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SEAPORT OPERATIONAL PERFORMANCE IN NIGERIA: CASE OF APAPA PORT AND TIN CAN ISLAND PORT

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Thank you very much for your valuable contribution!
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SEAPORT OPERATIONAL PERFORMANCE IN NIGERIA: CASE OF APAPA PORT AND TIN CAN ISLAND PORT

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ABSTRACT

This study analyses the seaport performance at Apapa and Tin Can Island Port Lagos using specific port performance indicators. Data used were sourced from Nigeria Ports Authority's operational bulletin records. Cobb Douglas production function and ordinary least square method (OLS) was used for the analysis. E-view software version 10.0 was used for running the analysis. From the analysis, the result shows that Cargo throughput was used as a dependent variable and has a strong positive linear relationship with the explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees) with the R^2 value of 85.89% for Apapa port and 98.79% for Tincan Island port. The test of the hypothesis shows that there is a significant statistical relationship between the dependent and independent variables at a p-value of 0.05. The result shows that Tin can Island Port is more productive than the Apapa port from the output summary result and the hypothesis testing. Recommendations were made, emphasising that there is a need to provide effective port operations in the Nigerian seaports. The government should improve port operations by reducing port congestion, Apapa road traffic gridlock, and ease delays in port documentation at the ports. There is also a need for the formulation and implementation of effective policies as a way of ensuring efficiency in the ports.

Keywords: *Port Performance, Turnaround Time, Port Operation, And Ship Traffic.*

1. INTRODUCTION

Maritime has been a major driver of the economy of any developed nation because transport is an integral part of a booming economy of any nation. The seaport is liable for the socio-economic development of nations worldwide. The seaport is the lifeline of maritime activities. Thus the downfall of the seaport system would mean the breakdown of the maritime industry. The expansion and development of Nigeria's seaports represent a crucial factor in the development of the nation. Over 70% of businesses in Nigeria are situated close to the ports. The Lagos area constitutes about 40% of the businesses (Ogunsanya, 2008).

From the pre-independence era to date, the country's maritime transport sector industry is faced with the domination of transcontinental ships and shippers from the industrialized market economies of the US, Western Europe, Asia, and Dubai. To regulate this, succeeding developments brought about the opening of Apapa port, Tincan Island port, Port Harcourt ports, and Calabar port, leading to the establishment of the Nigerian Ports Authority by the establishment of Ports Act 1954 to load and release as well as preserve and grow the seaports.(Njoku, 2009). International maritime transport has drastically changed in the last decade and also maritime transport is growing at a high rate. Today in any perspective and in any nation, it is very important to note that seaport offers effective, sufficient, and viable services. If they fail to do so, shippers will find them too expensive or too time-consuming and will go elsewhere for their shipping services. Therefore, if ports do not offer cost-efficient aids, the cost of cargo importation will increase for consumers and exports will not be economical in the international markets, national revenue will deteriorate, and conjointly the living standard of all citizens will increase.

Being an interface between land and maritime transport, the port is extremely vital to the Nigerian economy as nearly all her imports and exports are moved through the seaports. The ports' significance is confirmed by the fact that just about 90.0% of Nigerian imports and exports are sea-borne. Aside from being the main gateways to the nation, the seaports play an essential role in the nation's economy. Nigerian ports symbolize the second largest supply of revenue generation after hydrocarbon products (NPA, 2015). Thus, Nigeria's seaports' growth and development represent a vital element of the country's overall development. Efforts to enhance port performance need a co-operative action by both the public and private sectors. Most required is private sector involvement to guarantee development in the quality of services offered. The private sector ought to take the lead where there are adequate infrastructure and appropriate regulative setting.

The Nigerian ports perceived a fast transformation due to its reform; the Nigerian seaports were a concession to the port operators known as concessionaires. Before the advent of port concession (1956-2005), the Nigerian seaport system suffered from a diversity of problems including the following: The turnaround time for vessels was usually too time-consuming and usually measured in weeks, months, subject to the freight being cleared; Cargo handling facilities and equipment owned by the Nigerian Port Authority were insufficient and lacked maintenance that results in shipping firms contracting these machines from private sectors after having paid Nigerian Port Authority (NPA), Dwell time for merchandise in ports was extended. As a result of the compounded issues in the Nigerian seaports, the costs of the imported product were high, and exports cannot compete in the international market thus resulting in a downward trend in our balance of trade and a further sharp decline in the productivity and economic indicators (Ochiabuto, 2014).

For some years now, maritime transport has been facing low operational performance, which has hindered the efficiency and productivity of the seaports' performance. As a result of globalization, transport has become an important factor in improving the country's economy. Within the transport sector, the port plays an important role in the utilization of any economy of the nation. Nigerian seaports have progressively been stressed to improve efficiency and productivity by guaranteeing that seaport services are offered on an internationally competitive basis. The Apapa port and Tin can port, which are strategically situated at Lagos, operates largely under poor equipment and obsolete infrastructure, which is one of the issues upsetting the seaport's performance, productivity, and efficiency. But the concession that was carried out between the years 2005-2006 brought about more development in the Nigerian seaports in terms of equipment and cargo handling infrastructures by the concessionaires. Tom (2009) believes that Nigeria ought to be warned concerning the reappearance of congestion in its port. According to him, regardless of the assorted waivers approved by the government, the dwell time of delivery within the port is gradually jerking up against anticipated time. He expressed the manual dispersing method as one of the main features accountable for the reappearance of the imminent congestion.

Congestion is another major factor hindering the Apapa and Tincan Island port performance as it affects the rate of discharge and loading of the consignment at the port. Poor road condition of the major road leading to Apapa and Tincan Island ports is another major factor that affects the seaports' operational performance. This problem causes delays in cargo deliveries and arrivals of shippers, clearing and forwarding agents, port authority staff, and other maritime stakeholders to carry out their operations at the port. Other major issues facing the Apapa and Tincan Island port are low revenue, low patronage of vessels due to the poor road network, and traffic congestion on the Apapa road, this determines if port turnaround time will be low or high. One of the primary measures of vessel performance is the turnaround time when the turnaround time for ships is too long, it will lead to congestion in the port which will discourage other vessels from calling in. Turnaround time is usually assessed in weeks, months, subject to the freight which is being burdened or cleared.

The study aims to carry out a comparative analysis of Apapa and Tin Can Island port's seaport performance in Lagos. The objectives of this study are to assess the seaport operational performance in the study area, to identify various operational performance indicators in the seaports, to examine the cargo throughput, ship traffic, berth occupancy, turnaround time, and the number of employees of the ports, to assess the seaport performance at Apapa port, to assess the seaport performance at Tin Can port and to compare the port operational performance of Apapa seaport and Tin can island port.

1.1 Study Area

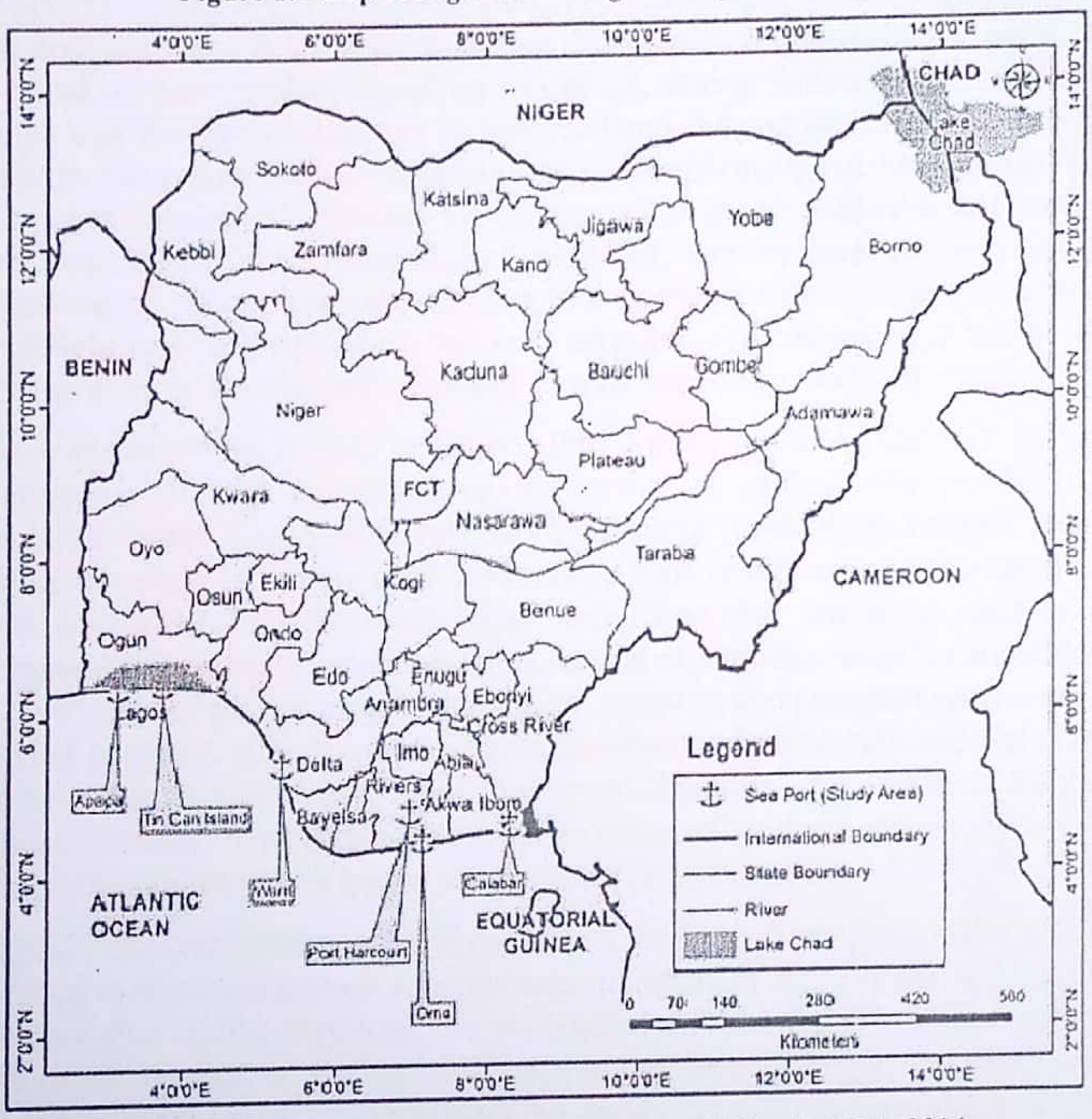
1.1.1 Apapa Port Complex

This study is focused on the Lagos Port Complex. The Lagos port complex consists of Apapa port and container terminal now called the APM terminal. The Apapa port complex occupies about 120 hectares of land with a conventional berth that service all kinds of cargoes. The port has about 24 berths for handling both dry cargo, container cargo. The Apapa port complex total quay length is about one kilometre with an average draught of 11.5m at the berth, with a total of 13 transit sheds and a space of 78,869 square meters with 8 warehouses and a space of 58,042 square meters. During port reforms in 2004-2006, the port terminal was concession into four terminal operators; they are Apapa Bulk Terminal Ltd (ABTL), A.P Moller Terminal (APMT), ENL Terminal, and GDNL Terminal. Apapa port complex. This port happens to be the seaport hub in Nigeria because most transhipment of general cargo and container cargo is being transported to other ports and hinterlands through the port. It also serves as a major port for some other West African countries like Niger and some other parts of the West African region.

1.1.2 Tin Can Island Port

Tin Can Island Port has located North-West of Lagos Port Complex. The port came into existence due to high economic activities that occurred after the Nigeria Civil War. The high traffic of cargo throughput through import and export that result in high port congestion led to the expansion of the port by constructing Tin Can Island port to cushion the effect of the port congestion and thereby decongesting Apapa port complex. Tin Can Island port has the capacity to handle 10-16 vessels at a time, and the port itself occupies 73 hectares of land. After the 2006 concession, Roro Port was merged with Tin Can Island Port, and these ports were privatized through port concession to a private operator, such as Port and Terminal Multi-service Ltd (PTML). They took over the port and make it the next busiest port after Apapa Port Complex in Nigeria.

Figure 1.1 map of Nigeria showing all the ports in Nigeria



Source: Modified from the administrative map of Nigeria. NPA, 2016.

2. LITERATURE REVIEW

According to Tongzon (2009), Performance conveys an efficiency element on how satisfactory the resources exhausted are utilized and, in this regard, seaports, and terminals remodel inputs in a procedure into outputs. Bichou (2004) industrialized a logistics and supply chain methodology to assess seaport performance. The outline they employed is often useful for port efficiency by concentrating port methods on actions that produce the most value-added worth in logistics and supply chain management. Ha (2017) initiated a hybrid multi-stakeholder context for the modeling of seaport performance indicators. The structure bargains as an analytical tool for performance assessment of terminals and seaports. Though they consider the various seaport investors to calculate port performance, the investors do not embrace various types of users, and the coefficient of those indicators is not attained from investors but subject matter specialists.

Applying the Cobb Douglas production model, Sun (2006) estimated the efficiency of the container port production. Annual panel information from 1997 to 2005 was collected for each of the 83 container terminal operators. Their inputs were the handling capability between the ship and also the quay, the handling capability between the quay and the yard, the number of berths, the length of quay lines, the terminal area, the storage capability of the port, and also the refers points whereas the product throughput was the output. Hanaa (2016) applied the standard data envelopment Analysis (DEA) of 9 seaports in Saudi Arabian. They used 2 output and 3 inputs to measure port performance for the year 2014, the author concluded that Jazan port is considered inefficient and most of the ports also are inefficient.

Somuyiwa (2015) studied the link between freight handling equipment and seaport productivity at Apapa seaport and Tin can Island seaport, Lagos. The research employed 50 plant operatives as sampled size based on easy random sampling procedure, during which questions like how storing facility of Apapa and Tin can seaport can be analyzed and the connection between equipment and productivity within the seaport. This information was afterwards analyzed through regression analysis and Pearson Product Moment Correlation Co-efficient. The study disclosed that port productivity elements were insufficient, unserviceable, and outdated, storing facilities was insufficient and incapable of catering for freight's present capacity in the pre-reform era. Whereas in the post-reform era additional freight handling equipment has been acquired, storage capacity has been magnified, modern freight handling equipment with elevated elevate capability has been acquired.

Joseph (2014) administrated a study of Nigeria Port Authority (NPA) Calabar. It determined the impact of automation of port operations on the extent of performance within the port. The exploration/research design (cross-sectional) and descriptive (in-depth-interview) research design were adopted for the study. Comtois (2007) examined port rivalry among Shanghai and Ningbo, which share an equivalent 14 hinterlands. They recognized that low value, quality of services, essential government strategies on local expansion, natural capabilities, sensible inland transportation infrastructure, and logistics structures, growing freight reserves, and prominent liners such as Maersk and K-Line added to ports' effectiveness. Seaport abilities and performance differ throughout the world. Singapore seaports are pleased with their port efficiency. for instance, Singapore's ship turnaround time is less than 10 hours; Singapore has an elevated level of productivity per wharf meter; and consequently, the sum of yearly trades is 8 million (Tongzon, 2007)

Cullinane (2003) used cross-sectional and panel data versions. They applied the SFA with Cobb-Douglas cost function to access the privatization accomplishment of 5 Korean and United Kingdom container terminals. For inputs, they took the managerial service, the employees' salaries, and the capital cost of terminal operations, the net book value of mobile and freight, and handling equipment. For outputs, they took the turnover resulting from the supply of container terminal facilities, however, excluded property trades. Tongzon & Heng (2005) employed the Cobb Douglas production to gaug25 container terminals' efficiency levels and study the link between seaport efficiency and seaport special characteristics. They concluded that the non-public sector participation within the port industry will develop the port operation efficiency, which can successively raise port competitiveness. By exploiting the Translog cost function, Barros (2005) inspected the degree of the practical modification and technical efficiency in the Portuguese port for the 1999-2000 period. His results showed a mean score of the inefficiency of 39.6%, signifying an excessive level of waste in the management of seaports. The inputs include the price of labour and capital while the outputs included the number of ships and total freight.

Using the cross-sectional data for 2002, Trujillo (2007) conjointly employed the Cobb Douglas production function to analyze the technical efficiency of 22 European ports and estimate their legislation. They concluded that their analysis couldn't justify the factors that verify the extent of port efficiency.

Moreso, Wanke, Nwaogbe & Chen (2016) studied efficiency in Nigerian ports, handling imprecise data with a two-stage fuzzy approach. The study focused on assessing six major Nigerian ports' efficiency from 2007 to 2013 by applying a two-stage fuzzy-based methodology adequate to handle imprecise data. Fuzzy data envelopment analysis models for traditional assumptions concerning scale returns are employed to assess Nigerian ports' productivity over time. In the second stage, fuzzy regressions based on different rule-based systems are used to predict the relationship of a set of contextual variables on port efficiency. These contextual variables are related to different aspects of port service level, berth utilization, accessibility, cargo type, and operator type. The results reveal the impact of operator and cargo type on efficiency levels. Policy implications for Nigerian ports are derived.

Infrastructure financing and Management, the impact of concession on the operations and performance of Nigerian seaports, was studied by Omoke, Diugwu, Nwaogbe, Ibe, & Ekpe (2015). The study examined the effect of privatization on Nigerian seaports' performance, using pre- and post-privatization data. A Mann-Whitney Wilcoxon (MWW) test was applied to data (secondary) on two major indices of port operation (average berth occupancy and average turnaround time). The result of the analysis showed that on average, the berth occupancy and turnaround time improved from 51.35% to 72.47% and 8.18 days to 4.83 days, respectively. It was also found that at a 0.05 level of significance, the concession of Nigerian ports has significantly improved average berth occupancy and average turnaround time of the vessels calling at Nigerian ports. The study emphasizes the need to provide an enabling environment through the formulation and implementation of effective policies to ensure the optimal performance of the concession model.

Omoke, Diugwu, Nwaogbe, Mohammed, & Wokili (2017) studied on competitiveness analysis of selected seaports in the West African coast region using Analytical Hierarchical Process (AHP). The study analyzed the competitiveness of selected ports in the West Africa Coast region concerning vessel traffic, cargo throughput, and container traffic. The result reveals the percentage competition of each port during the study, it shows that Apapa port with (26.36%), is the most competitive port among the selected ports. It is 1.21 times more competitive than Tema port (21.41%), 1.48 times more competitive than the Tin-Can Island port (17.85%), 2.05 times better more competitive than Cotonou port (12.86%), 2.10 times better than Lome port (12.56%) and 2.94 times more competitive than Takoradi port (8.96%). The order of overall port competitiveness is Takoradi < Lome < Cotonou < Tin-Can < Tema < Apapa.

Omoke, Aturu, Nwaogbe, Ajiboye, & Diugwu (2017) studied the impact of port operations on the Nigerian economy, focusing on Apapa port. The specific objectives were to determine the impact of the gross registered tonnage of vessels on Nigerian gross domestic product, ascertain the influence of cargo throughput on Nigerian gross domestic product, and determine whether ship traffic significantly influences Nigerian gross domestic product. Data sourced from Nigeria Ports Authority's operational bulletin were analyzed using the multiple regression model. It was found that the gross registered tonnage of the vessel is significantly contributing to the Nigerian gross domestic product (GDP) at a 0.05 significant level, and that cargo throughput and vessel traffic have a positive impact on the economy but are not significantly influencing the Nigerian gross domestic product at 0.05 significant level. The paper recommends that vessel gross registered tonnage should be used as the basis for assessing port dues since it bears positive significance on the Nigerian economy.

Finally, from the literature reviews, the study will utilize Cobb Douglas Production Function and Ordinary Least Square method to compare the result of the operational performance of the two major seaports in Lagos, Nigeria. Several works of literature have used Cobb Douglas or other methods to study Nigeria seaports performance, but this study will make use of the two methods to derive the best operational performance or efficiency of the two ports to compare their results and make policy implications for the stakeholders and the government to employ a good decision making in the ports.

3 MATERIALS AND METHOD

From the study, the data employed for this research is secondary data. Secondary data were obtained from bulletins of the annual report of Apapa Port and Tincan Island ports and Nigeria Ports Authority (NPA) book of abstract which contains operational records of the seaport and its activities. The data acquired provides details regarding activities of seaport operations which can facilitate the researcher in achieving the objectives of the study. Data obtained are berth occupancy, cargo throughput, ship turnaround time, ship traffic, and the number of employees. During this study, Apapa port and Tincan island port terminals data were sourced for a period of fifteen years from 2003 to 2017 period.

3.1 Method of Data Analysis

Data collected were analyzed using the appropriate statistical tool. During the study's empirical analysis, the ordinary least square (OLS) method and the Cobb Douglas production function were used for the analysis. E-view software version 10 was used in running the analysis. The model tries to find the correlation between cargo throughput and Ship traffic, Berth occupancy, Turnaround time, and the number of employees. The model estimate simplified port operational performance and its production function in the study area looking at the output and the inputs of the two ports and comparing them.

3.1.1 Model Formulation

3.1.1.1 Production Function Model

The production function model used for the analysis as follows:

$$C(s_t|T_t) = bs_t^{\alpha}\, T_t^{\beta} \qquad (eqn. 3.1)$$

where:

C = Total production (Cargo throughput representing all the cargo shipped in a year).

s_t= Ship traffic.

T_t= Turn around time

α and β are the output elasticity of ship traffic and ship turnaround time, respectively.

b = Total factor productivity.

$$C(B_o|N_E) = bB_o^{\alpha} N_E^{\beta} \qquad (eqn. 3.2)$$

Where:

C= Cargo throughput.

B_o= Berth occupancy.

N_E=number of employees.

α and β are the output elasticity of berth occupancy and Number of employees, respectively.

b = Total factor productivity.

3.1.1.2 Cobb Douglas Production Model

The Cobb–Douglas production function is a specific practical method of the production model, broadly used to illustrate the technical association concerning two or more inputs (specifically physical capital and labour) and the number of output created by those inputs.

$$Y=AL^{\beta}K^{\alpha}$$

where:

Y = overall production (the actual worth of all cargoes manufactured in a year or 365.25 days)

L = labour input (the total number of person-hours worked in a year or 365.25 days)

K =capital input (a gauge of all apparatus, gear, and structures; the value of capital input divided by the price of capital)

A = Total factor productivity

α and β are the output elasticities of capital and labour, correspondingly. These values are constants determined by available technology.

Further, if $\alpha + \beta = 1$, the production function has constant returns to scale. if L and K are each improved by 20%, then P rises by 20%. However, if $\alpha + \beta < 1$, returns to scale are declining, and if $\alpha + \beta > 1$,

3.2 Hypothesis

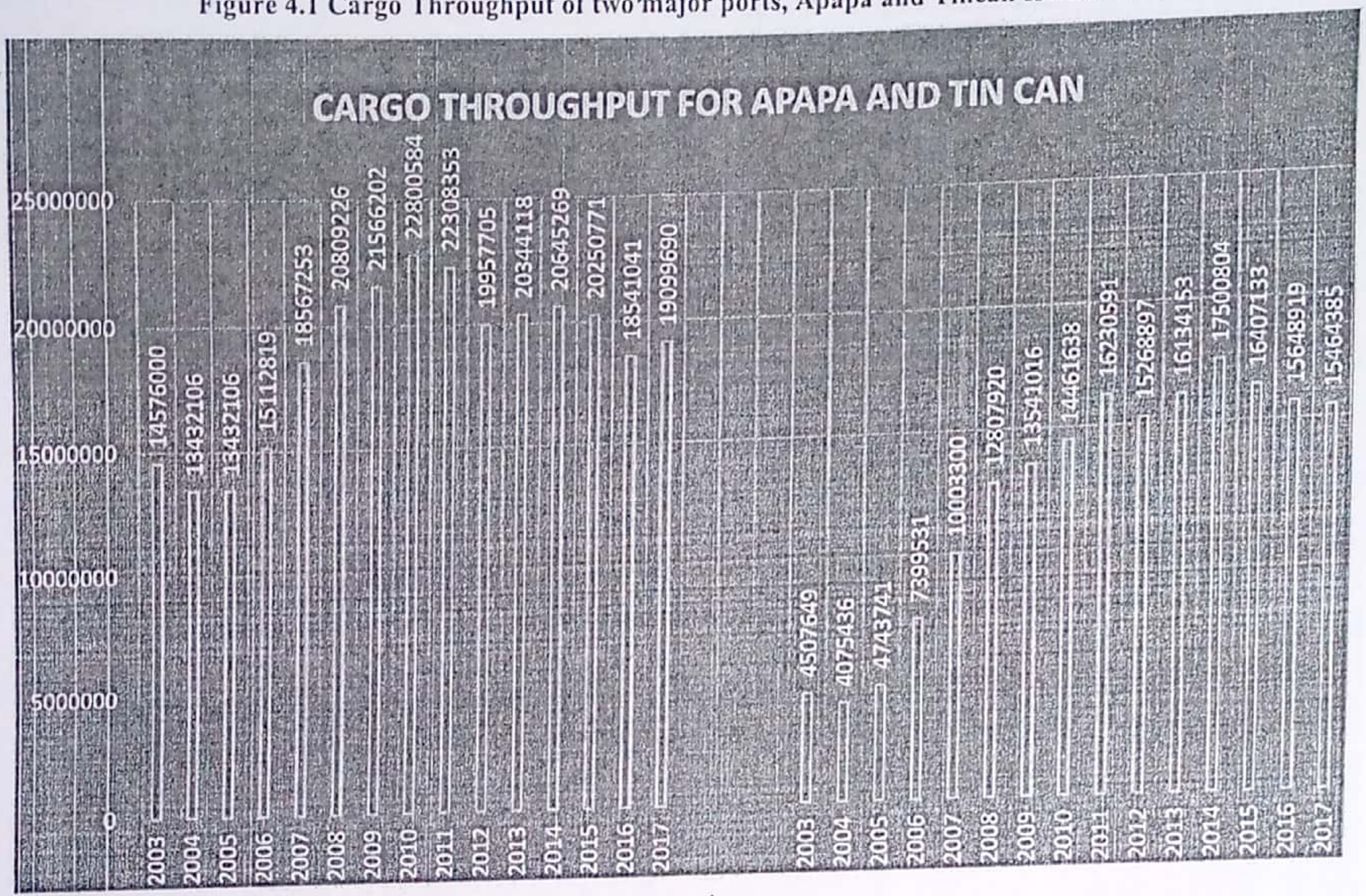
H_1: *There is a significant relationship between cargo throughput, ship traffic, berth occupancy, turnaround time, and number of employees for Apapa port*
H_1: *There is a significant relationship between cargo throughput, ship traffic, berth occupancy, turnaround time and number of employees for Tin Can Island port*

4 RESULT AND DISCUSSION

This section emphasizes the exhibition, discussion, and estimation of the operational performance for the study. It examines the Apapa seaport's performance using some parameters such as Cargo throughput as the output, Ship Traffic, Berth Occupancy, Ship Turn round time are used as the inputs. Figures below show various growth of the Apapa Port and Tincan Island Ports output and input characteristics and yearly growth.

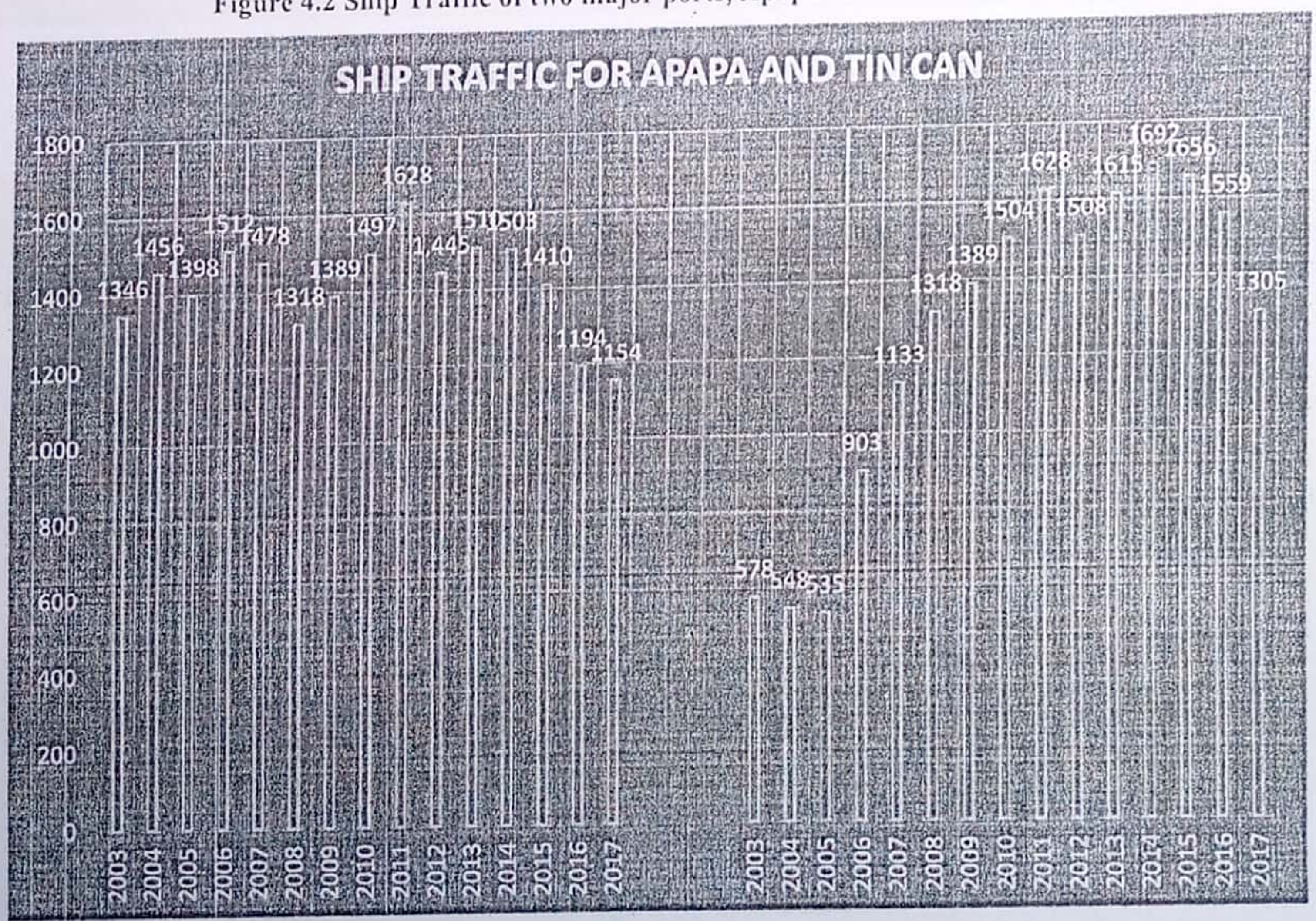
Figure 4.1 shows the Cargo throughput level for the two major ports in Nigeria, Apapa, and Tin Can Island seaport for 15 years from 2003-2017 at Lagos Nigeria. Figure 4.2 shows the ship traffic for the two major port Apapa port and Tin Can Island seaport for 15 years from 2003-2017 at Lagos Nigeria. Figure 4.3 shows the berth occupancy for the two major port Apapa port and Tin Can Island seaport for 15 years from 2003-2017 at Lagos Nigeria. Figure 4.4 shows the turnaround time for the two major ports Apapa and Tin Can Island seaport for 15 years from 2003-2017 at Lagos Nigeria. Figure 4.5 shows the number of employees for the two major port Apapa and Tin Can Island port for 15 years from 2003-2017 at Lagos Nigeria.

Figure 4.1 Cargo Throughput of two major ports, Apapa and Tincan Island Port



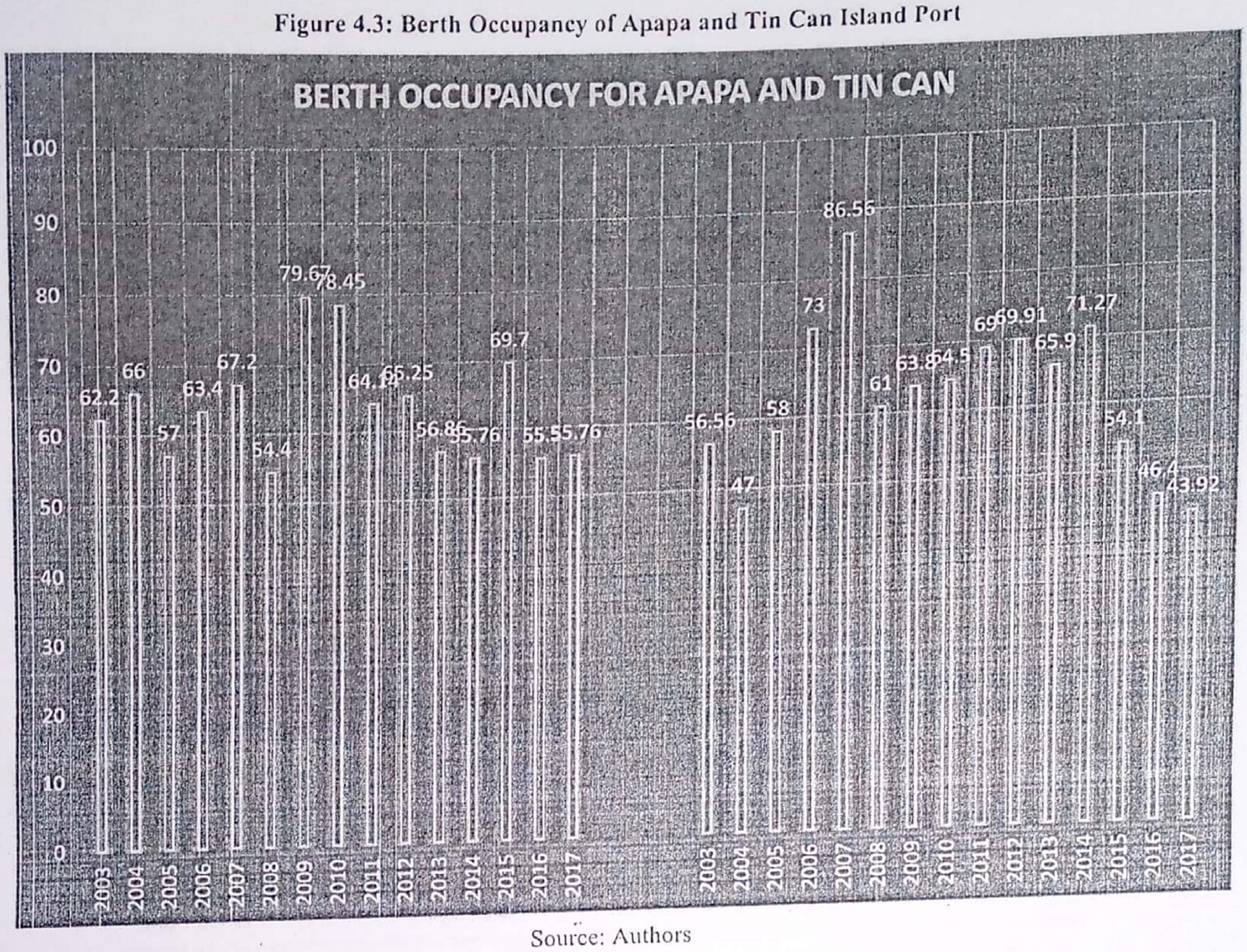
Source: Authors

Figure 4.2 Ship Traffic of two major ports, Apapa and Tincan Island Port



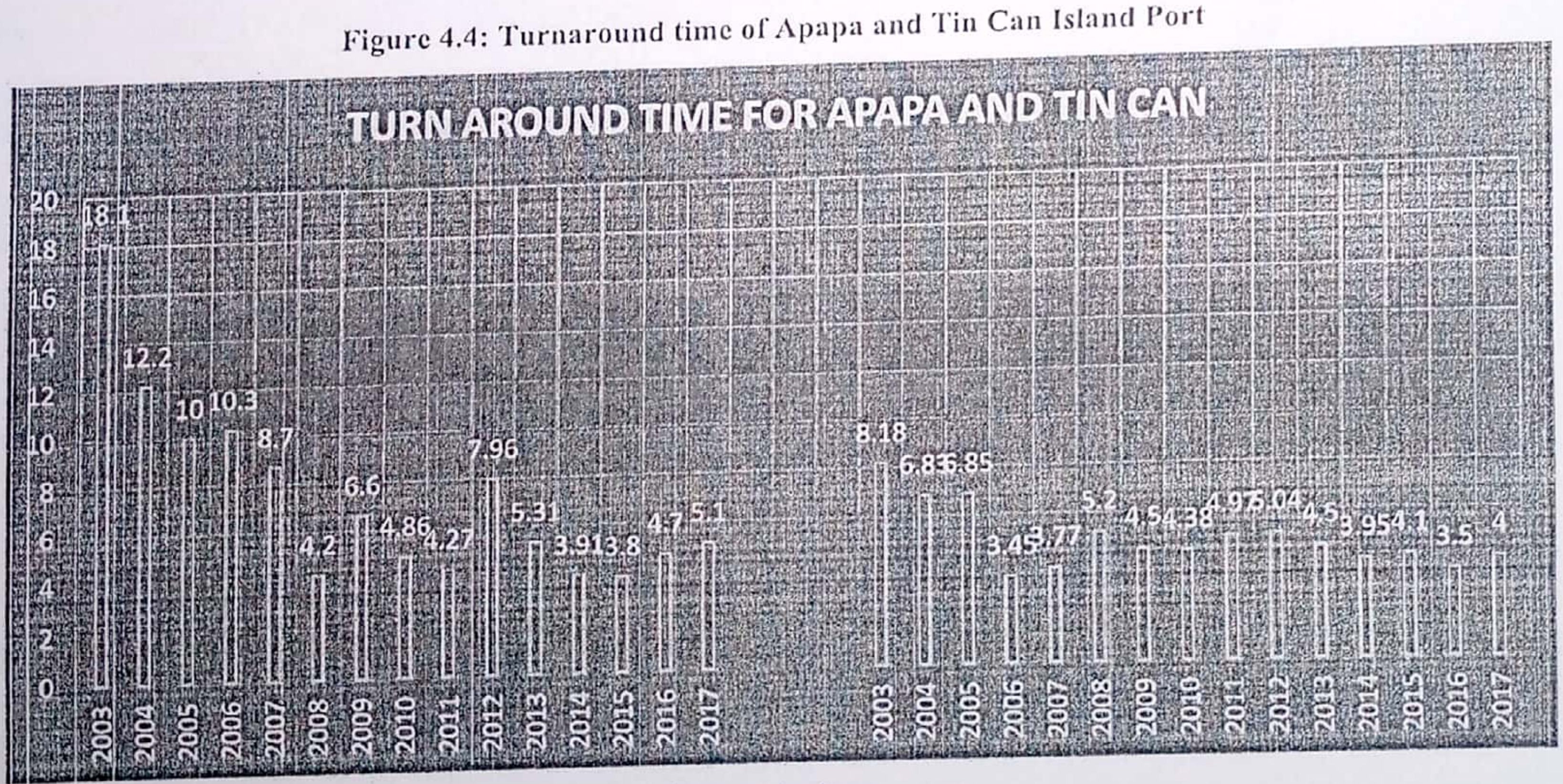
Source: Authors

Figure 4.3: Berth Occupancy of Apapa and Tin Can Island Port



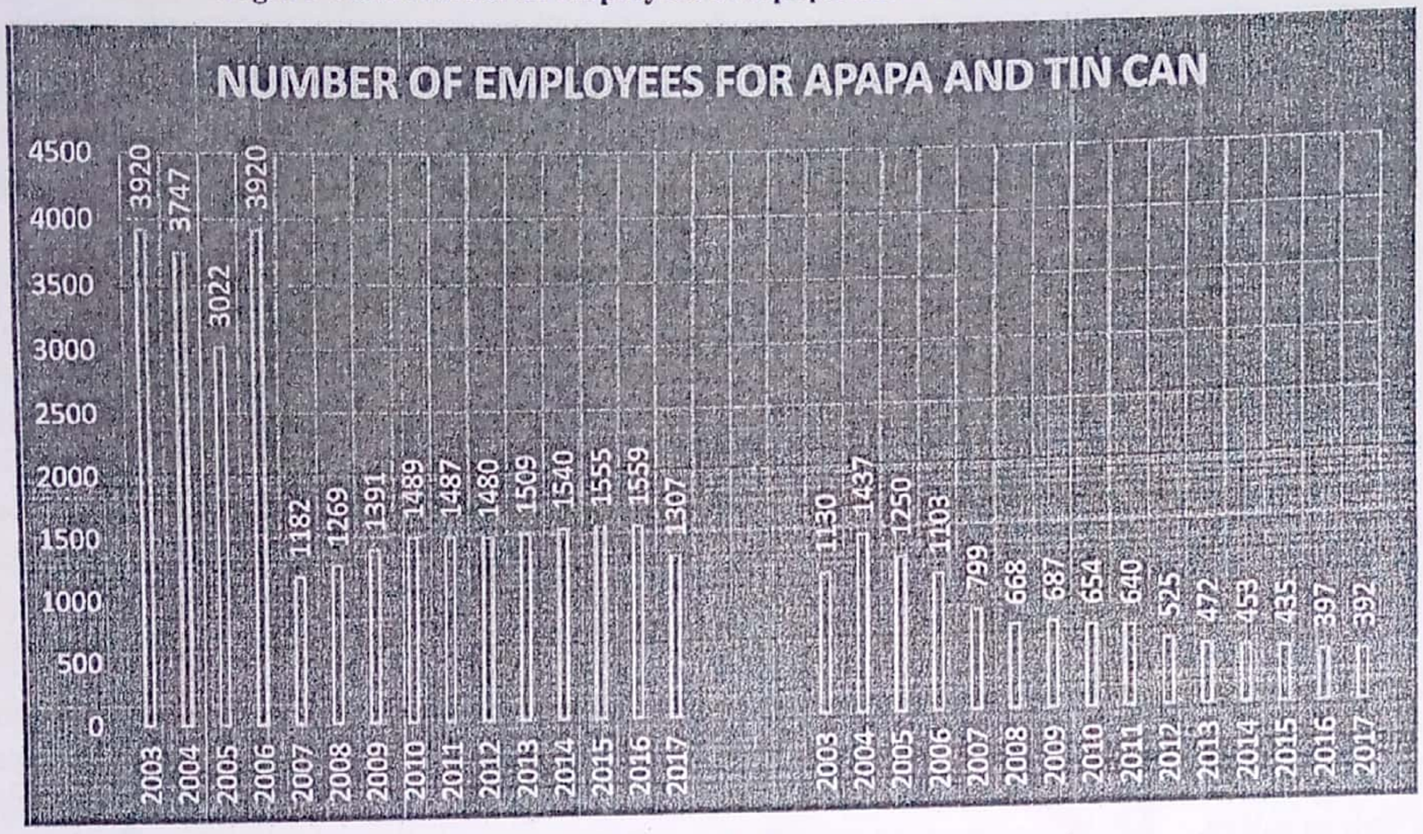
Source: Authors

Figure 4.4: Turnaround time of Apapa and Tin Can Island Port



Source: Authors

Figure 4.5: Number of employees of Apapa and Tin Can Island Port



Source: Authors

4.1 Analysis of Sea Port Performance of Apapa Port

Table 4.2: Result of the model for Apapa Sea Port Performance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13597969	4591538.	2.961528	0.0143
SHIP_TRAFFIC	3953.635	3315.805	1.192361	0.2606
BERTH_OCCUPANCY_	79896.71	51511.79	1.551037	0.1519
TURN_AROUND_TIME	-199334.0	176881.6	-1.126935	0.2861
NO_OF_EMPLOYEES	-1993.936	685.3111	-2.909535	0.0156
R-squared	0.858870	Mean dependent var		18762883
Adjusted R-squared	0.802418	S.D. dependent var		3145210.
S.E. of regression	1398053.	Akaike info criterion		31.40026
Sum squared resid	1.95E+13	Schwarz criterion		31.63628
Log-likelihood	-230.5020	Hannan-Quinn criteria.		31.39775
F-statistic	15.21414	Durbin-Watson stat		2.010693
Prob(F-statistic)	0.000296			

Source: Authors

$$C_{APP} = 13597969 + 3953.635\ ST + 79896.71\ BOY - 199334.0\ TAT - 1993.936\ NOE$$

where:

C_{APP}= Cargo Throughput for Apapa port

ST = Ship Traffic

BOY = Berth Occupancy

TAT = Turnaround Time

NOE = Number of Employees

4.1.1 Significance of Estimate and overall Regression Model for Apapa Port.

The coefficient of determination (R^2) for Apapa port is 0.858870 for the model, this indicates that there is a very positive linear relationship between the dependent variables (cargo throughput) and explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees) and that the explanatory variable accounted for 85.89% of the variations in the cargo throughput in Nigeria from 2003 to 2017, While the remaining 14.11% variation in the real cargo throughput for Apapa port is explained by other exogenous variables that are excluded in the models (error term). This implies that the coefficients are high as 86% for Apapa. The coefficient of determination (R^2) measures the proportion of the variation in the dependent variable that is explained by the combination of the independent variables in the regression model (Salvatore & Reagle, 2002).

The Durbin-Watson statistic was used to detect the presence of autocorrelation (a relationship between values separated from each other by a given time lag) from a regression analysis that is, it tests the independence of error in the least square regression. As a rule of thumb, if D-W is less than 2.0, there is an indication that the successive error terms are on average, close in value to one another and positively correlation, it, therefore, means that there is a presence of autocorrelation and if greater than 2.0, there is no autocorrelation. The Durbin- Watson statistics for the Apapa port is 2.0 which shows that there is a presence of autocorrelation because it is not greater than 2.

The standard error and mean of the dependent variable test were carried out to ascertain the correctness, statistical significance, and reliability of the parameters estimated. The standard error of estimate for Apapa port is computed to be 4591538, which is small compared to the mean of the dependent variable cargo throughput which is 18762883. This indicates that there is a statistical significance between ship traffic, berth occupancy, turnaround time, number of employees, and cargo throughput for Apapa Port.

4.2 Analysis of Sea Port Performance of Apapa Port

Table 4.3 Output Model Summary Result Tin Can Island Sea Port

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5772904.	2647245.	2.180721	0.0542
SHIP_TRAFFIC	8519.958	1229.961	6.927016	0.0000
BERTH_OCCUPANCY_	-23568.32	16933.82	-1.391790	0.1942
TURN_AROUND_TIME	36097.77	181701.3	0.198665	0.8465
NO_OF_EMPLOYEES	-3974.048	1521.220	-2.612408	0.0259
R-squared	0.987865	Mean dependent var		12279674
Adjusted R-squared	0.983011	S.D. dependent var		4820532.
S.E. of regression	628324.4	Akaike info criterion		29.80070
Sum squared resid	3.95E+12	Schwarz criterion		30.03672
Log-likelihood	-218.5053	Hannan-Quinn criteria.		29.79819
F-statistic	203.5108	Durbin-Watson stat		2.025168
Prob(F-statistic)	0.000000			

$$C_{TC} = 5772904 + 8519.958\ ST - 23568.32\ BOY + 36097.770\ TAT - 3974.048\ NOE$$

where:

C_{TC} = Cargo Throughput for Tin Can port

ST = Ship Traffic

BOY = Berth Occupancy

TAT = Turnaround Time

NOE = Number of Employees

From the regression equation above, the value of the constant terms C_{TC} (CARGO THROUGHPUT) is 5772904. This signifies that if the explanatory variables are held constant, the C_{TC} is 5772904. Thus this is the autonomous value of the CARGO THROUGHPUT.

4.2.1 Significance of Estimate and overall Regression Model for Tin Can Island Port.

The coefficient of determination (R^2) for Tin can port is 0.987865 for the model, this indicates that there is a very strong positive linear relationship between the dependent variables (cargo throughput) and explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees) and that the explanatory variable accounted for 98.79% of the variations in the cargo throughput in Nigeria from 2003 to 2017, While the remaining 1.21% variation in the real cargo throughput for Tin Can port is explained by other exogenous variables that are excluded in the models (error term), This implies that the coefficients are high as 99% for Tin Can island port. This indicates that the Tin can island port has a stronger relationship between the dependent variable and the exploratory variables. The coefficient of determination (R^2) measures the proportion of the variation in the dependent variable that is explained by the combination of the independent variables in the regression model (Salvatore & Reagle, 2002). The Durbin- Watson statistics for Tin can port is 2.025168. The standard error of estimate or Cargo throughput for Tin can port is 2647245, which is small compared to the mean of the dependent variable cargo throughput which is 12279674. This indicates that there is a statistical significance between ship traffic, berth occupancy, turnaround time, number of employees, and cargo throughput for Tin can Island Port.

4.3 Test for Hypothesis One

H_1: There is a statistically significant relationship between cargo throughput and Ship traffic, berth occupancy, turnaround time, number of employees for Apapa seaport.

Using the Prob (F-statistic) value, the P-value for the Apapa seaport is 0.000296. Since the P-value for Apapa seaport is less than 0.05, this indicates that there is a statistically significant relationship between the dependent variable Cargo throughput and the explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees). This implies that the more the input parameters are working effectively the more the operational performance increases, thereby having an optimal operational output. (Pius, Nwaogbe, Akorele and Masuki, 2017 & Nwaogbe et.al. 2016).

4.4 Test for Hypothesis Two

H_1 = There is a significant relationship between cargo throughput and Ship traffic, berth occupancy, turnaround time, number of employees for Tin Can port.

Using the Prob (F-statistic) value, the P-value for Tin Can seaport is 0.000000. Since the P-value for Tin Can port is less than 0.05, this indicates a significant relationship between the dependent variable Cargo throughput and the explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees). This implies that the higher the parameter operations in terms of the ship's turnaround time, employee operational services, berth occupancy, the higher cargo throughput, thereby increasing seaport to operational performance (Nwaogbe et al., 2019 & Nwaogbe et al. 2016). Wanke et al. (2016) state that airports' operational performance is the measurement of how productivity and efficiency of the airport are rated based on the input and output variable estimation.

4.5 Comparison of Apapa Sea Port and Tin Can Island Port Operational Performance

Table 4.4 shows the summary of descriptive statistics for the sample of the two seaports Apapa and Tin can and the variables used for the Ordinary least square model (OLS) analysis. The additional seven contextual and business-related variables were collected to explain differences in Apapa and Tin's efficiency levels can island seaport. The contextual variables are based on cargo throughput, berth occupancy, ship traffic, number of employees, and ship turnaround time. Those variables descriptive statistics are presented in Table 4.4 and are related to the seaport's efficiency and performance. The descriptive analysis of the two major ports Apapa and Tin Can Island Port using various port performance indicators such as Cargo Throughput, Ship Traffic, Berth Occupancy, number of employees, and Turnaround time shows the standard deviation, skewness, kurtosis, and Jarque Bera values.

4.6 Discussion

Table 4.2 shows the exponents of the explanatory variables that become the coefficients; this, therefore, qualifies the coefficients of the explanatory variables (independent variables) as a measure of the degree of responsiveness (elasticity) of the dependent variable to the change in the explanatory variables. The coefficients of each explanatory variable (ship traffic, berth occupancy, turnaround time, and the number of employees) are the elasticity response of the dependent variables (CARGO THROUGHPUT) concerning relative explanatory variables. The regression equation above shows that the value of the constant terms C_{APP} (CARGO THROUGHPUT) is 13597969. This signifies that if the explanatory variables are held constant, the C_{APP} is 13597969. Thus this is the autonomous value of the CARGO THROUGHPUT.

In the context of the computed elasticity (i.e. coefficient of the explanatory variables), the result suggested that a unit change in output ST will cause a 3953.635 unit rise in C_{APP}. This means that there is low output for Apapa seaport and for this to develop, more output from this sector will enhance the performance. A unit change in BOY will cause a 79896.71unit change in C_{APP}. This means that the performance of Tin Can Island is low compared to Apapa port and for this to develop, an increase in berth capacity will be mobilized and this will eventually affect the cargo throughput positively. A unit change in TAT will result in a -199334.0 unit change in C_{APP}. This means that the turnaround time of Apapa seaport is lower as compared to that of Tin Can Island. A unit change in NOE will result in 1993-936 change in C_{APP}. This means that a unit change number of employees for Apapa seaport is more significant as compared to that of Tin Can Island.

Table 4.4 Descriptive Analysis of Apapa Port and Tin Can Island Port

	APAPA							TIN CAN						
	APAPA MAX	MIN	STD DEV	SKEWNESS	KURTOSIS	JARQUE BERA	PROB	MAX	MIN	STD DEV	SKEWNESS	KURTOSIS	JARQUE BERA	PROB
CARGO THROUGHPUT	22800584	13432106	3145210	-0.637709	2.05581	1.573866	0.455239	17500804	4075436 .	4820532	-0.749996	1.960526	2.081552	0.353181
SHIP TRAFFIC	1628	1154.000	124.4794	-0.666547	3.043979	1.111922	0.573521	1692	535	420.7625	-0.79022	2.122200	2.042702	0.360108
BERTH OCCUPANCY	79.67	54.40000	8.024030	0.763526	2.650736	1.533673	0.46448	86.56	43.92	11.49717	0.180961	2.685985	0.143495	0.930766
NUMBER OF EMPLOYEES	3920.000	1182	1040.409	1.123745	2.436184	3.355685	0.186776	1437.000	392	337.0693	0.832507	2.384099	1.969751	0.373486
TURN AROUND TIME	18.1	3.8	3.998705	1.403627	4.409859	6.167733	0.045782	8.18	3.450000	1.380408	1.175285	3.352246	3.530788	0.171119

Source: Authors

The F statistics are used to ascertain the overall significance of the model. This decision is made based on comparing the calculated F statistics (Focal) and the tabulated F (Ftab). Since Fcal > Ftab (15.21414> 6.06 and 3.48) at both 1% and 5% level of significance, table 4.2 shows a positive statistically significant relationship between, ship traffic, berth occupancy, turnaround time, number of employees, and cargo throughput.

Furthermore, table 4.3 shows the context of the computed elasticity (i.e. coefficient of the explanatory variables). The result suggested that a unit change in ST will cause an 8519.958 unit rise in C_{TC}. This means that there is low output for Apapa seaport compared to Tin can port and for this to develop, more output from this sector will enhance the performance. A unit change in BOY also will cause a -23568.32 unit change in C_{TC}. This means that Tin Can Island's performance is low compared to Apapa port and for this to develop, an increase in berth capacity will be mobilized, which will eventually affect the cargo throughput positively. A unit change in TAT will result in a 36097.77 unit change in C_{TC}. This means that the turnaround time of Apapa seaport is lower as compared to that of Tin Can Island. A unit change in NOE will also result in a -3974.048 change in C_{TC}. This means that a unit change number of employees the number of employees for Apapa seaport is more significant than that of Tin Can Island.

The F statistics were used to ascertain the overall significance of the model. This decision is made based on comparing the calculated F statistics (Fcal) and the tabulated F (Ftab). Since Fcal > Ftab (203.5108> 6.06 and 3.48) at both 1% and 5%-level of significance as shown in table 4.3, there is a positive statistically significant relationship between, ship traffic, berth occupancy, turnaround time, number of employees, and cargo throughput.

Comparing the Apapa port and Tin Can Island port, from the output summary, the result shows that Tin can Island has R^2 square of 0.987865 (99%), Adjusted R of 0.983011 (98%), and Prob (F-statistics) of 0.00000 while Apapa port has R^2 of 0.85887 (86%), Adjusted R of 0.802418 (80%) and a Prob (F-Statistics) of 0.000296. The result shows that Tin Can Island Port is more productive and efficient than Apapa port in terms of port performance because it has F- statistics of 0.000000 while Apapa port has F-statistics of 0.000296. This is due to the heavy traffic congestion that occurs at the Apapa road that leads to the port, this also causes many delays for the articulated vehicles that come to carry cargo from the port.

5 CONCLUSION

In conclusion, the study finding reveals that independent variables (ship traffic, berth occupancy, turnaround time, and the number of the employee) have a significant relationship between the dependent variable (cargo throughput). The Apapa port operational performance analysis demonstrated a statistically significant relationship between the dependent variable Cargo throughput and the explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees). Secondly, the Tin Can Island port operational performance analysis results show a statistically significant relationship between the dependent variable Cargo throughput and the explanatory variables (ship traffic, berth occupancy, turnaround time, and the number of employees). Moreso, comparing the two major ports, the result shows that Tin Can Island Port is more productive in terms of performance than Apapa port, with Apapa port R^2 of 88% and Tin Can Island with R^2 99%. Based on the study findings the recommendations were made that operational service at Apapa port is improved to meet port user's demand. The government should work toward rebuilding the access road to the Apapa port complex and as well develop an integrated multimodal transport system to enhance port operation logistics services and transportation of cargoes to decongest the port. The two major seaports (Apapa port and Tin Can Island port) should also develop and maintain customer-oriented marketing strategies to improve affordability and repeat patronage at the port. Lastly, the

Government should create industry-specific policy implications to encourage and support direct investment in the maritime sector to help bring port users to comfort to the ports. Finally, there is a need to rebuild Apapa port road to have a free flow of traffic and reduce delays in the carriage of goods from the seaports.

REFERENCES

Barros, C. (2005). Decomposing Growth in Portuguese Seaports: A Frontier Cost Approach. *Maritime Economics Logistics*, 297-315.

Bichou, K. a. (2004). Maritime Policy & Management. *A logistics and supply chain management approach to port performance measurement* 31, 47-67.

Comtois, C. a. (2007). Port competition in the Yangtze River Delta. *Asia Pacific Viewpoint*, 299-311.

Cullinane, K. S. (2003). A stochastic frontier model of the productive effciency of Korean container terminals. *Applied Economics* (35), 251-267.

Ha, M. Y. (2017). In Comparative analysis of port performance indicators: independency and interdependency, *Transportation Research Part A: Policy and Practice*. 103, 264-278).

Hanaa, A. (2016). Efficiency Assessment of Jazan Port Based on Data Envelopment Analysis. *Mediterranean J Soc Sci* 7, 320-327.

Joseph, A. A. (2014). Port Automation and Performance: A Study of Nigeria Port Authority (NPA) Calabar, Cross River State, Nigeria. *International Journal of Management Sciences, 3* (9), pp. 636-650.

Njoku, I. (2009). *Evaluation of Transport Infrastructural Development in Nigeria and its Effect on the National Economy.* Federal University of Technology. Owerri: An unpublished.

NPA. (2015). Handbook on Port and Harbour Development in Nigeria, Nigerian Ports Authority, Lagos, Nigeria.

Nwaogbe, O. R., Diugwu, I. A., Mohammed, M., Omoke, V. &Gidado, S. U. (2016). Project infrastructure management and economic growth: the impact of seaport concessioning on Nigeria's economic growth (a focus on delta port), *International Journal of Business and Applied Social Science* 2, (4), pp. 37-49.

Nwaogbe, O. R., Monday, A., Matthew, O. S., Omoke, V., & Nze, I. C. (2019). Demand Analysis for Air Travels In Nigeria -An Expository Study1, I 54th Annual Meetings of the Canadian Transportation Research Forum, May 26 - 29, 2019 at Vancouver, British Columbia

Ochiabuto, A. C. (2014, August). *The Impact Of Reforms On Port Performance In Nigeria: A Case Study Of Onne And Rivers Ports*. A Thesis Submitted To The Postgraduate School, Federal University Of Technology, Owerri, Imo State, Nigeria.

Ogunsanya, A. A. (2008). *Seaport development in Nigeria.* Ibadan: HEBN Publishers, pp. 1-19.

Omoke, V., I. A. Diugwu, O. R. Nwaogbe, C. C. Ibe, and D. A. Ekpe. (2015). "Infrastructure Financing and Management: The Impact of Concession on the Operations and Performance of Nigerian Seaports." *Journal of Behavioural Economics, Finance, Entrepreneurship, Accounting and Transport* 3 (2), pp. 65–70.

Omoke, V., Diugwu, I.A., Nwaogbe O.R., Mohammed M., & Wokili H. (2017). Competitiveness Analysis of Selected Seaports in West African Coast Region Using Analytical Hierarchical Process, *Port Harcourt Journal of Social Sciences* 7., pp. 211-228.

Omoke V., Aturu A. C., Nwaogbe O.R., Ajiboye, A.O., and Diugwu I. (2017). Analysis of the Impact of Port Operations on Nigerian Economy: A Focus on Apapa Seaport, *Port Harcourt Journal of Social Sciences*, 7, pp. 278-287.

Oni, S. I. (2008). Development of inland ports in Nigeria. In Oyesiku, O.O. & Gbadamosi, K.T. *Port Administration and Development in Nigeria.* Ibadan, pp. 88-99.

Pius, A., Nwaogbe, O. R., Akerele, O.U., & Masuku, S. (2017). An Appraisal of AirportTerminal Performance: Evidence from Murtala Muhammed International Airport (MMIA). International Journal of Professional Aviation Training & Testing Research 9 (1) pp. 1-27.

Somuyiwa, A. O. (2015). Correlate Of Port Productivity Components In Tin Can Island Port, Apapa, Lagos. *European Journal of Logistics Purchasing and Supply Chain Management, 3* (1), pp. 44-57.

Sun, X. Y. (2006). Econometric Analysis of Technical Efficiency of Global Container Operators. Proceedings of the 11th International Conference of Hong Kong Society for Transportation Studies: Sustainable Transportation, pp. 667-676.

Tom, K. (2009). Reoccurrence of congestion in Nigerian ports, *Port news, 15* (6), pp. 2-10.

Tongzon. (2007). Determinants of Competitiveness in Logistics: Implications for the ASEAN Region. *Maritime Economics & Logistics*, *9* (1), pp. 67-84.

Tongzon. (2009). Logistics and Transportation Review. In Port choice and freight forwarders", *Transportation Research Part E,* 45, pp. 186-195.

Tongzon, & Heng, W. J. (2005). Port privatization, efficiency, and competitiveness: Some empirical evidence from container ports (terminals). *Transport Res Part A: Policy Pract,* 39, pp. 405-424.

Trujillo, L. T. (2007). The European Port Industry: An Analysis of its Economic Efficiency. *Maritime Economics Logistics*, pp. 148-171.

Wanke, P. F., Nwaogbe, O. R., & Chen, Z. (2017). Efficiency in Nigerian Ports: Handling Imprecise Data with a Two-Stage Fuzzy Approach, *Maritime Policy, and Management MPM),* 44 (8), pp. 1-17 https://doi.org/10.1080/03088839.2017.1410588

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