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PERFORMANCE APPRAISAL OF NIGERIAN AIRPORTS: STOCHASTIC FRONTIER ANALYSIS

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Abstract:
This paper analyses productive efficiency of Nigerian airports to determine which of these airports are operating efficiently and they will be ranked using their performance outcomes between 2005 – 2015 as the bases for this ranking , a panel data sourced from the Federal Airport Authority of Nigeria (FAAN) is used for the analysis. Efficiency frontier was then calculated to determine movements of passenger, cargo and aircraft, using a parametric model known as Stochastic Frontier (SF). Results revealed that among the four airports assessed in this study, Muritala Mohammed International Airport was the most efficient, with a score of 71%. In second position, was Malam Aminu Kano International Airport with an efficiency score of 63%.While, Namndi Azikiwe International Airport scored 60% at third position. In fourth position is the Port Harcourt International Airport with the score of 59%. Thus, only one airport "PHC DOM" was operating at the efficient level throughout the year 2007. However, the average score for Nigerian airport's efficiency is 64%, which suggests that there is a room for an increase in the efficiency level at these airports by 36%. This can be achieved by designing common policies for resources procurement and utilization, including, sharing of the best practice. Policy implications are derived.

Key words:
Nigerian Airports, productive efficiency, Stochastic Frontier model

INTRODUCTION

Modern days' service industry is increasingly complex operations, demanding excellence across a wider and diverse set of competences, including the management of various stakeholders in the transportation sector [1] . Growing service expectations from the passengers, airlines and the official-imposed restrictions on aircraft charges; with the statutory requirement to satisfy a national or regional development role mean that airports are constantly pushed to improve performance, service quality, and grow passenger numbers [2, 6]. The ability to focus operational costs and investments on the core competence areas "heterogeneous resources" that matter most is vital in meeting these contemporary challenges. It is only the activities representing important capabilities that differentiate an airport, give it exclusive and maintainable competitive advantage in its market that should merit serious consideration and review in-line with the service users' and regulatory body demands. After all, these actions allow the airport to deliver its exclusive value proposition [3, 4] . By contrast, any capability that is essential in keeping the airport running, but make no difference to the carriers or travelers charges', must be also considered to improve performance and efficiency level for a better service experience. Activities and capabilities that add no value to the airport operation should be cut back or eliminates to keep the cost of operation lower. Airport assessment can be a valuable and effective tool in the quest for improving and sustaining efficiency level [5, 24].

1 CHAPTER 1

Most Nigerian airports are publicly owned and operate facilities by the government, due to their key roles and relative importance in transporting passengers and goods within the country. However, in the last decade, the nation has witnessed incremental privatization of airports through public-private partnership and concessionaire agreement, to encourage healthy competitions within the industry and reduce financial dependency of the government. This relative importance to the transport industry is constructed in the usually poorly maintained roads, in Nigeria are known for these road's damage quickly due to heavy rain fall and extreme hot weather [1]. Moreover, with some of these airports located far away from the main cites, there is a cultural tendency of allowing certain practice to continue without any control, these airports are old and with some form of deterioration that needs attention. Since the country does not budget enough for their transportation ministries, it is difficult to improve these airport's condition, which would turn them into capital-intensive facilities, labor intensity prevails [7,15]. Airport's manager and staff operating throughout the country tend to adopt a common practice of rent seeking, leaving things that should be done immediately to stop further damages undone, because of poor organisation orientation. Therefore, when an issue comes up, they tend to resolve it proactively using their own orthodox means. This culture/tradition is widely spread in the country airports and very few of them can resist this aged long practice within the industry [8, 1].

Given the relative importance of labor to the shortcoming of capital, management practices may differ from one airport to another, this can be heavily influenced by contextual variables. Scattering in the efficiency scores, are the result of distinct management practices and their cross effects of contextual variables, this can create what is known as "unobserved heterogeneity," which has been the motivation of several studies in the past years [9, 15, 23]. Heterogeneity is an important element for model misidentification that can lead to unreliable parameter assessment [10]. In the transportation industry, heterogeneity reflects the range and presence of superior productive factors, which are in limited supply, they are immobile factors, which cannot be extended. In most cases, these are quasi-fixed, whereby their supplies cannot be extended easily, moreover, these factors are scarce and inadequate to meet demand for their services. The focus on Nigerian airports provides fertile ground for insight into managerial capability and the heterogeneous resources in the nation efficiency initiatives, since these aspects fall within exogenous variables and physical resources, there are both labor and capital intensive [11]. In the meantime, previous studies at the national level have offered a strong underpinning and motivation behind this work [12,13,14].

1.1 Aim and objectives

The paper evaluates productive efficiency of selected airports, using a ten-year panel data from four airports between 2005 - 2015. Specific objectives in this research are.

- To estimate airports production capacity.
- To rank these airport‘s performances according to their productive efficiency.
- To determine sources of efficiency, change and factors responsible for them.
- To recommend possible ways for production improvement.

1.2 Study hypotheses

With fierce competition to increase movement of aircrafts, passengers, and cargoes in the industry, Nigerian airports not only use physical resources to achieve their goals, but then again trust on their managerial capabilities to deliver the organisation objectives. In fact, these factors are fully entrenched in the contextual variables "exogenous and heterogeneous" [15, 25]. Airport productions such as movement of aircraft, passengers, and cargoes, including the aspect of managerial capability and the likely impact of contextual variables on the efficiency levels can be determined using various hypotheses. The research hypotheses are presented as follows.

- **$H0_1$:** There is no statistical significant influence between terminal capacity, number of employees, total assets, and the total cost of passenger movement.
- **$H0_2$:** There is no statistical significant influence between terminal capacity, number of employees, total assets, and the total cost of aircraft movements.

2 LITERATURE SURVEY

Efficiency is defined as the ratio between outputs and inputs, as a distance between the quantity of input and output, and the quantity of input and output that defines a frontier, the best possible frontier for a firm in its cluster industry [16]. As [17, 25] noted several complex econometric methods were used in the last few decades for assessing airport efficiency, these studies have been conducted using two main models known as parametric and non-parametric. Non-parametric models "Data Envelopment Analysis (DEA)" were by [18] , who carried out an investigation into efficiency and productivity of twelve (12) Australian airports using both DEA and Malmquist TFP index for his analysis. [19] examined the efficiency of thirty-five (35) Brazilian airports and identified areas that needed improvement. [20] investigated the scale and technical efficiency of European airports using DEA method. [21] they used DEA in evaluating the allocative and technical efficiency of Portuguese airports. [23] studied the performance of selected United Kingdom airports, using DEA for their data analysis. While, [24] compared the surface measure of overall performance and used data envelopment analysis in examining the performance of Spanish airports. [11] study on scale efficiency measurement in DEA with interval data, using two-level programming approach, which shows that interval efficiency measures can alert decision-makers to the fact that the efficiency is not a fixed value. This will enhance airports' planning and decisions making, considering the uncertainty within the industry. In the research, two examples with interval data, one hypothetical and one real, assist in explaining the proposed method and the properties as a result.[12] conducted a study into Nigerian airports' productive efficiency, using Fuzzy-DEA. In their study, Fuzzy DEA was used to study the performance of airports' productive efficiency. Their result shows that fewer significant contextual variables are identified as efficiency drivers. When controlling for fuzziness and randomness, capacity cost was found to be the only significant variable, in addition to a learning component represented by trend.

[14] benchmarked North American airports, by comparing the results of Productivity Index, using DEA and SFA. In their study, they examine the efficiency performances of sixty-two (62) Canadian and U.S. airports. Unlike most previous studies, this study includes aeronautical and non-aeronautical outputs of airports as they are inexplicably tied to each other in airport production. The empirical results revealed that the efficiency scored and rankings measured by these alternative methods are quite like each other in the top fifteen (15) and bottom Fifteen (15) ranked airports, whereas, are considerable differences between airports in the middle range. From their analysis, they found out that the percentage of non-aeronautical revenue, passenger volume, average aircraft size. Percentages of international and connecting traffic significantly affect our airport efficiency estimates in all the three alternative approaches used. Airport assessment compares performance or capacity against the industry standard, using different industry indicators and analytical tools [10, 21]. Thus, it is a relatively new practice that was developed a few decades ago to assist airports react and sustain competition and standard within the industry [11]. Airport assessment is used to identify areas of improvement, as many service users are concerned with the quality of service at the airport, in terms of value for money, the evolution of communication technology has changed the way customers recieved service information globally. Therefore, strategic benchmarking of airport can be used as a catalyst for change and ethical growth, which brings a better customer experience and long-term sector sustainability [8].

2.1 Theoretical model: RBV

The study conceptual framework is adapted from Resource-Based View (RBV), based on resource management. The model aims to create holistic resources management that is detailed and fit for purpose in understanding production within the airport context. The concept suggests that "the possession of strategic resources provides an organisation with a wonderful opportunity to develop competitive advantages over its rivals"[27]. The general assumption is that the underlying productions are heterogeneous across organisations. Organisations in possession of these unique resources can produce more and meet service users' demand effectively than those without. In practice, heterogeneity means that organisations with different capabilities can compete, break-even and achieve more in the marketplace. While those without can only expect to break-even only, but those with higher resources can earn rents as well [27]. Heterogeneity in the service industry, reflects the presence of superior productive factors that are; valued, rare and inimitable (VRI), they are limited in supply and immobile, as it cannot be extended. In most cases, these are quasi-fixed, in the sense that their supply cannot be extended rapidly. These resources are known to be scarce and they are inadequate to meet demand on their services. For example, in the airport context, it can be longer / bigger runways that can accommodate fleets of larger aircraft, being the only airport in the country to possess this type of resource guarantees a competitive edge over others and this is known as a heterogeneous asset- valuable, rare, difficult to imitate or substitute. The resource-based theory regards organsiation as a bundle of resources and capabilities, it amplifies the link between organisation's internal characteristics such as resources and capabilities and its performance [27, 20]. Figure 1, illustrates RBV and link to the airport context.

Fig.1 *Resource Based View*
Source: [27]

In the above diagram, the resources needed to achieve competitive edge are physical asset and human intellectual capital. The physical asset can be purchased in the marketplace, while human intellectual capital cannot be bought, as they are exclusive and intrinsically related to the organisation managerial capability [27]. In this case, airports can gain competitive advantage if the present strategy adopts is value-creating [27], and this requires some level of managerial competency. In the service industry, benchmarking is used within and outside the organisation to explore the best practice that can add real value to the production and it is used for changing performance level, by comparing past and current activities with similar firms. In this case, the competitive frontier is anchored on the best practice: airport that accomplishes its production activity, with fewer amounts of resources invested is efficient [12, 21].

3 METHODOLOGICAL FRAMEWORK: SFM

A panel data sourced from the statistic department of the Federal Airport Authority of Nigeria (FAAN), was the preferred option for this research. The study covered ten years' period from 2005 to 2015, and the rationale behind the sample population. Selected areas of these airports were investigated, due to the complex nature of their characteristics and dimensions. Therefore, production frontier was tailored for two outputs (passenger and aircraft movement) and four outputs (terminal capacity, number of employees, total assets, and total cost). These variables were transformed into log form and then used for the analysis.

Tab. 1: *Names of Nigerian Airports and Abbreviations.*

Sn	Abbreviations	Names of Nigerian Airports
1	ABJ DOM	Nnamdi Azikiwe International airport Abuja –Domestic wing
2	ABJ INTL	Nnamdi Azikiwe International airport Abuja –International wing
3	KAN DOM	Mallam Aminu Kano International Airport- Domestic wing
4	KAN INTL	Mallam Aminu Kano International Airport- International wing
5	MMA DOM	Murtala Muhammad International Airport – Domestic wing
6	MMA INTL	Murtala Muhammad International Airport – International wing

7	PHC DOM	Port Harcourt International Airport- Domestic wing
8	PHC INTL	Port Harcourt International Airport- International wing

Source: [29] FAAN

SFA was used to determine the efficiency levels of various airports. [24] further explained that SFA framework was first developed by [22, 23] He explained that the stochastic frontier method postulated that producers/firms on a norm fail to achieve the production frontier. This is since inefficiencies is in existence and cannot be explained by measurable variables. Therefore, a one-sided error with the traditional symmetric noise term is integrated with the model to capture inefficiencies that cannot be clearly explained. The SFA measures the difference between the inefficient units and the frontier by the residual which is assumed to have two components; noise and inefficiency that can be calculated with econometric tools. The SFA was used to analyze the productive efficiency of selected airports in Nigeria.

3.1. Model formulation

$$yit = xit\beta + eit \quad (1)$$

$$eit = vit - uit \quad (2)$$

Where yit is the output of the airport i in period t, xit Is the input vector of the same airport in the same period. The error term is defined by eit and is comprised of two elements; the inefficiency of the airport uit and errors arising from statistical noise, measurement mistakes and factors which are uncontrollable vit [28]. Further explaining the stochastic frontier problem, supposing the production function within a firm is to be determined, in an ideal world where there is no error or inefficiency, the firm would produce;

$$yi = f(xi, \beta) \quad (3)$$

But stochastic frontier analysis assumes that each firm under produces because of certain levels of inefficiency, thus

$$yi = f(xi, \beta)\varepsilon i \quad (4)$$

Where ei the efficiency level for the firm and must be in the interval (0-1). When ei=1, the firm is producing optimally. When it is <1, the firm is not making most use of its inputs given the current level of technology within the firm is considered as the production function. Outputs are always assumed to be positive, i.e. $yi > 0$ so also the degree of technical efficiency is assumed to be positive i.e.$ei > 0$. Output is also subjected to random shocks hence,

$$yi = f(xi, \beta)ei \, \exp vi \quad (5)$$

Taking the natural log of both sides;

$$ln(yi) = ln\{f(xi, \beta) + ln(ei) + vi\} \quad (6)$$

If there are *n* inputs with a linear production function in logs, we define $ui = -ln(ei)$ and this will yield;

$$ln(yi) = \beta o + \sum_{j=1}^{n} \beta j \; ln(xij) + vi - ui \quad (7)$$

Since ui was subtracted from $ln(ei)$, $ui > 0$ which supports the statement earlier stated that $0 < ei \leq 1$.

Productivity output indexes used in this study are;
Y_1=Passenger movement
Y_2= Aircraft movement

Productivity input indexes used are; X_1 = Terminal capacity
X_2 = Number of employees
X_3 = Total asset
X4 = Total cost

These parameters will be used alternatively in the equations stated above to get the efficiency levels for the various specifications required.

4 ANALYSIS AND DISCUSSION OF FINDINGS

The input and output variables used for the study are described as shown in the table below. This summary is presented in the natural log forms (In) of the actual values used for simplicity and compatibility with the software used to run the analysis.

Tab. 2: *Data analysis summary*

Ln Variable	Description	Mean	Standard deviation	Minimum	Maximum
Ln Y_1	Log of Passenger movement	13.09716	1.985618	0	15.29467
Ln Y_2	Log of Aircraft movement	9.092736	1.683511	0	11.31056
Ln X_1	Log of Terminal Capacity	6.471566	0.765687	4.997212	8.209308
Ln X_2	Log of Number of Employees	6.385074	0.539375	5.347108	7.265453
Ln X_3	Log of Total Asset	22.68452	1.725496	17.50109	25.73488
Ln X_4	Log of Total Cost	20.11723	1.640357	16.65485	23.79226

Source: Fieldwork

4.1. Productive efficiency estimation

To estimate the actual productivity level of airports against the required maximum output/frontier. This could be done by using either the half normal, exponential, or truncated distribution since our data is not assumed to be distributed normally. We adopt just the half normal and exponential distribution as our basis for SFA. The table below presents the results gotten from the stochastic frontier using both the half normal and exponential distributions for the production function frontier.

Tab. 3: *Estimated SFA functions*

Estimation of production function – SFA						
	Half Normal Model			**Exponential Model**		
Estimates	**Coefficient**	**Standard error**	**T ratio**	**Coefficient**	**Standard error**	**T ratio**
Constant	-2.32977	1.41013	-1255.57	-0.51492	1.454551	-1.67
Terminal capacity	-0.19688	0.077832	-6000.93	-0.30741	0.135793	-2.245
Employee	1.227939	0.201104	18502.6	1.917255	0.370208	5.17
Total asset	0.1766	0.060089	11000.94	0.2013	0.107879	1.89
Total cost	0.096931	0.054322	16998.91	-0.1597	0.107466	-1.47
Σ	1.9360135	0.279459		0.98059	0.15335	
σ_u	0.8535299	0.577366		0.358637	0.305655	
σ_v	0.508449	0.036749		0.888653	0.111032	
Λ	13150000	0.582784		0.448229	0.391303	
Log L	-130.127			-135.832		

Source: Fieldwork

$$ln(yi) = \beta o + \sum_{t=1}^{n} \beta t \ ln(xit) + vi - ui \quad (8)$$

The output obtained from the frontier includes estimates of the coefficients of the explanatory variables, which show the corresponding level change associated with the dependent variable. In the case of employees, for every 1% increase in output, there is a corresponding 1.23 increase in number of employees. Total asset and total cost record changes of 0.18 and 0.096 respectively while terminal capacity records the change of 0.19 for the half normal distribution and corresponding values for the exponential distribution. The standard deviations of both error components are shown by σ_u =0.85 and σ_v=0.51 for the half normal distribution and the respective values for the exponential distribution as shown in the table. σ_u= standard deviation of the error component inefficiency, σ_v = standard deviation of the error component random noise. Total error is also estimated and represented by σ, $\sigma = (\sigma^2_u + \sigma^2_v)^{1/2}$. The ratio of the standard deviation of the inefficiency component to the standard deviation of the random component i.e. $\lambda = \frac{\sigma u}{\sigma v}$ are 0.1315 and 0.448 for half normal and exponential models respectively. Maximum likelihood estimators are obtained from the frontier output and these estimators help to simplify the estimate manipulations of the log likelihood and its derivatives. Log R represents the log likelihood ratio =-130.127 & -135.832 for the half normal and exponential models respectively, which determines the presence of inefficiency in the models. The corresponding standard errors and on t-ratios are also shown in the table. With the assistance of this table, values are substituted into the main equation to explain the actual productive efficiency.

4.2. Efficiency scores analysis

The efficiency levels of the airports are estimated in table 4. Since the data was transformed into log form, the efficiency level is measured in percentage. From the SFA estimate gotten, the inefficiency of each airport predicted, this is the measure of the shortfall of airport from the frontier. Corresponding efficiency scores are then calculated by removing the inefficiency score from the frontier i.e. 100%. If the observation equals 100%, in the frontier i.e. the ideal production rate/function, the airport is productive and efficient. But if it is below

100% it is inefficient. After getting the efficiency estimates of the airports given the combination of the present level of output and input, efficiency scores are predicted by returning a value between 0-1 as efficiency score. For a stochastic frontier analysis, if the efficiency level =1 means the airport is producing at an efficient level while if the efficiency level is <1 shows that the airport is not producing the efficient level (inefficient).

The table 4 below shows the efficiency score estimates of all the airports for the study period. Airports with estimates <1 can improve their productive efficiency by increasing the input variables or a combination of these variables to yield a better output. It has been observed that only PHC DOM operated at an efficient level in 2007. Asides this airport for that year, all other airports are observed to be operating at inefficient levels. It shows that the four airports studied need to improve their input to increase the technical efficiency of the airports. Privatizing can achieve this some of the airports to have a good output or by other means of improvement. This can further be done for all airports and the efficiency level for each will now be increased and so also a corresponding increase in productive efficiency.

$$TEi = \frac{Yi\ (\,actual\ output)}{f(Xi;\beta)\ (frontier)} \tag{9}$$

$$\exp TEi = \frac{\exp(\beta 0+\beta t(lnX1it)+\beta t(lnX2it)+\beta t(lnX3it)+\beta t(lnX4it)+\ Vi+Ui}{\exp(\beta 0+\beta t(lnX1it)+\beta t(lnX2it)+\beta t(lnX3it)+\beta t(lnX4it)+\ Vi} \tag{10}$$

Tab. 4: *Airport efficiency score estimate*

Years	**Airports**	**Abj**	**Kano**	**MMA**	**PHC**
2005	DOM	0.763533	0.630423	0.737574	0.822178
	INT'L	0.273993	0.616282	0.701359	0.752255
2006	DOM	0.799596	0.608852	0.731295	0.677239
	INT'L	0.32125	0.617943	0.635496	0.677239
2007	DOM	0.754548	0.638928	0.729218	1
	INT'L	0.202918	0.629651	0.732983	0
2008	DOM	0.773038	0.651623	0.743404	0.245541
	INT'L	0.283526	0.597899	0.73573	0.245541
2009	DOM	0.786213	0.659588	0.759328	0.835785
	INT'L	0.362774	0.551633	0.734371	0.622111
2010	DOM	0.796881	0.749935	0.772496	0.247825
	INT'L	0.47407	0.570153	0.739057	0.247825
2011	DOM	0.795757	0.756433	0.770105	0.833178
	INT'L	0.462339	0.589573	0.738258	0.685799
2012	DOM	0.772327	0.724251	0.765332	0.730034
	INT'L	0.490142	0.553601	0.745572	0.730034
2013	DOM	0.788931	0.738331	0.762352	0.83434
	INT'L	0.618638	0.541415	0.756153	0.197099
2014	DOM	0.773006	0.701671	0.761272	0.780111
	INT'L	0.531513	0.587792	0.753293	0.780111
2015	DOM	0.76435	0.535312	0.757258	0.849642
	INT'L	0.573819	0.573838	0.154873	0.747917

Source: Fieldwork

The mean technical efficiency score was 64% ranging between 0 and 1%. There is a great prospect for the improvement of technical efficiency of these airports in that it is feasible to increase production by 36% from the existing level of technology and input use.

Tab. 5: *Overall efficiency estimate*

	ABJ	KANO	MMA	PHC	OVERALL
MEAN	0.598325	0.628415	0.714399	0.587596	0.639169
MIN	0.202918	0.535312	0.154873	0	0
MAX	0.799596	0.756433	0.772496	1	1

Source: Fieldwork

4.3. Airports ranking

With the efficiency scores obtained for each airport as shown in the table 4. a graph showing the efficiency levels for the airports at their corresponding years is seen in fig 1. The higher the bar on the graph, the higher the efficiency of the airport and the more productive that airport is. From the chart, airports with lower bars can be said to be performing at a less efficient level than those with higher bars. The graph can also be used to compare the performance of the airports for each year. The blue bars represent Abuja airport, red bar represents Kano airport, green for Lagos and purple for Port Harcourt airports respectively.

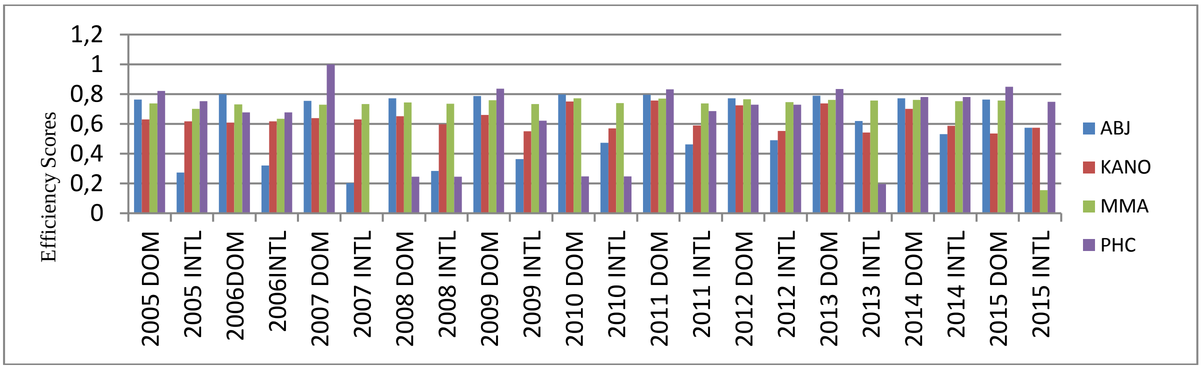

Fig 1. *Airports Efficiency Scores*
Source: Fieldwork

To further rank these airports in order of their productivity, an average was taken for each airport for the study period. The airport with the highest efficiency was determined and is said to be the most efficient airport in the group while that with the lowest efficiency score is said to be the least efficient airport. This is illustrated using table 6 and fig 2 below.

Tab. 6: *Airport ranking:*

Airports	Efficiency	Rank
ABUJA	0.598325	3
KANO	0.628415	2
MMA	0.714399	1
PHC	0.587596	4

Source: Fieldwork

MMA, has the highest efficiency score for the given years at 0.714399 or 71% and can be said to be the most efficient airport in the group, this is closely follow by Kano airport with an efficiency score of 0.628415 or 63%, next is Abuja airport with 0.598325 or 60% and finally PHC with a score of 0.587596 or 59%.

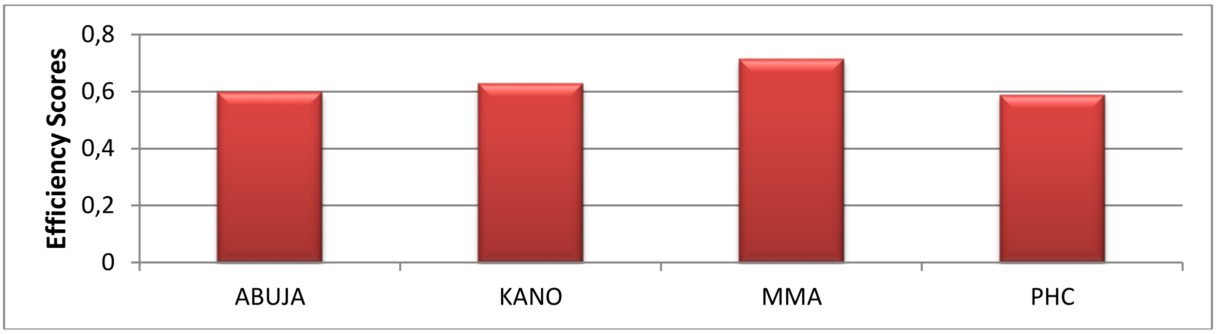

Fig 2. *Airports Ranking:*
Source: Fieldwork 2017

4.4. Hypotheses testing in Nigerian airports

For the hypothesis test, Wald test was used which is a parametric test used in SFA to determine if the parameters used are significant on the dependent variable or not. If the p-value is <0.05, the null hypothesis is rejected, the alternative hypothesis is accepted.

H01: P-value = 0.00. Since the p value is less than 0.05, we discard the null hypothesis and acknowledge the alternative hypothesis that there is a statistical significant influence of terminal capacity, number of employees, total asset, and total cost on passenger movements.

H02: P-value = 0.00. Since the p value is less than 0.05, we discard the null hypothesis and acknowledge the alternative hypothesis that there is a statistical significant influence of terminal capacity, number of employees, total asset, and total cost on aircraft movements.

5 CONCLUSION AND RECOMMENDATIONS

This paper has analysed productive efficiency in Nigerian airports. The analysis was carried out using SFA Model, as it allows simultaneous measurement of heterogeneous contextual variables and their impact on the efficiency levels. The main implication is that a single guideline is needed for the Nigerian airports in the area of operation, for procurement and usage of resources. The study analysis confirms that Muritala Mohammed Airport (MMA) is the highest ranked airport with 0.714399 score and also the most efficient airport. In the second place is Malam Aminu Kano Airport with an efficiency score of 0.628415, While, Nnamdi Azikiwe Airport (NAA) came third with an efficiency score of 0.598325, In fourth position is the Port Harcourt Airport (PHC) with an efficiency score of 0.587596. The study findings also confirmed that PHC DOM was the only airport operating efficiently in the year 2007. However, combined efficiency score is 64% for these airports and this implies that there is still a room for improvement in an efficiency level by 36% at these airports.

Successfully meeting service expectations of air passengers, carriers and regulators, and other stakeholders — while optimizing heterogeneity factors and delivering a better service experience to an increasingly demanding users and governments alike; is not an easy task. A critical input should consider comparator and competitor airports in such a manner that it can offer useful views of efficiency opportunities at the national level. Therefore, developing a clear insight into airport's heterogeneous resources and managerial capabilities, can enhance performance and provides a focus for efficiency initiatives[15, 8]. By so doing, the airport operators throughout the country can operate sustainable, competitive, and profitable organisations that deliver on strategic goals.

In order to increase these airports efficiency FAAN authorities should develop common policies for procurement and consumption of physical resources in the operational areas of these airports. In effect, public policies regarding Nigerian airports ought to consider factors such as heterogeneity presence and managerial practices, they should be standardized across these airports. For instance, the regulators FAAN should develop policies based upon the airport characteristic, using scale size and concentrate on enhancing movement of cargo, aircraft and passenger.

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