



ASSESSMENT OF OPERATIONAL PERFORMANCE OF PUBLIC SECTOR FUNDED INFRASTRUCTURE IN NIGERIA: THE AIRPORTS PERSPECTIVE

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ABSTRACT

The study assessed the performance of public sector funded infrastructure in Nigeria, with a special focus on airports. It utilized secondary data obtained from the Federal Airports Authority of Nigeria (FAAN), the Nigerian Civil Aviation Authority (NCAA), and the National Bureau of Statistics (NBS) covering the period 2004 to 2016. A simple regression analyses of the data were carried out using total number of employees as the predictor variable and the total aircraft movement, total passenger movement, and total cargo movement as the dependent variables.



The results of the analyses show that the p values calculated were < 0.05 alpha value, implying existence of a statistical relationship among the dependent variables (aircraft movement, passenger throughput, and cargo throughput) and independent variable (number of employees). Furthermore, the time series graphs show fluctuations in growth of the outputs (passenger throughput, aircraft movement and cargo throughput) for the Nigerian air transport system at various periods. This study has shown that there is a need for the government and stakeholders to take immediate actions in tackling factors responsible for the decline and fluctuations in the air transport industry.

Keywords: air transport; passenger throughput; aircraft movement; operational performance; infrastructure

1. INTRODUCTION

“Measurement is the first step that leads to control and eventually to improvement. If you can’t measure something, you can’t understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it.”

- H. James Harrington

The transport sector is noted to be critical for development; transport investment promotes access and contributes to economic growth and quality of life, while inadequate transport sector performance constrains development, aggravates the conditions of the poor, harms the environment, ignores the changing needs of users and exceeds the capacity of public finances (WORLD BANK, 1996).

There are benefits derivable from adequate investment in the transport sector. For instance, WORLD BANK (1996) projected an economic rate of return of about 22% on transport projects upon completion, a lowered agricultural production costs due to increased access to markets and credit, an indirect facilitation of the development of the non-agricultural rural economy, increased labor market efficiency and access to amenities, as well as domestic and international trade through a more efficient movement of people and freight .

The importance of the transport sector to economic development is further noted by Owen (1987), who argues that mobility is about the most important contributor to economic and social progress because the other components of a satisfactory life (ranging from food and health to education and employment) rely on the availability of adequate means of movement of people, goods and ideas. This notion finds strong support in Easterly and Rebelo (1993), whose work established that investment in public infrastructure in transport has a significant and positive effect on economic growth.

There are also country specific studies, for instance, Dharmawan (2012), that highlight the relationship between provision of adequate (air) transport infrastructure and economic performance. A similar relationship between investment in transport infrastructure and economic growth is equally observed in Nigeria. For instance, the study by Bosede et al. (2013) concluded that investments in transport infrastructure contributed positively to growth, with a strong and statistically significant impact. The outcome of this study has necessitated arguments in favour of economic policies that would not only improve the transport infrastructure, but also increase the investments in the sector with a view to achieving a sustainable economic growth in Nigeria.

These possible benefits notwithstanding, it has been observed that the contribution of the transport sector to Nigeria's GDP has been dwindling. This is in spite of the enormous expenditure by the Government aimed at promoting viable sustainable transportation system. Consequently, studies, for instance by Anfofum et al. (2015), have recommended a proactive and dynamic cohesive transport policy that would be beneficial to all stakeholders as a solution.

Therefore, there is a need to periodically assess a nation's transport policy with a view to making it more efficient and effective. This entails an efficient use of the sector's resources as well as a proper maintenance of the assets, because "public transport systems that fall into disrepair because they are economically or financially unsustainable, fail to serve the needs of the poor, and often have environmentally damaging consequences" (World Bank, 1996).

A failure to periodically review a nation's transport policy framework leads to a possible stagnation in the expansion of transport physical infrastructure; because a

rapid growth in transport demand strains the transport capacity, leading to capacity crisis, increase in congestion, and other challenges (UGBOAJA, 2013). Based on the observations by Pabedinskaitė and Akstinaitė (2014), the development of a proactive and cohesive transport policy in Nigeria can best be achieved through an assessment of the operational efficiency and the quality of the services provided by the sectors and its sub-sectors.

Transport infrastructure connotes different things to different people. Consequently, this study adopts the description of transport infrastructure by Crockatt (2000) as encompassing air infrastructure among others, as well as the definition of air transport infrastructure as the facilities and oversight required to provide efficient and on-time air transport services to the public (JUAN, 1995).

The aviation industry has been chosen because of its strategic role in the attainment of sustainable development. It has been observed that improvement in the air transport infrastructure (encompassing airports and air-traffic management), lowers transport costs, supports rapid economic growth and increases personal mobility, thus plays a key role as a facilitator of, and good complement to policies aimed at improving living standards and poverty alleviation (OXFORD ECONOMIC FORECASTING, 2003).

Earlier studies, for instance by Ishutkina and Hansman (2008), found a positive relationship between air transport and economic development. Again, the study by Baltaci et al. (2015) supports the view of airline transport as being an important factor that positively affects economic growth such and that an economic growth could be achieved by increasing the number of active airports and traffic frequency.

It is within the above context that this paper attempts to assess the operational performance of airports in Nigeria. This, it is hoped, would lead to the (re) establishment of clearly defined responsibilities and objectives of the various stakeholders within the sector, improved control by administrators, management and regulators, a strategic alignment of objectives, as well as a better understanding of the business processes in the sector (KAYDOS, 1998).

2. LITERATURE REVIEW

In view of the level of competition in global business environment, there is a need for targeted cost-effective timely investment, as well as the development and implementation of policies that would lead to successful economic development (JUAN, 1995). To achieve this, management principles (e.g. total quality management) are used to assess operational performance, that would form the basis for the development of plan(s) capable of enhancing customer satisfaction through continuous improvements in quality of products, services and processes.

It has been proven that the adoption of these management philosophies or principles lead to improvements in various aspects of a business endeavor such as competitiveness, the ability to satisfy the requirements of customers, effectiveness, flexibility, and competitiveness of business organizations (OAKLAND, 1995; OAKLAND, 2003; TERZIOVSKI, 2006). The application of total quality management principles to services oriented organizations such as airports has been discussed in Bon and Mustafa (2013).

According to the United States Federal Aviation Administration, “an airport is defined in the law as any area of land or water used or intended for landing or takeoff of aircraft including appurtenant area used or intended for airport buildings, facilities, as well as rights of way together with the buildings and facilities.” An inference from Gillen and Lall (2001), is that an airport is a complex and highly sophisticated system, made up of an air system comprising of two major elements, the airside and landside.

The basic functions of an airport are to provide access for aircraft to the national airspace, permit easy interchange between aircrafts, and facilitate the consolidation of traffic. To effectively deliver these functions, an airport must have some basic infrastructure elements such as runway, taxiways, aprons (airside infrastructure) and airport ground resources for passengers or cargo. Airport infrastructure could be seen as an aggregate of different services (airside, landside, security and safety, as well as surface) offered in an airport (JUAN, 1995).

Airside services include the airfield, gates, jet-ways, all facilities associated with the movement of aircraft, as well as all facilities beyond the passenger security areas such as runways, taxiways, aprons whereas the landside services encompass

all facilities associated with the movement of passengers and baggage to or from aircraft, facilities devoted to service passengers into and inside the terminal areas such as passenger services, food and beverage concessions, duty free, car parking (JUAN, 1995; JUAN, 2001).

Furthermore, security and safety services include facilities that are associated with the provision of police, security, customs, immigration, fire and rescue, while surface access refers to road and rail (JUAN, 1995; JUAN, 2001). Among the concerns of airport industry is how these services are performed; as such, routine measurement of productivity becomes important.

Earlier studies established a positive relation between availability of infrastructure and level of economic performance. With specific reference to the transport sector, a study on the implication of improvement in transport infrastructure and economic growth by Bosede et al. (2013) recommended an increase in the budgetary allocation to the transport sector as a way of improving infrastructure availability. Hence, there is a need to ensure that allocated funds are judiciously spent.

Many studies (JARŽEMSKIENĖ, 2012; ZHANG et al., 2012; TSENG et al., 2008) have been carried out on the operational performance of airports with a view to assessing their efficiency, productivity, rate of development, as well as capacity utilization. For instance, a study by Pius et al. (2017a) assessed the operational performance of Murtala Muhammed International Airport (MMIA) terminal in Lagos and established a statistically significant relationship between aircraft movement and variables such as total cost, total assets, wages, and number of employees of the airport.

Another study by Wanke et al. (2016) on the productive efficiency of Nigerian airports using Fuzzy-DEA identified airport fixed costs (capacity cost) as an efficiency driver and suggested the adoption of an airport efficiency improvement policy based on keeping capacity (fixed) costs under control.

Airport performance assessment is carried out for reasons such as attraction of investments, reduction of operational cost, improvement of efficiency, monitoring of safety and environmental impact among others (DOGANIS, 2005). Most airports aim to maximize the movement of aircrafts, while increasing efficiency level in their

operations processes as a way of achieving sustainable competitive edge over their competitors in the sector.

Stephens and Ukpere (2011) note that air transport is relatively expensive when compared with other modes of transport like road, rail and water transportation, and competent and motivated human resources are needed for effective and efficient utilization of physical infrastructure within the airports. Therefore, the availability of human resources and its capabilities becomes crucial in any performance assessment.

To this end, some studies, for instance, Sutia et al. (2013) have been carried out to investigate the influence of investment in human capital on airport performance. The provision of airport infrastructure is capital intensive and requires long gestation periods to generate returns and breakeven.

Indeed, existing literature has suggested that airports that are effectively regulated and subjected to good performance controls would invariably have efficient terminals capable of earning higher profits and/or further investments (NWAOGBE et al., 2017a; OGWUDE et al., 2018; PIUS et al., 2017b; NWAOGBE et al., 2017b).

Infarct, a study by Ahmad and Schroeder (2003) empirically showed that as human resource management system deviates from the ideal-type human resource management system, the plant's performance decreases, and this relationship is statistically significant.

A study of the operational efficiency of major airports in the United States carried out by Sarkis (2000) was based on four resource input measures including airport operational costs, number of airport employees, gates and runways, and five output measures including operational revenue, passenger flow, commercial and general aviation movement, and total cargo transportation.

3. RESEARCH METHODOLOGY

3.1. Study Area

This study covers air transportation in Nigeria for both domestic travel and international travel. Nigeria is a country occupying 923,768.64 square Kilometres, situated on the West Coast of Africa and lies on latitudes 4° North of the Equator and latitudes 3° and 14° on the East of the Greenwich Meridian. It shares boundaries



with The Republics of Benin and Niger in the West, Cameroon in the East, Niger and Chad in the North and the Gulf of Guinea in the South (NIGERIAN NATIONAL PETROLEUM CORPORATION, 2016).

It has nine (9) international airports, the major ones being Murtala Muhammad Airport, Lagos, Nnamdi Azikwe Airport, Abuja and Malam Aminu Kano Airport, Kano. The Murtala Muhammed Airport is the hub and very busy, accounting for about 80% of the total air transportation operation services in Nigeria. The Federal Airport Authority, Nigeria Civil Aviation Authority and the Nigeria Airspace Management Agency, have more than 24 local airports, some international airports also function as local airport.

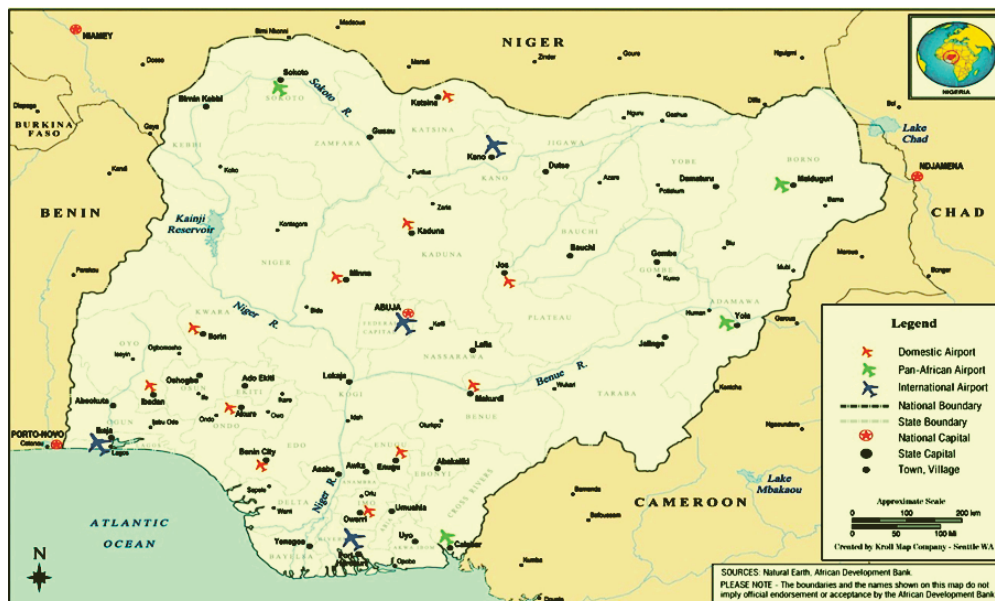


Figure 1: Map showing some airports in Nigeria

3.2. Formulation of Hypothesis

The following hypothesis are proposed to facilitate data collected to arrive at a specified conclusion, they are:

- **H₁**: There is a significant relationship between number of employee and aircraft throughput.
- **H₂**: There is a significant relationship between number of employee and passenger throughput.
- **H₃**: There is a significant relationship between number of employee and cargo throughput.

3.3. Choice of Method

A determination of whether there is a significant linear relationship between the specified independent variable X, and a dependent variable Y as indicated in the proposed hypothesis, would focus on the slope of a regression line. Thus the decision to use regression analysis for this study. In situations where there is only one independent or explanatory variable (as in this case), Salvatore and Reagle (2002), observe that a simple regression analysis is carried out. The suitability of regression analysis for this study is shown variously in Aczel and Sounderpandian (2009), Rencher (2003), Weiss (2012).

3.4. Source of Data and Analysis Software

This study utilised secondary data (2004-2016) from the Federal Airports Authority of Nigeria (FAAN), Nigerian Civil Aviation Authority (NCAA), and the National Bureau of Statistics (NBS). Statistical Package for the Social Sciences (SPSS) was used for the linear regression analysis, while Minitab Statistical Software was for was used for data presentation, graphical of time series. **Table 1** shows the data used in the analysis.

Table 1: Cumulative Data of Nigeria air transport operation Statistical Data

YEAR	TOTAL PASSENGER MOVEMENT (MILLION)	TOTAL CARGO MOVEMENT (KG)	TOTALNUMBER OF EMPLOYEES (THOUSAND)
2004	8,157,152	99,411,126	25,004
2005	8,310,515	77,286,904	24,689
2006	8,208,195	93,248,313	24,375
2007	8,409,944	94,523,909	23,246
2008	8,723,864	99,831,668	23,748
2009	12,526,464	166,782,990	23,432
2010	13,981,677	180,836,476	23,117
2011	14,889,820	175,809,524	22,803
2012	14,116,790	182,804,328	20,177
2013	15,274,833	198,443,781	21,321
2014	15,722,423	201,208,117	21,453
2015	15,092,478	211,324,605	22,112
2016	14,562,191	165,568,809	22,301

3.5. Development of Regression Model and Equation Introduction

The simple linear regression, is a type of regression in which a single numerical independent variable, X, is used to predict the numerical dependent variable Y. It is observed from sources such as (RENCHE, 2003; WEISS, 2012; ANDERSON et al., 2015; TABACHNICK; FIDELL, 2013; ACZEL; SOUNDERPANDIAN, 2009) that a general simple regression model, assuming a



linear relationship between the dependent variable and the independent variable, takes the form:

$$Y = \beta_0 + \beta_1 X_1 + \epsilon \quad (1)$$

Where,

Y is the dependent variable

X₁ is the independent variable or predictor

β₀ is the Y intercept

β₁ is the slope

ε (the error term) is a random variable

Berenson et al. (2012) note that the $Y = \beta_0 + \beta_1 X_1$ portion of a simple regression equation is a straight line, with the slope of the line (β_1), representing the expected change in *Y* per unit change in *X*, and the intercept (β_0), representing the mean value of *Y* when *X* equals 0. The overlying assumptions used here have been explained in great details (ANDERSON et al., 2015; KELLER, 2014; RENCHER, 2003).

The error term, ϵ , is assumed to be normally distributed with a mean of zero and standard deviation (σ) and is independent of the error terms associated with all other observations associated with all other observations. Again, the probability of the error distribution is normal, while the randomness in the dependent variable (*y*) comes from the error term (ϵ).

A total number of seven variables were selected and used for this study. The dependent (response) variables are total aircraft movement (TAM), total passenger movement (TPM), and total cargo movement (TCM), while the independent (predictor) variable is total number of employees (TNE).

The TAM describes the total number of aircraft arriving or departing the airports (including international and domestic traffic from both commercial and private airlines). An aircraft that arrives once and departs once is recorded as two movements.

The TPM is the number of passengers arriving or departing over a period of one year, excluding those passengers who are just transiting from the airport. A passenger that made a round trip journey is counted as two origination and Destination (O&D) passenger.

The TCM describes the annual record of cargo loaded or unloaded at the airport. The TNE is the total number of staff (strategic, tactical, and the operational level), working at the airport at a given time.

3.6. The Coefficient of Determination (r^2) and Adjusted Coefficient of Determination

According to Keller (2014), there are several models that can be used to assess regression models. This study shall use coefficient of determination (r^2), T-test and the F-test analyses shall be used as a measure of goodness of fit and significance. 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 (ACZEL; SOUNDERPANDIAN, 2009; SALVATORE; REAGLE, 2002). The coefficient of determination can be determined using equation (4) below (ACZEL; SOUNDERPANDIAN, 2009; NEWBOLD et al., 2013);

$$r^2 = \frac{\text{Regression Sum of Squares (RSS)}}{\text{Total sum of squares (TSS)}} \quad (2)$$

But,

$$SST = RSS + \text{Error Sum of Squares (ESS)} \quad (3)$$

Making RSS the subject in equation (3), substituting into equation (2) above and solving, we have;

$$r^2 = \frac{RSS}{TSS} = \frac{TSS - ESS}{TSS} = 1 - \frac{ESS}{TSS} \quad (4)$$

R-square always lies between 0 and 1, with literature suggesting that a value of r^2 close to 0 implies that the estimated regression equation explains none of the variation in Y, while an r^2 close to 1 implies that all points lie on the regression line (SALVATORE; REAGLE, 2002; ACZEL; SOUNDERPANDIAN, 2009; WEISS, 2012).

The coefficient of determination (r^2) measures the rate of variation in the dependent variable, explained by the independent variable. The coefficient has a result between zero and one (0 and 1), with a value of (1) demonstrating a great fit. The values are changed to percentage, to find out the strength of relationship compared with the significance level between the variables. The decision rule here

states that if $r^2 \geq 50\%$, the relationship is strong; But if $r^2 < 50\%$, then relationship is weak.

In order to establish if a significant relationship exists between the dependent variable and the independent variable(s), the F-test would be used to test for overall significance. Where an overall significance exists, a t-test, which tests for individual significance, would be used to ascertain if each of the individual independent variables is significant (ANDERSON et al., 2015; ACZEL; SOUNDERPANDIAN, 2009).

The implication of rejecting H_0 is that there is sufficient evidence, statistically, to conclude that one or more of the parameters is not equal to zero and that the overall relationship between the dependent variable and the independent variable is significant. However, if H_0 cannot be rejected, then there is no sufficient evidence to conclude that a significant relationship is present.

Recall from equation (1) above that the regression model proposed for this study is $y = \beta_0 + \beta_1 x_1$. Therefore, the hypotheses for the F-Test involve the parameters of the regression model, thus:

$$H_0 = \beta_0 = \beta_1 = 0 \tag{5}$$

The decision rule for F-Test for overall significance is to reject H_0 if $p\text{-value} \leq \alpha$ or $F \geq F_\alpha$. F_α is based on an F distribution having p degrees of freedom in the numerator and n-p-1 degrees of freedom in the denominator.

$$F = \frac{MSR}{MSE} \tag{6}$$

where MSR is mean square due to regression and MSE is mean square due to error.

Rejecting H_0 signifies that a sufficient statistical evidence to conclude that one or more of the parameters chosen is not equal to zero exists.

The decision rule for t-Test for individual significance is to reject H_0 : if $p\text{-value} \leq \alpha$; or $t \leq -t_{\alpha/2}$; or if $t \geq t_{\alpha/2}$.

There are however observations that the values of r-squared are affected by the inclusion of unnecessary independent variable. In this situation, it is recommended that a modified version of r-squared, the adjusted r-squared, which has been adjusted for the number of predictors in the model be used. The adjusted r-squared can only increase if the new term improves the model more than would be

expected by chance, and decreases when a predictor improves the model by less than expected by chance (MINITAB BLOG EDITOR, 2013)

4. DATA ANALYSIS AND DISCUSSION

4.1. Descriptive Statistics

Table 2 shows the descriptive statistics of the data used. The values of the mean and standard deviation show that the data are original.

Table 2: Descriptive statistics of the data

	TOTAL AIR MOVEMENT (THOUSAND)	TOTAL CARGO MOVEMENT (KILOGRAMS)	TOTAL NUMBER OF EMPLOYMENT (THOUSAND)	TOTAL PASSENGER MOVEMENT (MILLION)
Mean	224274.5385	149775426.9	22906	12152026.62
Median	225922	166782990	23117	13981677
Maximum	275827	211324605	25004	15722423
Minimum	177627	77286904	20177	8157152
Std. Dev.	33207.94558	48826191.47	1413.10415	3212267.529
Skewness	-0.058259227	-0.302168401	-0.28379064	-0.326573458
Kurtosis	1.581045181	1.421353454	2.29792036	1.269282607
Jarque-Bera	1.097963386	1.547730107	0.44149318	1.853574445
Probability	0.577537622	0.461226952	0.80191987	0.395823362
Sum	2915569	1947080550	297778	157976346
Sum Sq. Dev.	13233211799.23	28607963684695100.00	23962360.00	123823952136685.00
Observations	13	13	13	13

A preliminary analysis was carried out on the variables to test the pattern of distribution as well as conformity to the normality assumptions. This is because many statistical analyses (especially inferential analysis) require that a distribution be normal or nearly normal (BROWN, 2016; BROWN, 2011).

Table 2 shows that the skewness (S) values of total aircraft movement, total cargo movement, total number of employees, and total passenger movement range between -0.328 and -0.058. This result suggests that the data used are approximately symmetric around the mean because the values are between -0.5 and +0.5 (BULMER, 1979), and that distributions have long left tails because of the negative signs (IHS GLOBAL INC., 2015).

Again, the values of mean and median of the data confirms that the distributions are left-skewed, because the mean is usually less than the median in a skewed-left distribution (NEWBOLD et al., 2013). Furthermore, the Kurtosis (K) values for total aircraft movement, total cargo movement, total number of employees,

and total passenger movement range between 1.269 and 2.297, leading to the conclusion that the distributions are platykurtic as the kurtosis values are less than three ($K < 3$) (IHS GLOBAL INC., 2015; RENCHER, 2003).

The Jarque-Bera (JB) test was used to test the hypothesis that the samples are drawn from a normal distribution. The probabilities associated with the Jarque-Bera are all above 0.05 ($p > 0.05$). Therefore, we do not have enough statistical evidence to reject the null hypothesis that the data is normally distributed. Thus, we conclude that it is likely that the data follows a normal distribution.

4.2. Analysis of Aircraft Movement

Figure 2 shows the trend of aircraft movement between 2004 and 2016. It is observed that the Nigeria aviation industry has been facing challenges from years back following the continuous fluctuations as seen in the graph.

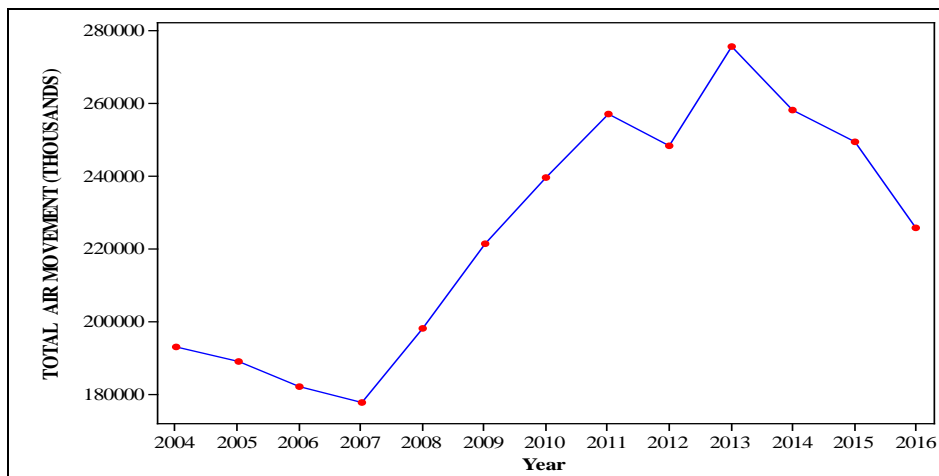


Figure 2: Aircraft Movement Between 2004 and 2016

The graph shows a steady decline in aircraft movement between 2004 and 2007. This decline in aircraft movement could be explained by the exit of Nigeria's carrier, the Nigeria Airways, from the market in 2004. The lowest dip occurred in 2007, which was the year that the concession of terminal two of the Murtala Mohammed Airport (MMA2) was granted to Bi-Courtney Aviation Service Limited (BASL) by the Government of the Federal Republic of Nigeria. An upward trend in aircraft movement is noticeable again between 2008 and 2011.

An explanation for this is that the concession of terminal two of the Murtala Mohammed Airport to Bi-Courtney Aviation Service Limited (BASL) boosted aircraft movement in the country. However, between year 2011 and 2012 there was also a slight decrease in aircraft movement, with a rebound again in 2013, which represents

the peak in aircraft movement. The decline from 2013 to 2016 is due to recession and inflation in the country.

In order to test H₁, which states that there is a significant relationship between number of employee and aircraft throughput, a simple regression analysis was used to test for the level of significance and correlation existing between the number of employees (the independent variable) and aircraft movement (the dependent variable). The scatterplot diagram (Figure 3) of variables shows negative association between total air movement and total number of passengers.

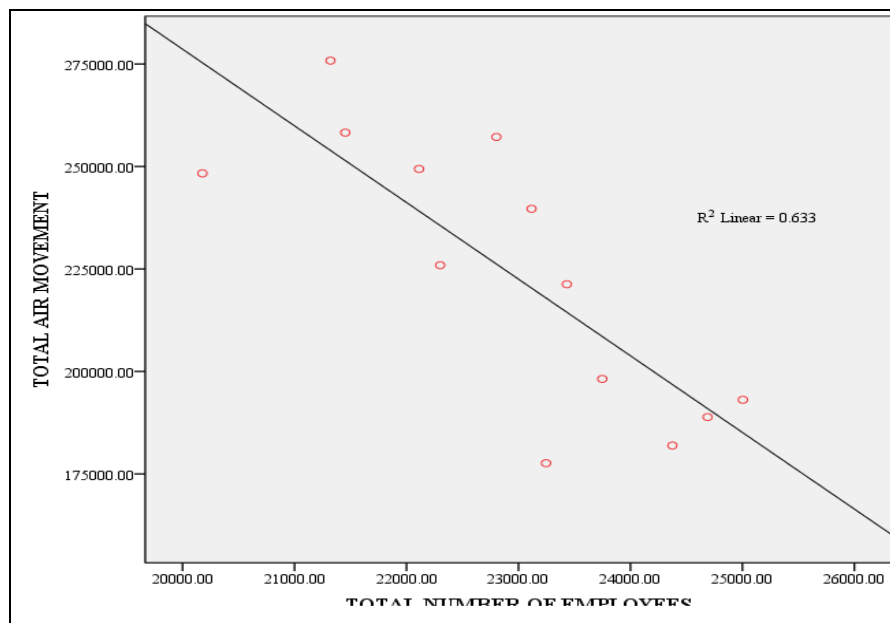


Figure 3: Scatter Plot of Total Air Movement Vs Total Number of Employees

The analysis of variance is shown in Table 3, while Table 4 contains the model summary.

From the result of the analysis of variance (ANOVA) presented in Table 4, the model significance is $F(1,11)=18.973, P = 0.001$. We can conclude that the regression model statistically significantly predicts the outcome variable as the sig. (-value) of 0.001 is less than alpha (0.05). We therefore accept the hypothesis that there is a significant relationship between the total number of employee and total aircraft movement.

Table 3: ANOVA^a Table

Source	DF	Sum of Squares	Mean Square	F	Sig.
Regression	1	8376648545/121	8376648545.121	18.973	0.001 ^b
Residual Error	11	4856563254.110	441505750.374		
Total	12	13233211799.231			

a. Dependent Variable: TOTAL AIRCRAFT MOVEMENT
 b. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES

From Table 3, Adjusted R Square value of 0.600 signifies the 60% of the variance in total aircraft throughput (response variable) can be explained by the number of employees (the predictor or explanatory variable). An R value of 0.796 indicates a high degree of correlation between the dependent variable (Y) and the independent variable or explanatory variable (X).

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.796 ^a	.633	.600	21012.03823

a. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES

Again, since we are able to get a significant value as the coefficient of the equation (β), it gives a relationship between the dependent and independent variables. This implies that the higher aircraft movement operations in terms of take-off and landing, the higher aircraft traffic services, thereby increases airport operational performance (PIUS et al., 2017).

Table 5: Regression Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	652546.467	98494.995		6.625	.000
	TOTAL NUMBER OF EMPLOYEES	-18.697	4.292	-.796	-4.356	.001

a. Dependent Variable: TOTAL AIRCRAFT MOVEMENT

From Table 5, we predict total aircraft movement from total number of employees as follows:

$$\text{Total aircraft movement} = 652546.467 - 18.697(\text{Total number of employees}) .$$

The negative 18.697 shows that for every variable of aircraft movement predicted there will be a negative increase in the number of employee by 18.697. The p-value (< 0.05) next to the total number of employee implies that this variable is significant in explaining total aircraft movement.

4.3. Analysis of Passenger Movement

Figure 4 is the time series graph of passenger throughput in Nigeria from 2004 to 2016, showing a distinct fluctuation in passenger throughput in the country. It could be seen from the graph that there was limited movement between 2004 and 2008, after which passenger throughput began to increase sharply from the year up to 2011 with a passenger throughput of 14,889,820.

This is perhaps as a result of the concession arrangement in some of the airports. Although there was a decline in 2012, another increase was seen immediately after this up to 2014, with up to 15,722,423 total number of passengers moved. There was another decline in passenger throughput up to 2016, perhaps, caused by the recession in the country, which affected various airline industries, and the impact of high exchange rate on the price of aviation fuel.

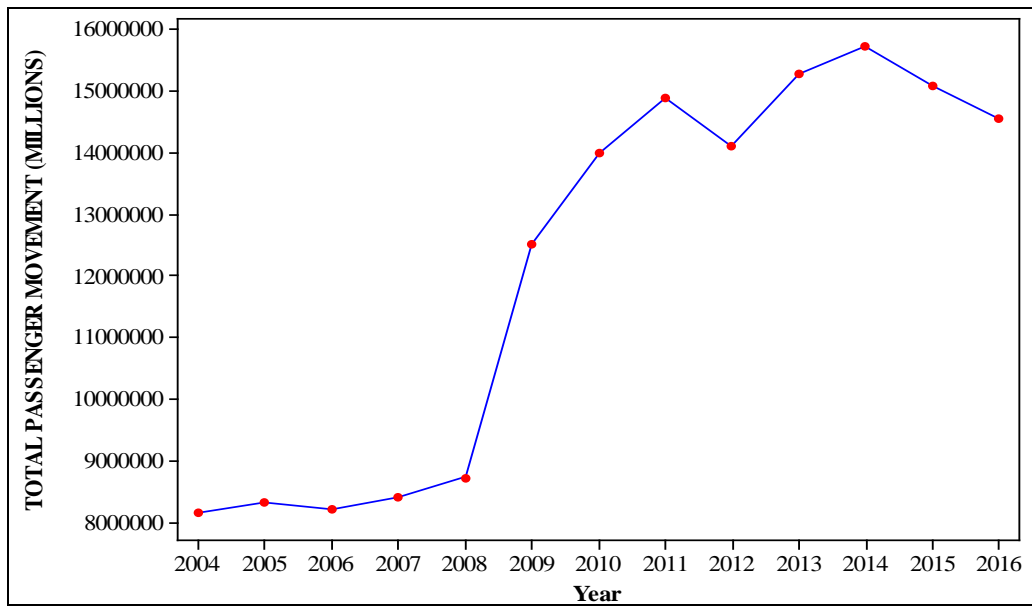


Figure 4: Passenger Throughput (2004 to 2016)

A scatter plot of total passenger movement and total number of employees (Figure 5) shows a negative association between the two variables.

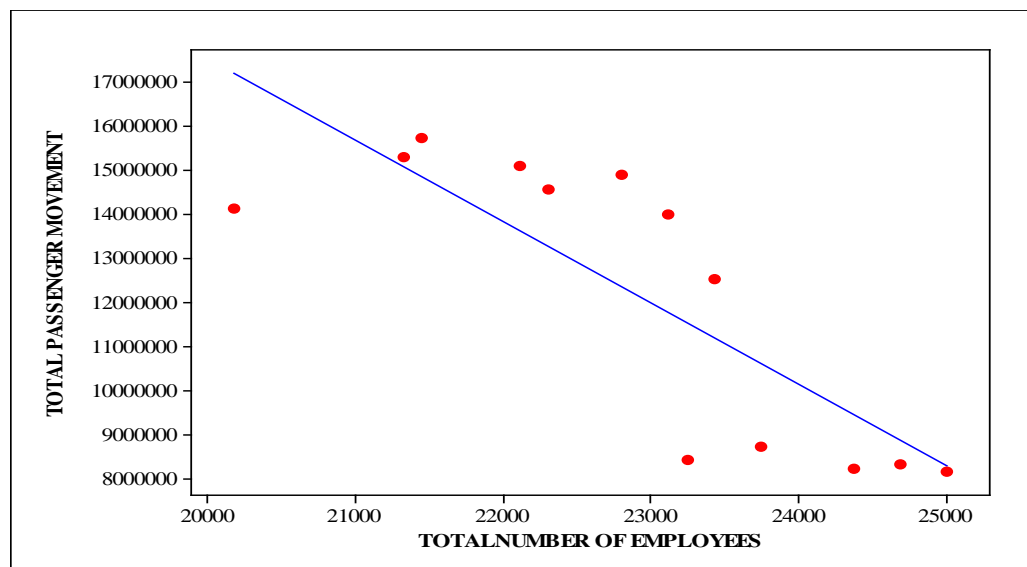


Figure 5: Total Passenger Movement vs Total Number of Employees

The analysis of variance is summarised in Table 6, while Table 7 is the regression model summary. From the result of the analysis of variance (ANOVA)

presented in Table 6, the model significance is $F(1,11) = 21.132$, $P=0.001$. Hence, it can be concluded that the regression model statistically significantly predicts the outcome variable as the sig. (P -value) of 0.001 is less than alpha (0.05). Therefore, there is enough statistical evidence to accept the hypothesis that there is a significant relationship between the total number of employee and total passenger movement.

Table 6: ANOVA

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	81433995095030.40	1	81433995095030.40	21.132	.001 ^b
	Residual	42389957041654.60	11	3853632458332.24		
	Total	123823952136685.00	12			

a. Dependent Variable: TOTAL PASSENGER MOVEMENT
 b. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES

The adjusted R Square value of 0.627 implies that about 62.7% of the variance in total passenger throughput is explained by the number of employees. An R value of 0.811 indicates a high degree of correlation between the dependent variable (Y) and the independent variable or explanatory variable (X).

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.811 ^a	.658	.627	1963067.105

a. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES

Table 8: Regression Coefficient

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error			
1	(Constant)	54378745.095	9201976.630		5.909	.000
	TOTAL NUMBER OF EMPLOYEES	-1843.478	401.024	-.811	-4.597	.001

a. Dependent Variable: TOTAL PASSENGER MOVEMENT

Using the result shown in **Table 8**, we can predict total passenger movement from total number of employees as follows:

$$\text{Total passenger movement} = 54378745.095 - 1843.478(\text{Total number of employees})$$

The implication of the above is that for every variable of passenger movement predicted, there will be a negative increase in the number of employee by a figure of about 1843. The p-value (< 0.05) obtained for the total number of employee implies that this variable is significant in explaining total passenger movement.

4.4. Analysis of Cargo Movement

The time series graph of annual cargo throughput of Nigeria air transport operation is shown in Figure 6. The graph shows continuous fluctuation of cargo throughput, with the highest decline in cargo carried occurring in 2005, before it started increasing continuously again up to 2015 when it peaked.

The positive catalyst to this gradual increase was the airport concession arrangement that came into being from 2006. Cargo movement began to experience a decline again from year 2015 till date, due to economic recession in the country.

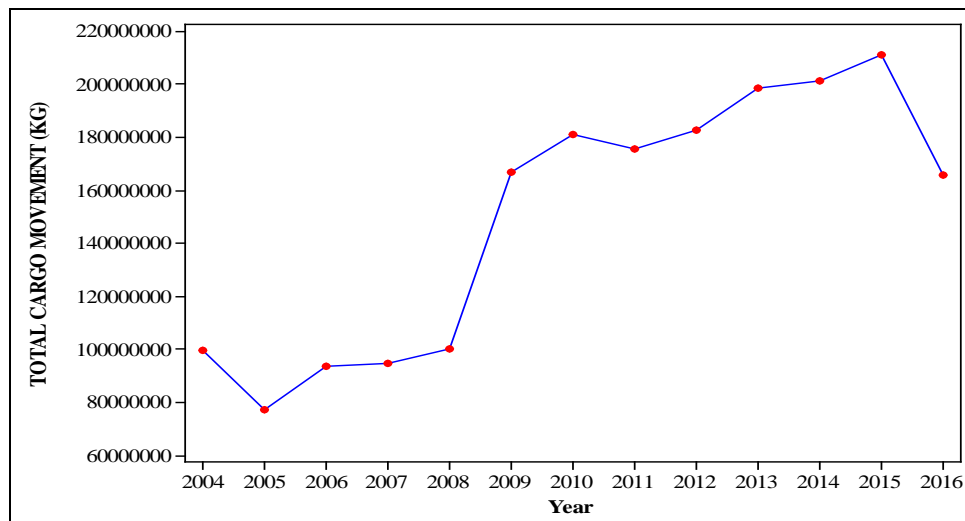


Figure 6: Cargo Throughput (2004 to 2016)

A scatter plot of total cargo movement and total number of employees (Figure 7) shows a negative association between two variables.

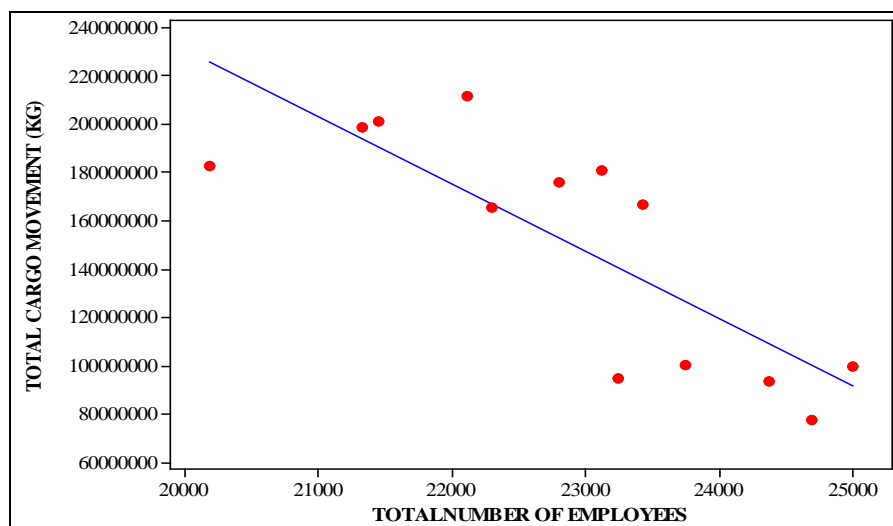


Figure 7: Scatter plot of Total Cargo Movement Vs Total Number of Employees

The analysis of variance is presented in Table 9, while Table 10 is the regression model summary is shown. The analysis of variance (ANOVA) shown in Table 10 shows the existence of a significant relationship between cargo movement and number of employees.

The ANOVA result shown in Table 9, gives a model significance of $F(1,11) = 20.234$, $P=0.001$. Thus, the regression model statistically significantly predicts the outcome variable as the sig. (*P*-value) of 0.001 is less than alpha (0.05). This is enough statistical evidence for us to accept the hypothesis that a significant relationship exists between the total number of employee and total passenger movement.

Table 9: ANOVA

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18532852220026400.00	1	18532852220026400.00	20.234	.001 ^b
	Residual	10075111464668700.00	11	915919224060791.00		
	Total	28607963684695100.00	12			
a. Dependent Variable: TOTAL CARGO MOVEMENT						
b. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES						

The adjusted R Square value of 0.616 implies that 61.6% of the variance in the response variable (total cargo throughput) can be explained by the predictor variable (the total number of employees). An R value of 0.805 indicates a high degree of correlation between the dependent variable (Y) and the independent variable or explanatory variable (X).

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805 ^a	.648	.616	30264157.42

a. Predictors: (Constant), TOTAL NUMBER OF EMPLOYEES

Table 11: Regression Coefficient

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	786799131.662	141864773.028		5.546	.000
	TOTAL NUMBER OF EMPLOYEES	-27810.342	6182.495	-.805	-4.498	.001

a. Dependent Variable: TOTAL CARGO MOVEMENT

Using the result shown in Table 11, we can predict total cargo movement from total number of employees as follows:

Total cargo movement = 786799131.662 – 27810.342 (Total number of employees)

This suggests that for every variable of cargo movement predicted there will be a negative increase in the number of employee by a figure of about 27810. The p-value (< 0.05) obtained for the total number of employees implies that this variable is significant in explaining total cargo movement.

5. CONCLUSION

In conclusion, the study observed that the air transportation industry has been facing turbulence over the years, suggested by the result from air transport operation analysis which shows growth within year 2007 to 2014 notably. The result shows a growth in passenger throughput from 8,409,944 to 15,722,423, aircraft movement increased from 177,627 to 258,624, and cargo throughput increased from 94,523,909kg to 201,208,117kg.

This steady increase was as a result of concession and privatization of some airports. Furthermore, from year 2015 it was observed that there was a steady and serious decline in the level of air transport operational performance. Passenger throughput declined to 14, 562,191 in 2016, while the cargo throughput decreased to 165,568,809kg, and aircraft movement experienced a significant decrease to 225,922.

Overall, it means that Nigeria's air transport performance is sub-optimal because of the serious decline in the various output variables. Officially, Nigeria faced recession from the year 2015 resulting to an increase in the price of dollar. This increase in dollar in relation to the value of Naira has put many airlines out of business at worse or rationalisation of operations at best. The outcome of the hypothesis tested shows that number of employee has a significant relationship with aircraft throughput, passenger throughput, and cargo carried respectively.

The work has been constrained by the dearth of data on total operational cost, total assets, total check-in counters, number of gates, and terminal capacity. This greatly affected the level of statistical analysis carried out in this study. For instance, while it would have been desirable to use multiple regression (instead of simple regression analysis) to determine which variable impacts more on the response variable, this was not possible because there was only one predictor variable (TNE).

The above limitations notwithstanding, the outcome of the study has some policy implications. For instance, in view of the significant impact of number of employees on total aircraft movement, total passenger movement as well as total cargo movement, the Federal Airports Authority of Nigeria (FAAN), Nigerian Airspace Management Agency (NAMA), Nigerian Civil Aviation Authority (NCAA) and the operating airlines should be staffed with adequately motivated staff in order to ensure and maintain optimal performance. Furthermore, based on the commendable performance attributable to the concession arrangement in some of the airports, there is need for divestment of government interest in these airports in order to enhance performance.

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