



Determinants of the Development of Air Cargo Handling Operations in Lagos International Airport, Nigeria

Adedotun J. Adenigbo, MSc*; **Abimbola. G. Olaleye, MSc** and **Feyishola.O. Akinsehinwa, MSc**

*Department of Transport Management,
School of Management Technology,
Federal University of Technology, Akure, Nigeria.*

E-mail: jaadenigbo@futa.edu.ng; agolaleye@futa.edu.ng; foakinsehinwa@futa.edu.ng

**Corresponding Author: +2348034894900*

Abstract: *This study examined the myriads of factors that are capable of influencing the growth and development of air cargo handling operations at the Murtala Mohammed international airport, Lagos. The study made use of primary data collected by simple random sampling of cargo agents at the airport. A total of 203 cargo agents were surveyed at the airport. The data collected were analysed using Factor Analysis (FA) to determine the most significant influencing the development of cargo handling operations at the airport. The FA results indicated customs efficiency (92.6%), traffic level (62.5%) and the airport links with other airports (63.4%) as the most significant factors determining the development of cargo handling operations at the airport. This highlights the need for airport managers to operate airports with efficient customs costs and clearance time that will ensure increased traffic volume.*

Keywords: Air cargo, cargo agents, cargo traffic, customs efficiency.

1. Introduction

Airports as essential part of the air transport system provide the infrastructures needed to enable passengers and cargo to be transferred from surface to air mode and allow airlines take off and land (Graham, 2003). The role airports play in the movement and development of cargo handling operations cannot be overemphasised. Cargo handlers, shippers and airlines alike are so conscious of this that efforts are put in place individually

to ensure business is transacted with utmost efficiency at airports. This is because air cargo transportation system is designed to provide fast and efficient shipment of goods.

A search of the literature on Nigeria air cargo traffic revealed that much attention had not been accorded to the sub sector of the economy. While the analysis of the flow of passenger and aircraft movement (Afolayan et al., 2012), flight operations with emphasis on safety and security, airline services (Adeniyi and Olufemi, 2011), airline choice of passengers patronage and issues on policy and bilateral agreements have received much attention by scholars, the air cargo traffic analysis seems to have been neglected. Others are studies covering air transport demand (Aderamo, 2010); airport choice and cargo volume; and airport development (Aun, 2013) among others. However, there exist vast literature in developed countries on air cargo issues that identify common themes and provide the empirical basis on which to develop the present study. Examples of such works include Grunschlob (2005), Zhang (2003); Huiet al. (2004); Gardiner et al. (2005) and Kasarda et al. (2006).

It is implied from literature that researchers in the Nigeria aviation sector are yet to concentrate their efforts to assess the determinants for traffic growth and development of air cargo handling operations at airports. These factors play important roles in the ability of an airport to develop its cargo traffic and handling operations through cargo agents' business in a competitive aviation market that exists in Nigeria. This study, therefore, aimed to examine the factors that cargo agents consider most significant to the development of cargo handling in Lagos airport.

2. Materials and Methods

The study relied on primary source of data collection involving the survey of cargo agents who were registered members of the Association of Nigeria Licensed Custom Agents (ANLCA) in Lagos, through questionnaire administration. A total of 217 copies of the questionnaire were administered using simple random technique with the support of the branch Chairman and two research assistants. The survey successfully gathered information from 203 members of ANLCA to form the sample size for the study. This represented a 93.5% success rate. The sample size for the study is said to be adequate according to the suggestion of Hair et al. (1995) referred to in Williams et al. (2010) that sample sizes should be 100 or greater to be adequate for inferential statistics analysis. The sampling technique ensured that agents were surveyed with equal chance of being selected. This was meant to certify that the information obtained reflects the intents of the cargo agents regarding the factors that determine the development of cargo operations in Lagos airport. Information in the questionnaire were presented such that cargo agents will

have to indicate the weight they attached to a multiple of factors that is capable of influencing the air cargo operations at the airport.

The instrument was designed on a multiple-item measurement fashioned on the 5-point Likert scale to allow for a wide measurement of the degree of the agents' consideration of each factor presented in the questionnaire. The determining factors measured were fifteen (15), which were extracted and modified from literature (Gardiner et al, 2005; Ohashi et al., 2005; Ubogu 2013; Ozoka, 2009). These items included airport location, airport capacity, concentration of industry, airport security, airline flight route, market size, handling cost, traffic level, cargo volume, airport infrastructure, airport linkage, service quality, customs efficiency, airport charges, and flight frequency. The variables were tabulated for the agents to rank in order of significance from 1 – Not Significant to 5 – Highly Significant.

Factor analysis was employed as technique for data analysis. This is in the light of the need to reduce the variables to a few orthogonal ones that could be used to explain the major factors that determine cargo traffic growth and operations development in Lagos airport. The factor analysis was to highlight the three most significant factors serving as determinants for cargo operations development in Lagos.

The main purpose of the factor analysis was to determine the number of common factors needed that can adequately describe the correlations between the observed variables, and estimate how each factor is related to each observed variable by estimating the factor loading (Oyesiku, 2000). This study adopted the notation for factor analysis presented by Laudau and Everitt (2004) and used by Ubogu (2013) as a model for mathematical specification;

$$x_1 = \lambda_{11}f_1 + \lambda_{12}f_2 \dots + \lambda_{1k}f_k + u_1 \quad (1)$$

$$x_2 = \lambda_{21}f_1 + \lambda_{22}f_2 \dots + \lambda_{2k}f_k + u_2$$

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•
•

$$x_q = \lambda_{q1}f_1 + \lambda_{q1}f_2 \dots + \lambda_{qk}f_k + u_q$$

The equations above can be re-written as:

$$x = \Lambda f + u, \quad (2)$$

where,

$$\chi = \begin{bmatrix} x_1 \\ \cdot \\ \cdot \\ \cdot \\ xq \end{bmatrix}, \Lambda = \begin{bmatrix} \lambda_{11} \dots \lambda_{1k} \\ \cdot \\ \cdot \\ \cdot \\ \lambda_{q1} \dots \lambda_{qk} \end{bmatrix}, f = \begin{bmatrix} f_1 \\ \cdot \\ \cdot \\ \cdot \\ fk \end{bmatrix}, u = \begin{bmatrix} u_1 \\ \cdot \\ \cdot \\ \cdot \\ uq \end{bmatrix} \quad (3)$$

Furthermore, since the factors are unobserved, their location and scale can be fixed arbitrarily, therefore one can assume that only part of the variation in a given population is contained in the variables used to define that population. For this reason, only some of the observed variations in the factors in the study area are due to variations in all the variables under consideration.

3. Data Suitability and Adequacy Assessment

It is normal that a data set to be used in statistics of this nature be subjected to a test of suitability and adequacy. Therefore, to evaluate the suitability of the data, internal consistency checks were conducted using Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and the Bartlett test of sphericity (See Table 1). These tests were employed based on the requirement of factor analysis prior to factor extraction as suggested by Williams et al. (2010). The importance of the test was to determine if the samples were adequate to allow the use of factor analysis.

Table 1: KMO and Bartlett's Test of Sampling

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.704
Bartlett's Test of Sphericity	Approx. Chi-Square	952.338
	Df	105
	Sig.	0.000

Source: Author's data analysis.

The result in Table 1 shows a sampling adequacy value of 0.704, and significant at $p < 0.01$, which indicated that the data obtained is adequate and suitable for the analysis. This is according to Cornish (2007) statement that a KMO result should be over 0.700 to be sufficiently correlated. Therefore, with a value above this threshold, the data was considered to be reliable for the use of factor analysis.

4. Results and Discussion

The results of the analysis in Table 2 showing the communalities estimates of the variables after extraction indicated that only three of the variables with extraction value greater than 50% can be attributed to the common factors that are capable of determining the development of air cargo operations at the airport. These variables were airport capacity with 59.1% and customs efficiency having 89.8%. However, the other variables with extracted values less than 50.0% showed a percentage variance that was low, and suggested that the variables could contribute little to the three common factors.

Table 2: Communalities Estimates of the Determinants of Lagos Air Cargo Handling Development

	Initial	Extraction
Airport Location	.372	.244
Airport Capacity	.528	.591
Industries	.560	.286
Security	.501	.302
Airline Flight Route	.514	.366
Market Size	.354	.180
Cargo Handling Cost	.339	.055
Traffic Level	.516	.491
Cargo Volume	.467	.409
Infrastructure	.442	.277
Linkage with Airports	.371	.432
Service Quality	.488	.168
Customs Efficiency	.675	.898
Airport Charges	.569	.432

Adenigbo, et al.

Extraction Method: Principal Axis Factoring

Source: Author's data analysis.

Furthermore, the total variance of the determinants of the development of air cargo handling operations at Lagos airport presented in Table 3 indicated that the percentage of the total variance accounted for by the factor analysis shows six variables with eigenvalues greater than 1. The percentage of the total variance explained indicated that Factor one had initial eigenvalue of 3.270 accounting for 21.80% of the total variance explained by the analysis. Similarly, factor two revealed an eigenvalue of 1.997 thereby accounting for 13.32%, Factor three had 1.738 with 11.59%, Factor four reported eigenvalue of 1.44 with 9.59%, Factor five reported 1.183 with 7.89% variance, and

factor six having eigenvalue 1.084 with 7.23% of the variance. The significance of these factor loadings provided a clear indication of the underlining factors determining the development of air cargo operations at the airport which have been reduced to six major factors with eigenvalues greater than 1.00. These were the dominant loadings for each factor. These eigenvalues were the proportion of the total variation in the data set that was explained or at best summarized by a factor. The cumulative percentage of the variance revealed that the six factors alone accounted for 71.41%, which indicated the proportion of the total variation that is explained by these six factors.

Table 3: Total Variance of the Determinants of Lagos Air Cargo Handling Development Explained

Factor	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.270	21.798	21.798
2	1.997	13.315	35.114
3	1.738	11.589	46.702
4	1.439	9.593	56.295
5	1.183	7.887	64.182
6	1.084	7.228	71.410
7	.837	5.579	76.989
8	.732	4.880	81.869
9	.681	4.537	86.406
10	.494	3.295	89.701
11	.482	3.213	92.914
12	.429	2.863	95.777
13	.279	1.863	97.640
14	.188	1.254	98.894
15	.166	1.106	100.000

Source: Author's data analysis.

According to Laudau and Everitt (2004), attempt must be made to identify the variables that can explain the underlining dimensions of the issue under consideration. However, the communality table alone cannot be relied upon to identify the variables that explain which factors determine the development of cargo handling operations in Lagos airport, therefore, some methods of factor rotation (varimax) was employed. The purpose was to maximize the variance of the squared loadings to produce orthogonal factors with a view to interpreting the factor analysis. In practice, an arbitrary threshold value of 0.4 was equated as high loadings while the factor loadings are reordered according to size (Laudau and Everitt 2004).

Table 4 shows the rotated factor matrix of the explanatory variables. It can be observed from the Table that four of the variables did not load on any of the three extracted factors to be influencing the development of cargo handling operations in Lagos airport. This indicated that the variables were not important in the discussion of the determinants of the development of cargo operations in the airport. The variables were service quality, cargo handling cost, flight frequency and market size.

Table 4: Rotated Factor Matrix^a of the Determinants of Lagos Air Cargo Handling Development

	Factor		
	1	2	3
Customs Efficiency	.926		
Airport Charges	.558		
Service Quality			
Cargo Handling Cost			
Traffic Level		.625	
Capacity		.608	.402
Cargo Volume		.604	
Infrastructure		.519	
Location		.405	
Linkage with airports			.634
Flight Route			.513
Industries			.453
Security			.409
Flight Frequency			
Market Size			

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 6 iterations.

Source: Author's data analysis.

A further examination of Table 4 shows the variable with highest factor loadings on each of the extracted factors. For instance, customs efficiency loaded 92.6% on Factor 1, traffic level loaded 62.5% on Factor 2 while Factor 3 had linkage with airports having 63.4% loading. These were found to be the most important factors that explained the determinants of the development of cargo handling and operations in Lagos airport.

For customs efficiency to have the highest loading value on Factor 1 emphasizes that customs operations at airports is a major determining factor for the development of cargo handling and operations at airports. This calls for the need to provide efficient customs operations that is characterised by reduced clearance cost and time. This is in relation to the statement of Zhang and Zhang (2002) that any customs administration that can provide reliable, timely clearance, or immediate release based on pre-clearance, creates a competitive advantage for the airport. Also, the issue of the significant importance of traffic level implied that increasing cargo traffic at any airport is an indication of developed cargo handling operations. This relate to the fact that network with other airports has the tendency to increase traffic not only for cargo but aircraft and passenger at the airport.

5. Conclusion and Recommendations.

The development of cargo handling and operations at airports presents an understanding of the variability of traffic level, rather than its average value. This is crucial to the effective management of an airport. For airport managers, the strategy for the successful management of an airport should involve devising ways to compensate for a number of factors that, individually or in combination, act to reduce the efficiency of the airport. This should be done with a view to improving the efficiency of the airport in cargo operations. While it is imperative for airport operators to give attention to the need for increased cargo traffic through efficient customs operations; it is also important that airports have adequate links with other airports for enhanced cargo operations.

The study subjected 15 variables believed to have capacity to determine the development of cargo handling and operations in Lagos airport to factor analysis. It was, therefore, concluded from the study that customs efficiency, traffic level and linkage with airports served as the most significant factors determining the development of cargo handling operations influencing the choice of cargo agents operating in Abuja airport, Nigeria.

6. References

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