

International Journal of Scientific Research in _ Multidisciplinary Studies Vol.8, Issue.2, pp.01-06, February (2022)

Examination of the Trend of Port Performance Using the Standard Indexes: A focus of Apapa Port Complex, Lagos, Nigeria

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Available online at: www.isroset.org

Received: 20/Dec/2021, Accepted: 18/Jan/2022, Online: 28/Feb/2022

Abstract— This study analyzed the impact of port performance on Nigeria economy, with a s focus on Apapa port Complex. Therefore, the objectives of the study are to examine the trend of port performance using the standard indexes and their relationship to the economic growth of the nation. The data for the study were sourced from Nigerian Ports Authority and Nigerian Shippers' Council. The study revealed that the percentage contributions of port revenue to GDP was at its highest level of contribution in 2017 at 24.57%. The study shows a steady rise in the contribution per ton of cargo handled to revenue as shown by the trend line for prediction. The slope of the trend line is upward sloping from left to right with occasional peaks at intervals. Such intervals were recorded for 2002, 2008 and 2017. Cargo throughput and tons per ship in port were found to have a positive significant impact on economic growth of the nation while the influences of turnaround time and berth occupancy rate were not significant. The study therefore recommended that vessel gross registered tonnage should be used as the basis for assessing port dues since it has a positive significant impact on Nigerian economy.

Keywords- Port Performance, Gross Domestic Product, Cargo Throughput, Turnaround Time

I. INTRODUCTION

The maritime transport and logistics plays an important role in underpinning world trade. The connectivity of nations is also critical to the benefits derived from involving in international trade. Lying at the heart of international transport and supply chain system, ports play a pivotal role as an interface between the various available transport modes [1]. According to [2] seaport is the compulsory transit point for the bulk of this trade, permitting the import of goods, which the country does not itself produce in sufficient quantity, and the export of items contributing to the development of its economy. It is a place for the provision of further service, which add value to the products transported and thus helps the increasing demand of trade. Port activities, therefore, contribute not only to the economic independence of a nation but also vital to the political independence, and perform a strategic role in the international trade. Shipping has been an link important logistical by which commercial relationships have been established between widely separated parts of the world [3]. The economic development of a nation depends on several factors, and developed infrastructure is a key factor amongst others. [4] was of the view that infrastructure is the lifeline of any business activity, proper infrastructure increases business activity manifold. Infrastructure development can play a major role in promoting growth and equity. Ports are the gateway for foreign trade and developed port facilities

provide a platform for smooth exports and imports. As used in this study port refers to a location on a coast or shore containing one or more harbors where ships can dock and transfer people or cargo to or from land. Port locations are selected to optimize access to land and navigate water, for commercial demand, and shelter from wind and waves. Since ports throughout history handled every kind of traffic, support and storage facilities vary widely, may extend for miles, and dominate the local economy. Some ports have an important military role. However, port performance is measured by its capacity in cargo handling, the size of vessels, and amount of cargo traffic as well as ship turnaround. Ports have been, and still are, an integral part of freight transportation as they play a major role in a country's development and prosperity. Hence, port performance and efficiency are vital for a country's economy because the world economy continues to be the driving force behind the maritime sector [5]. [6] revealed that Economic growth and development of any country largely depends on the performance metrics of its international trade and investments because no single country can exist on its own. Domestic and foreign trades will be difficult without efficient transportation system to convey marketable goods and maritime business presents opportunity for the transportation of large volume of cargo. The growth in the maritime industry has resulted in the rise in the throughput of cargo, leaving the port operators to the task of meeting up in the clearing of cargo within the shortest period of time. High or increasing congestion,

high turnaround time of the ship, delays at the port, and increase in dwell time of ship and low labor productivity are few among the challenges that are rising in Nigerian Economic impact of land-based transport ports. infrastructure, in general are essential for justifying the economic contribution of large infrastructure facility developments. "They are especially controversial when prospectively to justify public subsidy or used extraordinary planning permission". Therefore, the aim of port impact studies is to inform the general public about the economic contribution of ports. This aim alone is not a small task, as ports facilitate socio-economic infrastructure and generate external economies that are often not visible to the general public, but consent is required whenever port facilities are established or expanded [7]. Today, it remains undecided as to whether or not ports contribute to their surrounding national or regional economies.

It is in the light of the foregoing that this study sought to examined the port performance on the Nigeria economy using gross domestic product as the major standard indexes such as cargo throughput, berth occupancy rate, Ship Turnaround Time (STRT), ton per ship in port and total revenue from 2000 to 2020 with a view to determining the impact of gross registered tonnage of vessels on Nigerian gross domestic product; and ascertaining their relationship to the economic growth of the nation.

II. RELATED WORK

The port performance has frequently been studied in the academic literature, and the first studies on the subject are focused on financial or operational dimensions. However, today, port performance has become multi-dimensional due to the changing roles of the ports to its stakeholders, and the fact that local competition has been replaced by global competition through continuously developing routes, etc. Through the literature, scholars continuously insist that no standardized or uniform definition of performance exists, and they argue on how it is a multidimensional concept. [8] examine the effect of Port Revenue Performance on Nigeria's economic growth by critically evaluating the Nigerian Ports Authority Performance. The findings showed that total revenue to gross registered tonnage had positive and significant effect on economic growth while operating surplus to operating revenue showed a negative but significant effect and operating surplus to cargo throughput showed insignificant effect. In the study of [9] analyzed the impact of port operations on Nigerian economy, with a focus on Apapa port. It was found that gross registered tonnage of the vessel is significantly contributing to the Nigerian gross domestic product (GDP) at 0.05 significant level, and that cargo throughput and vessel traffic have positive impact on the economy but are not significantly influencing the Nigerian gross domestic product at 0.05 significant level. [10] identifies the significant factors affecting the revenue generation of Bangkok Port. The study illustrates that the Container Import, Exchange rate, and the value of Land and property trading are positive significantly performs

with the revenue of Bangkok Port. Especially, Exchange rate is the highest contributed to the revenue of the port following by the Container Import and the value of Land and property trading respectively. [11] presents the current status and trends over time in the environmental situation of European ports, based on the results of a wide representation of Eco Ports members (90 ports). It is interesting to highlight the growing awareness of Climate change among ports as well as the increasing implementation of green initiatives in ports. [12] assessing the efficiency of Nigerian ports from 2008 to 2017 by applying Data Envelopment Analysis. The findings reveal the operational performance of the Onne port as the most efficient, followed by Apapa and lastly by Rivers Port. Variable Return to Scale (VRS) yielded more efficient results than COnstant Return to Scale results over the years of the study. The ports operating under constant return to scale are efficient, while the ones operating at increasing return to scale needs to be improved to make them efficient. [13] completed a study in China and showed that there was a positive relationship between value-added operations at ports and economic activity. Another study in china by [14] completed a study in China and showed that port efficiency increased growth in a country and also in its neighboring countries. Poor efficiency in ports was also seen to be a significant contributor to poor economic performance in South Africa [15]. [16] completed a study in 10 West European countries and showed that port efficiency, as measured by port throughput, increased growth and employment opportunities. [17] examines the influence of quality of port infrastructure on port performance and its relative impact on the Nigerian economy. The result of the Regression analysis reveals that the quality of port infrastructure in Nigeria increases GDP per capita by 96.9% for every one percent increase in port infrastructure, reduces Ship turnaround time by 29.1% for every one percent increase in port infrastructure, increases by 20.9% for a percent increase in Liner Shipping Connectivity and increases by 55.6% for a percent increase in Cargo Throughput.

III. METHODOLOGY

The study seeks to examine the port performance using the standard indexes and their relationship to the economic growth of the nation. The seaport under review in this study is the Apapa Port Complex. The Apapa Port Complex also referred to as Premiere Port (Apapa Quays) is the earliest and largest Port in Nigeria. It is situated in Apapa, Lagos State, the commercial center of Nigeria. The Port was established in 1913 and construction of the first four deep water berths commenced in 1921. The Apapa Port is well equipped with modern cargo handling equipment and personnel support facilities making her cost effective and customer friendly. It enjoys intermodal connection - Rail, Water and Road. It boasts of four-wheel gate of about 8 meters for oversize cargoes and this has given the Port an edge over others in the handling of oversized cargoes. Therefore, the data for the study were sourced from Nigerian Ports Authority and Nigerian

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Shippers' Council. This study covers a period of twenty years (2000-2020) where time series data on Gross Domestic Product (GDP) per capita (dependent variable) and cargo throughput, berth occupancy rate, Ship Turnaround Time (STRT), ton per ship in port and total revenue were implored for the analysis. The statistical

tools adopted for data analysis include trend analysis and multi-linear regression. The regression line which defines this relationship is expressed as:

$$y = \beta_0 + \beta_{tp} + \beta_b + \beta_{strt} + \beta_{TPS} + \beta_{TR} + e \dots \dots Equation 1$$

where y is the GDP, β_0 is the y-intercept $\beta_{tp} + \beta_b + \beta_{strt} + \beta_{TPS} + \beta_{TR}$ are the coefficients of the variables; *tp* is berth occupancy; *b* is berth occupancy, *strt* is ship turnaround time, *tps* is ton per ship in port, *tr* is total revenue. Note that all the variables are average of what was gotten from 2000 to 2020. The analysis will help get the linear relationship that exists amongst these variables.

IV. RESULTS AND DISCUSSION

A. Trend of port Performance Indexes

To appreciates the trend of port performance indexes and the relationship to economic growth, the objective will be addressed along the lines of the following: percentage contribution to GDP; contribution per ton of cargo handled to revenue; contribution per ton of ship to revenue; net flow (exported throughput less imported throughput); and port performance indexes and their relationship to economic growth of the nation.

i. Percentage Contribution to GDP for Apapa Port Complex

Revenue generated at the seaports are quite vital. Relating the performance of seaports to gross domestic products calls for the examination of the worth of the seaports' revenues to the national GDP. This is what this section set out to achieve by assessing the percentage contribution of cargo handled at the Apapa port complex to gross domestic product using the port financial performance indicator that's the revenue generated within the study period (2000 to 2020). These were presented in Figure 1. The study revealed that the percentage contributions of port revenue to GDP was at its highest level of contribution in 2017 at 24.57%. There were periods of other lower peaks and troughs but in general the trend showed to be upward sloping to the right, indicating a steady improvement in percentage contribution of the seaport to the GDP. The fluctuations can be attributed to a couple of reasons of factors such as volume and value of annual throughput and the types services that various calling vessels used at the seaports as well as the length of time they stayed to be served. These varies on annual basis and would reflect in the total annual revenue that the seaports make. Findings of this study is in tandem with Richard & Edith (2020). Depicting further, any one percent increase on ton of cargo handle will on the other hand give a percent increase on the

GDP. Cargo traffic of Apapa port complex will positively affect the economic growth of the country and this can only be achieved by reducing ship and truck turn-round time which will on the other side increase cargo throughput. It's pertinent to state that Apapa port complex, maintained level of effectiveness between the years 2008 all through 2020.



Figure 1: Percentage contribution to GDP, using port financial performance (Port revenue) for Apapa Port Complex. Source: Authors Field Work, 2021

i. Contribution per Ton of cargo Handled to Revenue

Cargo tonnage seems to be the most fundamental measure of port terminal throughput which includes all that passes through the terminal. Cargo tonnage does not include the weight of shipping containers themselves, even though the movement of empty containers may be significant portion of port activity. Tonnage of cargo handled, otherwise called Port Throughput, measures the amount of cargo vessels bring to the port that the port actually handled over a given time. With this, contribution per ton of cargo handled to revenue is a measure of the monetary value of throughput over a given time. The Figure 2 showed the contribution per ton of cargo handled in Apapa port. There is a steady rise in the contribution per ton of cargo handled to revenue as shown by the trend line for prediction. The slope of the trend line is upward sloping from left to right with occasional peaks at intervals. Such intervals were recorded for 2002, 2008 and 2017. The simple deduction from this is that these years had more valuable cargo moved that made their contribution per ton to revenue higher. The lower the throughput (tons moved via the seaport) with a corresponding high revenue, the better the contribution to revenue that will be recorded.



Figure 2: Contribution per Ton of Cargo Handled to Revenue Apapa Port Complex. Source: Authors Field Work, 2021

i. Contribution per ton of Ship to Revenue

Not all vessels that calls at a seaport add so much to the revenue generated in the port of call. One might argue therefore, that the contribution per ton of ship revenue can be used as medium to "weed out" vessels that merely occupy berths but with little contribution to the revenue base of the seaport. Figure 3 shows the per ton of ship to revenue to Apapa Port complex. An average of two million four hundred and forty-two thousand, three hundred and forty-five (2,442,345) naira contribution ton to revenue was recorded for the period studied, however, it must be pointed out that earlier years had lower contribution that corresponded with pre-concession time when port performance was not too good. A remarkable fact must be highlighted with 2020, despite the year having very poor vessel calling and lower throughput, the period had the best contribution per ton of ship to revenue. This is due to the high valuation of the cargo brought in during the year even though throughput were poor. It must be pointed out that cargo traffic for high value commodities were high as commerce actually went less physical due to the lockdown and the pandemic. The slope of the trendline slopes upwards from left to right indicating the potential for future growth in later years of more valuable cargo passing through the seaport. It was observed that from year 2017 the value of the ton per ship to revenue has been decreasing. Even with that, the overall trendline showed that there is room for growth.



Figure 3: Ton per ship in Apapa Port Complex. Source: Authors Field Work, 2021

i. Net flow for Apapa port complex and Tin Can Island Port

Net flow are the estimation of the total volume of country's exports minus the total value of its imports. Belay Seyoum (2009) [18] noted that a positive net export indicates a trade surplus and on the other hand, a negative net exports indicates a trade deficit. A trade surplus or trade deficit reflects a country's balance of trade which is essentially, shows whether a country is a net exporter or importer, and to what extent. It not news that Nigeria is an import-oriented economy and that can be seen on Figure 4. It can be seen that Apapa port takes in more imports than it pushes out export. There has been a steady negative net flow since the start of the period of this study. There was a slight drop in negative net flow immediately after the concession but the negative trend continued later with time and reached the lowest trough in 2011 culminating the period when the great depression was felt highest in Nigeria and a recovery started. The export increased but there were still negative net flows from 2012 till 2017. The closure of the border in 2019 and the demand for appropriate tariff be paid on imports led to a drop in imports. The promotion of export and agriculture by the current Federal Government drove export to higher values and the negative net flow was reduced between 2019 and 2020.



Figure 4: Net flow for Apapa Port Complex Source: Authors Field Work, 2021

B. Port Performance Indexes and their Relationship to Economic Growth of the Nation

Having discussed the trend of different port performance indexes earlier in the previous sections, Table 1 and 2 discussed the multiple regression analysis results between the GDP and the standard indexes. The outcome of the model observation can be easily being understood that 81.3% of the variation in GDP for the years under study can be explained by the variation in the independent variables which simply depicts that there is a high goodness of fit between the dependent and the independent variables. The adjusted R^2 of 0.813 means that the model has accounted for the 81.3% of variance on the independent variables. Going by the observation from the regression model in Table 2, it is noticed that the cargo throughput at the port stands to be the most influential indicator of increasing port performance and productivity whereby any unit change in throughput will amount to a unit change in GDP of the country followed by ton per ship in port with p-value of 0.0470. The level of significant that is P-value of 0.0073 is less than the chosen significant level of 0.05. Hence this is the basis to say that there is a significant relationship between cargo statistical throughput of the seaport. The other independent variables that have a p-values greater than the chosen 0.05 do not have a direct relationship with the GDP of the country but that does not mean that do not have a respective contribution to other logistics or economic growth variables just that their relationship with GDP is not statistically significant. This result is corroborating with the finding of Omoke, et. al (2018) and Njoku et al (2021).

 Table 1: The multiple regression analysis results between the GDP and the standard indexes

Model	R	R	Adjusted	Std.error	p-				
		Square	R Sqaure		value				
1	0.927	0.860	0.813	68514628909.945	6.32E-				
					06				

Predictors: (constant), throughput, ton per ship in port, total revenue, turnaround time, berth occupancy rate

Table 2: Regression output Result

variab le	Coefficients	Std error	t (df=	p- val	95% lower
ie –			(ui= 15)	ue	
Interce	590,617,035,	234,259,733,	2.52	.02	91,304,234,1
pt	852.9670	119.0740	1	35	53.3627
Throug	17,990.8875	5,803.6036	3.10	00	5,620.7992
hput			0	73	
Ton	-	8,840,393.73	-	04	-
per	19,130,056.2	37	2.16	70	37,972,909.4
ship in	827		4		889
port					
Total	1.3995	0.8593	-	12	-0.4321
Reven			1.62	42	
ue			9		
(Naira)					
Turnar	-	6,054,191,00	-	12	-
ound	9,808,089,72	2.6870	1.62	60	22,712,292,3
time	9.3731		0		90.7824
Berth	-	2,849,062,37	-	16	-
Occup	4,179,314,80	1.0999	1.46	31	10,251,947,5
ancy	7.2207		7		03.3731
rate					

Dependent variable: GDP Source: Authors Field Work, 2021

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V. CONCLUSION AND FUTURE SCOPE

This study examined the port performance using the standard indexes and their relationship to the economic growth of the nation. The standard indexes assessed include; cargo throughput, berth occupancy, ship turnaround time, ton per ship in port and total revenue. From the analysis, it shows that effective port operations are important in boosting Nigeria economy because about 90% of Nigeria imports pass through the seaport. The study revealed that the percentage contributions of port revenue to GDP was at its highest level of contribution in 2017 at 24.57%. and there is steady improvement in percentage contribution of the seaport to the GDP. Cargo throughput and tons per ship in port were found to have a positive significant impact on economic growth of the nation while the influences of turnaround time and berth occupancy rate were not significant. The study therefore recommended that vessel gross registered tonnage should be used as the basis for assessing port dues since it has a positive significant impact on Nigerian economy; there should be improvement in the number and capacity of cargo handling equipment to enhance port operations vessel turnaround time and berth occupancy; and the Nigerian government should develop the country's inland infrastructure of rail and water ways. Port equipment and infrastructures must be adjusted in line with current traffic flows which invariably increases the port performance hence reduces the number of time vessels spend at port.

ACKNOWLEDGMENT (HEADING 5)

We humbly acknowledge the faithfulness and indispensable help of God Almighty for granting us the strength and grace to embark on this great study and for its fruitful conclusion. We appreciate the management of the Federal University of Technology Akure for the platform to service in the institution.

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