



Assessment of Vessel Turnaround Time Among the Seaports in Nigeria

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Abstract

The study on assessment of vessel turnaround time among seaports of Nigeria was necessitated by the fact that port plays a critical role in development of Nigeria as a country. The role played by transportation in the movement of cargo from point of origin to destination is economical, social, and environmentally significant. This study examined the analysis of vessel turnaround time (VTT) among seaports of Nigeria. The study used secondary data on number of ships completed and the average vessel turnaround time for each of the six ports in the country from the period of 2018 to 2020. The hypothesis was tested using analysis of variance (ANOVA) with the aid of SPSS version 24.0. The findings of the results among others showed that there is a significant difference in the turnaround time of seaports in Nigeria. It was concluded thereof that there is a statistically significant difference in the turnaround time of seaports in Nigeria. This led to our recommendation that policies that will change the character of the ports in terms of vessel and cargo handling to match up with world standards should be established as a matter of urgency if at all the government need any form of significant development of ports in the country. It was also recommended that port authorities should engage in proactive port investment policies to provide adequate port infrastructure for quick vessel handling, so as to cause declining trend in vessel turnaround time, improve vessel traffic volume, cargo throughput and port revenue.

Keywords: Vessel Turnaround Time (VTT), Ships Completed, Average Vessel Turnaround Time

Introduction

Time is a critical determinant in container transportation. The necessity of offering weekly services influences the quantity of vessels utilized and the choice of ports of call (Agarwal & Ergom, 2008). Shippers' supply chains are influenced by the arrival and departure schedules of boats, and their port selection is frequently determined by accessibility and proximity, both of which are time-sensitive factors (Tongzon, 2009). From the shipping line's perspective, time is comprised of two components: time spent at sea and time spent in port. The scholarly research predominantly focuses on the former, partly due to the fact that transit durations between ports typically represent the longest elements of shipping services (Brouer, et al., 2013). A further cause stems from the recent implementation of slow steaming, driven by elevated fuel expenses, necessitating modifications in service arrangements and the quantity of boats utilized (Cariou & Notteboom, 2011). This study concentrates on port time. A single port call may last slightly over 24 hours; however, as most container services encompass numerous port calls – typically between 10 and 18 during complete outbound and return

journeys – the aggregate time spent in port constitutes a substantial portion of the overall service duration.

The duration of each port call consists of multiple elements: the attachment of mooring lines and securing the vessel at the berth, supplying the ship and bunkering; nevertheless, the most time-intensive activity is the loading and unloading of containers between the ship and the shore. The duration of cargo handling is contingent upon the operational efficiency of the port, encompassing not only the ship-to-shore gantry cranes but also the terminal activities, including container stacking, berth-side operations, and the patterns of container arrivals and departures at entry gates. Recent efforts to quantify the links between Average Terminal Turnaround Times (ATTs) and port terminal efficiency factors globally (Ducruet, et al., 2014; Slack, et al., 2018) have revealed that the associations are, at best, tenuous. Slack et al. (2018) noted that Average Turnaround Times (ATTs) vary by area, with East and North Asian ports exhibiting the shortest ATTs, while West Coast US and African ports demonstrate the longest ATTs. Disaggregating ATTs regionally yielded significantly greater correlations with efficiency metrics. Additional study indicates that transshipment ports facilitate quicker ship turnover compared to others (Cullinane, et al., 2006), while mega boats necessitate extended terminal durations relative to smaller ships (Merk, 2015), suggesting that vessel types or port operations may affect Average turnover Times (ATTs).

This study examines the duration of ships' stay in Nigerian ports. The average vessel turnaround times (ATTs) for a core group of terminal operators across six Nigerian ports engaged in significant container trades have been acquired. A comprehensive database was built, comprising measures derived from real port times instead than estimates or numbers extracted from service schedules. This offers a significant research instrument. Time delays at ports are regarded as indicators of congestion and suboptimal productivity, while enhanced time performance is recognized as a determinant of port competitiveness and efficiency (Peters, 2001; Zhang et al., 2014). However, the absence of actual time measurements has hindered comprehensive testing of this hypothesis. The velocity of vessel turnarounds is regarded as a critical element for transshipment. The assembled data offers a chance to examine the correlations between port duration and port efficiency. The primary research issue examined is: how do AVTTs differ across the six ports in Nigeria, and how is this temporal metric associated with port performance?

The operational conditions of Nigerian port terminals since the pre-concession period exhibit minimal cargo throughput, inefficiency, prolonged ship turnaround times, poor berth occupancy, and subpar customer service levels. Numerous ports in Nigeria continue to underperform despite the implementation of the port concession strategy. Nigerian ports,

classified as landlord ports, function inadequately; rather than adhering to the international standard of forty-eight (48) hours for a ship to berth, unload cargo, and depart, it typically takes three (3) to five (5) days, and occasionally extends to weeks or even a month for a vessel to finalize cargo operations, including both direct and indirect delivery of general and containerized cargo, across the six ports in the nation. This indicates that certain issues are causing delays at the six ports in Nigeria.

In 2020, the number of vessels that visited the port decreased by 18.21% compared to 2015. The average vessel turnaround time for each of the four terminal operators at Onne port continues to rise, despite recent investments in infrastructure and cargo handling equipment, together with a decrease in the number of vessels visiting the port. Comparing the operational data with that of adjacent ports reveals that the performance of the neighboring ports is more robust. Consequently, Nigerian port operations require evaluation to enhance their competitive standing in both regional and worldwide markets.

Consequently, it became essential to evaluate the performance of ports in Nigeria to comprehend their growth factors and developmental capacities regarding turnaround time, as this impacts their revenue generation over time, and to determine if there are significant differences in vessel turnaround times among Nigerian seaports.

Review of Literature

Theoretical Framework

Location Theory

The Weberian location theory pertains to the minimizing of costs inside triangular configurations. The theory asserts that the site of a facility should be determined by minimizing transportation costs (Burns, 2015). In other words, it is presumed that there exist two locations, **A** and **B**, from which materials are to be transported to market **P** (Figure 1). The theory posits that the most economical transportation option between the two locations should be chosen. Despite criticisms regarding the assumption of identical transportation costs for both raw materials and finished goods, this postulation remains valuable in port site and transportation feasibility analyses (Okoko, 2006).

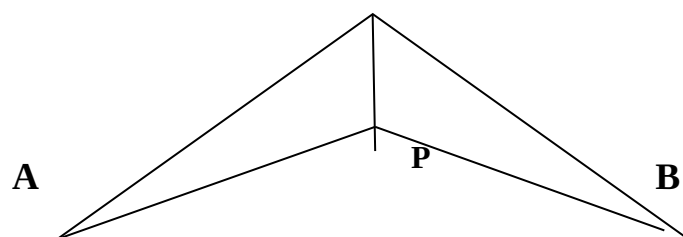


Figure 1: Location Theory (Culled from Okoko, 2006)

The ports cannot possess equivalent potential for generating traffic in maritime logistics. Haezendonck and Notteboom (2002) noted that numerous factors can influence the demand for a specific seaport. Competition was one such factor. Parola et al. (2005) contended that competition differs from competitiveness, the latter signifying a port's capacity to enhance value and attract greater traffic than its counterparts. Heaven et al. (2000) identified location as a significant factor influencing seaport growth. Kim (2015) observed that Korean shippers are apprehensive about the distance between origin and destination, loading hours, cargo handling, trucking, and expenses. Notteboom et al. (2000) concluded from their data that a correlation exists between port size and seaport efficiency.

Burns (2015) posits that the primary aim of a port's strategic location may be to generate revenue or establish a competitive advantage. The marine business is dynamic, marked by unpredictable changes between demand and supply factors. Ports are affected by political factors, trade agreements, currency fluctuations, unstable trade prices, security issues, and conflicts (Onifade, 2020). The strategic positioning of ports may depend on global capital markets, the demand and supply of production elements, transit regions such as the Suez or Panama Canals, Free Ports or Free Trade Zones, value-added trade centers, and shipbuilding activities. Consequently, the logistics and positioning of a port must be meticulously informed by the transshipment site, port dimensions, economic scope of the hinterland, port efficiency metrics, and cost considerations (Onifade, 2020).

The location theory was utilized in the study since it posits that position serves as a competitive advantage, attracting economic activities, particularly in the context of a port enhancing value to produce greater traffic than its counterparts. The study aims to assess the performance of six ports, with their individual capacity to create traffic and minimize costs significantly influencing their productivity and efficiency over time.

Conceptual Framework

Vessel Turnaround Time (VTT)

Turnaround times directly affect port container performance from both economic and operational perspectives (Maduka, 2004). Increased turnaround time correlates with diminished container performance and heightened port congestion. The primary objective of any port is to enhance its throughput and ultimately reduce the turnaround times of vessels.

Vessel Turnaround Time is defined as the cumulative duration a vessel remains in a port from arrival to departure (Daganzo & Goodchild, 2005). Vessel Turnaround Time (VTT), while presented as a distinct temporal metric, encompasses a compilation of various sub-activities, including berth waiting time, maneuvering duration, mooring and unmooring intervals, idle periods, container handling time, and additional time elements until the vessel departs from

port boundaries (Moon, 2018). Simultaneously, it is essential to emphasize that these temporal metrics are affected by numerous additional parameters, including berth availability, the number of quay cranes, yard congestion, crane operator efficiency, and others. Furthermore, delays resulting from adverse weather conditions, such as strong winds, limited visibility, and tidal fluctuations, must be acknowledged, as these factors are beyond the control of terminal operators.

Empirical Review

This study is founded on the research of other researchers who have examined numerous facets pertinent to this topic. A review of the extant literature by other experts is essential to ascertain the relevance of this study and facilitate comparisons.

Ojadi and Walters (2015) analyzed the key elements influencing the effectiveness of the Lagos seaports. This study aimed to determine the key elements affecting the operational efficiency of Lagos seaports to enhance liner trade activities. The research employed an operational-based methodology to analyze the dynamics of the several interfaces within the port value chain. The study employed a research methodology that integrated constructivism and post-positivism, focusing on the exploration and comprehension of the diverse stakeholders within the port value chain. The project's epistemology utilized the exploratory sequential mixed method research strategy, comprising a qualitative approach followed by a quantitative approach, at the operational level of port operations. The research findings indicated that considerable obstacles persist, with some of these challenges affecting all aspects of port operations. Challenges are encountered in corruption, trade fraud, inadequate transport infrastructure, a lack of supply chain culture, and deficiencies in the implementation of the 'contract of customs.' Moreover, these variables encompass the inadequacies in services and facilities offered by state agencies, government-designated service providers, and private sector entities, including truckers, inland container depots, and terminal owners. Targeted recommendations are proposed to resolve the identified difficulties, which, if executed, might substantially mitigate the existing inefficiencies in the operations of the Lagos ports.

Nyema (2014), in his examination of factors affecting the efficiency of container terminals at Mombasa Port, identified that inadequate quay and gantry crane equipment, reduced berth times, delays of container ships, prolonged dwell times, container cargo and truck turnaround times, customs clearance, limited storage capacity, poor multimodal connections to the hinterland, and inadequate infrastructure directly contribute to container terminal inefficiency and port congestion. Data were analyzed with the Statistical Package for Social Sciences

(SPSS) and Microsoft Excel 2013. The same issues confronting Dar es Salaam Port have been disclosed, necessitating a comprehensive strategic strategy for resolution.

Acciaro and Serra (2013) identified the unpredictability of cargo dwell time as a significant contributor to trade costs in their study of prolonged container stays at various African ports, as shippers must increase their inventory levels to mitigate this uncertainty. In summary, delay is not the sole concern when evaluating the influence of dwell time on trade performance; the predictability and reliability of cargo stay periods are also critical, since they significantly affect the overall costs of trade logistics. Refas and Canteen (2011), in their World Bank research report titled “Why Does Cargo Spend Weeks in African Ports,” highlighted the case study of Douala, Cameroon, indicating that port efficiency is enhanced through improved berth operations, clearance procedures, timely ship handling, truck operations, gate operations, and behavioral modifications among stakeholders. This enhancement would need a decrease in dwell periods, facilitating the efficient movement of cargo inside and beyond the port region. The report recommended that modernization of customs administration is necessary to ease port congestion. However, at the Dar es Salaam port, the situation is characterized by incongruity due to unilateral planning and operations.

Materials and Methods

The research utilized an exploratory methodology with a descriptive survey design to perform a comparative comparison of turnaround times at Nigerian ports. A descriptive study design delineates and documents the current state of affairs (Mugenda & Mugenda, 2003). Data were acquired from secondary sources. The materials utilized for extracting secondary data for this study comprise operational records and publications from the Nigerian Ports Authority (NPA) regarding Key Performance Indicators at the ports, which detail the number of ships processed, average waiting time for berth, average duration at berth, and average turnaround time (in days). Additional sources encompass journals, magazines, textbooks, and the Internet.

The data gathered by the Nigerian Port Authority (NPA) on Key Performance Indicators at the ports, including the number of ships processed, average waiting time for berth, average duration at berth, and average turnaround time (in days) from 2018 to 2020, were utilized to assess the turnaround time of Nigeria's seaports. The proposed hypothesis was evaluated by one-way Analysis of Variance (ANOVA). This technique was selected to assess discrepancies in vessel turnaround time among Nigeria's seaports. The statistical analysis was

conducted utilizing the Statistical Package for Social Sciences (SPSS) version 24.0 and Excel 2010.

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Results and Discussion

Table 1: Number of Ships Completed and Average Vessel Turnaround Time of Nigerian Ports (2018 - 2020)

S/N		2018		2019		2020		AGGREGATE TOTAL PER PORT	
	Name of Port	No. Ships Completed	Average VTT	No. of Ships Completed	Average VTT	No. of Ships Completed	Average VTT	No. of Ships Completed	Average VTT
1	Lagos Port Complex	690	7.81	639	6.74	535	8.13	1864	22.68
2	TinCan Island Port Complex	792	5.37	889	4.04	735	6.36	2416	15.77
3	Delta Port Complex	58	3.29	77	3.71	57	3.31	192	10.31
4	Rivers Port Complex	205	5.79	199	5.89	241	8.97	645	20.65
5	Onne Port Complex	264	4.3	308	3.91	265	5.18	837	13.39
6	Calabar Port Complex	218	4.32	157	3.27	124	5.26	499	12.85
	GRAND TOTAL	2227	30.88	2269	27.56	1957	37.21	6453	95.65

Source: NPA Reports, Various Issues (2018 – 2020), and SPSS Window Output, Version 22.0

The number of ships completed and the average vessel turnaround time (AVTT) for all the six ports is displayed on Table 1. The distribution revealed that in the year 2018, the AVTT was highest for Lagos port complex and it recorded about 7.81, followed by 5.79 for Rivers port complex; while the least of 3.29 was recorded for the Delta port complex. The distribution further revealed that in the same year 2018, Onne port complex recorded 4.3 for the average vessel turnaround time, Calabar port complex had 4.32 for the average vessel turnaround time, while TinCan Island port complex had 5.37 as the average vessel turnaround time.

The displayed information on table 4.8 also revealed the number of vessels a port handles overtime. The Lagos port complex recorded a total number of 690 ships as number of ships completed in 2018; TinCan Island port complex recorded 792 ships and it's the highest number of ships completed by a port in 2018; Delta port complex recorded a total of 58 ships which is the least number of ships completed by any port in the country in 2018; Rivers port complex recorded 205 as number of ships completed for the year, Onne port complex recorded 264 ships for the year, while the Calabar port complex handled a total number of 218 ships in 2018.

In year 2019, the TinCan Island port complex recorded a total of 889 ships as the highest number of ships completed by a port in the country; Lagos port complex recorded in 2019 a total of 639 ships completed for the year; Delta port complex recorded a total of 77 ships completed for the year and this is also the least number of ships completed by any port in the country for the year; Rivers port complex handled a total number of 199 ships in the year; Onne port complex handled a total of 308 ships, while the Calabar port complex handled a total of 157 ships in the year.

The distribution for the year 2019 revealed that the AVTT was also highest (6.74) at Lagos port complex and a recorded value of 3.27 was for the Calabar port complex, which was the lowest. In the year 2019, AVTT of TinCan Island port complex reduced from 5.37 in the previous year to 4.04. Rivers port complex recorded 5.89 value for AVTT for the year 2019 and this was the second highest value by ports in the country; Onne port complex recorded a value of 3.91 as the AVTT for the year, while Delta port complex recorded the second lowest value of 3.71 as the AVTT for the year 2019.

In the year 2020, the TinCan Island port complex recorded a total of 735 ships as the highest number of ships completed by a port in the country with the AVTT value of 6.36. In the same year, Lagos port complex recorded a total of 535 ships as the second highest number of ships completed in the country with an AVTT value of 8.13, which is also the second highest AVTT by a port in the country for the year. Also, in the same year 2020, Delta port complex recorded the lowest number of ships completed and the lowest value for AVTT of 57 ships and 3.31 respectively; Rivers port complex recorded a total of 241 ships and the highest value of 8.97 for AVTT in the year; Onne port complex recorded a total of 265 ships and a value of 5.18 for AVTT,

while Calabar port complex recorded a total of 124 ships and a value of 5.26 for AVTT for the year.

The computation for the AVTT for all sampled ports between 2018 and 2020 showed that the least values of 10.31 and 12.85 were recorded for Delta port complex and Calabar port complex respectively. However, the Lagos port complex recorded the highest value of 22.68 overall AVTT between 2018 and 2020, followed by the Rivers port complex, which recorded 20.65 AVTT between 2018 and 2020.

The grand total of number of ships completed and average vessel turnaround time for all the ports in the country on yearly base showed that the ports in the country recorded the least number of 1957 ships completed in the year 2020 and the highest value of 37.21 for the AVTT for the year. This could be attributed to the outbreak of Covid-19 across the globe, which affected all the businesses, including the ports in Nigeria. The data on each of the ports in the country also confirmed this position, as all the ports recorded slight drops in the number of ships completed in the year with a relatively higher values for AVTT for the ports with the exception of Rivers port complex which recorded a slight increase in the number of ships completed and a corresponding increase in the value of AVTT of 8.97 in the year.

Generally, the TinCan Island port complex recorded the highest total number of ships of 2416 between 2018 and 2020, followed by the Lagos port complex which recorded a total of 1864 ships and then Onne port complex with 837 ships and Rivers port complex recording 645 ships. The Delta port complex recorded the lowest total number of ships of 192 between 2018 and 2020, and the Calabar port complex, which recorded 499 ships, followed this. Thus, the TinCan Island port complex handled more number of vessels among sampled ports between 2018 and 2020.

The results of the One-way analysis of variance for the first hypothesis are hereby displayed in Table 2 and Table 3.

Table 2: Test of Homogeneity of Variances for Average VTT

Levene Statistic	df1	df2	Sig.
2.501	5	12	.090

Source: NPA Reports (2018 – 2020), and SPSS Window Output, Vs. 22

Table 3: ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38.338	5	7.668	6.904	.003
Within Groups	13.328	12	1.111		
Total	51.665	17			

Source: NPA Reports (2018 – 2020), and SPSS Window Output, Vs. 22

A one-way analysis of variance was conducted to evaluate the null hypothesis that there is no significant difference in the turnaround time of seaports based on port location in Nigeria (N = 18). Table 2 indicates the assumption of homogeneity of variances that was tested and found tenable using Levene's Test, $F(5, 12) = 2.50$, $p = .09$. The significance value for the test of homogeneity of variance .090 is greater than 0.05, (i.e., $0.90 > 0.05$), we have not violated the assumption.

Table 3 revealed that the ANOVA was significant, $F(5, 12) = 6.90$, $p = 0.003$, $n^2 = .000$. Thus, there is a significant evidence to reject the null hypothesis and conclude that there is a significant difference in the turnaround time of seaports based on port location in Nigeria. However, the actual difference in the mean scores between groups was quite small based on Cohen's (1988) conventions for interpreting effect size.

The statistics for the number of ships completed and average vessel turnaround time among the sampled ports revealed that the TinCan Island Port Complex handled more number of ships between 2018 and 2020. Despite having the highest number of ships completed within the period under review, TinCan Island Port Complex recorded a better average vessel turnaround time than the Lagos Port Complex, Apapa, and the Rivers Port Complex, Port Harcourt. The Delta port recorded the best average vessel turnaround time due to the few number of ships completed at the port. Generally the number of ships completed at each port could be held responsible for the average vessel turnaround time at the port with the exception of Lagos Port Complex and Rivers Port Complex which handled fewer number of ships than the TinCan Island Port Complex but had a longer average vessel turnaround time.

A critical assessment of the findings from the One-way ANOVA reveals that there is a significant difference in the turnaround time based on port location in Nigeria. This observation provides a clear answer to the first research question. It is already established that there are important differences between the average turnaround times

of individual ports (Ducruet 2014), but the evidence presented in this study provides indisputable evidence of differences between the ports in Nigeria as well. While some of this difference may be due to varying numbers of containers discharged and loaded by each carrier, for which there are no data available, the ATT scores are too differentiated between ports for this to provide a full explanation.

Conclusion and Recommendations

The study focused on the comparative analysis of vessel turnaround time among seaports in Nigeria between 2018 and 2020. Findings revealed that the dispersion of imports across the ports paints a fairer picture of the performance of each one of them. Generally, the level of vessels and cargoes handled by sampled ports varied between 2018 and 2020 and it was observed that they all experienced staggering growth overtime as this were blamed to several factors ranging from poor policy implementation by government, insecurity to poor facilities around ports that would have increased vessels' turnaround time and container dwell time. Based on the findings, the study thereby concludes that there is a statistically significant difference in the turnaround time of seaports in Nigeria.

The study thereby recommends that policies that will change the character of the ports in terms of vessel and cargo handling to match up with world standards should be established as a matter of urgency if at all the government need any form of significant development of ports in the country. Port authorities should engage in proactive port investment policies to provide adequate port infrastructure for quick vessel handling, so as to cause declining trend in vessel turnaround time, improve vessel traffic volume, cargo throughput and port revenue.

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