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An operational performance of Apapa seaport, Lagos complex Nigeria

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ABSTRACT

Performance measure is an area of interest to economist and policymakers because, major sources of economic growth and welfare improvement rely on the productivity growth. This study centres on the efficiency and productivity of Apapa port, Lagos complex Nigeria, aimed at determining the productivity and efficiency level of Apapa seaport using turnaround time, Berth occupancy, personnel strength and revenue generation as output and input index respectively. The study analysed the secondary data sourced from Nigeria Port Authority (NPA) between 2003 and 2017 using Stochastic Frontier Analysis (SFA) by the aid of STATA version 11 software. The result of the study shows that Apapa port is performing efficiently at 100% score level in year 2003, 2004, 2011, 2013 and 2014 respectively. The mean operational performance of Apapa seaport for this study were measured at 0.905694 efficiency level, implicating that Apapa seaport were operating at 0.094306 inefficiency level from 2003 to 2017, this occurred because the technique (SFA model) employed by the study considered all the random noise that were present in the variables used. The study recommended that Apapa port can improve her productivity level and overall level of technical efficiency through an adequate financing, furnishing with infrastructure, superstructure include ground handling instrument and by encouraging the private initiative.

Keywords: Seaports, SFA model, Productivity, Turnaround time and Efficiency.

1. INTRODUCTION

To determine efficient and effective managerial tools in maritime logistic, Investigators across the globe have developed productivity and efficiency model includes a model for measuring benchmark level (Dutra, et al. 2015). Apapa seaport is regarded as one of the element of transportation which is filling the existing gap between the foreign and home trade, contributing directly or indirectly to the Gross Domestic Product (GDP) of Nigerian states. International trades are facilitated by efficient transport while the success of any trade is demonstrated to have been affected by inefficiency of transport system (Tanaka, 2010). In a close related manner, transport inefficiency is a

barrier to trade success in most of African countries with seaport related challenges (Onwuegbuchunam, 2013). These are links to the inability of Nigeria government to continue financing the already established port infrastructures.

It is pertinent to note that the port infrastructures and superstructures are own, maintain and develop by NPA. NPA is the landlord in charge of Nigerian seaports, responsible for the maintenance as well as the operations of the entire seaports (Pinwa, 1999). Performance Indicators is as mechanical tools that allow the general monitoring of set of characteristics of a specific seaport that enable encourage managers to accomplish an efficient and effective performance (Ensslin, 2017). However, performance is one the element used in measuring the competitiveness in any types of company.

In the same clime, Port operational performance measure the rate at which the input index is been used per each unit of output index (Obigwe, 2010). Port productivity usually centre on the relevance of cargo traffic efficiency to the port system, aimed at increasing the port efficiency (Ndikom, 2008). The accuracy level at which each port operate is been referred to as port performance (Ndikom, 2006). The significant of port reformation process is to make Nigerian ports efficient and productive while ensuring that Apapa port is economically buoyant, socially viable and environmentally friendly within its operational performance. The Nigerian ports require fundamental reforms to rebrand and expand her operations and these have witnessed some operational development by the entire ports system and also to provide a comparable service level of economy to those advanced countries around the world (Ndikom, 2008).

In recent time, the Nigerian port system has experienced some challenges caused by the inadequate policy, the market friendly policy adopted to private concessionaires in maritime transport through monetary reforms, are more favourable and profitable in terms of revenue. Recently, the Nigeria government developed a well structural reforms for operations in Nigerian ports because of the malfunctions experienced from the ports system which merry-go-round the operational activities and seriously affected the port performance (Ndikom, 2008).

This paper is aimed at evaluating the operational performance of Apapa seaport, Lagos complex. It is pertinent to note that an adequate planning, coordinating, organizing, leading, directing and commanding are the life wire and the backbone of effective port performance. However, the coordination and planning of the port's activities have been hijacked by the people of high political classes who are conversant with the management ideas of port operations setting and this has caused another set of challenges manifesting into unproductive and inefficiency of Nigerian port system (Ndikom, 2012).

2. LITERATURE AND EMPIRICAL CLARIFICATION

Kenedy, Lin, Yang & Ruth (2011) carried out a study on sea port operational efficiency, the study used stochastic frontier analysis model and structural equation model to assess operational performance of five (5) Asian ports. The study shows that, there is a need to improve the operations of the seaport and indicated the critical factors affecting the operations of the port. Oghojafor, Kuye & Alaneme (2012) used secondary data obtained from NPA to study all ports in Nigeria before the concession programme of year 2006.Interview questions and media reports were used as an instrument for the study using the content analysis. The outcome of the study revealed that, the concession programmes have generated more revenue for stakeholders but the port is lack infrastructure to operate efficiently.

Akinwale & Aremo (2010) examined the management crises under concession programme in all ports in Nigeria, using content analysis archives to boost and address the socio-economic development and the port performance of Nigerian port respectively. The study concluded that until the Nigeria government introduces people-friendly innovative idea, the crises of Nigerian ports will still continue. Oyatoye, Adebiyi, Okoye & Amole (2011) carried out a study on congestion challenges in Nigerian ports by application of the queue theory. The paper aimed at significance of queuing theory to the port congestion challenges used queue modelling to measure the arrival rate and provide solution to the causes of the congestion in Tin-can Lagos port. Information gathered was analysed through content analysis to identify critical factors causing congestion in the port. The result study shows that, there is adequacy of berths in Nigerian ports for the intensity vessels traffic.

Okeudo (2013) studied an impact of port performance reform on Onne and River ports. The study used cargo traffic, turn round time of vessels and number of berths Occupancy as secondary data obtained from NPA between 2001 and 2010. The finding used the reforms and sample t-test to check the difference between the variables tested. The t-test of the findings shows an improvement rate in vessels calling at the ports, promoting the cargo traffic, meaning that the port is operating efficiently and effectively. The study recommend that, an effective intermodal transport should be introduced.

Ndikom (2013) studied the factors and effects of delay on productivity of ports in Nigeria, using regression analysis. The study identified delay causative factors and their negative impact on Nigerian port. The result of the study shows that poor planning, inconsistency policy and inadequacy facilities respectively impacted the ports negatively impact respectively while other factors

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have little positive impact on the ports productivity. Emighara & Ndikom (2012) carried out a study on Delay Factors evaluation of Nigerian seaports using Apapa port complex. The study identified different delay causative factor using primary data through which each respondents were asked to rank delay causative factors accordingly. Multiple Regression Analysis were used on annual rankings of the causative factors and used to formulate the forecasting equation model.

Somuyiwa & Dosumu (2008) used qualitative and quantitative approach to study logistic infrastructure and port development at Apapa port, proposed the logistic infrastructural at which port congestion could be dwindled. The study recommended that, use of private finance initiative will promote inter-modality and increase the services range to prospective customers, promote the effectiveness and compatibilities advantageous of distinct business.

3. RESEARCH METHOD

3.1. Study Area

Apapa port is the largest seaport and headquarters of Nigerian Ports Authority (NPA) serving as gateway to the Nigeria economy. The port, characterized with 9.0 depth and quay length of 2459m, predominantly handles wheat and bulk cement with up to 90,000 tons silo storage capacity. Apapa port provide over 500m multi-purpose berths for husbanding vessels traffic and quay handling passengers' traffic for ferry services and a terminal that can store up to 100,000 tons of product in automated storage tanks. The port is made up of Apapa wharf extension, Bulk vegetable oil wharf, Atlas cove oil terminal, Ijora wharf, Fish wharf and Apapa petroleum wharves.

3.2. Definition of Variables used for the Study

Ship Traffic: This is the totality of the inward and outward traffic comprises of the import and export cargo and domestic incoming and outgoing cargo annually discharged in a port.

Berth Occupancy: This is a process of vessel having been allocated to a berth is process and arranged by the port Authority and Shipping Company to bring into particular berth for discharging of her cargo.

Ship Turnaround Time: This is a number of times a vessel calls at a particular ports within a specialized periods in a year.

Personnel Strength: This is the total number of officers and staffs working in Apapa port within a specific period in a year.

Revenue Generation: This is the total income in naira realized by the Apapa port complex within a period of one year.

3.3. Data Source

The secondary data was extracted from annual NPA Abstract books from 2003 to 2017 for Apapa port, Lagos complex. SFA model was used as technique through STATA version 11 software.

3.4. Model Formulation

Stochastic Frontier Analysis is a technique for determining efficiency level and the frontier level base on the efficiency of the frontier. This technique is first postulated by Aigner et al., (1977) use for calculating the level of efficiency and frontier in a given set of criteria.

Thus:

$$\mathbf{TE} = \frac{\mathbf{y_i}}{\mathbf{f\,(x_i,\beta)\exp\quad(v_i)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{1})$$

$$f_u\,(u) = \frac{1}{\sigma u} exp\{-\frac{u}{\sigma u}\}\ldots\ldots (2)$$

Where:

Y_1 = ship traffic (productivity output index)

X_1, X_2, X_3, and X_4 = Turnaround time, Berth occupancy, Personnel Strength and Revenue generated respectively.

4. RESULT

Stochastic Frontier Analysis only understand variables in log form, the collected raw data comprises of four (4) input variables and one (1) output variables were transformed into log form, between 2003 and 2017.

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4.1. Estimation of Operational performance of Selected Airports

Table 1 Productivity Function Result

Regression Analysis Sampling Result				
Root MSE	**0.1152**			
R^2	**0.9346**			
Adjusted R^2	**0.9084**			
Observations	**15**			
Index	Coef. of index S. Error	T-test	P > | t |	
Constant	**21.2115**	**1.3371**	**15.86**	**0.000**
Ln-Turnaround time	-0.2387711	0.1107727	-2.16	0.057
Ln-berth Occupancy	-0.1833036	0.2717965	-0.67	0.515
Ln-personnel strength	-0.5711339	0.0882668	-6.47	0.000
Ln-Revenue generation	0.0434156	0.0300851	1.44	0.180

Source: Author's Computation, (2021).

Table 1 shows the calculated production function of Apapa port for all the input variables used by the study. Regression result shows that, the association between the input index & output index. The coefficient of revenue generation shows a positive value of 0.0434156 with a standard error of 0.0300851 and correlated with the test value of 1.44.

4.2. Analysis of the Actual Productive Efficiency of the selected Airports using SFA

The function of SFA is the analysis of actual productivity function of any set of attribute against the required maximum set of the output. This paper considered the exponential distribution to calculate the production frontier.

Table 2: Estimated Stochastic Frontier Analysis Using Exponential Distribution Model

Index	**Coeff. of index**	**S.E**	**T-ratio**	**P>T**
Constant	21.56386	0.0000845	2.6e+05	0.0000
Ln TRT	-0.1862525	4.43e-06	-4.2e+04	0.0000
Ln BRTOC	-0.0704971	.0000198	-3568.31	0.0000
Ln PSNL	-.612126	2.22e-06	-2.8e+05	0.0000
Ln RVNG	0.0186446	6.68e-07	2.8e+04	0.000
Ln σ^2_v	-39.07278	438.5144	-0.09	0.929
Ln σ^2_u	-4.525587	0.5163978	-8.76	0.000
Sigma(σ_v)	3.28e-09	7.18e-07		
Sigma(σ_U)	0.1040594	0.026868		
Sigma $(\sigma)^2$	0.0108284	0.0055917		
Lamda (λ)	3.18e+07	0.026868		
Log K	18.9419			

***Note: TRT = Turnaround time, BRTOC = Berth Occupancy, PSNL = Personnel strength, RVNG = Revenue Generation.**

Source: Author's Computation, (2021).

4.3. Estimation of Operational Performance of Apapa port using SFA

The estimated SFA result of operational performance of Apapa seaport, Lagos complex from 2003 to 2017.

Table 3 SFA Estimated Efficiency score of Apapa port from 2003 to 2017

Years	Efficiency Scores	Ranking
2003	1	1
2004	1	1
2005	0.860919	8
2006	0.6927136	10
2007	0.9052154	4
2008	0.8455328	9
2009	0.9168597	3
2010	0.9044671	5
2011	1	1
2012	0.7832143	9
2013	1	1
2014	1	1
2015	0.9421111	2
2016	0.8851854	6
2017	0.8491858	7
Average score	0.905694	

Source: Author's Computation, (2020).

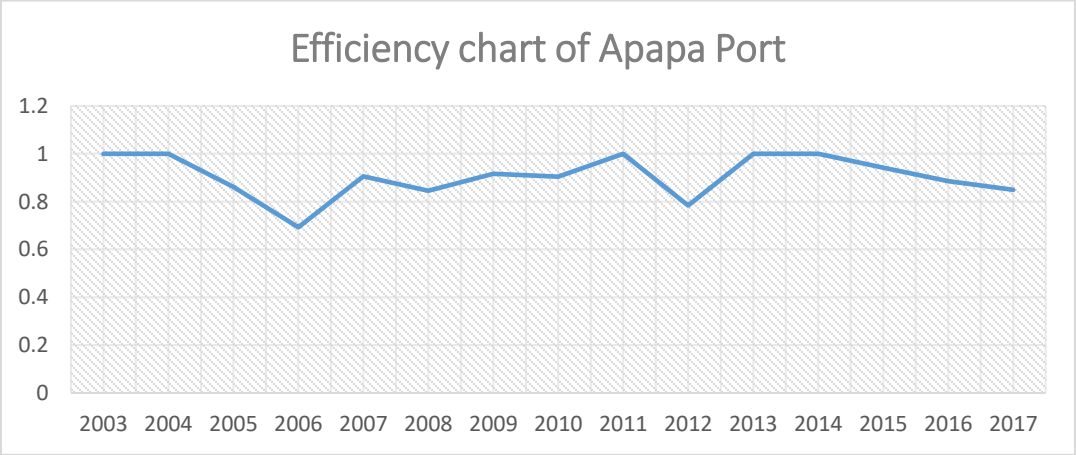

Figure 1 Efficiency Graph of Apapa Port, Lagos complex.

The table 3 shows that Apapa seaport is productive and efficient with an efficiency score level of 1 or 100% in year 2003, 2004, 2011, 2013 and 2014 respectively, meaning that the input variables are accurate for the set of output variables produced in these years respectively. The seaport could be said to be efficient and productive if the efficiency score level is equal to 1 or 100%only. It is important to state that, for any seaport to operate below efficient score of 1 (100%), the port will be term as an inefficient and unproductive.

Table 4: Result of Hypothesis Experiment

Hypothesis	t-test	P-value	Result
H_{01}: There is no a significant relationship between ship traffic and Turnaround time of vessels.	-2.160	0.057	**Accept Ho**
H_{02}: There is no a significant relationship between ship traffic and berth occupancy	-0.670	0.515	**Accept Ho**
H_{03}: There is no a significant relation between ship traffic and personnel strength.	-6.470	0.000	**Reject Ho**

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Ho4: There is no a significant association between ship throughput and revenue generation	1.44	0.180	**Reject Ho**

Source: Author's Computation, (2021).

4.4. Conclusion on Hypothesis Test

Decision rule: - State that if p-vale ≤ α (0.05), the reject Ho.

Hypothesis Testing Analysis 1:

H_{o1}: There is no a significant relationship between ship traffic and turnaround time of vessels.

Table 4 shows that the p-value calculated is 0.057, greater than tabulate value which is 0.05. Meaning that there is no statistical relationship between ship traffic and turnaround time of vessels. This study therefore, **accept** the **Ho** and **reject** the**H_1**.Therefore, the higher the ship traffic the lower the turnaround time of the vessels in Apapa seaport.

5. CONCLUSION

The study concluded that the operational performance of Apapa seaport as estimated by SFA model shows that, Apapa port is productive under the efficient score level of 100% in year 2003, 2004, 2011, 2013 and 2014 of respectively. The best operational performance of any seaport can be traced to its production and efficiency and this can be measured when a seaport husbanded a vessel with minimum turnaround time while cargo experience just-in-time delivery and operations cost are competitively reduce. Turnaround time, berth occupancy, personnel strength and revenue generation are factors that influences efficiency level. The mean operational performance of Apapa seaport for this study were measured at 0.905694 efficiency level, implicating that Apapa seaport were operating at 0.094306 inefficiency from 2003 to 2017. The study recommended that Apapa port can improve her level of technical efficiency through adequate financing and furnishing with infrastructure and superstructure include ground handling instrument and by encouraging the private initiative and improving their revenue generation and the input variables as well.

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Conflict of Interest

The author declares that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Akinwale A, A., & Aremo M, O (2010). Concession as a Catalyst for Crises Management in Nigerian Ports. *The African Symposium: An Online Journal of the African Educational Research Network,* 10(2). 323-342.
2. Dutra, A., Ripoll-Feliu, V.M., Fillol, Ensslin, A.G., S.R. & Ensslin, L. 2015. The construction of knowledge from the scientific literature about the theme seaport performance evaluation. International Journal of Productivity and Performance Management 64 (2): 243–269.
3. Emighara G., C & Ndikom B., C., O (2012). Delay Factors evaluation of Nigerian seaports Using Apapa port Complex as a Case Study. *Journal of Physical Science*, 3(2), 97-106
4. NPA Statistics, (2012). Nigeria Port Authority Abstract book, 2012.
5. Ndikom B., C., O (2013). A Critical Assessment of Delay Factors and Effects on Productivity in Nigerian Ports Authority: A Case Study of Rivers Ports Complex. *Green Journal of Business and Management Studies*, 3(2), 78-90.
6. Ndikom, O., B (2012). The fundamentals of freight forwarding management and practice in Nigeria.
7. Oghojafor B. E. A, Kuye O. L, & Alaneme G. C (2012). Concession as a Strategic Tool for Ports Efficiency: An Assessment of the Nigerian Ports. *American Journal of Business and Management 1(4), 214-222.*
8. Onwuegbuchunam, D., E. (2013). Port Selection Criteria by Shippers in Nigeria: A Discrete Choice Analysis. *International Journal of Shipping and Transport Logistics*, 5(4/5), 532-550.
9. Okeudo, G.,N (2013). Effect of Port Reform on Cargo Throughput Level at Onne Seaport Nigeria. A Comparative Study Before and After Reform Policy Implementation, *Journal of Business and Management*, 12(1), 7I-78.

10. Oyatoye, E, O., Adebiyi, SO., Okoye, JC & Amole, B., B (2011). Application of Queuing Theory to Port Congestion Problem in Nigeria. *European Journal of Business and Management*, 3(8), 1-14.
11. Somuyiwa A., O & Dosumu V.A (2008). Logistic Infrastructure and Port Development at Apapa Port, Nigeria, *Pakistan Journal of Social Science*, 5(9), 953-959.
12. Tanaka, L. (2010). Entrepreneurship Orientation and Business Performance of Small and Medium Scale Enterprises of Hambantota District Sri Lanka, *Asian Social Science Journal*, 6(3).
13. Kenedy, R, O., Lin, K., Yang, H & Ruth, B (2011). Sea-Port Operational Efficiency: An Evaluation of Five Asian Ports Using Stochastic Frontier Production Function Model, *Journal of Service Science and Management*, 4, 391-399.

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