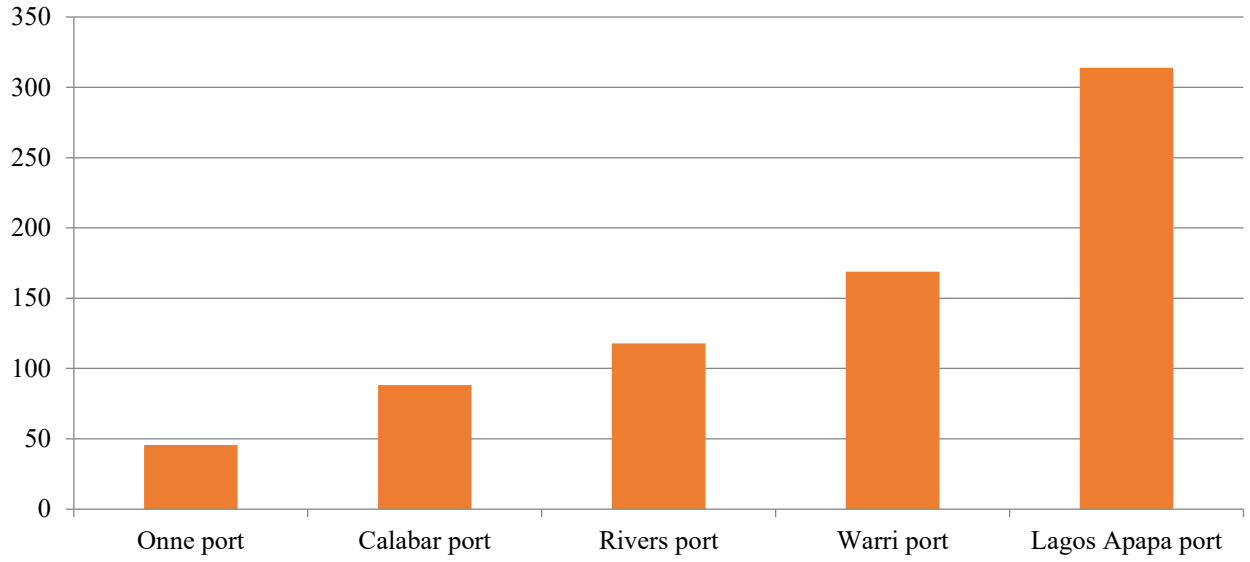


**Figure 2** Ranking Nigerian seaports in order of increased delays in ship turnaround time operations affecting ship-owners in post reform era.
Source: Prepared by Authors.

**Table 8** Determining the existence of significant difference between the global port sector ship turnaround time benchmark and average delay in ship husbandry in Nigerian seaports.

| | | **Mean** | **N** | **Std. Deviation** | **Std. Error Mean** |
|---|---|---|---|---|---|
| Pair 1 | GLOBALSTRT | 1.2924 | 15 | 0.04480 | 0.01157 |
| | SHDELAYNIGERIAVERAGE | 3.1860 | 15 | 0.51546 | 0.13309 |

**Paired Samples Test**

| | | Paired Differences | | | | |
|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95 % Confidence Interval of the Difference | |
| | | | | | Lower | |
| Pair 1 | GLOBALSTRT - SHDELAYNIGERIAVERAGE | -1.89351 | 0.52053 | 0.13440 | -2.18177 | |

**Paired Samples Test**

| | | Paired Differences | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|
| | | 95 % Confidence Interval of the Difference | | | |
| | | Upper | | | |
| Pair 1 | GLOBALSTRT - SHDELAYNIGERIAVERAGE | -1.60525 | -14.089 | 14 | 0.000 |

Source: Authors' calculation

**Table 8** above investigated the existence of significant difference between the global port sector ship turnaround time benchmark for all ships, and the Nigerian port sector average delays in ship turnaround time operations affecting operators in Nigerian ports. The results reveal a mean global port sector STRT benchmark of 1.29 days (30.96 hours) with standard deviation of 0.0448, and a mean Nigerian port sector delays in ship turnaround time operations of 3.19 days (76.56 hours) with standard deviation of 0.5155. The t-score is -14.089 and the p-value is 0.000 with 14 degrees of freedom. The study infers that there is significant difference between the extent of delays in ship husbandry operations in Nigerian port sector and the global port sector benchmark. The results imply that ship operators and charterers suffer much extended higher delays in Nigerian ports, suggesting the need for corrective measures to be implemented.

**Table 9** The existence of delay in the processing of container shipping/seaborne trade in Nigerian ports.

| | N | Range | Minimum | Maximum | Sum | Mean |
|---|---|---|---|---|---|---|
| TRADEDELAYNIGERIAPORTS | 15 | 4.40 | 11.60 | 16.00 | 206.40 | 13.7600 |
| TRADEDELAYONNE | 15 | 6.00 | 6.00 | 12.00 | 135.00 | 9.0000 |
| TRADEDELAYAPAPA | 15 | 4.00 | 15.00 | 19.00 | 251.00 | 16.7333 |
| TRADEDELAYRIVERS | 15 | 5.00 | 11.00 | 16.00 | 211.00 | 14.0667 |
| TRADEDELAYWARRI | 15 | 5.00 | 13.00 | 18.00 | 234.00 | 15.6000 |
| TRADEDELAYCALABAR | 15 | 8.00 | 9.00 | 17.00 | 201.00 | 13.4000 |
| Valid N (listwise) | 15 | | | | | |

**Descriptive Statistics**

| | Std. Deviation |
|---|---|
| TRADEDELAYNIGERIAPORTS | 1.23335 |
| TRADEDELAYONNE | 1.81265 |
| TRADEDELAYAPAPA | 1.57963 |
| TRADEDELAYRIVERS | 1.75119 |
| TRADEDELAYWARRI | 1.50238 |
| TRADEDELAYCALABAR | 2.44365 |
| Valid N (listwise) | |

Source: Authors' calculation.

**Table 9** above shows the result of the extent of delay in the processing of container shipping/seaborne trade in Nigerian ports in the five major seaports in Nigeria, in the extended years of post-reform from 2007 - 2021. The results of the study indicate that average delay suffered by shippers in their seaborne (containerized and non-containerized trade) processing in the Nigerian port sector is 13.76 days (330.24 hours) with a standard deviation of 1.2335. This implies that, following the implementation of the port reform policies in Nigeria, the Nigerian port sector still witnesses delays in processing seaborne import and export trade as a result of increased cargo dwell time, to the extent of 13.76 days (330.24 hours) on average. It also indicates that the port sector in Nigeria is still yet unable to achieve compliance with the global port sector standard cargo dwell time benchmark of 4.0 days (96) for all trade types. Thus, shippers transiting trade through the Nigerian seaports suffer delays up to an average of 13.76 days (330.24 hours), which consequently increase the port cost borne by the shippers. **Table 9** also reveals the extent of delay that shippers encounter in individual seaports. For example, in the Onne and Lagos Apapa seaports, the average delays encountered by shippers in getting their consignments delivered through the Nigerian ports between the 2007 - 2021 post reform period was 9.00 days (216 hours) and 16.73 days (401.42 hours), respectively, with respective standard deviations of 1.81265 and 1.57963. In the Rivers, Warri, and Calabar seaports, shippers encounter averages of 14.067 days (337.61 hours), 15.60 days (374.4 hours) and 13.40 days (321.6

hours) delays in processing shipping trade, respectively, in the ports, as a result of higher cargo dwell time in Nigerian ports, in comparison to the standard global port sector CDWT benchmark. The results indicate that the shippers encounter the most (highest delays in trade processing) delays in the Lagos Apapa port, followed by the Warri seaport, while in the Onne seaport, shippers encounter the least amount of delay in processing shipping trade. **Figure 3** below is a comparison of the amounts of delays in the processing of seaborne in individual Nigerian seaports, affecting shippers in Nigeria, in the post reform era.

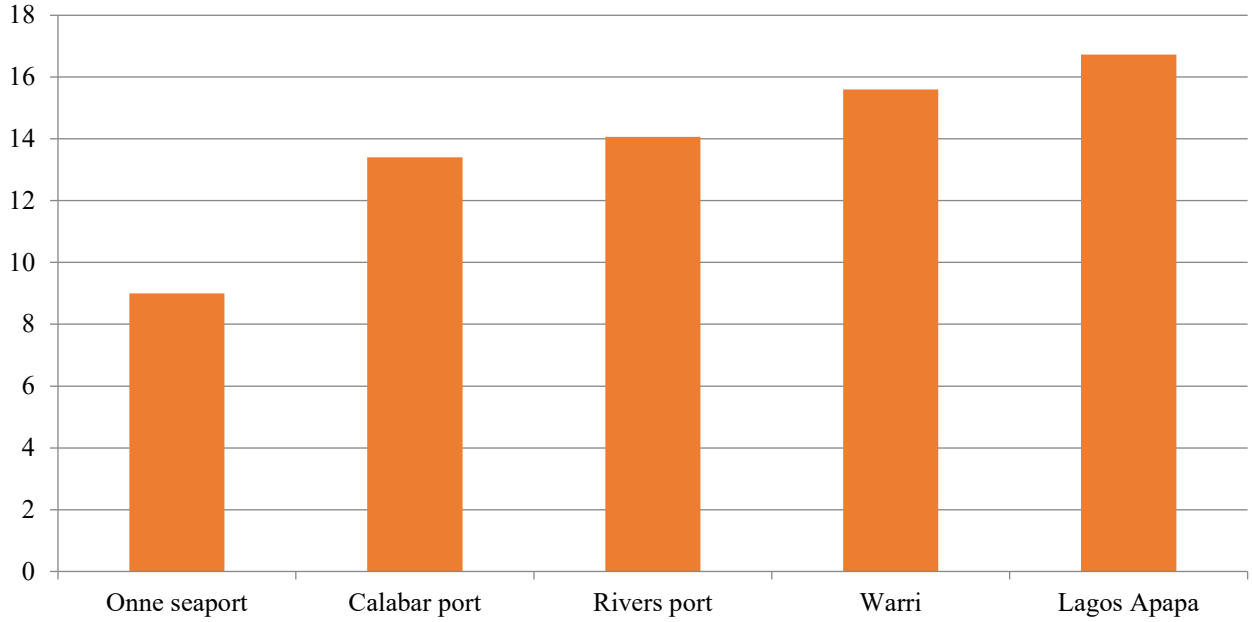


**Figure 3** Comparison of the amounts of delays in the processing of seaborne in individual Nigerian seaports, affecting shippers in Nigeria, in the post reform era.
Source: Prepared by Authors.

**Figure 3** above presents a graphical view of the extent of delay in days that shippers encountered in processing and delivering their seaborne trade and consignments through individual Nigerian ports. It is important to further show by what percentages these delays differ or are increased from the global port sector cargo dwell time benchmark, as shown in **Table 10** below.

**Table 10** Percentage (differences) between delays in processing shipping trade in Nigerian seaports and global port sector CDWT benchmark.

| Ports | Difference- increase in delay | | Difference- increase in delay | |
|---|---|---|---|---|
| | Days | %difference | Hours | %difference |
| Onne port | 5.000 | 125.00 % | 120.00 | 125.00 % |
| Lagos Apapa | 12.733 | 318.33 % | 305.59 | 318.33 % |
| Warri port | 11.600 | 290.00 % | 278.40 | 290.00 % |
| Rivers Port | 10.067 | 251.68 % | 241.61 | 251.68 % |
| Calabar port | 9.400 | 235.00 % | 225.60 | 235.00 % |
| Nigeria port sector | 9.760 | 244.00 % | 234.24 | 244.00 % |
| Global port sector benchmark | 4.000 | - | 96.00 | - |

Source: Authors' calculation.

The result of the study presented in **Table 10** above indicates that, between 2007 and 2021, represented as the post concession era in the Nigerian maritime/port industry, the delays in processing and delivering seaborne trade, affecting shippers in the sector, were about 244 % higher than the global port sector CDWT benchmark of 4 days (96 hours). The Nigerian port sector induces about 9.76 days (234.24 hours) higher delays in processing shipping trade through it than the global port sector CDWT benchmark. The individual ports of Nigeria each have higher time delays of processing shipping trade through it than the global port sector benchmark. For example, the delay experienced by shippers in Onne and Lagos Apapa seaport is 125 and 318.33 %, respectively, higher than the global port sector cargo dwell time benchmark. Rivers seaport, Warri port, and Calabar port have respective delays in processing seaborne trade through it of 251.68, 290.00, and 235.00 %, respectively; higher than the global port sector benchmark. **Figure 4** below shows the comparison of the global port sector CDWT benchmark and the Nigerian port sector average delays encountered by shippers in processing shipping trade in the ports.

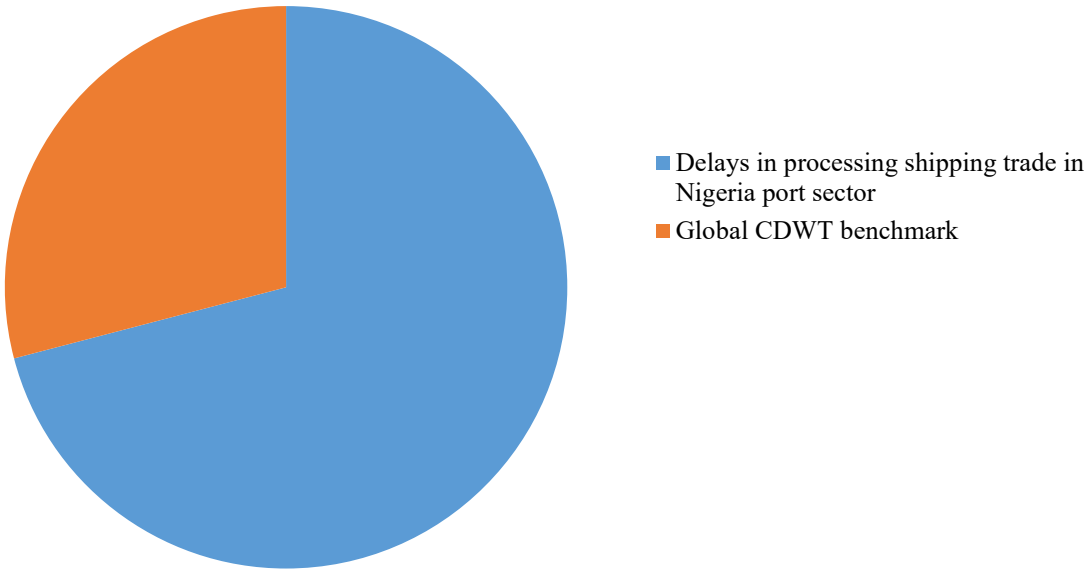


**Figure 4** Comparison of the global port sector CDWT benchmark and the Nigerian port sector average delays encountered by shippers in processing shipping trade in the ports.
Source: Prepared by Authors.

**Table 11** above investigates the existence of significant difference between the global port sector cargo dwell time (CDWT) benchmark for all trades, and the Nigerian port sector average delays in processing seaborne container and non-container trade transiting through the ports, affecting shippers in Nigeria. The results reveal a mean global port sector CDWT benchmark of 4.00 days (96 hours) with standard deviation of 0.000, and a mean Nigerian port sector delays in processing of seaborne trade of 13.76 days (330.24 hours) with standard deviation of 1.23335. The average difference between the delays in trade processing in Nigerian ports and the global port sector CDWT benchmark is 9.76 days (234.24 hours), against the Nigerian port sector. The t-score is -30.649 and the p-value is 0.000 with 14 degrees of freedom. The study infers that there is significant difference between the extent of delays in the processing of shipping trade in Nigerian port sector and the global port sector CDWT benchmark. The results imply that shippers suffer much extended higher delays in Nigerian ports in the post reform era, suggesting the need for corrective measures to be implemented.

**Table 11** Determining the existence of significant difference between global port sector cargo dwell time benchmark and average delay in processing shipping trade in Nigerian seaports.

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | GBLOBACDWT | 4.0000 | 15 | 0.00000 | 0.00000 |
| | TRADEDELAYNIGERIAPORTS | 13.7600 | 15 | 1.23335 | 0.31845 |

**Paired Samples Test**

| | | Paired Differences | | | | |
|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95 % Confidence Interval of the Difference | |
| | | | | | Lower | |
| Pair 1 | GBLOBACDWT - TRADEDELAYNIGERIAPORTS | -9.76000 | 1.23335 | 0.31845 | -10.44300 | |

**Paired Samples Test**

| | | Paired Differences | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| | | 95 % Confidence Interval of the Difference | | | | |
| | | Upper | | | | |
| Pair 1 | GBLOBACDWT - TRADEDELAYNIGERIAPORTS | -9.07700 | | -30.649 | 14 | 0.000 |

Source: Authors' calculation.

### 4.1. Test of hypotheses

The various hypotheses of the study were tested. The hypotheses tested include:
$H_{01}$: There is no delay in ship turnaround time operations in Nigerian seaports.
$H_{02}$: There is no existence of delay in the processing of container shipping trade in Nigerian seaports.

**Table 12** Test of hypothesis $H_{01}$: There is no delay in ship operations and husbandry in Nigerian seaports.

| | **Average delay in ship operation = $d_{ts}$** | **Decision: Accept $H_{04}$ if industry average = 0** |
|---|---|---|
| **Port sector/Industry Average** | 3.1860 | Reject ***$H_{01}$*** |
| **ONNE PORT** | 1.8776 | ***$d_{ts} > 0$; Reject $H_{01}$*** |
| **LAGOSAPAPA** | 5.3396 | ***$d_{ts} > 0$; Reject $H_{01}$*** |
| **WARRI PORT** | 3.4682 | ***$d_{ts} > 0$; Reject $H_{01}$*** |
| **RIVERS PORT** | 2.8136 | ***$d_{ts} > 0$; Reject $H_{01}$*** |
| **CALABAR PORT** | 2.4309 | ***$d_{ts} > 0$; Reject $H_{01}$*** |

Source: Prepared by Authors. Note: Since industry average $d_{ts}$is > 0, ***$H_{01}$*** is rejected.

The test of hypothesis $H_{01}$ shown in **Table 12** above reveals that the average delay in ship husbandry operations in the Nigerian port sector is 3.19, which is greater than zero, (i.e.: 3.19 > 0). Therefore, the null hypothesis ***$H_{01}$*** is rejected and the alternate, that there is the existence of delay in ship husbandry operations in Nigerian ports, is accepted. Similarly, it is expected that, from the results of the study, there is delay in ship husbandry operations in all the Nigerian ports of Onne, Lagos Apapa, Rivers, Warri, and Calabar.

**Table 13** Test of hypothesis $H_{02}$: There is no existence of delay in the processing of container shipping trade in Nigerian seaports.

| | Average Delay in ship operation = $d_{trade}$ | Decision: Accept $H_{02}$ if industry average = 0 |
|---|---|---|
| **Port Industry Average** | 13.7600 | Reject $H_{02}$ |
| **ONNE PORT** | 9.0000 | $d_{ts}>0$; Reject $H_{02}$ |
| **LAGOSAPAPA** | 16.7333 | $d_{ts}>0$; Reject $H_{02}$ |
| **WARRI PORT** | 15.6000 | $d_{ts}>0$; Reject $H_{02}$ |
| **RIVERS PORT** | 14.0667 | $d_{ts}>0$; Reject $H_{02}$ |
| **CALABAR PORT** | 13.4000 | $d_{ts}>0$; Reject $H_{02}$ |

Source: Prepared by Authors. Note: Since industry average is > 0, $H_{04}$ is rejected.

The test of hypothesis $H_{02}$ shown in **Table 13** above reveals that the average delay in the processing of shipping trade in the Nigerian port sector is 13.760, which is greater than zero, (i.e.: 13.760 > 0). Therefore, the null hypothesis $H_{02}$ is rejected, and the alternate, that there is the existence of delay in the processing of shipping trade in Nigerian ports, is accepted. Similarly, it is expected that, from the results of the study, there is delay in processing of shipping trade in all the Nigerian ports of Onne, Lagos Apapa, Rivers, Warri, and Calabar.

## 5. Conclusions

In conclusion, it is imperative to note the aim of this study, which is to evaluate the ship turnaround time operations and cargo trade delays of Nigerian seaports in the post privatization regime. The study employed the use of descriptive statistics, inferential statistics, and multiple linear regression models in establishing the objectives. The secondary data was obtained from the Nigerian Ports Authority (NPA), the Nigerian Shippers Council (NSC), and World Bank publications. The major findings of the study indicate that there is the existence of delay in ship turnaround time operations, as well as of delay in the processing of shipping trade in Nigerian ports. The quantum of delays was also ascertained, as the port sector average delay in ship turnaround time operations in Nigeria is 3.2 days. The most delay in ship husbandry operations is encountered by ship operators and charterers in Lagos Apapa port. This is subsequently followed by the ports of Warri, Rivers Port, Calabar, and Onne. The port sector average delay in the processing of shipping and container trade in Nigeria, as discovered by the study, is 13.7 days, and the Lagos Apapa port subject shippers' consignments to the most delay, of about 16 days. This is subsequently followed by the ports of Warri, Rivers Port, Calabar, and Onne. It is worthy to note that, with such statistics, Nigerian ports are not service friendly ports and, thus, ship-owners try their best to avoid its ports. This is with the view to avoid these delays evident in the ports, as both ship-owners and shippers experience high logistical costs in Nigerian ports owing to these avoidable delays. Additionally, owing to these anomalies, Nigerian ports will lose their ranking globally as port service friendly ports, thus killing the image of maritime trade in the country. There is urgent need to address these evident problems portrayed in this study, as Nigeria loses billions of Nigerian naira when ship owners and shippers avoid its ports owing to delays in ship turnaround time (STRT) and cargo dwell time (CDWT), which is not an index for globally efficient ports.

### 5.1 Limitations of the study

In the process of carrying out the research work, there were challenges, such as shortage of funding and lack of project writing grants. Time also constituted a huge challenge, as combining academic work, project writing, and care of the family was very time demanding such that it took a great deal of effort and commitment to actualize this work. Also, the data used for the research were sourced from various agencies, such as the Nigerian Ports Authority, UNCTAD, and World Bank reports; the degree of accuracy of the results of the study will thus depend on the degree of accuracy of the data sourced from the aforementioned sources.

### 5.2 Contributions to knowledge

The study has made useful contributions to the growth and development of knowledge in this area, as follows:

(i) It has provided that the disproportionate extent of delay in ship turnaround time operations in the individual seaports of Nigeria, in each of Onne, Lagos Apapa, Warri, Rivers, and Calabar ports, to be 1.878, 5.34, 3.47, 2.81, and 2.44 days, respectively.

(ii) It has provided that the disproportionate extent of delay in processing shipping trade in the individual seaports of Nigeria, in each for Onne, Lagos Apapa, Warri, Rivers, and Calabar ports, to be 9.0, 16.73, 14.1, 15.6, and 13.4 days, respectively.

### 5.3 Recommendations

In proffering lasting solutions to the evident problems identified in this study, the port authorities, terminal operators, and the Nigerian shippers' council should develop strategies to ensure that the ship turnaround times prevailing in Nigerian ports are compliant with the ship turnaround benchmark operational in the global port sector. This will guarantee reduced delay in ship husbandry in Nigerian ports, affecting ship operators. The amount of equipment in the ports should be greatly considered and reviewed upwards. In suing for a higher turnaround time, there should be in place a good amount of equipment, such as cranes and forklifts, to efficiently and effectively handle ship traffic and container tonnage expected at the ports. All yard operations need to be digitalized. Gross crane productivity, crane intensity, and berth productivity should be relatively considered also, as they pose a threat to ship turnaround time in Nigerian ports. The Nigeria Ports Authority (NPA) should, in developing a policy for eliminating delay in ship husbandry in Nigerian ports, prioritize Lagos Apapa port and Warri port first in the implementation of the strategies/policies, since ship operators encounter the most delays in those ports. This is followed by Rivers port, Calabar port and, lastly, Onne port. The Nigerian Shippers Council (NSC) should enforce terminal operators and government agencies to comply with the cargo dwell time benchmark of 4 days operational in the global port sector. Since the Lagos Apapa port, Warri port, and Rivers port subject shippers to the greatest delays in the processing of shipping trade, the implementation of strategies and policies to address delay in trade processing in ports should first consider these ports, before extending to Onne and Calabar, with the least delay experiences. Gate-in and Gate-out should be automated, and there should be proper management of all shipment related documents. If these recommendations are properly effected, Nigerian ports shall experience proper effectiveness and efficiency to be ranked among globally efficient ports.

## References

African Development Bank. (2010). *African Development Bank Report*. African Development Bank.

Annual Abstract of Statistics. (2016). Annual Abstract of Statistics.

Bichou, K., & Gray, R. (2004). A logistics and supply chain management approach to port performance measurement. *Maritime Policy and Management, 31*(1), 47-67. https://doi.org/10.1080/0308883032000174454

Carbone, V., & De Martino, M. (2003). The changing role of ports in the supply chain management: An empirical analysis. *Maritime Policy and Management, 30*(4), 305-320. https://doi.org/10.1080/0308883032000145618

Council of Supply Chain Management Professionals (CSCMP). (2010). Council of Supply Chain Management Professionals (CSCMP).

Eniola, O. J., Njoku I., Oluwatosin F. A., & Okoko, E. (2014). Performance evaluation of Nigerian Ports: Pre and post concession eras. *Journal of Civil and Environmental Research, 6*(2), 70-85.

Gbolahan, D. I., Omoke ,V., Ojekunle, J. A., & Nwaogbe, O. R. (2021). Assessment of port performance in Nigeria. *International Journal of Advances in Engineering and Management, 3*(8), 1854-1862. https://doi.org/10.35629/5252-030818541862

Haiwei, L., Weijian, M., Ning Z., & Yufei, F. (2015). Modeling and simulating the operation of the harbor portal crane. *Journal of Coastal Research, 73*(1), 89-94. https://doi.org/10.2112/SI73-016.1

Lee, E. S., Nam, H. S., & Song, D. W. (2012). *Defining maritime logistics and its value in Maritime Logistics*. In Song, D. W., & Panayides, P. M. (Eds.). Maritime logistics: A complete guide to effective shipping and port management. Kogan Page.

Nigerian Ports Authority (NPA). (2022). *Statistical report*. Nigerian Ports Authority.

Nigeria Shippers Council (NSC). (2019). *Performance report*. Nigeria Shippers Council.

Ndikom, O. B. (2011). *Fundamentals of Freight Forwarding Management and Practice in Nigeria*. University of Ibadan Press.

Ndikom, O. B., Nwokedi, T. C., Buhari, O. S., & Okeke, K. O. (2017) An appraisal of demurrage policies and charges of maritime operators in Nigerian Seaport Terminals: The shipping industry and economic implications. *Naše More, 64*(3), 90-99. https://doi.org/10.17818/NM/2017/3.3

Nwokedi, T. C., Ndikom, O. B., Okoroji, L. I., & Nwaorgu, J. (2021). Determinant port-related factors affecting the flow of shipping trade and logistics in Nigerian seaports. *LOGI – Scientific Journal on Transport and Logistics,12*(1), 261-270. https://doi.org/10.2478/logi-2021-0024

Tuna, O., & Arabelen, G. (2013). *Deniz Ulaştırma Lojistiği (Maritime Logistics)* (pp. 533-561). In Cerit, A., Deveci, A., & Esmer, S. (Eds.). Denizcilik İşletmeleri Yönetimi (Maritime Business Management). İstanbul, Beta Basım A.Ş.

UNCTAD (2021). *Review of Maritime Transport 2011, 2017 and 2022 Editions*. United Nations Conference on Trade and Development.

UNCTAD. (2022). *Review of Maritime Transport*. United Nations Conference on Trade and Development, New York and Geneva.

Wayne, K. T., Man, W. N., & Erika, M. (2014). Port service chains and port performance evaluation. *Transportation Research Part E: Logistics and Transportation Review, 69*, 236-247. https://doi.org/10.1016/j.tre.2014.05.008

World Bank. (2023). *World Bank Annual Report*. The World Bank.