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Predicting the Market Share of a New Airport in Multi-Airport Cities: the Case of Lagos

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PREDICTING THE MARKET SHARE OF A NEW AIRPORT IN MULTI-AIRPORT CITIES: THE CASE OF LAGOS

by

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PREDICTING THE MARKET SHARE OF A PROPOSED SECOND AIRPORT IN LAGOS USING A COMBINATION OF METHODS

by

Samson Oladele Fatokun

This Dissertation was prepared under the direction of the candidate's Dissertation Committee Chair, Dr. Steven Hampton, Professor, Daytona Beach Campus; and Dissertation Committee Members, Dr. Dothang Truong, Professor, Daytona Beach Campus; and Dr. Chunyan Yu, Professor, Daytona Beach Campus; and has been approved by the Dissertation Committee. It was submitted to the College of aviation in partial fulfillment of the requirements for the degree of Doctor of Philosophy in aviation

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ABSTRACT

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The primary objective of the study was to develop an empirical model that combines the contingent valuation method (CVM) with the isochrone analysis to predict the market shares of new airports in multi-airport cities and to apply the model to the case of Lekki International Airport (LIA), the proposed second airport in Lagos, Nigeria. In addition to predicting the market share that LIA could attain, the study also identified and analyzed the catchment areas as well as the willingness to pay (WTP) of would-be LIA passengers. Furthermore, the research identified the determinants of airport choice in the Nigerian market.

The CVM was used for the collection of the data; 1,176 valid in-person interviews were conducted at Murtala Mohammed International Airport (MMIA), Lagos. Descriptive statistics and logistic regression analysis were used to predict LIA's market share and identify the factors that influenced passengers' choice between the existing and the proposed second airport. Further, isochrones and passenger stated preference data were analyzed for the determination of the LIA's catchment areas for the business and non-business segments of the Nigerian market as well as the areas of spatial competition between MMIA and LIA. With regard to the passengers' willingness to pay, the median

of the WTP values was determined through descriptive statistics. The determinants of the WTP were also identified using a multiple regression analysis.

Using the combination of CVM and isochrone analysis, the present research predicted that LIA will attain 28.9% of the market share based on the contingent scenario presented to the passengers. Further, the study found that the exclusive catchment areas of LIA for business and non-business passengers were limited to two Local Government Areas (LGAs) of Lagos State. Passengers who chose LIA as their first choice were willing to pay NGN3000 (about $15 or 15% of an average domestic one-way ticket price) as additional fare to fly from the airport. However, the realization of the predicted market share will be contingent on LIA's ability to attract airlines, remedy the isolation of the proposed airport site, and apply the appropriate pricing policy.

DEDICATION

The present research is dedicated to God and to the burgeoning aviation industry in Africa. It is dedicated to those who work hard every day toward the growth of the aviation industry in Africa and the increase of its contribution to economies and the welfare of the people of the continent.

ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

The rapid growth in demand for air travel over the last three decades has imposed tremendous pressure on airport capacity, especially in large metropolitan areas. Consequently, we have seen not only major capacity expansions at existing airports, but also the construction of new airports such as Pudong International Airport in Shanghai, Incheon International Airport in the Seoul capital area, Kansai International Airport in the Osaka area, and Kuala Lumpur International Airport in Malaysia capital region, to name a few. These new airports compete for traffic with the incumbent airports within a multi-airport metropolitan area. Therefore, the objective of this study is to develop an empirical model that combines the contingent valuation method (CVM) with the isochrone analysis to predict the market shares of new airports in multi-airport cities or regions; and to apply the model to the case of Lekki International Airport (LIA), the proposed second airport in Lagos, Nigeria.

In recent years, economic growth has been stronger in Africa than in many other parts of the world. McKenzie & Company (2010) reported that Africa's economies recorded a real gross domestic product (GDP) growth of 4.9% a year from 2000 through 2008, more than twice its pace in the 1980s and '90s. In fact, economic growth accelerated across the continent in 27 of its 30 largest economies (McKenzie, 2010). In its 2013 Economic Report on Africa, the Economic Commission for Africa, an agency of the United Nations, observed that Africa's remarkable growth since 2000 has positioned the continent as the next frontier of opportunity. Improved political stability, sustained economic growth, and improved economic management are factors that contributed to a

noticeable shift in the global perception of the continent, moving from pessimism to enormous potential (Uneca, 2013).

One of the African countries with the fastest growing economy is Nigeria. The World Bank reported that the Nigerian GDP grew by 6.6% in 2012, higher than the average GDP growth of developing countries in that year, as shown in Table 1. The Nigerian GDP is also forecast to grow by 6% until 2016, above the forecast average GDP growth of developing countries. In the May 2013 edition of the Nigeria Economic Report, the World Bank also reported that Nigeria's short-term macroeconomic outlook was generally strong with the likelihood of stronger growth, reduced inflation, and reserve accumulation (World Bank, 2013).

Table 1

Comparative GDP Growth Forecast 2012 – 2016

	2012	2013	2014	2015	2016
Angola	5.2	5.1	8	7.3	7
Nigeria	6.6	6.7	6.7	6.8	6.8
Sub-Sahara African Countries	3.5	4.7	5.3	5.4	5.5
Developing Countries	4.7	4.8	5.3	5.5	5.7

Notes. The 2013 data are estimated while 2014, 2015, and 2016 data are forecast (World Bank, 2013).

GDP growth in Africa leads to an increased demand for travel. Similarly, increase in demand for travel has also positively affected GDP growth in the region. As a result, the number of passengers using airport facilities and the number of aircraft flying

in the African airspace as well as the quantity of freight handled at African airports have equally increased due to the growth in air commerce. Correspondingly, Nigeria has been recording growth in demand for air travel as shown in Figure 1. Demand for international travel has been growing steadily since 2010. The Nigerian market recorded a 6.5% increase in demand for international travel between 2012 and 2013. The trend was maintained between 2013 and 2014 with a 7% growth. The current growth in demand for travel in Nigeria prompted the civil aviation authorities to conduct an evaluation of the adequacy of the national aviation infrastructure.

With regard to air transport infrastructure, commercial airports in Nigeria were, until recently, owned by the federal government of Nigeria and managed by the Federal Airport Authority of Nigeria (FAAN). Presently, FAAN manages 22 commercial airports located in the 36 states of the federation. Some states without federal government owned airports have decided to build their own airports due to the growth of their regional economies, the emergence of a middle class, and the need to open their environment to the world. Gombe and Adamawa states in Northern Nigeria, and Delta and Akwa Ibom states in the southern part of the country built their own airports.

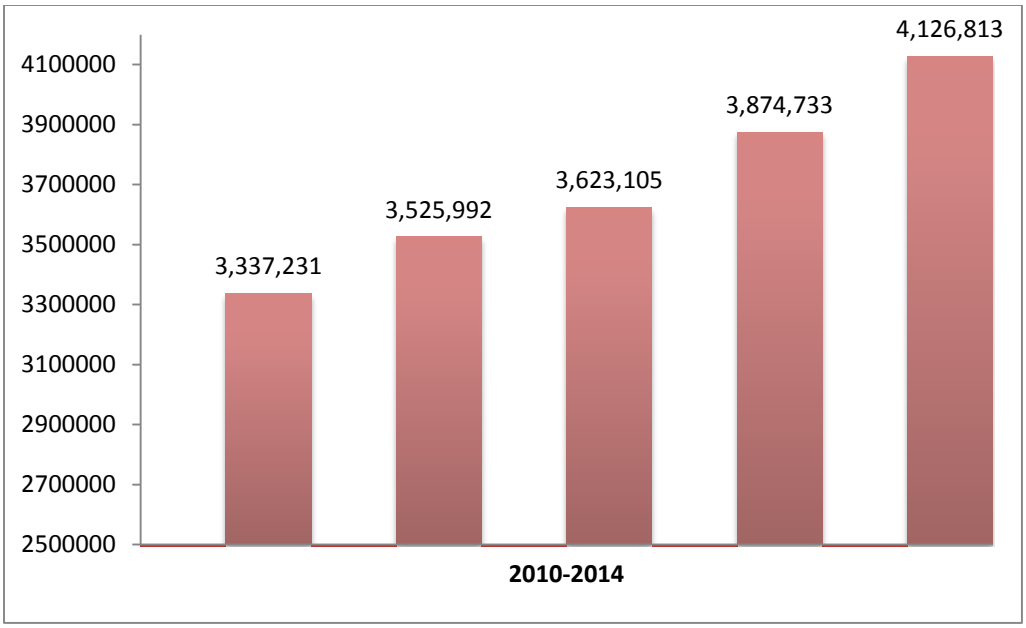

Figure 1. Demand for International Travel in Nigeria 2010-2014. Data compiled by the author from IATA sources.

Following the same trend, the Lagos State Government, in spite of hosting the foremost Nigerian airport (Murtala Mohammed International Airport), has embarked on building a greenfield state-owned airport named Lekki-Epe International Airport (LIA). The purpose of building LIA is to complement and support the economic activities of a Free Trade Zone being developed by the state government. LIA is not being built to respond primarily to the challenges of capacity constraint or service inadequacies at the existing airport, Murtala Mohammed International Airport (MMIA). The 2013 Momberger Airport Information Digest stated that MMIA's capacity was 7.4 million passengers in 2012 while it handled only 6,839,135 passengers in that same year (IATA, 2013) with no slot constraint for aircraft landing and take-off. However, the airport may reach its full capacity in the very near future if the earlier discussed growth in GDP and demand for travel are sustained.

The existing airport, MMIA, was built during the Second World War and named Lagos International Airport. It was renamed after the former Nigerian Head of State, Murtala Mohammed in 1976. The airport consists of an international terminal and two domestic terminals. Two runways serve the three terminals. Figure 2 shows that the international passenger traffic at Murtala Mohammed Airport has been growing since 2003.

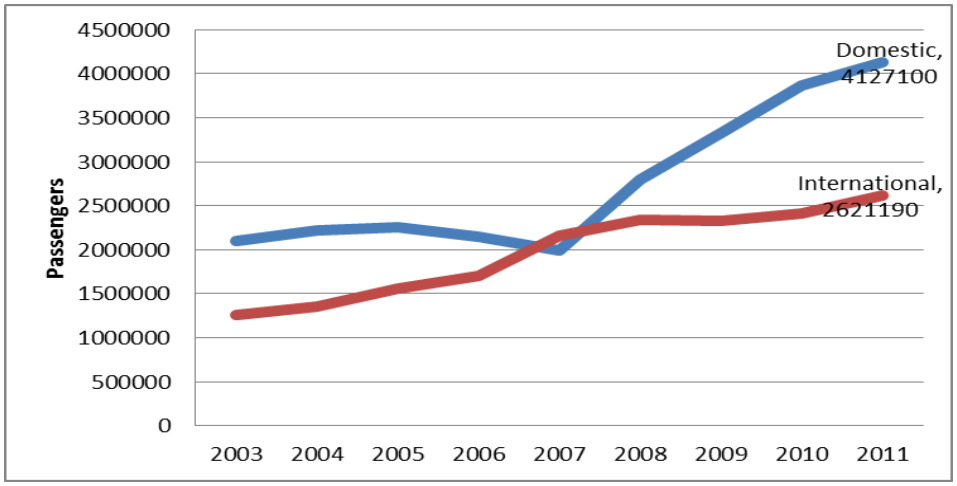

Figure 2. MMIA Passenger Traffic 2003-2011. Data compiled by the author from FAAN data.

While MMIA was built as a Federal Government facility and is managed by the FAAN, LIA is an initiative of the Lagos State Government primarily designed to support the Lagos State Free Trade Zone project. With its location next to the Free Trade Zone area, LIA is expected to support the project by contributing to the facilitation of the movement of persons and goods. The proposed second airport is also expected to be a catalyst for the rapid growth of the South-East region of Lagos State, where it will be

situated. The South-East region is projected to be one of the most promising future growth areas of Lagos State. MMIA is located in the northern part of the city, 62 miles away from the proposed site of LIA.

The proposed LIA is designed to handle about five million passengers annually at its initial stage, with the provision of a modular terminal for future expansion. The airport will be built and managed by private investors. The concessionaire is expected to build the airport with its various components (runway, apron, terminal, etc.) and develop access facilities such as secondary roads (BusinessDay, 2013). Also, the first phase of the LIA project is expected to be completed within four years of signing the concession agreement with the preferred bidder. LIA is designed with the capacity to accommodate Airbus A380 aircraft.

MMIA and the proposed LIA are both located in Lagos State as shown in Figure 3. They are expected to compete for different segments of the airport market. The locations of MMIA and LIA are separated by about 62 miles of urban development. Relatively, the two sites are not too close when compared to Charles De Gaulle and Orly airports in Paris separated by 36 miles. Heathrow and Gatwick in London are 44 miles apart. With overlapping catchment areas, MMIA and LIA are expected to engage in spatial competition. Like London and Glasgow, Lagos is about to become one of the first cities in Africa to host multiple commercial airports with different ownership and in competition with one another. The development constitutes a new phenomenon that is about to take place in Nigeria. The second airport experience is expected to spread to other African countries due to the economic growth levels presently observed all over Africa.

As this phenomenon develops in Africa, it is important to assess if the African airport market has grown enough for the competition that will involve airports located in the same city like Haneda and Narita airports in Tokyo, Heathrow and Gatwick airports in London, and Glasgow International and Prestwick airports in Glasgow. It is also important for aviation authorities in Africa to predict the additional capacity that will be needed in the next decades and analyze if it is more expedient to add capacity to the existing facilities or build new airports. Nigerian aviation authorities will also be interested in assessing whether a second airport in Lagos will be able to gain enough market shares to keep it viable.

Figure 3. Map of Lagos State showing the locations of Murtala Mohammed International Airport and Proposed Lekki International Airport. Two arrows indicate the position of the two airports on a map. Adapted from Lagos Metropolitan Area Transportation Authority (2015). *Lagos Map*. Retrieved from http://www.lamata-ng.com/

Prediction of the Market Share of a Proposed Second Airport

One of the concerns of the owner or the operator of a second airport is the ability to attract and retain new airlines and passengers. It is therefore important for policy makers or civil aviation authorities to have an understanding of the market shares that the proposed second airports will obtain. The viability of the airports in competition depends to a large extent on the market share they control. While it has been relatively easy to determine the market share controlled by airports already in existence, it is more challenging to predict the market share of a proposed second airport expected to be in full competition with an existing airport.

In the airport competition literature, the analysis of the catchment areas has been used for the evaluation of the market share of competing airports. Isochrones provide a geographical representation of catchment and competition areas. Mandel (1999) determined the catchment areas of some German airports aggregating transport flows using the airports being analyzed. Also, Booz & Company (2012) developed demand functions to predict the domestic and international market share of the proposed second airport in the Sydney area of Australia.

In addition to the catchment area analysis and the Booz & Company's model, the prediction of the market share of a proposed second airport in a competitive environment requires the elicitation of the market's stated preference for an airport against the others. The contingent valuation method (CVM) is one of the stated preference techniques used in the air transport literature for the airport demand analysis.

The Combination of the Contingent Valuation Method and the Isochrone Analysis

The limitations of isochrones and the Booz & Company's model were reviewed. While the Booz & Company's model was based on a limited sample and has not been widely tested, the isochrone analysis, based on access time to the airport, does not take into consideration the important price factor. The consideration of the limitation of those methods led to the search for another approach for the prediction of the market share of a proposed second airport in a competitive environment. The contingent valuation method, a stated preference technique, was used for the research.

The contingent valuation method is a survey technique used to elicit customers' preferences by asking them directly to indicate their willingness to accept (WTA) to give up a product or their willingness to pay (WTP) to obtain a specific product (UK CAA, 2002). This method is referred to as "contingent valuation" because it elicits information relative to a person's reaction to a good or service given certain hypothetical situations (UK CAA, 2002). However, the stated preference approach has only been used mostly in developed countries for the airport demand evaluation of an existing airport. To the best of the knowledge of the researcher, the CVM is yet to be used to predict the market share of a proposed (non-existing) airport in a competitive environment. Furthermore, the CVM has not been used in the African market, prior to this study, for the demand analysis of a proposed second airport in spatial competition with a primary airport.

The present research not only closed those gaps in the airport competition literature, it also went further by combining the CVM with the isochrone analysis for a more detailed prediction of a proposed second airport in the African market. In the present research, while the CVM supplemented the isochrone analysis with passenger

willingness to pay data; the isochrones also complemented the CVM with catchment and competition area data.

Significance of the Study

Demand for air transportation has been growing in Africa. As a result, the increasing liberalization of the regulatory framework of the African aviation industry has also been affecting airport regulation. Airport competition, hitherto experienced in Europe and other mature markets, is about to emerge in Nigeria and Africa. Nevertheless, many African airport managers remain characterized by lack of understanding of commercialism and recognition of business prospects (CAPA, 2010).

The present research, as one of the pioneer studies on airport competition in Africa, provides aviation stakeholders in Nigeria and Africa insight on the spatial airport competition about to emerge on the continent. It will enhance airport managers' understanding of the dynamics that will characterize the co-existence of primary and secondary airports that will be located in a same African city. More importantly, the research provides an approach for the prediction of the market share of a second airport in a competitive African airport environment. The research also helps airport managers in Africa understand the profile of the passengers in their markets as well as the factors that will influence passengers' choice of airports as the environment becomes competitive. Moreover, through the analysis of the WTP data, the research provides an insight on the level of airfare passengers are willing to pay to fly from the proposed second airport in Lagos, Nigeria.

Statement of the Problem

Airport co-existence in a competitive environment is emerging as a new development in the African air transport industry. The development can be attributed to the highlighted growth in demand for air travel, the need to develop airport infrastructure to meet the growing demand for air transportation, and the shift in the regulatory framework toward deregulation. Many African countries, like Nigeria, are responding to the increase in demand for air travel by building more airports but without conducting prior studies on the competitive dynamics of the co-existence of the existing airports and the new airports. As the competitive co-existence of airports in the same city is about to emerge in Africa, it is important for researchers and airport regulators on the continent to develop the capability to predict the market share of the proposed second airports. The prediction of the market share of the proposed second airports helps determine if spatial competition between two airports within the same city will have a positive impact on the growth of the fledging African airport business. It also provides insight on the viability of the second airport plans on the continent, thus the need for a method for the prediction of the market shares of proposed second airports in competitive co-existence with primary airports in Africa.

Purpose Statement

The purpose of the present research was to use the CVM and the catchment area analysis to predict the market share of the proposed second airport in Lagos, Nigeria. The results of the research provided more insight for the prediction of the market share of second airports that are about to emerge and compete with existing airports in Africa.

Research Questions

The present research addressed four main questions:

1. How much market share could the proposed second airport in Lagos attain while in competitive co-existence with the primary airport?
2. What are the most important predicting factors (predictors) for passenger preference between Murtala Mohammed International Airport and the proposed Lekki International Airport?
3. What will be the catchment area of passengers who will prefer to fly from the proposed Lekki International Airport, Lagos?
4. How much are passengers willing to pay should additional airfare be required to fly from the proposed Lekki International Airport, and what are the determinants of that willingness to pay?

Delimitations

Usually, airports engage in infrastructure improvement projects. Murtala Mohammed International Airport, the primary Lagos airport, is presently building an additional parking lot. The present research did not attach any special consideration to that project. The airport was considered only in its present structure. Also, the research was a snapshot demand valuation assessment of the proposed Lekki-Epe International Airport as it was conceived at the time of the research. Thus, the different developmental phases of a greenfield airport were not taken into consideration.

Furthermore, it is important to state that a second airport demand forecast was not the objective of the present research. Also, the focus of the research was not the

contingent valuation method. The intent of the research was to predict the market share that a greenfield second airport could gain in a competitive environment in Lagos, Nigeria.

Limitations and Assumptions

The research was based on the assumption that LIA would develop into an airport that offers services for domestic, regional, intercontinental, and general aviation flights as currently proposed by the Lagos State Government. It was also expected that MMIA would maintain its structure as an airport with two terminals for domestic and general aviation services and another terminal for international flights. MMIA and LIA being separately owned, it was assumed that they would be allowed to compete without government intervention.

Due to a lack of historical data related to passenger preference for a non-existent airport such as LIA, the author used the CVM to elicit passenger stated preference data. However, due to its reliance on hypothetical rather than real choice data, the CVM may be subject to preference uncertainty biases (Loomis &Ekstrand, 1998). The researcher mitigated the hypothetical bias and other potential CVM measurement errors in the research design.

Definitions of Terms

Greenfield Airport A new airport built from scratch on a new or undeveloped site. It has few or no constraints

	related to existing infrastructure (Business Standard, 2014).
Aeronautical revenue	Airport user charges related to flight operation.
Catchment area	A geographic area from where a large proportion of an airport's outbound passengers originate. A geographical area is considered a catchment area of an airport if it controls at least 25 % of the passengers originating from that area (UK CAA, 2011).
Commercial revenue	Airport charges not directly related to a flight operation.
Isochrone	Drawing on a map that joins points where a certain event occurs.
Stated Preference Methods	A set of techniques which uses individual respondent's statements about his or her preferences in a set of transport alternatives to estimate utility functions (Kroes & Sheldon, 1988).

List of Acronyms

ACI	Airport Council International
BAA	British Airport Authority
BASA	Bilateral Air Service Agreement
CAA	Civil Aviation Authority

CBD	Central Business District
CVM	Contingent Valuation Method
DC	Dichotomous Choice
FAAN	Federal Airports Authority of Nigeria
IATA	International Air Transport Association
IFC	International Finance Corporation
IRB	Institution Review Board
LCC	Low Cost Carrier
LIA	Lekki-Epe International Airport
MMIA	Murtala Mohammed International Airport
NCE	National Certificate of Education
NCS	Numerical Certainty Scale
NGN	Nigerian Naira (currency)
OND	Ordinary National Diploma
PC	Polychotomous Choice
PPP	Public-Private Partnership
PSO	Public Service Obligation
SPSS	Statistical Package for the Social Sciences
UAE	United Arab Emirates
UK	United Kingdom
VIF	Variance Inflation Factor
WTA	Willingness to Accept
WTP	Willingness to Pay

CHAPTER II

REVIEW OF THE RELEVANT LITERATURE

A review of the literature that informs the present research surveyed the development of competition in the airport industry and the subsequent emergence of secondary airports. The survey examined the position of the African airports in the global development of the airport industry. The present chapter also considered the role of secondary airports in the competition dynamics of the airport industry and reviewed previous studies on the competitive co-existence of primary and secondary airports.

Furthermore, the literature review focused on different methods used for the assessment of the airport market demand and their practical application for the prediction of market share between secondary and existing airports in a competitive environment. However, it is important to note that the air transport literature related to competitive airport markets has not been extensively developed as airport competition remains a recent phenomenon which is yet to emerge in many markets.

Background of Airport Competition and the Search for Market Share

Comparative overview of African and European airport markets. Airport data compiled by the International Finance Corporation (IFC) (2013) show that on average, African airports recorded higher revenue per passenger than airports in other parts of the world in 2011/2012, as presented in Figure 4. However, African airports are lower in productivity as they recorded a small passenger/employee ratio in the same period. It is also important to note that public African airports (Nigeria, Ghana, and Cape Verde) recorded lower employee productivity than the privately managed African

airports in Abidjan (Cote D' Ivoire) and Congo (IFC, 2013). Privately managed African airports seemed to be more efficient than those under government agency management.

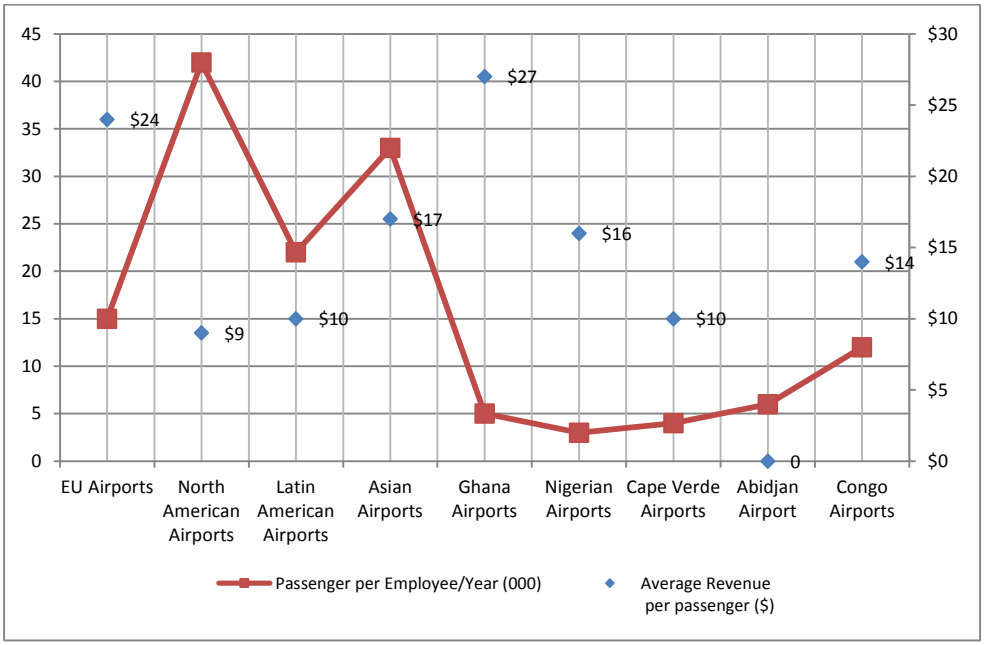

Figure 4. Global Benchmark of the Productivity of Selected African Airports 2011/12. The figure benchmarks the productivity of some selected African airports with airports in other parts of the world. Adapted from "Opportunites d' Investissements Liees a Des Partenariats Publics/Prives (PPPs) Aeroportuaires en Afrique" by International Finance Corporation, 2013.

Airports in Africa remain primarily public service entities still owned by governments and mostly managed by public agencies (CAPA, 2010). Aeroport d' Abidjan and Aeroports du Congo are some of the few privately operated airports in Africa (IFC, 2013). However, the private sector is becoming increasingly interested in the African airport industry as demand for air travel continues to grow on the continent. Changi Airport International in Singapore and Dodsal Infrastructure Development in the

UAE have manifested interest in managing Entebbe International Airport in Uganda (IFC, 2013).

Usually, airport revenues can be categorized into two main streams: (1) aeronautical revenue generated through aeronautical charges such as passenger charges, and (2) non-aeronautical/commercial revenue obtained through delivery of services like parking lots, retail, and real estate. African airports' revenue is predominantly aeronautical. They have been performing below average on commercial revenue generation when compared to other airports in the world as shown in Figure 5.

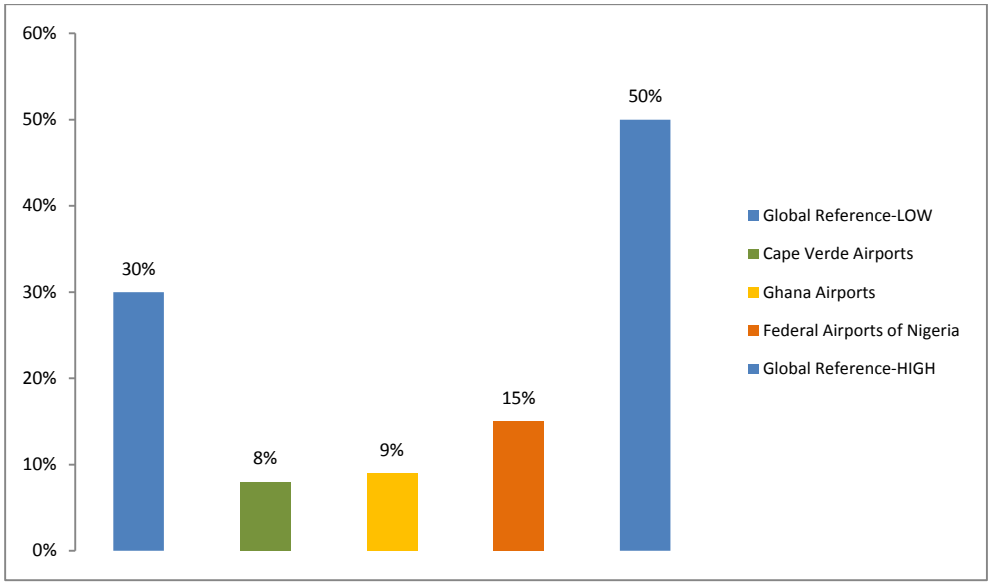

Figure 5. Commercial Revenue as a Percentage of Total Revenue (2011/2012). The figure compares the percentage of commercial revenue of airports in some African countries with global references. Adapted from "Opportunites d' Investissements Liees a Des Partenariats Publics/Prives (PPPs) Aeroportuaires en Afrique" by International Finance Corporation, 2013.

Unlike in Africa, the European airport environment is characterized by increasing competition. Airport Council International (ACI) Europe (2015) reported recently that 80% of European airport operators were corporatized businesses. Furthermore, a study conducted by Copenhagen Economics (2012) and commissioned by the ACI-Europe showed significant competition between European airports on the basis of geographic catchment area overlap. The study revealed that 63% of European citizens are within two hours' drive of at least two airports. Also, 38% are within two hours' drive to three airports. Moreover, European airports compete on the basis of route overlaps. Over 50% of the destinations offered at the busiest airports in Europe are also served by one or more airports around each large airport as shown in Figure 6. One of the consequences of the route overlap is seen in the increasing capacity of passengers to switch between European airports.

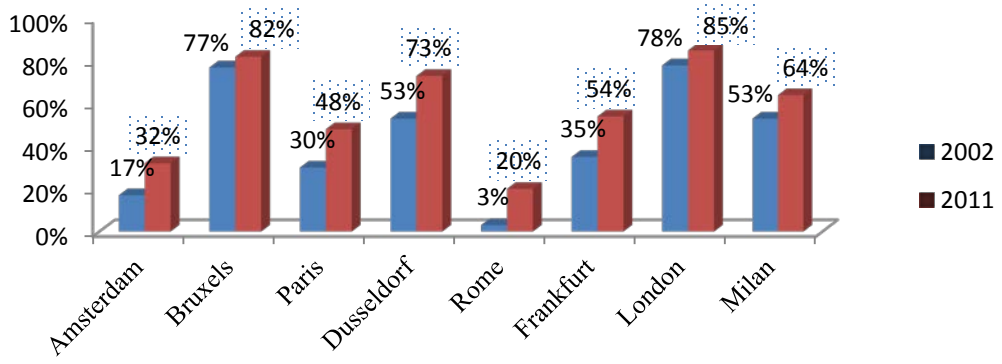

Figure 6. Share of destinations from airports that overlap with another airport within 2 hours' drive. The figure provides an insight on the level of competition among European airports. Adapted from "Airport Competition in Europe", Copenhagen Economics, 2012, retrieved from http://www.seo.nl/uploads/media/201247_Airport_Competition _in_Europe.pdf

Quoting SEO Economic Research's findings, Copenhagen Economics (2012) stated that on average, 44% of passengers at the ten busiest European airports have a choice of an attractive alternative. The airport environment in Africa and Europe seems to be different. Nevertheless, the African airport experience is moving gradually toward the present European airport context dominated by increasing competition.

Perception of airports as natural monopolies. In market economies, competition is considered a good development as it drives cost-efficiency, reduces prices, and helps expand output (Starkie, 2008). In many markets, airports are still perceived as natural monopolies. Airports are not seen to be engaged in active competition like airlines. This perception is informed by the fact that cities in many parts of the world have only one airport, and airlines flying into those cities are restricted in their choice of airports. Forsyth (2001) echoed this view when he perceived the low probability of competition between Australian airports as airlines operating into Australia did not have the opportunity to threaten to take their airport business elsewhere.

The perception of airports as natural monopolies is also based on some clauses in the restrictive Bilateral Air Service Agreements (BASA) which go as far as restricting airline operations to designated airports. Restrictive BASAs have the effect of; (a) reducing competing pressure between airports to drive down costs, (b) discouraging price competition, and (c) encouraging a complacent attitude by airports (Starkie, 2008). The factors mentioned above seem to have unwittingly turned airports into natural monopolies.

However, the situation is gradually changing in Africa and particularly in Nigeria. The regulatory framework of the aviation industry is being liberalized. In 2000, Nigeria signed an "Open skies agreement" with the U.S. The airport environment has also been changing due to the combined effect of factors that are moving airports from a natural monopoly into a competitive environment.

Emergence of airport competition. Starkie (2008) observed that competition between airlines or airline alliances in a deregulated environment and the commercialization of the airport sector are factors that have contributed to the emergence of airport competition. Airports, which were treated in the past as public service organizations, are being commercialized or privatized and are now seeking to attract airlines, passengers, and other service providers. Starkie (2008) attempted to define the basic airport product as a facility designed to allow passengers to join or leave an aircraft and for aircraft to take off and land. He also observed that airports usually combine the following services; (a) airside service (runway and control tower), (b) terminal business, (c) retailing, (d) property business hosting shopping malls, (e) maintenance, and (f) cargo facilities (Starkie, 2008).

Airport competition emerged in the deregulated European airport sector with the privatization of the British Airport Authority (BAA) in the United Kingdom in 1986. The privatization of BAA acted as a catalyst for the rapid corporatization and privatization of airports in many parts of Europe (Barett, 2000). A combination of factors contributed to the emergence of airport competition in Europe. In addition to the search for new airports (alternative to hub airports) by low-cost carriers, the privatization and

commercialization of European airports enhanced the development of competition between airports.

Starkie and Yarrow (2010) considered the airport as a platform where airlines and passengers (two-sided market) are the two main users. The greater the number of airlines servicing an airport, the more attractive it is to passengers. In the same way, the greater the number of passengers, the more attractive the airport is to airlines. The airport brings together passengers and airlines as well as passengers and retailers (Starkie and Yarrow, 2010). Airports compete not only on price but also through investment in capacity (runway and terminals) and service offering to airlines and passengers.

Airport market power. The airport market is also considered in airport literature as a "multi-sided" market as it generates revenue from passengers, airlines, retail, real estate, and other services. The affordability of airport user charges and the potential to generate revenue are some of the factors that influence airline choice of airport. These factors are also linked to the type and volume of passengers who use the airport, the volume of aircraft movement to and from the airport, the volume of freight handled, and the ancillary retail activities. The multi-sided nature of airport markets needs to be taken into consideration in airport market definition and the assessment of airport market power.

An important source of airport market power identified by Starkie (2008) is the agglomerations of economies associated with a network of services, as airlines and passengers prefer airports with a concentration of services that feed and distribute traffic. While passengers benefit from increased frequency and network scope, airlines benefit

from the concentration of services, transfers, and the opportunity to introduce bigger or more economical aircraft. If the market power of the airport is partly defined by the agglomeration economies, the more an airport acts as a major hub and the more dominant it will be (Starkie, 2008). Hub Airlines cannot easily afford to switch to other airports having invested heavily in establishing and maintaining their operational hubs at particular airports. Furthermore, airline revenues may be affected in switching between airports (Wiltshire, 2010). Hub airports like London Heathrow, Frankfurt, Amsterdam, and Paris Charles De Gaulle compete for long-haul transfer traffic (Starkie, 2008).

However, airport market power decreases and the opportunity for substitution between different airports increases as in the case of point-to-point services and non-network services mostly operated by low-cost carriers. Most importantly, the market power of an important hub is determined by the availability of proximate airports that can act as close substitutes (Starkie, 2008). The understanding of the alternatives available to each airline or passenger and the probability of switching to these alternatives helps assess the degree of market power an airport has. The more alternative airports are available, the higher the probability of switching from one airport to the other, and the lower the market power that an airport possesses.

The substitutability in terms of the ability of airport users and purchasers to find alternatives to products and services offered by the airport is the main issue regarding airport market definition (Starkie & Yarrow, 2010). The assessment of the substitutability of an airport is usually based on:

- The specific products and services offered
- Options available to users who want to switch airports

- The costs associated with the exercise of those options

Emergence and increasing prominence of second airports. Studies have shown that the number of airports servicing a city is influenced by factors such as: (a) geographic concentration of the population, (b) balance of resident and non-resident travel, (c) surface access, (d) ownership structure, (e) competitive landscape, (f) government policy, and (g) capacity constraint at individual airports. It has been observed in many markets that the need for a secondary airport was driven by factors such as: (a) capacity constraint at the primary airport, (b) low-cost carriers seeking access to destinations through low-price airports, and (c) the catchment area becoming large enough to accommodate two airports based on generalized cost of ground access in addition to pressure from surrounding development (Booz & Company, 2012). In many cases, the most compelling driver for a second airport has been the capacity constraint at the primary airport (Booz & Company, 2012).

In the United States, many major airports have become congested having reached their maximum capacity (Bonnefoy & Hansman, 2005). They are facing the challenge of the limitation of their capacity expansion due to environmental concerns, land space constraints, and political issues (Bonnefoy & Hansman, 2005). Consequently, secondary airports in the periphery of congested major airports are becoming increasingly prominent. The capacity still available at secondary airports has made them more attractive to low-cost carriers than the major airports. The more the growth in demand for travel puts pressure on the major airports' capacity, the more secondary airports

become prominent, and the higher the necessity for additional secondary airports to emerge in the coming years (Bonnefoy & Hansman, 2005).

However, in the case of the city of Lagos being studied, the second airport project was initiated to mitigate the challenge of the generalized cost of ground access, the pressure from economic development in the Lekki area, and the need for a greenfield airport to support the development of an export processing zone.

It is important to note that for multiple airports to co-exist in the same catchment area, the market needs to be large enough to accommodate and sustain more than one airport. The primary airport, usually preferred by network carriers or full service carriers, must have enough capacity constraint to allow the second airport to grow; otherwise a policy intervention in terms of segregation of market segments to each airport (domestic airport versus international airport) may be required for the second airport to survive (Booz & Company, 2012).

Several attempts at building multi-hub cities have failed as artificial or ambiguous allocation of market segments usually results in the failure of one of the airports, as exemplified by the case of Mirabel Airport and Dorval Airport in Montreal where the co-existence could not be sustained. Even the allocation of aviation market segment through policy intervention failed to sustain the new Mirabel Airport (Booz & Company, 2012). In a competitive airport co-existence model, the secondary airport needs to develop enough capacity to attract passengers, retain their commercial activities, and control an important share of the market.

Many times, airport planners make expensive mistakes by not adequately anticipating the pattern of traffic distribution between a new airport and the existing ones.

They wrongly invest in second airports by putting in place facilities that are too big for the demand that a second airport can generate (De Neufville, 1995). The case of Ciudad Real International Airport in central Spain is an illustration of secondary airport failure. The airport, which cost 1.1 billion Euros to build, opened in 2008. It was finally closed in 2012 and was sold at a bankruptcy auction in 2015 for just 10,000 Euros (BBC, 2016). De Neufville's (1995) study only identified the issue of planners' failure to predict adequately the traffic distribution between airports, leading to over-investment in second airports. He did not propose an approach for the appropriate prediction of the market share of a new second airport in a multi-airport system. Instead, he suggested a dynamic and strategic planning of secondary airports, which entails building up incrementally the airport capacity (De Neufville, 1995).

With regard to factors that influence passengers' choice of airport, Booz & Company identified: (a) ground access to the airport, (b) available airlines, (c) flight frequency, and (d) connectivity. Blackstone, Buck, and Hakim (2006) conducted a study on the determinants of airport choice in a multi-airport region, focusing on four competing airports in the middle Atlantic region of the U.S. They identified the following factors as significant determinants of airport choice: (a) the availability of international flights, (b) availability of low fares, (c) income, (d) convenience of parking, and (e) distance from residence to the airport. Blackstone et al. (2006) and Booz & Company (2012) did not identify the same determinant factors due to the difference in the two aviation environments. The determinants of airport usage may also be different in the African environment; thus the need to conduct the present research to predict the determinants of airport choice in an African multi-airport system.

Competition Dynamics between Primary and Proposed Secondary Airports

The review of the airport literature indicated that the co-existence of a proposed secondary airport and a primary airport could be based on the following co-existence models:

- Competitive airport model
- Complimentary airport model
- Hybrid airport model

The primary and secondary airports can compete on all market segments and be complementary, or compete only in some market segments and be complementary on the other segments (hybrid model). These airport competitive dynamics are illustrated in Figure 7. Considering Figure 7 and the fact that LIA and MMIA will compete against each other, it can be assumed that:

- Both airports will host network schedules.
- The same airport segments will be served by both competing airports.
- The two airports will serve as operational bases for airlines.
- The ownership of the two airports will be mutually exclusive as Murtala. Mohammed International Airport is owned by the Federal Government of Nigeria, and Lekki-Epe International Airport will be built by the Lagos State Government on public private partnership (PPP).

Airport Co-Existence Model	COMPETING	HYBRID	COMPLEMENTARY
CHARACTERISTICS			
Airline Network Schedule	Full duplication across both airports	Targeted duplication of some specific services	Mutually exclusive service offerings
Market Segment Served	All market segments serviced at both competing airports	Some crossover in market segments served	Mutually exclusive market segments served by each airports
Airline Bases	Multiple airlines based out of both airport sites	Multiple airlines potentially based out both airport sites-very limited degree of airline exclusivity likely	Multiple airlines potentially based out of both airport sites-some degree of airline exclusivity likely
Ownership Structure	Mutually exclusive competing airport owners	Mutually exclusive competing airport owners	One individual owner of both complementary airports

Figure 7. Competitive Dynamics Framework. The figure presents a review of airport competition dynamics based on three scenarios. Adapted from "Modelling of alternative airport sites, Report for the Department of Infrastructure and Transport Australia," by Booz and Company (2012), retrieved from http://westernsydneyairport.gov.au/scopingstudy/files/Booz_and_Company-Modelling_of_alternative_airport_sites.pdf

In addition to the four factors earlier discussed and highlighted in Figure 7, location and scalability of the airport are also important factors that influence the type of co-existence model the airports adopt. Location issues relate to the constraints associated with the physical location and access of the proposed second airport in terms of its level of isolation. Scalability relates to its ability to downsize or expand.

The Lekki-Epe International Airport will require a high level of scalability and a low level of isolation to compete effectively and wrestle considerable market share from the primary airport. As a greenfield airport, LIA meets the scalability requirement. The accessibility of LIA from the central business district (CBD) will be an important competition factor as the two airports compete for market share. The effect of environmental limitations is not the only issues facing an airport manager who considers building a second airport in a competitive environment. The prediction of the market share of the proposed second airport has also been a challenge.

Prediction of the Market Share of a Proposed Second Airport

A review of the airport literature revealed that attempts were made at predicting the market share of airports competing with each other. The following methods were used to predict the market share of second airports: (1) the Booz & Company model for a proposed second airport in Australia, (2) the catchment area analysis, and (3) the contingent valuation method in the UK. This section will review the three methods.

The Booz & Company's Model. Booz & Company's (2012) estimation of the market shares between the existing airport and the proposed new airport was based on the

relative generalized cost to access for the competing airports from the CBD. The development of the model for the prediction of the relative market share between the primary and the proposed airports was informed by an analysis of a similar relationship between competing pairs of airports in different parts of the world. They analyzed the relative market share between:

- Kuala Lumpur International Airport and Sultan Abdul Aziz Shah Airport in Kuala Lumpur.
- Melbourne Airport and Avalon Airport in Melbourne.
- Haneda Airport and Narita Airport in Tokyo.
- Istanbul International Airport and Istanbul Sabiha Airport in Istanbul.

In addition, they examined a range of factors to determine the impact of airport service offering on market share. The following factors were examined: (a) access to CBD from the airport, (b) number of destinations served, (c) number of airline services, and (d) the number of airline service frequencies. A benchmarking analysis table derived from the analysis of the above-mentioned factors for the pairs of competing airports as presented in Table 2 was used to determine the influence of generalized costs and service offering on the relative market share of two competing airports.

An analysis of the market share comparison showed a negative relationship between the secondary airport access cost and market share. The higher the access cost to the secondary airport, the lower its relative market share. Booz & Company (2012) developed demand functions to assess the relationship between the generalized cost of alternative and the market share based on four scenarios of patronage for the proposed second airport.

Table 2

Market Share Comparison

Competing Airport Pair		Market Share of A1	Access to CBD (A1/A2)*	Destination served (A1/A2)	Number of Services (A1/A2)	Service Frequencies (A1/A2)
Primary Airport (A1)	Secondary Airport (A2)					
Kuala Lumpur	Sultan Abdul Aziz Shah	92%	2.3	1.7	4.5	2.7
Melbourne	Avalon	97%	0.4	15	40.3	2.7
Haneda	Narita	96%	0.4	5.3	15.4	2.9
Istanbul	Sabiha	68%	0.4	1.6	2.1	1.4

Note. Access to CBD = Generalized cost of ground access to Airport 1 (A1) / generalized cost of ground access to Airport 2 (A2). Adapted from "Modelling of alternative airport sites, Report for the Department of Infrastructure and Transport Australia," by Booz and Company (2012), retrieved from http://www.infrastructure.gov.au/aviation/scopingstudy/files/Booz _and_Company-Modelling_of_alternative_airport_sites.pdf

Booz & Company (2012), through the model predicted that the proposed second Sydney airport will attain 50% domestic market share if the following conditions were met:

1) The generalized costs for the end-to-end journey from Kingsford-Smith Airport and the second Sydney airport are similar.
2) The service offering at the two airports is comparable.

The demand functions also predicted that the same generalized cost of access to the two airports will result only in 7% market share for the proposed second airport in a short-haul domestic routes scenario. Similarly, the demand function was used for the prediction of the international market share.

Limitation of the Booz & Company's model. The demand functions that drive the prediction of the relative market shares in the different scenarios were based on theoretical analysis that was informed by a limited number of competitive airport co-existence cases. As earlier discussed, the analysis of the correlation between the access cost to the secondary airport and its relative market share was based on only five competitive airport pairs. The size of the sample challenges the internal validity and generalizability of the model.

The Catchment Area Analysis. A grasp of the concept of airport catchment is important for the understanding of how airport market shares are structured. An airport catchment area is defined as a geographical area where a good number of the potential passengers of the airport are located. Airport catchment areas vary according to the type of air service the passengers patronize. Leisure and business passengers constitute different catchment areas for the same airport. Similarly, long haul and sort haul passengers originate from different catchment areas. Strobach (2010) considered catchment areas as market areas, geographic space where the probability of the selection of an airport is so high that the majority of the potential passengers living in that geographic space select this airport. He also observed that catchment areas were not static delimitations. Catchment areas can overlap, and the overlapping of the catchment areas, when it occurs, is considered an indication of airport spatial competition. The concept of a catchment area allows researchers to estimate the level of spatial competition between airports (Pavlyuk, 2012), and have an idea of the share of the market controlled by the competing airports. Starkie (2008) observed that the size of the

catchment area would be determined by the depth of the market consisting of the density of consumers and the production technology such as runway length and the number of gates. In figure 8, Starkie (2002) illustrated the concept of overlapping airport catchment areas.

Pavlyuk (2012) held that the radius of the catchment area could be defined by: (a) geographical distance, (b) travel time, and (c) travel cost. The approach suggested by Starkie (2008) consists of defining the relevant market for the airport's services, taking product and geographic scope into consideration. Starkie (2008) recommended the consideration of the airport industry as an industry subject to imperfect or monopolistic competition in a spatial setting as a more appropriate framework for the analysis of airport competition.

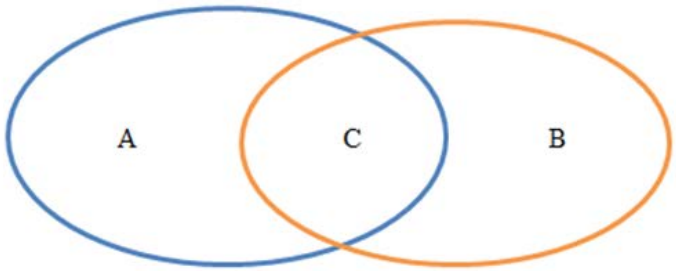

Figure 8. Airport Competition and Catchment Areas. Areas A and B represent the catchment areas of two airports, while area C (the intersection) represents the overlapping of the two catchment areas. Adapted from "Airport regulation and competition," by D. Starkie, 2002, Journal *of Air Transport Management*, *8*, 63-72.

The analysis of the catchment areas has been identified as an approach for the assessment of the geographical market share between competing neighboring airports.

The UK Civil Aviation Authority (CAA) and the Competition and Market Authority identified two methods for the analysis of airport catchment areas and their geographical markets: (a) the isochrones analysis based on the drive time to access the airport and (b) the historical usage patterns. They use the two approaches mainly for regulatory purposes (UK CAA, 2011).

Isochrone analysis. The drive time for an isochrone depends on the journey time acceptable to the passenger to travel to the airport. The UK CAA (2011) used a two-hour travel time to the airport to describe the potential catchment area of the leisure passenger. One-hour isochrone is used to represent the potential catchment area related to business passengers. It is expected that the business class passenger, being more time-sensitive than a leisure class passenger, will be more willing to use the airport with the shortest surface travel time even if it translates into paying a higher price. Similarly, the long haul passenger might be willing to accept a longer surface travel to the airport than the short haul passenger as it represents a smaller share of its overall journey (UK CAA, 2011).

Taking into consideration the above assumption, a survey was conducted in 2006 for the initial price control proposal for Heathrow, Gatwick, Luton, and Stansted airports. The analysis of the results shows that two-hour isochrones covers about 80-90% of the airports' short-haul leisure passenger base in the United Kingdom (UK CAA, 2011).

The mapping of a one-hour isochrone on the cumulative density distribution of short-haul UK business passengers for Heathrow, Gatwick, Stansted, and Luton airports was also conducted. Even though one-hour isochrone may be considered a conservative estimate of business passengers' propensity to travel to an airport for a flight, the

mapping showed noticeable differences between the four airports. The demarcation line of the one-hour isochrone better fit the actual passenger distribution of London Heathrow airport than London Stansted airport. The 0-70% passenger distribution density of Heathrow fit the one-hour isochrone, while a large proportion of the 0-70% passenger distribution density for Stansted airport was located outside the one-hour drive isochrone.

The above analysis and other studies conducted by UK CAA, the Competition Commission, and the Office of Fair Trading of the United Kingdom (UK CAA, 2011) show the analysis of isochrone as a useful technique to gather information on airport catchment areas and airport markets. Isochrone analysis can be particularly useful for the prediction of market share and the forward-looking analysis of the scope for potential passenger switching between competing airports. The overlap between the isochrones of neighboring airports provides a visual picture of the market base of an airport that might be contested by the other airports (UK CAA, 2011).

Limitation of the catchment area analysis. Isochrone analysis alone cannot provide a complete and accurate definition of airport market share in a competitive environment. Passengers' willingness to travel to or from the airport is affected by other factors including available flights and, most importantly, airfare (UK CAA, 2011).

The conventional approach for the analysis of airport competition relies on examining the overlap of defined airport catchment areas. However, the analysis of the overlap of the isochrones symbolizing the overlap of the catchment areas is not sufficiently sophisticated to assess the degree to which passengers switch from one airport to the other (IATA, 2013). Neither does it assess the role relative prices play in

influencing that decision (Frontier Economics, 2008). While isochrones are strong visual tools, they are limited in their provision of insight on the choice of airport that passengers actually make. However, the evidence of effective competition and control of market share between airports can be evaluated through the analysis of stated preference data.

Contingent Valuation and Stated Preference Approach

The stated preference approach consists in obtaining passenger stated preference for an airport using survey data. Contingent valuation (CV) is considered as one of the simplest forms of the stated preference method based on surveys. The instrument elicits participants' preferences by asking them to indicate their WTP to obtain a product or service as well as their WTA a payment for giving up a specific good or service (Malina, Schwab & Wollersheim, 2008). Simply put, the contingent valuation method is a technique where participants are asked about a current situation versus an alternative state with information elicited about how they react toward the alternative to the status quo given their WTP if necessary.

Usually, a contingent valuation study contains the following parts: (a) a detailed description of the good or service being valued, (b) questions that elicit the respondents' WTP or WTA, and (c) data about the respondents' characteristics and their preferences that are relevant to the good (Malina et al., 2008). UC San Diego (n.d.) recommends the following steps in conducting a contingent valuation:

- Define the service and the expected change in the service to be valued.
- Define the geographical scope of the market.
- Establish focus groups on components of the CV survey.

- Pretest the survey instrument.
- Administer the questionnaire.
- Test the reliability and validity of the results.

The "contingent" dimension of the CVM relates to a hypothetical scenario presented to the respondents. The CVM usually constructs a typical real-world scenario which remains hypothetical to the respondents of the CVM survey. Users of the CVM usually take the following steps when building the hypothetical scenario: (a) setting the reason for the payment (the expected improvement being contingent on payment made), (b) stating the bid vehicle or the method of payment which can come in the form of a direct sum of money to be paid, tax discount, or cash contribution, and (c) building a provision rule.

Data for CVM can be collected through telephone interviews, mail questionnaires, or personal interviews which take advantage of the face-to-face contact to increase engagement, reduce misunderstanding, and elicit spontaneous questions. Though considered the most expensive survey administration format, the face-to-face interview is considered the best, mostly when visual materials need to be presented (Rahim, 2008).

Reliability and validity of CVM results. Whitehead, Blomquist, Hoban, & Clifford (1995) discussed the skepticism about the validity and reliability of contingent valuation results. They found that the validity and reliability concerns in contingent valuation studies relate mostly to respondents who have little or no knowledge of the product or service being valued. Whitehead et al. (1995) classified CV survey respondents in three categories:

1. On-site users: respondents who have been on-site and are familiar with the product or service.
2. Off-site users: survey respondents who have read, learned, or talked about the product.
3. Non-users: the category of respondents who have not seen or heard about the product.

The non-use values in CVM are the most likely to be inaccurate because respondents are not familiar with the product (Whitehead et al., 1995). Therefore, it can be said that the reliability and validity WTP values depend on the amount and type of information the respondents receive. Whitehead et al. (1995) held that the better the information acquired by survey respondents either by personal experience or through a survey instrument, the more reliable and valid the WTP statements they make.

Literature provides further recommendations for the mitigation of validity and reliability concerns in CVM results:

- Design a questionnaire to test for potential biases.
- Ensure that bids for WTP are consistent with economic theories (e.g. Higher bid for individuals with higher income).
- Replication of the study may be necessary.
- Contrast the CVM results with estimates from other valuation methods (UC San Diego, n.d.).

Furthermore, CVM could be subject to some validity and reliability tests. The most used validity test in contingent valuation literature is construct validity which combines convergent validity and theoretical validity tests. Whitehead et al. (1995) held

that the convergent validity test assesses the convergence of the same contingent value construct measured in different ways. The theoretical validity test appraises the relationship of the measure between the contingent values (ability to pay) with the theoretical prediction.

Similarly, the "test and retest" method appears in literature as the most used type of technical reliability testing in contingent valuation. The test-retest method consists of surveying the respondents afresh, presenting them again with the same survey instrument, and comparing responses. The disadvantage of this CVM reliability test is its cost. The parallel form method is a cheaper contingent valuation reliability test. It entails using a single survey but with two related valuation questions designed as similarly as possible. For example, if initially the WTP valuation question is open-ended, the alternative form question within the same survey instrument could be a close-ended valuation question. The positive correlations between the measures obtained through the two similar questions are considered as evidence reliability of the two measures (Whitehead et al., 1995).

Respondent uncertainty in CVM. The theory of preference uncertainty in CVM studies deals with the disparity between the hypothetical values elicited from the respondents and their real economic behaviors (Akter, Bennett, & Akhter, 2008). The concern is about the extent to which hypothetical choices in CV studies correspond to actual economic choices (Blumenschein et al., 1998). Uncertainty in CVM studies arises in various ways including: (a) respondents having limited or no knowledge of the item or service being valued, (b) the influence of substitutes and complements, and (c) the design

of the CV questionnaire used to elicit valuation data from the respondents (Shaikh, Sun, & van Kooten, 2007). Respondent uncertainties could lead to measurement errors in CVM. A study conducted by Blumenschein et al. (1998) provided evidence of the presence of hypothetical bias in responses to a dichotomous choice (DC) question in CV studies. Furthermore, a study conducted by Johannesson, Loljas, and Johansson (1998) found that hypothetical *yes* responses overestimate the real *yes* response; thus the need for the incorporation of preference certainty measurement calibration in CVM research. Two preference uncertainty measurement methods have been frequently used in CVM literature: the numerical certainty scale (NCS) method and the polychotomous choice (PC) method (Akter et al., 2008).

The NCS method entails using a follow-up question to the *Yes/No* DC question. It asks the respondents to indicate their levels of certainty regarding their answer to the DC question using a certainty numerical scale that ranges from 1 to 10, where 1 stands for *very uncertain* and 10 for *very certain*. The original *Yes/No* DC responses are recoded as 1 or 0 based on a certainty threshold mark (Akter et al., 2008). In the CVM literature, the certainty cut-off mark varies from 6 to 10 as exemplified in Table 3. There has been no consensus among researchers on the adoption of a threshold target for the NCS method.

The PC method for measuring preference uncertainty provides respondents with a set of six responses to express their certainty. The post-decisional responses proposed by the PC models are: *Definitely Yes*, *Probably Yes*, *Maybe Yes*, *Maybe No*, *Probably No*, and *Definitely No*. One of the setbacks of the PC method identified in uncertainty preference

literature is the potential inability of respondents to distinguish clearly between *Probably Yes* and *Maybe Yes* or *Maybe No* and *Probably No* (Akter et al, 2008).

Table 3

Treatment of Uncertain Responses in NCS to Match Actual Behavior

	Champ et al. (1997)	Champ & Bishop (2001)	Ethier et al. (2000)	Poe et al. (2002)
Certainty Cut-off Mark	*Yes* = 10	*Yes* = 8 or higher	*Yes* = 7 or higher	*Yes* = 6 or higher

Note. Adapted from "Preference Uncertainty in Contingent Valuation" by Akter et al., 2008, *Ecological Economics*, 67, 345-351.

The preference uncertainty literature provides contrasting views about the usefulness of incorporating preference uncertainty information in CV studies. Researchers such as Champ and Bishop (2001) held that the calibration of preference uncertainty information in hypothetical responses mitigates hypothetical bias in CVM studies. However, Akter et al. (2008) found that the incorporation of uncertainty information in CV studies results in inconsistent welfare estimates. The results of the study conducted by Shaikh et al. (2007) showed that incorporating uncertainty information had the potential to increase goodness of fit. However, it could also introduce variances into the studies depending on the empirical method used to incorporate the uncertainty information (Shaikh et al., 2007). Johannesson, Liljas, and Johannsson (1998) conducted an experimental comparison of dichotomous choice contingent valuation questions and real purchase decisions. The study showed that the

hypothetical yes responses underestimated the real yes responses. It also demonstrated that the hypothetical "absolutely sure yes" responses underestimated the real yes responses. The approach that was adopted by the researcher on the usefulness of incorporating preference uncertainty information is summarized in Blumenschein et al.'s (1998) position. It stated that the certainty of a hypothetical yes question might be a significant predictor of the real yes response.

Applications of the CVM to air transport studies. Stated preference and contingent valuation methods have been widely used in marketing and transport sectors. Marketing uses CVM to price existing goods or services and determine how much consumers are ready to pay for new or improved goods or services. In the transport sector, CVM has been used to provide insight into the valuation of demand, as well as the consumers' travel decisions (Carson & Louviere, 2010).

Application to public transport studies in Dubai. Worku (2013) used the contingent valuation method to analyze passengers' willingness to use and pay for improved public transport services in the UAE. The objective of Worku's (2013) contingent valuation survey was to address the following research questions:

- Are passengers willing to use an improved public transport service in the UAE?
- What factors determine UAE residents' willingness to use and pay for an improved public transport service?
- How much were residents willing to pay per trip for an improved public bus transport service?

The survey was conducted on a sample of 852 UAE residents. Probit and ordered logit models were used to analyze the survey data. The results of the study showed:

- A strong likelihood of the average UAE resident to use the improved bus service.
- The willingness to pay for the improved bus service was contingent on the proximity of the bus station to the respondent's residence or place of work.
- 35% of respondents would be willing to pay United Arab Emirates Dirham (AED) 2-3 per trip, while 36% would be willing to pay more than AED 3 per trip for improved bus service (Worku, 2013).

Application to the evaluation of the benefits of regional airports in Germany. Contingent valuation method was used by Malina et al. (2008) to quantify the use and the non-use values of a secondary airport in Germany. They used the contingent-valuation approach to quantify the advantages that organizations gain from the use of the secondary German airport in a multi-airport region. The researchers gained insight into the monetized importance of the airport by asking the companies about their willingness to accept a fictitious permanent closure of the secondary airport (the created contingent situation). Based on a payment-card approach, the contingent valuation question was:

> "Imagine the (name of an airport) is going to be closed, leading to disadvantages for some companies in the region. We conclude from your answers to our questions that your company would be affected negatively. Imagine now, that you are offered an annual compensation for the closing down of (name of airport), e.g. By subsidy or lowering local business tax. Please mark the smallest amount that you would accept as compensation. Please bear in mind that the final

compensation paid will depend on the average compensation claimed by all respondents and not on your own compensation claim" (Malina et al., 2008 p 8).

The survey questionnaires were sent to 4,720 companies within the airport area. Out of 891 companies that took part in the survey, 819 completed it. The organizations indicated an annual compensation claim of nine million Euros. The study found that the overall compensation claim within the secondary German airport area was 82 million Euros and was estimated by linear regression of the sectorial per-employee values in the sample companies (Malina et al., 2008). The contingent valuation method was used to gain insight into the annual actual or prospective extra profits organizations could generate due to the presence of an airport.

Application to the demand evaluation of London Heathrow Airport, UK. In 2002, the UK CAA conducted a demand valuation survey of Heathrow airport against the competition of Gatwick, Luton, and Stansted airports. The main purpose of the CVM was to determine the proportion of Heathrow terminating passengers who consider the airport as their first choice and the compensation that would be required for them to patronize the less preferred airport in the South East of London (UK CAA, 2002). In the conduct of the contingent valuation study, London Heathrow Airport respondents were presented with the hypothetical scenario of the same price being available at Heathrow, Gatwick, Stansted, and Luton airports but keeping in mind that ease of access, frequency of flights, and facilities may differ from one airport to the other. Based on that hypothetical scenario, surveyed passengers were asked to mention their airports of first and second choice and how much cheaper their tickets must be for them to switch to the

second choice airport (UK CAA, 2002). This study aimed at eliciting passengers stated preference of the airport in competition against three others in the same metropolitan area.

As recommended by Whitehead et al. (1995), the UK CAA (2002) used the "test-retest" method to test the reliability of CVM by repeating the WTA question toward the end of the questionnaire, replacing the open-ended format with a payment card highlighting probable ranges of WTA value. WTA values were dropped when passengers provided inconsistent responses. 743 passengers were interviewed. Furthermore, 75 respondents out of 529 who preferred Heathrow did not provide an answer to the WTA questions, 43 (8%) provided inconsistent responses, and 69 (13%) rejected any compensation in the form of a fare reduction to patronize another airport in London. Therefore, the validation of the data left the UK CAA (2002) with 342 usable responses out of the respondents who indicated Heathrow as their most preferred airport. The UK CAA (2002) used a 5% trimmed means to mitigate the effect of outliers in the calculation of the average WTA for the sample. The analysis of the collected data provided the following results:

- 71% of the respondents mentioned Heathrow as their first choice airport.
- Affirmation of the primary airport (Heathrow) over other three secondary airports in the South East.
- Business passengers valued the primary airport (Heathrow) more than leisure passengers.
- Long haul passengers had stronger preference for the primary airport than either domestic or short haul passengers.

Applications of CVM in developing countries. Contingent valuation surveys have been applied in developing countries for the valuation of environmental quality and public programs. The CVM has been used to elicit residents' WTP for improved water supply in developing countries such as India, Pakistan, and Nigeria (Alberini & Cooper, 2000). Similarly, CVM was used to value sanitation in Ghana and Burkina Faso and to value the preservation of national parks in Kenya (Alberini & Cooper, 2000). However, to the best of the researcher's knowledge, CVM is yet to be applied for the valuation of airport market demand in Africa. The present research comes in as an extension of the application of the CVM to the African air transport industry and precisely to the airport market.

In their evaluation of the conduct of contingent valuation surveys in developing countries, Alberini and Cooper (2000) held that the application of CVM has generally followed high standards and produced useful results. Nevertheless, it found that the application of CVM in developing countries had been faced with challenges related to:

- The description of the commodity
- Protest and bias responses based on respondents' perception of the government's role in providing facilities.
- The presentation of the cost information to the respondents (Alberini & Cooper, 2000).

However, Whittington (2002) seemed to defer from Alberini and Cooper (2000) on the quality of some contingent valuation studies recently conducted in third world countries. His paper laid emphasis on the need to properly design and execute the CVM

for valid and reliable results, mostly in developing countries where some environmental peculiarities may be encountered.

Limitation of the contingent valuation method. A few concerns about CVM were found in the literature: (a) respondents may not think seriously about their answers as there is no penalty for negligence or frivolous responses, and (b) individuals who take the survey questions seriously may have an incentive to lie or distort their answers (Morey, 2012). While not taking the question seriously may add noise to the data, lying may add bias. Individuals may also give answers that are inconsistent with economic theories (UC San Diego, n.d.). More importantly, CVM is not the appropriate method for the second research question which relates to the determination of the catchment and competition areas between airports.

Summary

Airport competition is a relatively new development which is yet to be experienced in many air transport markets. As of 2010, only 9% of European airports were in wholly private ownership, 13% were mixed public-private, and 78% maintained majority public ownership (IATA, 2013). In Africa, airports remain primarily public service entities owned by governments and are mostly managed by public agencies (CAPA, 2010). The literature review mentioned various degrees of airport competition in the United Kingdom and Germany where many airports are privatized.

Airport competition is just about to emerge in Africa; thus, this literature review did not include any literature that focused on airport competition on the continent. To the

best of the researcher's knowledge there is no elaborate literature on airport competition in Africa. The present research comes as a precursory study on airport competition in Africa. With this emerging development, it will be important for relevant stakeholders to be able to predict the market share that the second airport will be able to contest and also provide an insight for the understanding of the airport market in Nigeria.

The method used by Booz & Company (2012) for the prediction of the market share between the primary airport in Sydney and the proposed second airport was based on the relative generalized cost to access the competing airports from the CBD and the analysis of a similar relationship between competing pairs of airports in different parts of the world. Booz & Company's (2012) approach is recent and needs to be validated with data from other markets as it was built on a limited sample size.

Furthermore, the literature review revealed that several other methods have been used for the assessment of competitive airport markets. UK CAA (2011) recommended the use of isochrone analysis as a particularly useful technique for competition analysis research geared toward informing the appropriate airport regulation. Isochrone analysis is recommended for forward-looking analyses that investigate potential airport competition dynamics likely to develop over time in a given market. However, it was found that isochrone maps alone could not provide an efficient prediction of airport market share.

A survey of relevant literature presented the stated preference approach to the assessment of competitive airport markets as a method that could provide some insight into competitive airport market share. The CVM is the stated preference technique that could be used for competitive airport market analysis. In contingent valuation, a survey

is sent to random or stratified samples of respondents selected from the general population which presents information about a particular problem with a hypothetical occurrence such as building a second airport (Rahim, 2008). As earlier discussed, the UK CAA (2002) used the CVM to conduct the demand valuation of London Heathrow Airport. The results of the CV study of UK CAA (2002) were found to be consistent with some of the results of the study on airport choice and competition in Germany conducted by Mandel (1999). Similarly, he found that business travelers strongly prefer the airport which offers the highest flight frequencies (like Heathrow).

However, the stated preference approach has only been used in developed countries for the airport demand evaluation of existing airports. To the best of the researcher's knowledge, CVM is yet to be used to conduct the demand analysis of a proposed airport (non-existing) in a competitive environment; neither has the method been used on the African continent for the prediction of the market share of a proposed second airport. The present research not only closed those gaps but went a little further by combining the CVM with the isochrone analysis to predict the market share and the catchment areas of LIA.

The widespread use of isochrone analysis in airport competition studies is due to its ability to define airport catchment areas and identify the overlapping of the catchment areas of competing airports. The overlapping section of the isochrones presents the geographical location of passengers whose ability to switch between airports needs to be understood. The ability and impact of passenger switching between airports remains an important factor in airport competition (ACI, 2014). While the isochrone analysis relies on the access time to the airport, it does not take into consideration the price factor.

However, the CVM provides insight on the price that passengers in catchment and competition areas are willing to pay to switch from one airport to the other. Therefore, the CVM can supplement the isochrone analysis with the WTP data. In the context of the present research, the isochrone analysis also complemented the CVM with the catchment and competition areas data.

CHAPTER III

METHODOLOGY

The review of the relevant airport competition literature discussed the limitations of the methods used in airport competition and demand valuation studies. The combination of the CVM and the isochrone analysis helped mitigate some limitations of each method and provided an appropriate approach for the prediction of the market share of a proposed second airport. The purpose of the present research was to predict the market share of a proposed second airport in Lagos, using an empirical method that combines CVM and isochrones analysis. The research also attempted to identify the predicting factors of passenger preference for the second airport and determine its catchment areas.

Research Approach

The contingent valuation survey instrument that was used to provide the data for the research was an amended version of the contingent valuation survey developed in 2002 by the UK Civil Aviation Authority to conduct a demand valuation of Heathrow airport. The instrument was tested by the UK CAA (2002) through pilot surveys for the mitigation of biases and the evaluation of the clarity and consistency of the questionnaire (UK CAA, 2002). Nevertheless, the instrument was modified to reflect the Nigerian context where it was used for this research. The instrument was pre-tested in the pilot survey and fine-tuned to fit the purpose of the research.

Design and procedures. The present research used a combination of two methods, namely the contingent valuation and the isochrone analysis. A contingent valuation survey provided the data for the two methods. The classical CV survey focuses on presenting a contingent scenario and eliciting WTP or WTA values from the respondents. The survey instrument presented in Appendix C is a CV survey with additional questions that provided data for all the research questions.

During the interview, the respondents were first presented with the contingent scenario of a second airport in competition with the primary airport. Then a contingent binary choice question was introduced to the passengers. They were required to state their choices for either the primary or the contingent second airport. The passengers who stated a preference for LIA were requested also to state the additional amount they are willing to pay for their airfare. The stated preference data and the willingness to pay data were analyzed for the prediction of the market share.

Furthermore, the contingent valuation survey was used to gather data on passenger location. The analysis of the stated preference and location data through an isochrone analysis helped determine the catchment area of LIA and the potential geographic location of LIA's market share. The combined analysis of the isochrones and the WTP data of the passengers in the catchment overlapping area will provide insight on the switching capacity of the passengers in the competition areas.

The understanding of the factors that influenced the airport choice of the passengers in Nigeria provided insight into the prediction of LIA's market share. The survey instrument included questions related to factors that could influence choice of airport. The researcher used logistic regression to analyze the data of the contingent

valuation survey in order to identify the airport choice determinant factors (independent variables) that are strongly related to the prediction of the airport choice (dependent variable) of the passengers in Nigeria.

Survey procedure. The researcher and a team of enumerators administered the contingent valuation survey through personal interviews at the international and domestic terminals of the Murtala Mohammed International Airport. The team of eight enumerators trained by the researcher was divided into two groups of four enumerators. One group conducted the interviews at the international terminal of MMIA while the second interviewed the passengers at the two domestic terminals of the airport. In reality, the survey was conducted simultaneously at the three terminals by the enumerators who were constantly supported by the researcher. The enumerators intercepted passengers at MMIA and interviewed those who were willing to participate in the interview. They interviewed passengers waiting to check-in, to depart, or to collect their baggage at the three terminals. The enumerators interviewed an average of 50 passengers daily. The researcher and the enumerators did not record any non-response to the main research questions related to the airport choice and the WTP/WTA. However, non-responses were recorded on the question related to the airfare. Some passengers did not know the price of their tickets; they were mostly cases of tickets purchased by organizations and not the travelers. Such cases were considered as missing data and were deleted.

During the survey, the enumerators held the questionnaires and interviewed the passengers. Questions were read out from the questionnaires. The data elicited from the passengers were inputted into the questionnaires by the enumerators as the interviews

took place. The questionnaires were not distributed to the passengers. It was expected that guiding the passengers through the survey would enhance the accuracy of the responses and strengthen the validity of the results.

However, not all intercepted passengers were interviewed. The Institution Review Board (IRB) consent form titled *Agreement to Participate* contained an introduction to the research, a consent request, and the eligibility conditions was presented to the passengers. The eligibility conditions restricted participation to passengers who were 18 years old and had been a resident in Nigeria for more than 12 months. A non-resident passenger might not have had an adequate appreciation of the contingent scenario that was presented in the survey. A copy of the consent form and other IRB documents are presented in Appendix A.

Pilot survey. A pilot survey was conducted to: (a) test the reliability and validity of the instrument, (b) understand how participants reacted to the crafted contingent valuation scenario and the elicitation procedure (Whittington, 2002), (c) arrive at the final version of the instrument that will answer the research questions, and (d) validate the adequacy of the training provided to the enumerators.

Using the pilot survey to test the instrument reliability. In the literature review, Whitehead et al. (1995) held that the most common type of technical reliability testing in contingent valuation is the "test-retest method". It consists of a resurvey of respondents, presenting them with the same survey instrument, and the comparison of the responses. A positive correlation between the two responses is considered as evidence of reliability

of the instrument. The "test-retest method" was used to test the reliability of the contingent valuation survey. In the pilot survey, the instrument combined the test and the retest attempts as two related and similar valuation questions that were presented in closed and open-ended question formats. Similarly, a positive correlation between the two responses was considered as evidence of the reliability of the measures.

It was also established in the literature review that WTP or WTA values stated by on-site users were more reliable than the ones expressed by off-site users, and that reliability and validity increase as the respondents are familiar with the contingent scenario (Whitehead et al., 1995). In line with that observation, the contingent valuation survey of this research was conducted as in-person interviews only with passengers at the airport (on-site users of the service) in order to strengthen the reliability of the instrument and the validity of the results. Passengers are airport users; they know what an airport is. Furthermore, the interviews took place at Murtala Mohammed International Airport.

Using the pilot survey to test the instrument validity. The pilot survey was used to conduct the assessment of the validity of the measures of the present contingent valuation research focusing on the theoretical, policy, and methodological areas of the studies. Mitchell and Carson (1988) developed an approach for the evaluation of the validity of individual CV studies focusing on theoretical, policy, and mostly methodological grounds. The methodological approach for the evaluation of the validity of CV studies was adopted for the evaluation of the validity of the present CV research. The use of Mitchell and Carson's (1998) approach to the assessment of the methodology of the present contingent valuation research helped determine the degree to which the

results of the study were free of bias from factors that are potential sources of errors. With a framework based on the assessment of four key aspects of the research, the approach not only helped the researcher rule out a good source of potential bias, but also strengthened the validity of the study by providing confidence in the research findings. Following this approach, the researcher scrutinized four main factors of the study as recommended by Mitchell and Carson (1988). The factors were: (a) the wording of the contingent valuation scenario, (b) the administration of the instrument, (c) the adequacy of the sample design and its implementation, and (d) the sequence in which substitute or complement airport amenities were valued.

Crafting the contingent valuation scenario. For the contingent valuation research to produce valid results, it is important that the CV instrument meets the dual criteria of satisfying the requirements imposed by economic theory and the need of the respondents for a meaningful and relevant set of questions (Mitchell & Carson, 1988). The CV survey was guided by the set of criteria presented in Table 4 to achieve the dual purpose.

The first two criteria listed in Table 4 relate to the fit of the issue presented by the contingent valuation and the requirements of theory and policy. In order to make sure that the scenario was adequately specified from a theory and policy perspective, the researcher ensured that the description of the proposed second airport in Lagos included the location, purpose, ownership, management, and other main features provided by the Lagos State Government. The closer the fit between the amenities actually valued in the contingent valuation and the amenities that the researcher wishes to value, the greater the

confidence that the CV findings are relevant to the policy decision (Mitchell & Carson, 1988).

Closely related to the first two criteria, the third requirement focuses on the necessity of communicating the scenario accurately to the respondents. The scrutiny of this factor is to ensure that respondents do not understand the scenario in a different way than intended by the researcher. Respondents' understanding of the CV scenario was evaluated through the pilot survey.

Table 4

Scenario Design Criteria and Contingent Valuation Measurement Outcomes

Is the scenario …	If not, respondent will…	Measurement consequences
Theoretically accurate?	Value wrong thing (theoretical misspecification)	Measure wrong thing.
Policy relevant?	Value wrong thing (Policy misspecification)	Measure wrong thing.
Understandable by respondent as intended?	Value wrong thing (conceptual misspecification)	Measure wrong thing.
Plausible to the respondent?	Substitute another condition, or not take seriously	Measure wrong thing. Unreliable, bias-susceptible don't know, or protest zero
Meaningful to the respondent?	not take seriously	Unreliable, bias susceptible don't know, or protest zero

Note. Adapted from "Evaluating the Validity of Contingent Valuation Studies" by Mitchell & Carson, 1988.

The fourth and fifth criteria, related to the plausibility of the scenario and the relevance of the amenity (second airport) to the respondents, also help elicit valid

responses to the CV scenario. With regard to the plausibility of the scenario, the desire of the Lagos State Government to build a second airport in the Lekki –Epe area was public knowledge. The initial steps taken by the Lagos State Government such as the acquisition of the land and the appointment of a consulting firm were widely reported in the daily newspapers in Nigeria. Passengers' dual role as respondents to the CV survey and also the beneficiaries of the construction of a second airport in Lagos enhanced the relevance of the amenity (second airport) to the respondents. Moreover, the fact that the researcher not only engaged passengers (users of the airport) as respondents, but also conducted interviews at the Murtala Mohammed International Airport (on-site) mitigates the challenges of the relevance of the amenity (airport) to the respondents. The five scenario design criteria were necessary for the crafting of a valid scenario and were applied to this research as earlier discussed. In addition to the crafting of the CV scenario, the methodological approach to the validity evaluation of the CV research included the administration of the instrument.

Furthermore, the CV scenario was subjected to the review of the experienced enumerators of Feliben Marketing Research Ltd. The review took place during the enumerators training sessions. The purpose of the review was to ascertain if the enumerators had the proper understanding of the CV scenario and evaluate their ability to communicate the scenario adequately to the passengers.

Administration of the survey instrument. The in-person interview was recommended as the technique of choice for CV surveys. Also, the methodological approach for the validity CV studies recommends a standardized procedure for

information gathering that ensures information by one person could be compared with the information provided by another (Mitchel & Carson, 1988). To this effect, the researcher ensured that enumerators strictly followed instructions not to offer any explanation or information other than those provided in the survey procedure.

Adequacy of the sample design and its implementation. The purpose of scrutinizing the sample design was to assess if the measures recorded during the pilot study were influenced by sampling biases such as the population choice bias, sampling frame bias, and sample non-response bias. The population chosen for the present research was the passenger traffic into Murtala Mohammed International Airport, Lagos. Passengers constituted a population that would benefit from a second airport. The amenity under valuation was relevant to them. Therefore, the population choice for this CV study was considered appropriate.

Measurement sequence. The fourth factor for the evaluation of the methodological validity relates to the effect of the sequence in which amenities are valued when they are substitutes such as MMIA and LIA. The valuation sequence may lead to multiple public good sequence aggregation bias (Mitchell & Carson, 1988). According to this theory, if the two airports are valued in sequence in a single study by the same sample of passengers, the WTP estimates for the individual airports will be biased unless the researcher replicates the actual contingent valuation sequence for each airport (Mitchell & Carson, 1988). In order to mitigate the multiple public good sequence aggregation bias, respondents were requested to provide a WTP estimate for only one airport, Lekki

International Airport, the proposed second airport. The design of the questionnaire took the theory into consideration as passengers were requested to provide WTP values only for their first choice airport.

Furthermore, Mitchell & Carson (1988) and Whittington (2002) recommended the pretesting of the CV instrument and the training of the investigators. Indeed, the literature review on CVM emphasized the importance of conducting a pretest survey through a split-sample experiment to test the validity of not only the survey instrument, but also the result of the contingent valuation. The pilot survey of the present research was conducted as a split-sample test where sub-samples were treated differently in order to test the survey instrument against "protest" response bias.

Split-sample test. In a binary contingent choice scenario, like in the present research, respondents usually use the opportunity of a survey to express dissatisfaction with either the present amenity (Murtala Mohammed International Airport, Lagos) or the Government, believing that any new amenity will always be better than the present one in use. Such "protest" response may result in biases that negatively affect the validity of the CV. The researcher conducted a split-sample experiment to evaluate the effect of the "protest" response on passenger stated airport preference and also the willingness to pay estimate. The result of the split-sample experiment helped the researcher test passenger understanding of the contingent valuation scenario. It also helped with the crafting of a contingent valuation scenario that elicited responses that accurately portrayed the stated preference concept that was measured. The process is also defined as validity testing by Babbie (2010). The treatment was to be included in the final version of the CV scenario

for the main CV survey if the treatment had a statistically significant effect on passengers' choice of airport.

The treatment of the split-sample test consisted in expressly mentioning "protest vote" in the CV scenario as expressed in this statement: "The main purpose of this survey is not to record protest vote against Murtala Mohammed International Airport or the Federal Airport Authority of Nigeria but evaluate how some factors may affect your choice of airport if Lagos State builds a second international airport at Lekki-Epe". The standard version of the present CV scenario; which was also called control version; was the following:

> The Lagos State Government is planning to build a second international airport at Lekki-Epe area of Lagos state. The airport will be located in the export processing zone that the state government is presently building and will be connected by access roads. The airport will be owned by Lagos State but built on a Public-Private Partnership (PPP) and managed through a concession. At the completion of the project, Lagos State will have two international airports namely Murtala Mohammed International Airport and Lekki International Airport. Firstly, which of the two airports will be your first choice assuming the same flight is available at the two airports for the same price and keeping in mind that ownership, management, ease of access, distance from central business area, and access from your residence may differ. Secondly, how much higher ticket price will you be willing to pay to fly from Lekki-Epe International Airport?

The treatment contingent valuation scenario that was presented to another subsample was the following:

> The Lagos State Government is planning to build a second international airport at Lekki-Epe area of Lagos state. The airport will be located in the export processing zone that the state government is presently building and will be connected by access roads. The airport will be owned by Lagos State but built on a Public-Private Partnership (PPP) and managed through a concession. At the completion of the project, Lagos State will have two international airports namely Murtala Mohammed International Airport and Lekki International Airport. Firstly, which of the two airports will be your first choice assuming the same flight is available at the two airports for the same price and keeping in mind that ownership, management, ease of access, distance from central business area and access from your residence may differ? Secondly, how much higher ticket price will you be willing to pay to fly from Lekki-Epe International Airport? Please, note that the main purpose of this survey should not be to record protest vote against Murtala Mohammed International Airport or the Federal Airport Authority of Nigeria but evaluate how some factors may affect your choice of airport if Lagos State builds a second international airport in Lekki-Epe.

The sample size for the pilot survey was determined using Neuman's (1997) recommendation of 30% if the population under study is 1000. As later discussed, the sample size for the contingent survey was 1,067 respondents. Therefore, the pretest sample size was 320 (1,067 * 30%) passengers. The 320 pretest sample size was divided

into two subsamples on 50-50 basis. The 160 passengers, who were randomly presented the control scenario by the enumerators during the pretest survey, were the control subsample. The treatment subsample was made of the other 160 economy passengers who were presented the treatment CV scenario.

The researcher used the Pearson Chi-Square test to evaluate: (a) the effect of including the "protest vote" statement in the CV scenario on the distribution of passengers' stated preference between Lekki International Airport (LIA) and Murtala Mohammed International Airport (MMIA) and (b) the effect of the binary contingency choice on the WTP estimates across the two subsamples. Considering the chi-square square statistics and the p-values, the researcher analyzed the statistical significance of the effect of the treatment on the distribution of the stated preference between the two airports and the willingness to pay estimates.

***No opinion and non-response biases*.** During the interview, the crafted CV scenario led respondents to state their preference between two airports, MMIA and LIA. Some interviewed passengers could respond to the binary contingent choice question by "no response", "not sure", or "don't know". Passengers who did not participate in the interview due to eligibility issues, time constraint, or other reasons were not considered or recorded as no opinion or non-response. In the present research, a response was considered as non-response if a passenger provided answers to most of the questionnaires but failed to answer the questions related to stating the airport preference and the estimation of the WTP (Item non-response bias). In addition, "not sure" or "don't know"

responses to airport preference and WTP/WTA questions were to be considered as non-response.

A review of the CV literature showed that non-response results are usually associated with respondents' lack of interest in the topic of the survey (Mitchel & Carson, 1988). In the design and framing of the sample for the present CV survey, passengers (main airport users) were selected as respondents. It is expected that airport users would be interested in topics related to the airport.

With regard to the "not sure" or "don't know" response to a binary contingent choice question as in the present CV survey, the National Oceanic and Atmospheric (NOAA) panel on contingent valuation recommended offering a "no vote" option in the design of the CV questionnaire (Arrow et al., 1993). However, recent studies have shown that offering a "No opinion" option does not significantly affect the quality of the CV survey data or the distribution of stated preferences between the binary options (Hoyos, & Mariel, 2010). Carson et al.'s (1998) study showed that offering a no opinion alternative in addition to the binary choice in the design of CV instrument affects rather negatively the amount of data collected; therefore, in the design of the present CV instrument, the researcher did not offer a no opinion alternative to the question that requested passengers to state their preference between MMIA and LIA. However, enumerators were allowed to record no opinion responses if provided by the passengers. Incidentally, at the end of the data collection period, the research did not record any non-response case as earlier defined.

Treating respondents' preference uncertainty. The research was conducted in Lagos, Nigeria, where English is not the native language. English language is only the lingua franca in Nigeria. The researcher believed that it was challenging for some respondents to distinguish clearly between the set of responses provided by the polychotomous choice method, mostly between "Probably Yes" and "Maybe Yes". In view of the language constraint and the additional variances the use of PC method could introduce in the present research context, the researcher used the numerical certainty scale to elicit respondent uncertainty information related to the airport preference binary and WTP elicitation questions. The CV survey included a follow-up question after the dichotomous airport preference and WTP questions. The follow-up question asked the respondents to evaluate their confidence in answering the airport preference and WTP questions on a scale of 1 to 10, where 1 stands for "not at all certain" and 10 for "very certain".

Taking into consideration Johannesson et al.'s (1998) research findings which stated that hypothetical "absolutely sure yes" responses (corresponding to "very certain" or 10 on the NCS scale) underestimate the real "yes" responses, the researcher did not use 10 on the NCS scale as response certainty threshold. As discussed in the literature and presented in Table 3, previous researchers adopted 10, 8 or higher, 7 or higher, and 6 or higher as certainty cut-off points. The present researcher took the average of 10,9,8,7, and 6, which is 8, as certainty threshold. Therefore, the response certainty cut-off point for the present research was 8 or higher on the NCS scale. A stated preference for LIA with a certainty response of 8 or higher was coded as 1. Stated preferences for LIA with

a certainty response less than 8 and stated preference for MMIA were coded as 0. With regard to the WTP, only valuations with certainty response of 8 or higher were retained.

Training of the enumerators. The researcher used experienced enumerators for the conduct of the contingent valuation interviews. Even though the experience and the commitment of the enumerators contributed positively to the quality of the CV survey, they did not obviate the importance of the field training and supervision the researcher needed to provide. The researcher was actively involved in the training of the enumerators and the administration and management of the survey (Whittington, 2002). The purpose of the researcher's involvement with the enumerators was to ensure that the survey provides accurate and unbiased data that were not influenced by the personal views of the enumerators. The training of the enumerators focused on two main areas: (1) a clear understanding of the objectives of the survey with its contingent scenario and (2) ensuring that the enumerators were equipped with the appropriate skills for high quality in-person interviews.

Furthermore, the exercise ensured that the interviewers understood the objectives of the survey as well as the contingent valuation scenario presented in the instrument. The interviewers needed to understand what the study was about. When necessary, they were to be able to respond to questions and provide clarification in an informed manner on the matters raised in the CV scenario. Therefore, the researcher ensured that the interviewers did not only have a common understanding of the subject-matter of the survey but also the capacity to provide answers to respondents in a consistent manner (Whittington, 2002). The researcher ascertained that the enumerators were acquainted

with the same survey procedure during the training and adhered to it during the pilot and main surveys. Ensuring that enumerators adhered consistently to the same procedure during the survey helped mitigate biases and strengthen the validity of the results.

Moreover, the training focused on providing the enumerators with the necessary skills to conduct high-quality in-person interviews. They were encouraged to ask questions during the training. During the pilot study, interviewers were required to write down questions that respondents asked and submit them for a review when they all met in a general training session. They were encouraged to identify high-quality responses to all the questions, as a missing variable in an interview can invalidate the entire interview. The pretest period was an opportunity for the interviewers to practice the administration of the questionnaire in order to avoid some foreseeable pitfalls. In addition to enhancing the enumerators' skills, the training also helped polish the instrument through the review of the enumerators' on-the-job training experience.

The elicitation procedure. The literature review indicated that the success of contingent valuation studies could be affected by the researcher's choice of the linkage between the CV scenario and elicitation procedure (Whittington, 2002). Airport competition literature provides some guidance on the choice of the elicitation question a CV researcher should make as presented in Table 5. Airports in Nigeria are government entities, and passengers perceive them as public organizations that provide public service. Very few airports in Africa are privately owned. In Nigeria, airports are owned by the Federal or State Government. In view of this categorization of an airport as a public

good, the research considered either case II or case IV in Table 4 for the conception of the elucidation procedure.

The case II, which combines a public good and an open-ended WTP valuation question, was considered by Whittington (2002) to be a mistake that the CV researcher must avoid. The literature review found the close-end, Yes/No valuation question to be a desirable approach for the valuation of a hypothetical public good such as a proposed second airport (Whittington, 2002). Therefore, the valuation question for the patronage of a hypothetical second airport in Lagos was a close-end question that asked respondents to indicate which of the two airports would be their first choice.

Table 5

The Linkage between the CV Scenario and the Choice of Elicitation Procedure

Type of elicitation procedure	CV scenario describes a hypothetical **private** good or service	CV scenario describes a hypothetical **public** good or service
Open-ended maximum WTP valuation question	Case I	Case II
Close end, **Yes/No** valuation question	Case III	Case IV

Note. Adapted from "Improving the Performance of Contingent Valuation Studies in Developing Countries," by D. Whittington, 2002, *Environmental and Resource Economics*, 22, 323-367.

Payment vehicle. The payment vehicle is the channel presented to respondents in the contingent valuation survey to express their WTP to acquire or retain a service or their WTA a payment for giving up a service (Malina, Schwab, & Wollersheim, 2008).

The CV scenario of this research asked the respondents to state how inexpensive their tickets should be for them to fly from the airport they did not select as first choice. The contingency of this section of the research, relating to an airport demand valuation, dealt with a WTA rather than a WTP. During the survey, respondents who stated their preference for the proposed second airport were asked to advise the extra airfare they would be willing to pay in order to fly from that airport after its completion. This section of the survey dealt with the WTP of some passengers. Therefore, the contingent valuation survey provided WTA and WTP values for analysis.

The literature review showed that CV studies made use of different payment vehicles, namely referendum, bidding, and payment card. The vehicles can be stated in terms of payment to fund, sum of money to be paid, tax exemption, or higher price for a good or service. In the present study, the contingent valuations (WTA and WTP) were expressed in relation to the value of the average airfare from Lagos to other destinations using a payment card as the bid vehicle. The use of airfare as the payment vehicle offered the respondents, who are passengers, a realistic and familiar reference for airport valuation (UK CAA, 2002).

Population and Sample

The researcher set the following parameters in the attempt to determine an appropriate sample size:

- The population size for the survey was set at 5,781,067 as Murtala Mohammed International Airport Lagos handled 5,781,067 passengers in 2013 (IATA, 2014).
- Though a 5% error margin is usually considered adequate, the researcher decided to work with a 3% error margin in order to have a larger and more representative sample size.
- A confidence level of 95% was set for the level of uncertainty that could be tolerated in the sampling exercise.

Raosoft sample calculator model was used to determine the sample size for the contingent valuation survey because the model was based on parameters similar to those set by the researcher. Olawale & Garwe (2010) and Zyoud et al. (2013) used the Raosoft sample size calculator which can be found at the Raosoft website: http://www.raosoft.com/samplesize.html. Raosoft, an organization providing survey software programs in the U.S., developed a sample size calculator model that uses the above-mentioned parameters to determine the sample size for surveys. The model is driven by the following equations (Raosoft, 2014):

$$x = Z(^{c}/_{100})^{2} r(100-r) \quad (1)$$

$$E = \text{Sqrt}[^{(N-n)x}/_{n(N-1)}] \quad (2)$$

$$n = {}^{Nx}/_{((N-1)E^{2}+x)} \quad (3)$$

Where:

N = Population size.

r = Fraction of responses in which the researcher is interested.

E = Margin of error.

$Z(c/100)$ = Critical value for the confidence level c.

n = Sample size.

The sample size of the contingent valuation survey for the proposed research was estimated using the Raosoft sample size calculator model. The parameters were input into the model which determined a minimum sample size of 1,067 respondents. The sample of 1,067 passengers was derived from a population of passengers who have been flying to and from Murtala Mohammed International Airport, Lagos. Importantly, the sample of 1,067 respondents consisted of only valid interviews. As a matter of fact, it was expected that the enumerators would conduct interviews for more than 1,067 passengers to arrive at the sample size earlier determined.

Sources of the Data

Data for the present phase of the dissertation was obtained through in-person interviews. The instrument that was used for the CV survey is presented in Appendix C, the respondents were engaged in in-person interviews that were conducted by trained enumerators. Participants were interviewed only within the airport environment at the domestic and international terminals of Murtala Mohammed International Airport. The purpose of limiting the conduct of the interviews to the three terminals was to mitigate biases related to the geographical location of the respondents and strengthen the methodological validity of the contingent valuation. The enumerators interviewed both departing and arriving passengers. This research did not cover transit passengers as they are, usually, not expected to reside in Lagos.

Ethical issues. The conduct of the in-person interviews in this research involved human subjects, thus the need to ensure that the ethical principles of the respect for persons, beneficence, and justice were upheld during the survey. With regard to the principle of respect for the person, the researcher informed the respondents about the objectives of the research and the voluntariness of their participation. In addition, the respondents were provided with an informed consent form. The subjects were free to withdraw from the interview at any time. The survey procedure ensured that respondents made an informed decision about their participation in the survey.

The survey instrument did not collect the identification data of the respondents in order to mitigate the risk of harm to the privacy and confidentiality of the participants. The survey only collected de-identified data as respondents were not required to provide information related to their identity, zip code, or date of birth. The researcher ensured that the survey did not harm the respondent.

Furthermore, the ethical principle of justice was upheld as respondents were passengers who are also airport users. They were randomly selected. By randomly selecting airport users for a survey that relates to the airport, the researcher ensured the ethical principle of justice was taken into consideration while dealing with human subjects (Bailey, 2014).

The data collection did not commence until the approval of the IRB of Embry-Riddle Aeronautical University was obtained. The IRB found that the data collection procedure of the present research fell under the exempt category. Consequently, the IRB authorized the researcher to commence data collection. In addition to the IRB approval, the researcher applied for the permission of the FAAN for the conduct of the survey at

the domestic and international terminals of MMIA. The collection of the data commenced only after the approvals of IRB and FAAN were obtained. Copies of the approvals are presented in Appendix A.

Data Collection Device

The survey instrument, presented in appendix C, contains four main parts:

1) The profile of the participants who generated data such as residence area, income, market segment, and origin/destination.
2) The hypothetical scenario which was presented to the participants through a short story. The purpose of the story was to adequately craft a contingent valuation scenario that would allow the respondents to appreciate the focus of the survey and the scope of the problem. The story described a hypothetical "deal" which the passenger can either accept or reject (Whittington, 2002).
3) The valuation questions that elicited information from the respondents with regard to the airport they would select as first choice and the compensation they would require for the patronage of the less preferred airport.
4) The elicitation questions were followed by the reliability and validity testing questions located at the end of the questionnaire.

Treatment of the Data

Descriptive statistics. Descriptive statistics were used to analyze the different variables of the data collected through the contingent valuation survey. The review of the descriptive metrics helped the researcher understand and prepare the data for the different

statistical tools that were used for the analysis of the data. The descriptive metrics that were used include: counts, percentages, frequency, mean, standard deviation, and minimum and maximum values. The researcher used the Statistical Package for the Social Sciences (SPSS) for the descriptive statistic evaluation of the variables.

Data preparation. The researcher used SPSS to examine the nature of the data. With regard to missing data, the researcher first assessed their types and potential impacts. Then, two approaches were considered to remedy the missing observations: calculating replacement or using only the valid data for the research (Hair, Black, Babin, & Anderson, 2010). The use of the person-to-person interview approach helped mitigate missing data incidents as it provides the advantages of face-to-face contact, the reduction of misunderstanding, and the possibility of spontaneous questions.

Moreover, the data were examined for the purpose of detecting, describing, and profiling outliers. The researcher used the Mahalanobis D square for the detection of outliers and subsequently considered if they should be retained or deleted from the data. With regard to the testing of the assumptions of multivariate analysis, the overall sample size of 1,067 provided enough observations per estimated parameters (at least 10) for the two categories of the binary dependent variable. The statistical assumptions of normality, homoscedasticity, linearity, and absence of correlated errors are not required for logistic regression analysis (Hair et al., 2010). In addition, categorical variables such as “gender” or “Airport preference” were coded for the purpose of statistical analysis. Similarly, the binary variables were coded (1 or 0) as a dummy variable.

Research question 1: How much market share could the proposed second airport in Lagos attain while in competitive co-existence with the primary airport? The distribution of the responses to the binary contingent choice question, which asked passengers to state their preference between Murtala Mohammed International Airport and the proposed Lekki International Airport was reported as count and percentage. It was also presented through the use of histograms.

Research question 2: What are the most important predicting factors for passenger preference between Murtala Mohammed International Airport and the proposed Lekki International Airport? The question dealt with the identification of the independent variables that impacted group membership of the binary dependent variable. In airport economics literature, Blackstone, Buck, and Hakin (2006) identified: (a) income; (b) the use of competing airports; (c) convenience of parking; (d) distance from residence to the airport; (e) availability of low fares, and (f) the availability of international flights as determinants of airport choice in a multi-airport region. The present research assessed if similar or different variables were determinant of airport preference in Nigeria. The dependent variable *First Choice* is a binary nonmetric variable with two outcomes: MMIA and LIA. The metric and nonmetric independent variables were:

1. Length of stay in Nigeria
2. Access time
3. Class of travel
4. Airfare

5. Purpose of travel
6. Choice of airport amenity
7. Amount willing to pay or accept
8. Gender
9. Level of education
10. Income

The researcher used logistic regression to determine the independent variables that predict the membership of the categories of the binary dependent variable *First Choice*. Logistic regression is the most appropriate statistical technique when the dependent measure is binary and the dependent variables are metric or non-metric (Hair et al., 2010). A forward stepwise model estimation was used for the entry of variables into the logistic regression model starting from a base model. The logistic regression equation was:

$$\text{Logit (first choice)} = a + b1X1 + b2X2 + b3X3 + \text{----} bnXn \qquad (4)$$

Where:

a = Constant.

b1 … bn = Regression coefficients.

X1 … Xn = Predicting variables.

The regression model was validated through a split-sample estimation of the predictive accuracy of the model. The sample was split into analysis and hold out

samples. The model was to be considered valid if the reduction in the predictive accuracy between the analysis sample and the hold out sample was less than 10%: (a) the creation of analysis and holdout samples and (b) the analysis of the hit ratio for the holdout sample. The validation exercise helped the researcher evaluate the external validity and practical significance of the logistic regression model (Hair et al., 2010) in the context of the prediction of LIA's market share.

Research question 3: What will be the catchment area of passengers who will prefer to fly from the proposed Lekki International Airport, Lagos? The catchment area analysis was used to predict the geographical area from which a significant proportion of the passenger originated. The administrative delimitation of Lagos State into 20 Local Government Areas (LGA) was used for the analysis. The researcher adopted the UK CAA's threshold whereby a Local Government Area was considered a catchment area for an airport if at least 25% of the passengers it originates patronize the said-airport (UK CAA, 2011). The data used for the delimitation of MMIA's and LIA's catchment areas was derived from passengers' responses to questions 3 and 13 of the interview script in Appendix C. The overlapping of the catchment areas between MMIA and LIA were analyzed for the prediction of potential passenger substitution and competition between the two airports. Isochrones were used to conduct addition analysis of the catchment areas.

An isochrone describes a catchment area around an airport. The drive-time isochrones were built around MMIA and LIA. The isochrones were built using congestion-free drive time to MMIA or LIA when taking public ground transport in

Lagos. In the absence of an authoritative local publication on drive time within Lagos, the researcher compiled the congestion-free drive time data between the 20 LGAs and MMIA and LIA using the estimates provided by Google Map.

The UK CAA used a two-hour travel time to an airport for the geographical description of the potential catchment area for non-business passengers and a one-hour isochrone for business passengers (UK CAA, 2011). Adopting the UK CAA's threshold, the researcher built two types of drive-time isochrones for MMIA and LIA: a one-hour isochrone built around MMIA and LIA for business passengers and a two-hour isochrone built for non-business passengers. The isochrones were mapped over the 20 LGAs of Lagos State.

Isochrone overlapping provided a visual illustration of the market share that might be contested by both airports. Moreover, catchment areas of each airport were compared with the corresponding isochrones in order to determine how the catchment areas fit into the isochrones. The analysis of the fitness of catchment areas into the isochrones provided insight on the characteristics of business and non-business passengers for each airport and particularly LIA.

Research question 4: How much are passengers willing to pay should additional airfare be required to fly from the proposed Lekki International Airport, and what are the determinants of that willingness to pay? The estimates of the WTP of passengers who selected LIA were derived from the contingent valuation data using the descriptive statistic output which determined the lower and upper bounds estimates of the WTP values. With regard to the estimation of the mean WTP for LIA, the researcher

made use of box plot to mitigate the challenges of reporting errors, “protest”, or asymmetric values. In addition to the mean WTP, the median WTP was determined. Though mean WTP has been the traditional measure used in benefit-cost analysis, median WTP represents the flat amount that would receive majority approval as a standard public choice criterion (Carson, 2000).

With regard to the identification of the factors that determine passengers’ willingness to pay in Nigeria, a multiple regression technique was found appropriate due to the nature of the variables. The dependent variable *Amount Willing to Pay* was metric and continuous. The selection of the independent variables was guided by the CVM literature. In a study conducted in Nigeria, Ifabiyi (2011) identified income, demographic, and education as factors that determined willingness to pay for water at household level in Kwara State of Nigeria. Similarly, Samdin, Aziz, Radam, and Yacob (2010) found that income, nationality, education level, and marital status influenced the willingness to pay for entrance permit of Taman Negara National Park in Malaysia. The researcher assessed if similar or other factors influenced passengers’ willingness to pay for airport services in Nigeria. Therefore, variables that were already cited and discussed as determinant factors of WTP in CVM literature and additional variables were selected as independent variables for the present research question. The following were the selected independent variables:

1. Income
2. Level of education
3. Gender
4. Local government location

5. Length of stay in Nigeria
6. Access cost
7. Class of travel
8. Airfare
9. Purpose of travel
10. Choice of airport amenity

Nonmetric variables such as *Gender, Local Government Location, class of travel, purpose of travel, Choice of Airport Amenity* and *Airport Choice* were coded and transformed into dummy variables in order to meet the multiple regression requirements of dependent and independent variables being metric.

Only cases where the selection of LIA as first choice airport and WTP met the certainty threshold of 8 on a scale of 10 were selected as valid for the present research question. Even though the application of the numerical certainty scale depleted the data, with a sample size of 285 cases, the observations to variables ratio was 20:1, exceeding the minimum of 5:1 required for multiple regression analysis. Unlike in the case of logistic regression earlier discussed, it was important to assess if the assumptions for the multiple regression analysis were met. The assumptions assessed were:

1. The linearity of the relationship between the dependent variable Amount Willing to Pay and the 10 independent variables earlier discussed.
2. The heteroscedasticity of the variance.
3. The normality of the dependent and independent variables.
4. The multicollinearity between the independent variables.

With regard to the multiple regression method, the researcher used the stepwise method which started with a method containing only a constant. At each step of the estimation of the model, the independent variable with the highest correlation with the dependent variable and which significantly improved the predictive accuracy of the model was retained. The process continued until there were no more predictors that could contribute significantly to the improvement of the predictive accuracy of the model. The multiple regression equation was:

$$WTP = b0 + b1x1 + b2x2 + b3x3 + \ldots + bnXn + e \quad (5)$$

where:

b0 = A constant.

b1, b2, b3 … bn = Regression Coefficients.

x1, x2, x3 … xn = Predictors.

e = Error Term of the Model.

Summary. The present chapter discussed the research methodology adopted for achieving the purpose of the research, which is to predict the market share of a proposed second airport in Lagos, Nigeria. A combination of methods was used for the provision of the answers to the four research questions. While the contingent valuation method was found appropriate for the collection of the data, logistic regression, isochrones, and multiple regression were also applied for the analysis of the data. A logistic regression model was built for the identification of factors that influence membership of the two categories of the binary airport choice dependent variable. Further, the isochrone

analysis was used to determine the MMIA and LIA catchment areas. The determinants of passengers' willingness to pay were identified using the multiple regression analysis.

The Raosoft sample calculator was used to determine the appropriate sample needed for the MMIA traffic population. Based on a conservative 3% error margin, the sample size for the research was calculated to be 1067 cases. The results of the prediction analyses are discussed in the following chapter.

CHAPTER IV

RESULTS

The purpose of the present study was to predict the market share that the proposed second airport in Lagos could attain in a competitive environment. To accomplish this, the contingent valuation method was used to collect the data through intercept interviews conducted onsite at MMIA. The in-person interviews of the eligible domestic and international passengers at the three terminals of MMIA took five weeks to complete.

As recommended in the review of the CVM literature, a pilot study was conducted prior to the principal research. The purpose of the pilot study was to assess respondents' understanding of the crafted contingent valuation scenario, test the reliability and validity of the instrument, and arrive at the version of the instrument that will be used for the main research. The present chapter presents the results of the pilot study and the principal research.

Results of the Pilot Study

After training, the enumerators and the researcher conducted 320 in-person interviews at the three terminals of MMIA. The treatment of the collated data consisted of: (a) the deletion of cases with missing data, (b) the identification and removal of outliers, and (c) the removal of cases with airport choice certainty response lower than 8 on the NCS scale. As discussed earlier, the NCS threshold adopted for this research was 8. Only 235 cases were found usable after the treatment of the data.

Reliability testing. The test–retest method adopted for the testing of the reliability of the present CV instrument examined the correlation between the responses to two pairs of test and retest questions. A Spearman's correlation test was used to examine the correlation between the pair of variables (test and retest): *First Choice Airport*/*Confirmation of Airport Choice* and *Amount Willing to Pay or Accept*/*Confirmation Amount for WTP or WTA*. The reliability testing of the pairs of variables was conducted starting with the normality test of the four variables.

The results of the normality test summarized in Table 6 show that the skewness and kurtosis statistics of the four variables were not zero. In a normal distribution, the value of the standard error of skewness and kurtosis is zero (Field, 2009). Therefore, the four variables were not normally distributed.

Table 6

Normal Distribution Statistics

	First Choice Airport	Confirmation of Airport Choice	Amount Willing to Pay or Accept	Confirmation Amount for WTP or WTA
Skewness	.678	.303	2.635	2.480
Std. Error of Skewness	.159	.159	.159	.159
Kurtosis	-1.554	-1.925	6.653	5.575
Std. Error of Kurtosis	.316	.316	.316	.316

Note: The skewness values of the four variables are positive while the kurtosis values of the airport choice variables are negative. The kurtosis values of the WTA and WTP values are positive, which indicates heavy-tailed distribution.

Since the data was not normally distributed, the Spearman's correlation coefficient was used to test the correlation of the pairs of variables. With regard to the first choice airport pair of responses, the output for the Spearman's correlation test reported in Table 7 shows a correlation coefficient of 0.817. Since the significant value of the coefficient was less than 0.05, it was concluded that passengers' responses to the airport choice question were significantly related to their response to the retest question.

Table 7

Correlation First Choice Airport and Confirmation of Airport Choice

			First Choice Airport	Confirmation of Airport Choice
Spearman's rho	First Choice Airport	Correlation Coefficient	1.000	.817**
		Sig. (2-tailed)		.000
		N	235	235
	Confirmation of Airport Choice	Correlation Coefficient	.817**	1.000
		Sig. (2-tailed)	.000	
		N	235	235

Note: **Correlation is significant at the 0.01 level (2-tailed).

The output of the Spearman's correlation test between the amount passengers were willing to pay or accept and their confirmation of the amount is reported in Table 8. The output shows that the two variables had a Spearman's correlation coefficient of 0.958. The significance value of the coefficient being less than 0.05 indicated that there was also a significant relationship between the pair of variables. The Spearman rho

correlation coefficients of the two pairs of variables were close to 1. Thus, the analysis shows that the correlations were positive and strong, and the assessment indicates strong instrument reliability.

Table 8

Correlation Amount Willing to Pay or Accept and Its Confirmation

			Amount Willing to Pay or Accept	Confirmation Amount for WTP or WTA
Spearman's rho	Amount Willing to Pay or Accept	Correlation Coefficient	1.000	.958**
		Sig. (2-tailed)		.000
		N	235	235
	Confirmation Amount for WTP or WTA	Correlation Coefficient	.958**	1.000
		Sig. (2-tailed)	.000	
		N	235	235

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Validity testing. As discussed in the previous chapter, the Mitchell and Carson's (1988) methodological approach was adopted for the evaluation and strengthening of the validity of the CV instrument. The approach, which focuses on the theory, policy, and method, is aimed at determining the degree to which the CV results were free of bias from factors that could be sources of errors (Mitchell & Carson, 1988). The impacts of the following bias on the instrument measures were assessed:

1. Protest bias
2. Uncertainty bias
3. Non-response bias

4. Sampling bias

Protest bias. A split-sample experiment was conducted during the pilot interviews in order to assess the impact of protest bias on the measures. The purpose of the split-sample experiment was to assess if the passengers' binary choice of an airport was affected by a protest bias against MMIA or its management. The chi-square statistics of the experiment, reported in table 9, show that the exact significance value of the Pearson Chi-Square was 1. Since the *Exact Significant* value was higher than 0.05, there was no significant relationship between the control group and the experimental group.

Table 9

Chi-Square Split-Sample Test-Airport Preference

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.010	1	.919	1.000	.514
N of Valid Cases	235				

Table 10 shows that the Goodman and Kruskal's Lambda values are zero. The Goodman and Kruskal's lambda values indicate that the split-sample grouping did not predict the category membership of the dichotomous variable *First Choice Airport*. The

result confirmed the Pearson Chi-Square test result and indicates that airport choice measures were not influenced by the protest bias.

Table 10

Directional Measures Split-Sample Test – Airport Preference

		Value	Asymptotic Standardized Error[a]	Approximate Significance	Exact Significance
Goodman and Kruskal tau	Split -Sample Experiment Grouping Dependent	.000	.001	.919[a]	1.000
	First Choice Airport Dependent	.000	.001	.919[a]	1.000

Note. a. Based on chi-square approximation

With regard to the effect of the protest bias on the WTP or WTA values, the output of the Chi-Square test recorded a Pearson Chi-Square significance value of 0.474. The significance value (two-sided) of the Pearson Chi-Square was higher than 0.05 as showed in Table 11. The result indicates that there was no significant association between passengers' willingness to pay or accept and the split-sample grouping. The assessment of the split-sample test showed that the measures were free of protest bias.

Table 11

Chi-Square Tests Split-Sample Test - WTP

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	34.888	35	.474	.491	
N of Valid Cases	235				

Uncertainty bias. The numerical certainty scale (NCS) was used to mitigate the response uncertainty bias. NCS was applied against passengers' responses to the binary airport preference question. Respondents, who were not certain of their responses to the airport choice question up to 8 on a certainty scale of 1 to 10, had their responses deleted from the data. After deleting responses that did not meet the certainty requirement, the total number of valid cases for the pilot study was reduced to 235 from the 320 interviews conducted. Table 12 reports that descriptive statistics of the variable Certainty Airport choice. The output shows that 49.4% of the respondents were absolutely certain of their responses, while 25.5% and 25.1% indicated high certainty levels 8 and 9, respectively.

Table 12

Descriptive Statistics – Certainty Airport Choice

Certainty Level	Frequency	Percent	Valid Percent	Cumulative Percent
8	60	25.5	25.5	25.5
9	59	25.1	25.1	50.6
10	116	49.4	49.4	100.0
Total	235	100.0	100.0	

Non-response bias. Though an opportunity was provided by the enumerators to accept non-responses, the survey did not record any non-responses to the airport choice and willingness to pay or accept questions. The respondents were not only passengers but also beneficiaries of the airport products and thus were interested in the subject of the research and accepted to participate in the interview. Conducting the CV interviews with respondents who are interested in the subject of the investigation helped mitigate the non-response bias. As discussed earlier in the review of the CVM literature, it has been found that non-response results are usually associated with respondents' lack of interest in the topic of the survey (Mitchel & Carson, 1988).

Sampling bias. With regard to the sampling frame, the qualification criterion was applied during the IRB informed consent process and through question Q2 of the interview script. Passengers who have been in Nigeria for less than one year and passengers who have no knowledge of Lekki, the area where the proposed airport will be located, were either disqualified from the interviews or had their interviews removed

from the data. Using intercept interview, passengers were intercepted randomly at MMIA, and those who accepted to participate in the interview were presented the "Agreement to Participate" which includes the eligibility conditions. The "Agreement to Participate" is one of the IRB documents presented in Appendix A. Furthermore, international passengers who were in transit at the airport were not interviewed as they did not meet the eligibility condition of at least 12 months of residency in Nigeria.

Contingent Valuation Instrument for the Main Research. The survey instrument for the main research was determined after the analysis of the results of the pilot study. The result of the split-sample test, during pilot study, indicated that responses to the contingent valuation scenario were not subjected to protest bias. Therefore, Question 13 in the main interview instrument presented only one version of the contingent valuation scenario. Furthermore, based on the review of the conduct and results of the pilot study with the enumerators, Questions 5, 6, and 11 were rephrased with additional information. The structure of the instrument was also amended to mitigate survey administration errors. Appendixes B and C present the instruments used for the pilot study and main research.

Descriptive Statistics of the Main Study

The enumerators were advised to increase the number of interviews to be conducted from 1,076 as indicated in Chapter 3 to 1,300 in order to ensure that the determined sample size was maintained after data cleaning. After cleaning the data and applying the NCS threshold to passenger's evaluation of the certainty of their response to

the dichotomous airport preference question, 1,113 cases were accepted as valid and retained for further investigation.

Table 13 shows that out of the 1,113 valid cases, 29% of the passengers rated 8 on the scale of 1 to 10, the certainty of their response to the airport choice question; while 35.5 % rated their response 9 and 35.2 % rated their responses 10. Furthermore, 77% of the respondents were travelling on domestic flights while 23% were embarking on an international trip as reported in Table 14. In addition, 92.9% of the passengers interviewed were holding economy class tickets.

Table 13

Airport Choice Certainty

NCS Rating	Frequency	Percent	Valid Percent	Cumulative Percent
8	326	29.3	29.3	29.3
9	395	35.5	35.5	64.8
10	392	35.2	35.2	100.0
Total	1113	100.0	100.0	

The output in Table 14 also shows that 58.2% of the passengers were on a business trip. The present result confirms the observation of a high proportion of business travelers during the pilot survey. As reported in Appendix E, the output of

descriptive statistics of the pilot study data showed that 49% of the travelers were business passengers.

Administratively, Lagos State is divided into 20 local government areas. Figure 9 shows the distribution of the respondents over the 20 LGAs and the neighboring Ogun State. The three LGAs with the highest number of interview respondents were: Ikeja where MMIA is located, Eti-Osa, and Alimosho. They accounted for 236, 170, and 160 respondents, respectively.

Table 14

Descriptive Statistics

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Domestic	858	77.1	77.1	77.1
International	255	22.9	22.9	100.0
Economy Class	1034	92.9	92.9	92.9
Business Class	79	7.1	7.1	100.0
Non-business	465	41.8	41.8	41.8
Business	648	58.2	58.2	100.0

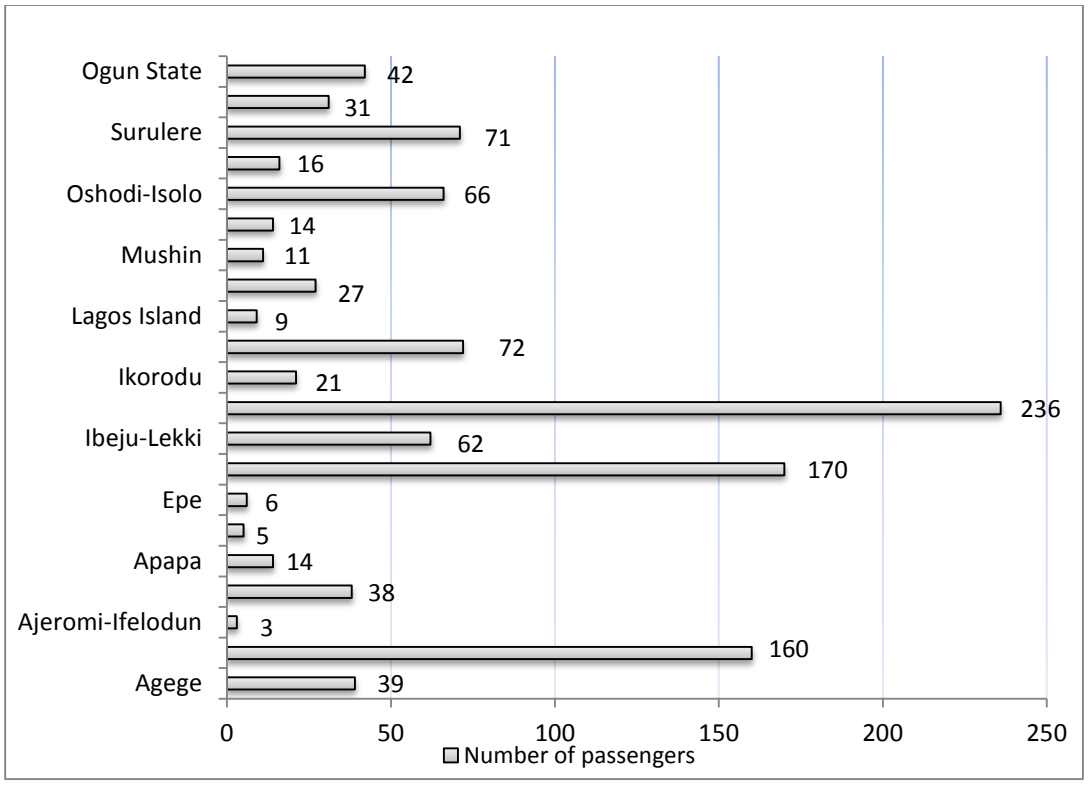

Figure 9. Respondents by Local Government Area and Ogun State.

Respondents' Profile. During the conduct of the interviews, 1,113 respondents provided valid data. Males and females were interviewed. As shown in Figure 10, 54.5% of the respondents were male while 45.5% were female.

With regard to age, while 19% of the respondents were aged between 18 and 25 years, 71% of the interviewees were aged between 18 and 50 years. Moreover, 99% of the respondents were below the retirement age of 65, as shown in Figure 11. The average passenger interviewed at MMIA was 36 years old. The respondents were relatively young. Nevertheless, they had stayed in Nigeria for a long time. 97.8% of the respondents had stayed in Nigeria for more than five years.

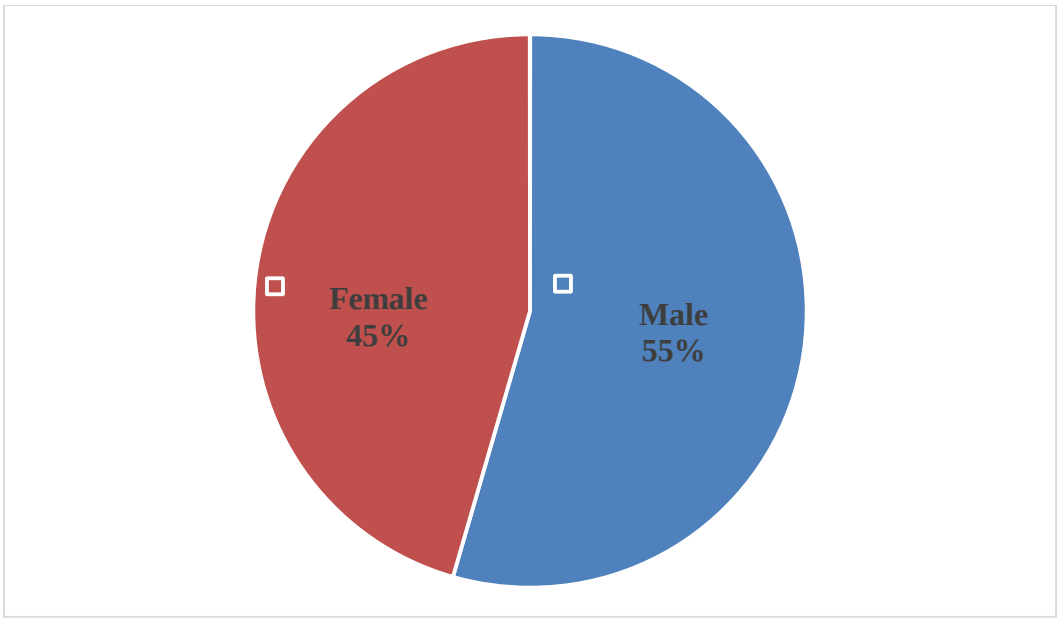

Figure 10. Passenger Gender

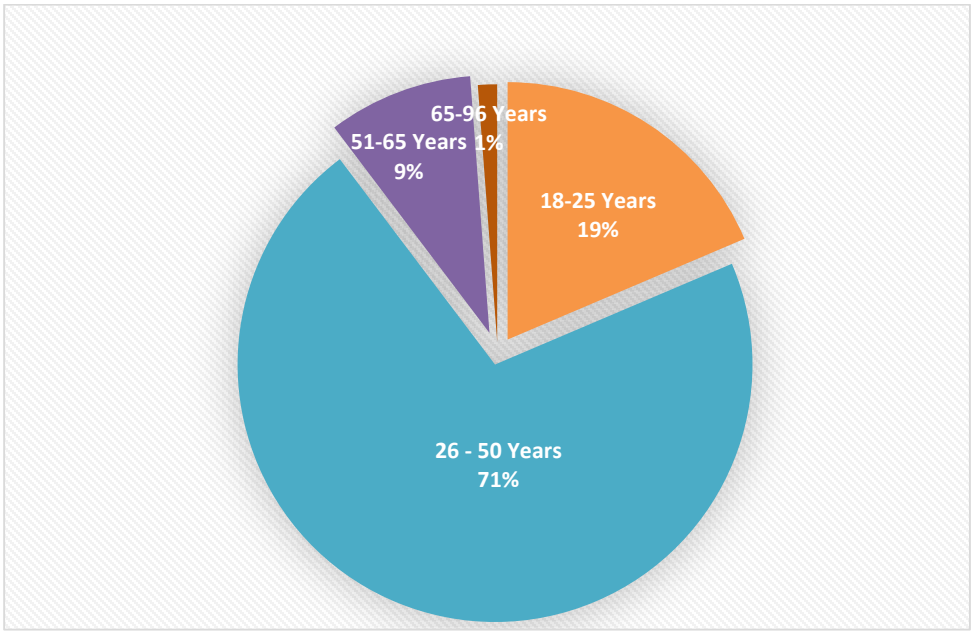

Figure 11. Age of the respondents.

As reported in Figure 12, the interviewees were educated passengers. Only 3.1% of the respondents had primary and secondary school education. In fact, 4.3% of the passengers had OND (Ordinary National Diploma) or NCE (National Certificate of Education) qualifications. The OND delivered by Polytechnics and the NCE awarded by teacher training institutions in Nigeria are post-secondary school qualifications. Furthermore, 92.6% of the passengers had completed university education.

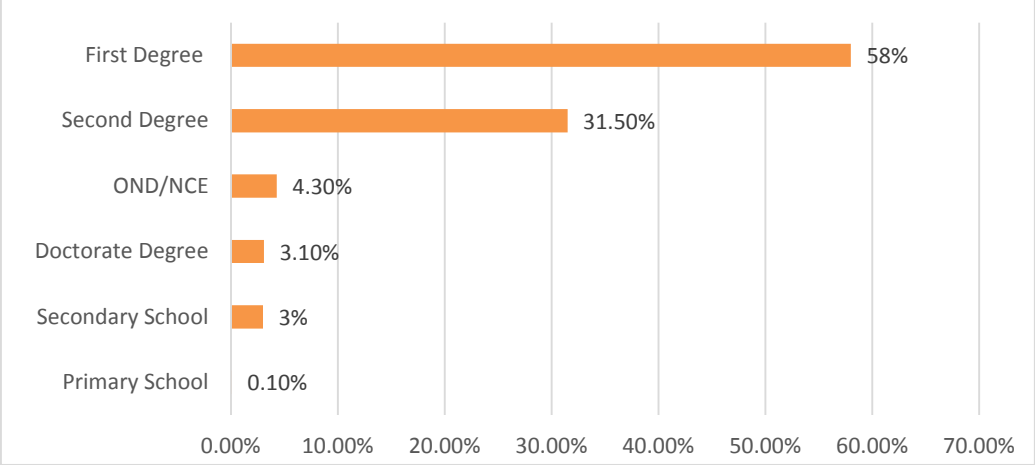

Figure 12. Respondents' Education.

Annual income was presented in five categories, starting with annual income below NGN 3.6 million as the lowest division and above NGN 24 million as the highest earning bracket. The analysis of the results of the survey showed that 48.2% of respondents received annual incomes below NGN 3.6 million, while 28.3% fall within the bracket of NGN 3.6 to 6 million, as shown by Figure 13. In addition, 5% of the passengers were found in the highest category of annual income above NGN 24 million. The average annual income of the respondents was in the NGN 3.6 – 6.00 million

bracket, which at the current exchange rate correspond to USD 18,000 - 30,000 respectively.

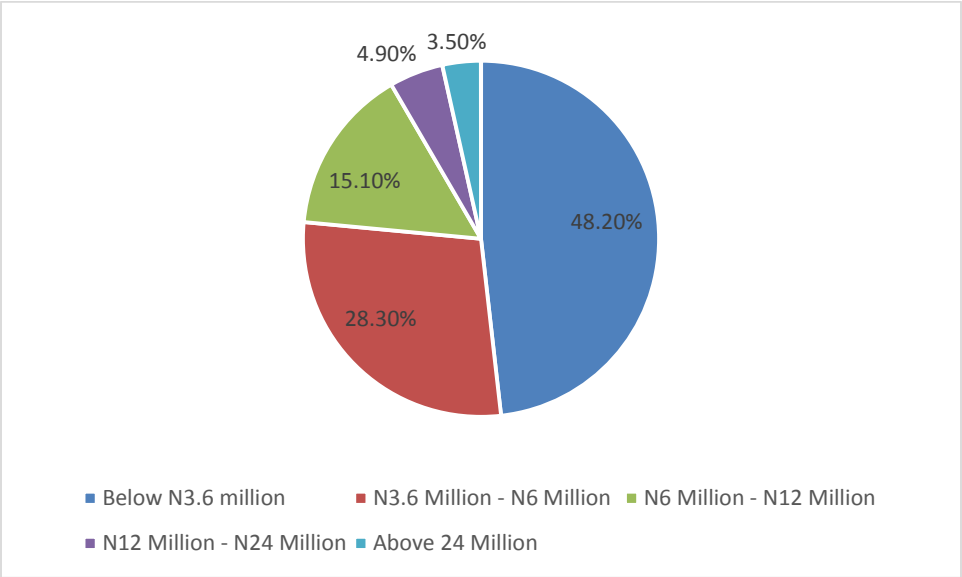

Figure 13. Respondents' Income

Answers to the Research Questions

Research question 1: How much market share could the proposed second airport in Lagos gain while in competitive co-existence with the primary airport?

791 respondents, representing 71.1% of the passengers interviewed, chose MMIA as their first choice airport; whereas the remaining 28.9% stated their first choice preference for the proposed second airport. Based on the contingency presented to the respondents, LIA gained 28.9% market share. Table 15 reports the descriptive statistics of the *First Choice Airport* variable.

Table 15

Descriptive Statistics for First Choice

	Frequency	Percent	Valid Percent	Cumulative Percent
MMIA	791	71.1	71.1	71.1
LIA	322	28.9	28.9	100.0
Total	1113	100.0	100.0	

Research question 2: **What are the most important predicting factors for passenger preference between Murtala Mohammed International Airport and the proposed Lekki International Airport?** As earlier discussed, the forward stepwise method of the Logistic regression was used to identify the independent variables that impacted the group membership of the dichotomous dependent variable. The binary categorical dependent variable is *First Choice Airport* with two categories, namely MMIA and LIA. As identified in the previous chapter, 10 independent variables were selected as predictors:

1. Length of Stay in Nigeria
2. Access Time
3. Class of Travel
4. Airfare
5. Purpose of Travel
6. Choice of Airport Amenity

7. Amount Willing to Pay or Accept
8. Gender
9. Level of Education
10. Income.

Estimating the base model. Table 16 shows the base model started with a log likelihood value (-2LL) of 1339.008. The score statistic of 1339.008 was obtained after 3 iterations. The base model included a constant with coefficient -0.899.

Moreover, Table 17 shows the list of the predictors with their score statistic and their significance. The predictor *Access Time* with the highest significant score statistic (191.332) was added to the first step of the estimation. The other independent variables were candidates for entry into the model at the subsequent steps.

Table 16

Forward Stepwise Base Model

Overall Model Fit: Goodness-of-Fit Measures						
		Value				
-2 Log likelihood		1339.008				
Variable in the Equation						
		B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Step 0	Constant	-.899	.066	184.847	1	.000	.407

Table 17

Variables Not in the Equation of the Base Model

Independent Variables	Score Statistic	Significance
Stay Nigeria	**4.803**	**.028**
Access Time	**191.332**	**.000**
Class of Travel	**17.273**	**.000**
Airfare	.035	.852
Purpose of Travel	.538	.463
Airport Amenity	.084	.772
Willing Amount	**6.512**	**.011**
Gender	1.628	.202
Education	4.329	.037
Income	**18.293**	**.000**

Forward stepwise estimation step 1: Adding variable *Access Time.* The effects of adding the predictor *Access Time* to the model is presented in Table 18. The inclusion of the predictor improved the model as the value of the log likelihood (-2LL) reduced by 191.573. The reduction in the value of log likelihood (-2LL) signifies an improvement in the fit of the model (Hair et al, 2010). Moreover, the R square measures provided by the Cox & Snell R Square and the Nagelkerke R Square were within reasonable levels of model fit, 0.158 and 0.226, respectively. Table 18 also shows a non-significant Hosmer and Lemeshow's measure of overall fit with value of 14.083 and a *p* value of 0.029. The non-significance of the measure shows that the model fit was acceptable (Hair et al, 2010).

Table 18

Logistic Regression Stepwise Estimation: Adding the First Predictor

Change in Goodness-of-fit Measures			
		From Base Model	
	Value	**Change**	**Significance**
-2 Log likelihood	1147.435	191.573	0.000
Cox & Snell R Square	0.158		
Nagelkerke R Square	0.226		
	Value	**Significance**	
Hosmer and Lemeshow Test	14.083	.029	

Overview of the forward stepwise estimation of the model from Step 1 to Step 5. The estimation of the model to its optimal value was carried out in five steps. The final model was derived from the last step which was step 5. The results of each of the steps of the model are presented in Appendix D. Adding another variable to the final model did not bring any significant improvement to the model.

Table 19 shows how the model estimation fit evolved. Two basic measures were used to measure the model estimation fit: the -2 times the log of likelihood (-2 log likelihood) and the Pseudo R square. The -2 log likelihood measure decreased from 1147.435 in Step 1 to 1096.661 in step 5. Compared with the base model, the -2 log likelihood reduced by 18% (1339.008 – 1096.661). Moreover, pseudo R square values, represented by the Cox & Snell R Square and the Nagelkerke R Square, increased consistently from Step 1 to Step 5. The reduction in the measures of the -2 log likelihood and the increase of the pseudo R square values indicate that the fit of the model improved from the base to the last estimation of the model.

Table 19

Summary Assessment of the Model Estimation Fit

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1147.435[a]	.158	.226
2	1128.027[b]	.173	.247
3	1105.777[b]	.189	.270
4	1101.321[b]	.192	.275
5	1096.661[b]	.196	.280

Note. a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001. b. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

As the variables earlier mentioned were added, the predictive accuracy of the model changed. Table 20 shows that, at Step 1, the model was 75.2% accurate in its prediction of the membership of the binary variable *First Choice*. The predictive accuracy of the model improved consistently as variables were added to the model and reached 77.3% at Step 5. Even though the predictive accuracy of the model decreased slightly in Step 3 by 0.52%, from 76.6% to 76.2%; the model regained and maintained the increasing predictive accuracy trend in steps 4 and 5. As shown in Table 19, the entry of the third predictor still improved the fit of the model in spite of the decrease of the predictive accuracy by 0.5% between steps 2 and 3. The estimation of the model ended with 77.3% predictive accuracy which represents about 2.72% improvement on the accuracy of Step 1 classification.

Table 20

Summary of the Overall Classification

Prediction of *First Choice* membership	Overall Percentage Correct
Step 1	**75.2**
Step 2	**76.6**
Step 3	**76.2**
Step 4	**76.8**
Step 5	**77.3**

Table 21 shows the independent variables that were added to the model and the stage at which they were added. After *Access Time* in Step 1, the variable *Income* recorded the highest significant score statistic and was added to the model in step 2. *Stay in Nigeria* and *Class of Travel* were added in steps 3 and 4, respectively. The last predictor added to the model was *Amount WTP or WTA.* Therefore, the variables that contribute to the optimum goodness-of-fit of the model and the most accurate predictability of the membership of the dichotomous dependent variable are listed in Step 5 of the estimation.

Table 21

Variables Entered into the Model

								95% C.I. for EXP(B)	
		B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**	Lower	Upper
Step 1[a]	**Access Time**	.019	.002	152.962	1	.000	1.019	1.016	1.022
	Constant	-2.625	.164	257.688	1	.000	.072		
Step 2[b]	**Access Time**	.019	.002	153.398	1	.000	1.019	1.016	1.022
	Income	.299	.068	19.556	1	.000	1.349	1.181	1.540
	Constant	-2.924	.183	255.334	1	.000	.054		
Step 3[c]	**Stay Nigeria**	-.029	.006	21.301	1	.001	.971	.959	.983
	Access Time	.020	.002	158.428	1	.000	1.020	1.017	1.023
	Income	.395	.072	30.424	1	.000	1.485	1.290	1.709
	Constant	-2.11	.246	73.622	1	.000	.121		
Step 4[d]	**Stay Nigeria**	-.029	.006	21.496	1	.000	.971	.959	.983
	Access Time	.020	.002	154.337	1	.000	1.020	1.017	1.023
	Class of Travel	-.572	.269	4.521	1	.033	.565	.333	.956
	Income	.372	.073	26.070	1	.000	1.450	1.257	1.672
	Constant	-1.538	.364	17.849	1	.000	.0215		
Step 5[e]	**Stay Nigeria**	-.028	.006	19.679	1	.000	.972	.960	.984
	Access Time	.020	.002	154.263	1	.000	1.020	1.017	1.023
	Class of Travel	-.593	.271	4.802	1	.028	.553	.325	.939
	Amount WTP_WTA	.000	.000	4.830	1	.028	1.000	1.000	1.000
	Income	.357	.073	23.875	1	.000	1.429	1.239	1.650
	Constant	-1.667	.371	20.159	1	.000	.189		

Note. a. Variable entered on step 1: Access Time; b. Variable entered on step 2: Income; c. Variable entered on step 3: Stay Nigeria; d. Variable entered on step 4: Class of Travel; e. Variable entered on step 5: Amount WTP_WTA.

Estimation of the coefficients. Table 21 presents two coefficients: the original logistic coefficient (*B)* also known as logit value and the exponentiated coefficients presented as *Exp (B)*. The estimation of the coefficients of the independent variables was conducted using the original logistic coefficient (*B*) in Table 21. The logistic regression equation was therefore formulated as below:

Logit *First Choice* = -1.667 + (– 0.028 x Stay in Nigeria) + (0.020 x Access Time)
+ (-0.593 x Class of Travel) + (0.00 x WTP/WTA)
+ (0.593 x Income). (6)

The directionality and magnitude of the relationships. The signs of the original logistic coefficients were examined for the determination of the direction of the relationship. Similarly, the magnitude of the relationship of the predictors was accessed through the exponentiated coefficient, Exp (B), reported in Table 21. Meanwhile, the calculation of the magnitude of the change in the odds value is shown in Table 22. The five predictors have different impacts on the direction and magnitude of the relationship:

1) *Stay Nigeria*: The negative direction of the coefficient for the independent variable *Stay Nigeria* is not as a result of collinearity. The predictor *Stay Nigeria* has no strong correlation with the other independent variables. As shown in Table 21, the exponentiated coefficient, Exp (B), of the predictor *Stay Nigeria* is 0.972. The direction and the calculated magnitude of the coefficient in Table 22 show that a unit change in the variable *Stay Nigeria* reduces the odds by 3%.
2) *Access Time:* As presented in Tables 21 and 22, the direction of the coefficient of the predictor *Access Time* is positive. An hour change in access time will change the odds by 2%.
3) *Class of Travel*: The variable *Class of Travel* refers to the aircraft cabin the passenger booked. For instance, the passengers were either traveling in

business class or economy class. Tables 21 and 22 indicate a negative direction of the coefficient. A unit change in class of travel of the passengers leads to 44.7% reduction in the airport choice.

4) *WTP or WTA*: The magnitude of the coefficient for the predictor WTP/WTA is zero which means that the variable has no effect on the odds. A unit change in the amount the passenger is willing to pay or accept does not produce any effect on the airport choice. Since *WTP/WTA* is expected to influence passengers' choice of airport, the magnitude of the coefficient may not be totally zero but a small decimal that was rounded to zero during the analysis.
5) *Income:* With a positive coefficient magnitude of 43%, the independent variable *Income* was classified as the predictor with the highest positive influence on passenger airport choice in the Nigerian market. A unit-change in income increases the odds of airport choice by 43%.

Table 22

Magnitude of the Coefficients

	Stay Nigeria	**Access Time**	**Class of Travel**	**WTP WTA**	**Income**
Exponentiated Coefficient Exp(B)	.972	1.020	0.553	1.000	1.429
Exponentiated Coefficient - 1.0	-0.03	0.02	-0.447	0.000	0.429
Percentage Change in Odds	**-3%**	**2%**	**-44.7%**	**0%**	**43%**

Multicollinearity test. Even though logistic regression analysis is not concerned by prior assumption verification, it can be affected by the bias of collinearity between the predictors. It was therefore necessary to verify if the result of the logistic regression estimation was affected by multicollinearity of the independent variables. Multicollinearity diagnostic was conducted through a linear regression analysis. The results are summarized in Table 23.

Table 23

Coefficients Analysis

Coefficients		
	Collinearity Statistics	
	Tolerance	VIF
Stay in Nigeria	.909	1.100
Access Time	.984	1.010
Class of Travel	.958	1.044
WTP/WTA	.981	1.019
Income	.890	1.124

Note. Dependent variable: *First Choice.*

According to Menard (1995) and cited by Field (2009), a coefficient tolerance lower than 0.1 is an indication of a strong probability of collinearity. Similarly, VIF (Variance Inflation Factor) values higher than 10 are precursory signs of collinearity between the variables. Table 23 reports the tolerance and VIF measures of the coefficients of the five variables under study. The tolerance values are far higher than 0.1 and relatively uniform. The tolerance values are close to 1. The strong tolerance values

indicate that the variances of the predictors are not explained by other independent variables. Similarly, the VIF values are far lower than 10; they range between 0.890 and 0.984. It can also be concluded that the estimation of the logistic regression that identified the independent variables that influenced the group membership of the binary dependent variable *Airport Choice* was free of multicollinearity bias.

Validation of the result. The validation of the logistic regression results was conducted through a split-sample validation. The sample was split by 50% into analysis and holdout sub-samples. The analysis sub-sample had 557 cases while the holdout sample contained 556 cases. As shown in Table 24, the model predicted the value of the binary dependent variable with 76.10% accuracy utilizing the analysis sample. The model recorded 77.70% predictive accuracy with the holdout sample. With the difference in the predictive accuracy of the model for the holdout and analysis samples being less than 3%, it can be concluded that the logistic regression model demonstrated external validity. Therefore, the results of the logistic regression were accepted as valid.

Table 24.

Comparative Classification Table of the Analysis and Holdout Samples

	Analysis Sample			**Holdout Sample**		
First Choice	MMIA	LIA	**Percentage Correct**	MMIA	LIA	**Percentage Correct**
MMIA	355	30	97.20	380	26	93.60
LIA	103	69	40.1	98	52	34.70
Overall Percentage			**76.10**			**77.70**

Research question 3: What will be the catchment area of passengers who will prefer to fly from the proposed Lekki International Airport, Lagos? This question focused on the prediction of the catchment area of the proposed second airport in Lagos. The catchment area analysis covered the 20 LGAs of Lagos State. As discussed in the previous chapter, an LGA was considered an airport catchment area if at least 25% of the passengers who originated from the LGA chose the said-airport as their first choice airport. Table 25 reports airport preference for each LGA. It shows the number and percentage of passengers that selected MMIA or LIA in each LGA.

Table 25

Catchment Area Statistics

	MMIA		LIA		
	Originating Respondents	Percentage	Originating Respondents	Percentage	Total
Agege	39	100%	0	0%	39
Alimosho	151	94.30%	9	5.70%	160
Ajeromi-Ifelodun	3	100%	0	0%	3
Amuwo-Odofin	37	97.30%	1	2.70%	38
Apapa	10	71.40%	4	28.60%	14
Badagry	2	40%	3	60%	5
Epe	1	16.70%	5	83.30%	6
Eti-Osa	22	13%	148	87%	170
Ibeju Lekki	1	1.70%	61	98.30%	62
Ikeja	214	90.60%	22	9.40%	236
Ikorodu	11	52.30%	10	47.70%	21
Kosofe	64	88.80%	8	11.20%	73
Lagos Island	1	1.20%	8	88.80%	9
Lagos Mainland	21	77%	6	23%	27
Mushin	6	55%	5	45.00%	11
Ojo	11	79%	3	21%	14
Oshodi Isolo	59	89.30%	7	10.70%	66
Shomolu	14	87.50%	2	12.50%	16
Surulere	58	81%	13	19%	71
Ifako-Ijaye	31	100%	0	0%	31
Ogun	34	81%	8	19%	42
Total	790	70.98%	323	29.02%	**1113**

Figure 14 shows the 17 LGAs where at least 25% of the originating passengers chose MMIA as their first choice airport. Those 17 LGAs constitute the catchment areas for MMIA with a dense concentration in 3 three LGAs that immediately surround

MMIA. Ikeja, Alimosho and Kosofe constitutes the high density area for MMIA's market share.

Figure 14. Catchment Area of MMIA based on Passengers' Stated Preference

LGA with high density of MMIA passengers

Other catchment areas of MMIA

As shown in Figure 15, LIA accounted for at least 25% of the respondents in eight LGAs, namely: Apapa, Badagry, Epe, Eti-Osa, Ibeju Lekki, Ikorodu, Lagos Island, and Mushin. The catchment LGAs of the proposed second airport accounted for 298 out of the 1,113 valid respondents. With regard to the density distribution of LIA's passenger base, the concentration of the potential LIA passengers was located in two LGAs, namely Eti-Osa and Ibeju-Lekki, which accounted for 65% of the total number of passengers who chose LIA as their first choice. The site for the proposed LIA is located in a remote area of Ibeju-Lekki LGA. Badagry LGA was also found in the LIA's catchment area. Badagry LGA is separated from the main catchment area of LIA by MMIA's catchment area. Badagry appears like an *outlier catchment area* for LIA.

The LIA catchment area accounts for only 27% of the total number of passengers interviewed. As shown in Tables 14 and 15, some LGAs were catchment areas for the two airports. Each airport accounts for at least 25% of the respondents in four LGAs which are Apapa, Badagry, Ikorodu, and Mushin. The catchment areas of the MMIA and LIA overlapped in those four LGAs. The spatial competition between the two airports is expected to take place in those four LGAs.

Figure 15. Catchment area of LIA based on passengers' stated preference.

LGA with high density of LIA passengers

Other catchment areas of LIA

Analysis of business passengers' isochrone. As discussed in the previous chapter, isochrones were built for MMIA and LIA using the congestion-free drive-time data for Lagos State shown in Table 26. The congestion-free drive time data shows that all 20 LGAs of Lagos State could be reached from MMIA within two hours because of its central location. However, it takes more than two hours to reach LIA from some LGAs in a congestion-free drive time using public transport. Figure 16 shows the business

passengers' catchment areas determined through the analysis of the data generated by the CV interviews and the drawing of the one-hour drive time isochrone.

Table 26

Congestion-free Drive-Time to MMIA and LIA (Hour)

	Murtala Mohammed International Airport, Ikeja	Lekki International Airport
Agege	0.33	1.92
Ajeromi-Ifelodun	0.57	1.57
Alimosho	0.52	2.32
Apapa	0.65	1.63
Badagry	1.62	2.92
Epe	1.97	0.75
Eti-Osa	0.92	1.00
Ibeju-Lekki	1.40	0.58
Ifako-Ijaye	0.38	2.00
Ikeja	0.25	1.90
Ikorodu	1.02	1.05
Kosofe	0.43	1.72
Lagos Island	0.70	1.72
Lagos Mainland	0.50	1.83
Mushin	0.52	1.07
Ojo	0.95	2.65
Oshodi-Isolo	0.25	1.85
Shomolu	0.58	1.73
Surulere	0.55	1.65
Amuwo-Odofin	0.62	2.10

Note. Compiled by the researcher from "Lagos-Google Maps" by Google (2015), retrieved September 2015 from https://www.google.co.za/maps/place/Lagos,+Nigeria/@6.5482201,3.3975005,11z/data=!3m1!4b1!4m2!3m1!1s0x103b8b2ae68280c1:0xdc9e87a367c3d9cb?dg=dbrw&newdg=1

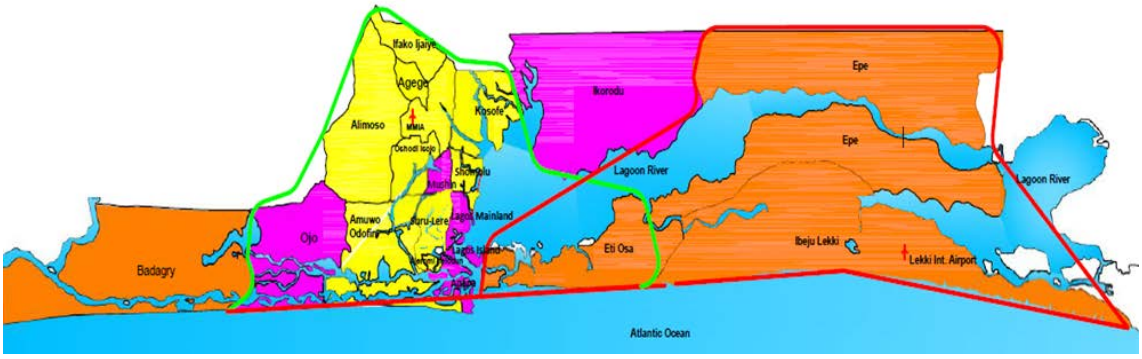

Figure 16. One-hour isochrone for MMIA and LIA.

Exclusive business catchment area of MMIA

Exclusive business catchment area of LIA

LGAs where the catchment areas of MMIA and LIA overlap

Business isochrone of MMIA

Business isochrone of LIA

Figure 16 presents one-hour isochrones built around the two airports for the identification of the catchment area of business passengers. The isochrone outlines in green represents the potential business passengers' catchment area for MMIA based on one-hour drive-time to the airport. Similarly, the isochrone outlined in red represents the potential business passengers' catchment area for LIA based on one-hour drive time to the airport.

Figure 16 also shows business passengers' catchment areas based on passengers' stated preference expressed during the interviews. Represented in yellow are the LGAs where at least 25% of the business passengers chose MMIA as first choice airport. The LGAs in brown represent LIA's business passengers' catchment area by stated preference. The six LGAs in purple are the overlap between LIA and MMIA's business passengers' catchment areas based on passengers' stated preference during the interview.

When the catchment areas delimitated by the isochrones are superimposed on the catchment areas derived from the stated preference of the passengers, the following were observed:

1. There was a disparity between the delimitations of the two catchment areas.
2. While the isochrones overlap only over one LGA (Eti-Osa), the catchment areas through stated preference overlap six LGAs.
3. Ikorodu and Badagry that were not covered by either of the isochrones recorded business class preference for LIA.
4. Five of the LGAs covered by the overlap of the catchment areas of the two airports are found in the MMIA isochrone.

Non-business passengers' catchment area. Two-hour drive time isochrones were built for non-business passengers' catchment areas. In Figure 17, the isochrone in green represents the catchment area of MMIA's non-business passengers based on two-hour drive time to reach the airport. The isochrone in red represents the potential catchment area for LIA's non-business passengers based on two-hour drive time to the airport. While MMIA's isochrone covers the 20 LGAs of Lagos State, LIA's isochrone excludes four LGAs. LIA's isochrone is entirely included in MMIA's isochrone. Based on two-hour drive time, MMIA's catchment area entirely covers LIA's catchment area.

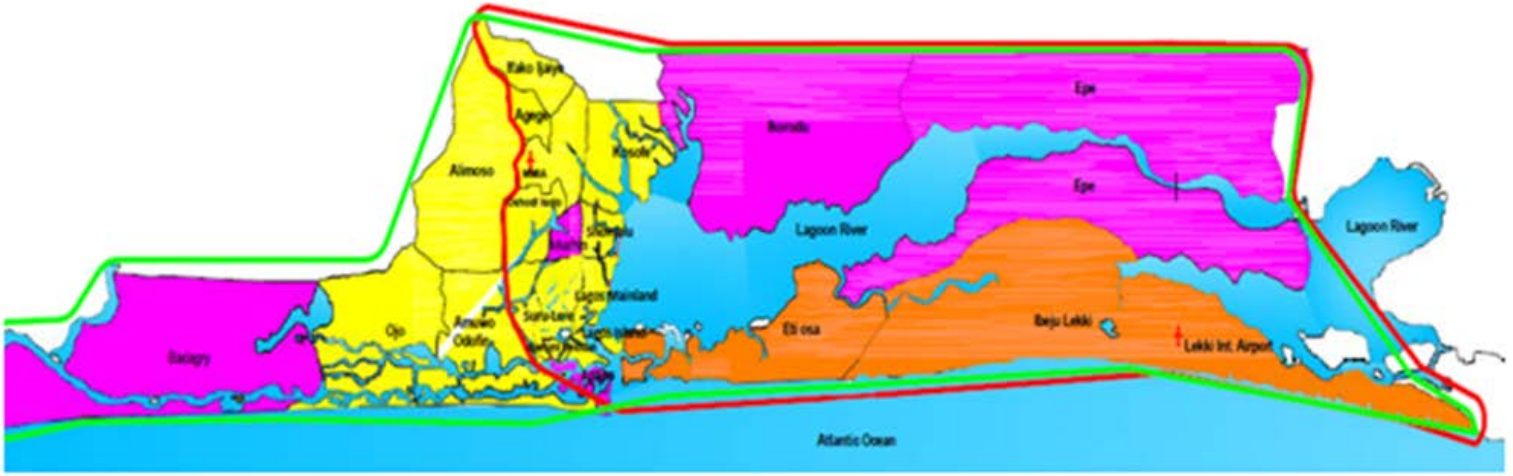

Figure 17. Two-hour Isochrone and Catchment Analysis

Exclusive non-business catchment area of MMIA

Exclusive non-business catchment area of LIA

LGAs where the catchment areas of MMIA and LIA overlap

Non-business isochrone of MMIA

Non-business isochrone of LIA

Moreover, Figure 17 shows the non-business catchment areas of the two airports based on non-business passengers' stated preference. Only two LGAs in orange (Eti-Osa and Ibeju-Lekki) constitute the exclusive catchment area for LIA. The LGAs in yellow represent the non-business passengers' catchment area for MMIA based on non-business passengers' stated preference. The overlap of the two airports' catchment areas covers the LGAs in purple.

In terms of market share of non-business market segment based on passengers' stated preference expressed in the interviews, LIA recorded a relatively higher proportion of non-business passengers (30.32%) than business passengers (28.09%). LIA and MMIA are expected to be engaged in spatial competition for non-business passengers in five LGAs: Apapa, Badagry, Epe, Ikorodu, and Mushin. LIA's catchment area for non-business passengers spreads over eight LGAs and accounts for 30.32% of the total number of non-business passengers.

Research question 4: How much are passengers willing to pay should additional airfare be required to fly from the proposed Lekki International Airport, and what are the determinants of that willingness to pay? The research determined the extra fare passengers who chose LIA as first choice were willing to pay and the factors that influenced that willingness to pay. As previously discussed, 322 respondents chose LIA as the airport of first choice with a response certainty of 8 and above on a scale of 1 to 10. However, only 285 cases were found valid for the present research question.

The descriptive statistics summarized in Table 27 show that the mean for the WTP was 4022.81 while the median was 3000. The SPSS box plot output reported in Figure 18 shows that the WTP data was free of outliers. The box plot confirmed 3000 as the median for WTP. The Zero WTP accounted for the highest proportion (23.9%) of the passengers who chose LIA as first choice airport. 50% of the passengers are willing to pay between 1000 and 4000 Naira.

Table 27

WTP *Descriptive Statistics*

N	Valid	285
Mean		4022.81
Median		**3000.00**
Mode		0
Std. Deviation		4076.980
Variance		16621766.741

WTP	Frequency	Percent	Valid Percent	Cumulative Percent
0	68	23.9	23.9	23.9
1000	6	2.1	2.1	26.0
1800	1	.4	.4	26.3
2000	49	17.2	17.2	43.5
2500	1	.4	.4	43.9
3000	33	11.6	11.6	55.4
3200	1	.4	.4	55.8
4000	10	3.5	3.5	59.3
5000	61	21.4	21.4	80.7
6000	3	1.1	1.1	81.8
7000	7	2.5	2.5	84.2
8000	2	.7	.7	84.9
10000	33	11.6	11.6	96.5
12000	1	.4	.4	96.8
15000	2	.7	.7	97.5
16000	1	.4	.4	97.9
20000	6	2.1	2.1	100.0
Total	285	100.0	100.0	

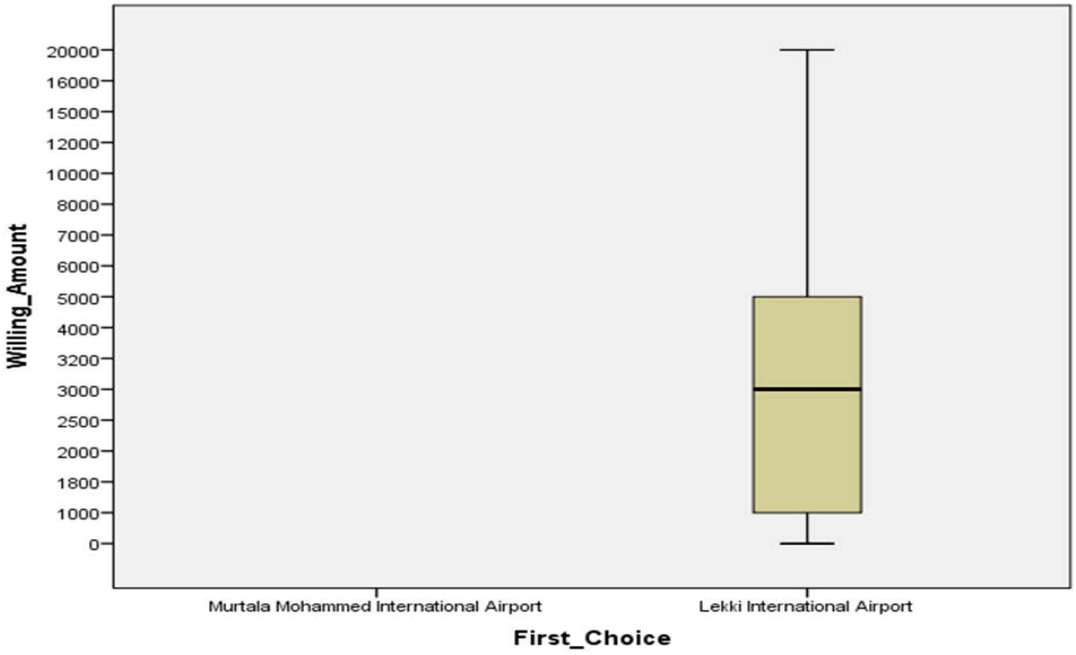

Figure 18: Box plot analysis for the variable Willing Amount.

Determinants of WTP. As discussed in the previous chapter, multiple regression analysis was used to determine the predictors that influenced the dependent variable *Amount Willing to Pay*. 10 independent variables were selected as predictors. Unlike the logistic regression used for the second research question, the multiple regression analysis requires a prior check of the assumptions.

Checking the assumptions. Investigations were conducted to check if the four main assumptions of the multiple regression analysis were met. The assumptions of linearity, independence of error terms, normality, and multicollinearity were checked.

The linearity of the relationship between the dependent variable WTP and the independent variables was assessed through the scatterplots in Figure 19. The partial

regression plots show the relationship between the dependent variable and some of the independent variables. As shown in Figure 19, the variables *Income*, *Education*, *Gender*, and *Local Government Area* violate the assumption of linearity.

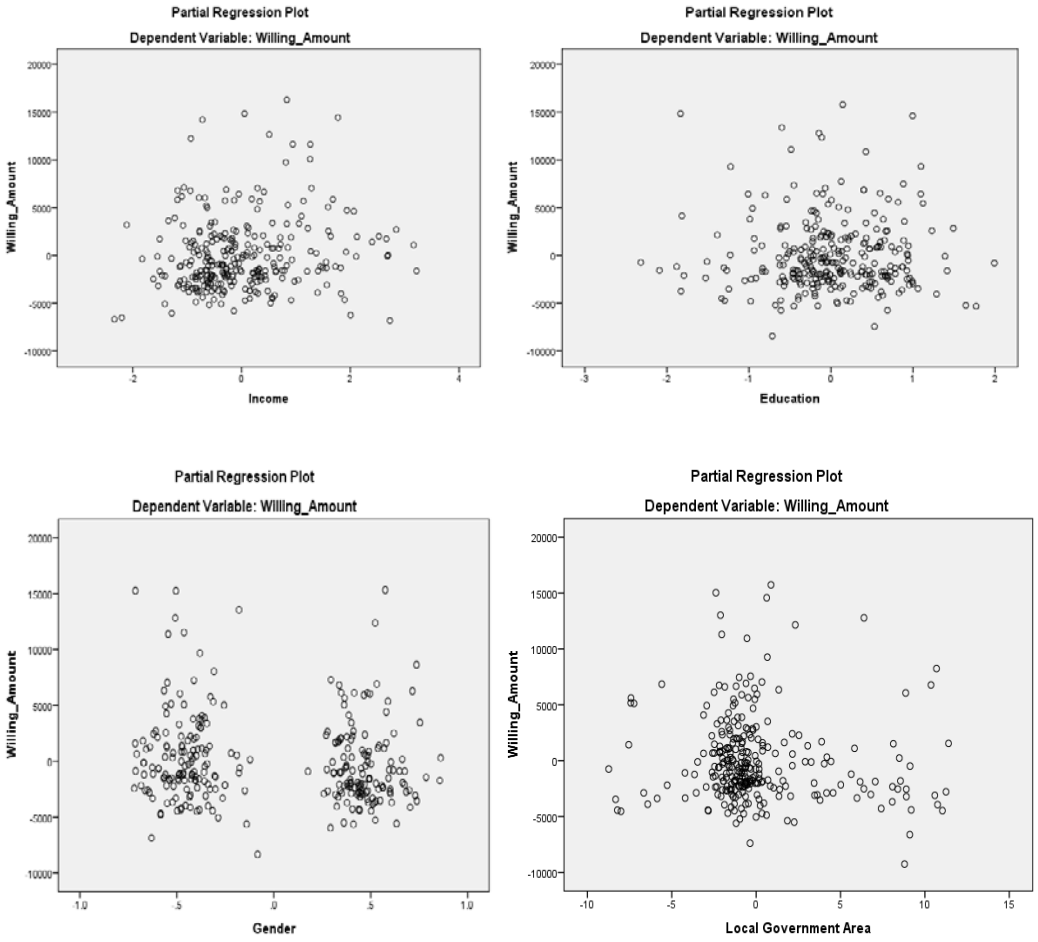

Figure 19. Partial regression plots.

With regard to the independence of the errors, the Durbin-Watson test was used to assess the correlation of the observations of residual terms. It is expected that two observations of residuals should not be correlated (Field, 2009). Table 28 shows a test

statistic of 1.981. The test statistic, being lower than 2, indicates a positive correlation of the residuals. Therefore, the assumption of the independence of the errors was considered as not met.

Table 28

Durbin-Watson Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.383	.147	.116	3833.665	1.981

The multicollinearity between the independent variable was assessed by the *tolerance* and the *VIF* values of the predictor. The coefficient table of the multiple regressions showed *tolerance* and *VIF* values of 1. The tolerance value of 1 indicates that 100% of the variance of the predictor can be accounted by the predictor itself and 0% by the other predictors. The multicollinearity assumption of the regression was not violated.

The assessment of the normality of the error distribution was done through:

1) Normal P-P plot of regression of standardized residual,
2) Normal Q-Q plot of the variable Amount Willing to Pay, and
3) Kolmogorov-Smirnov (K-S) and Shapiro-Wilk (S-W) test of normality (Table 29).

Figure 20 presents the normal P-P plot of the regression of standardized residual and the normal Q-Q plot of the dependent variable *Amount Willing to Pay*. The two plots show a deviation of the dots from the line, which indicates a deviation from normality.

Furthermore, the numerical tests of normality confirm the deviation from normality as the test statistic values of the K-S and S-W tests are significant.

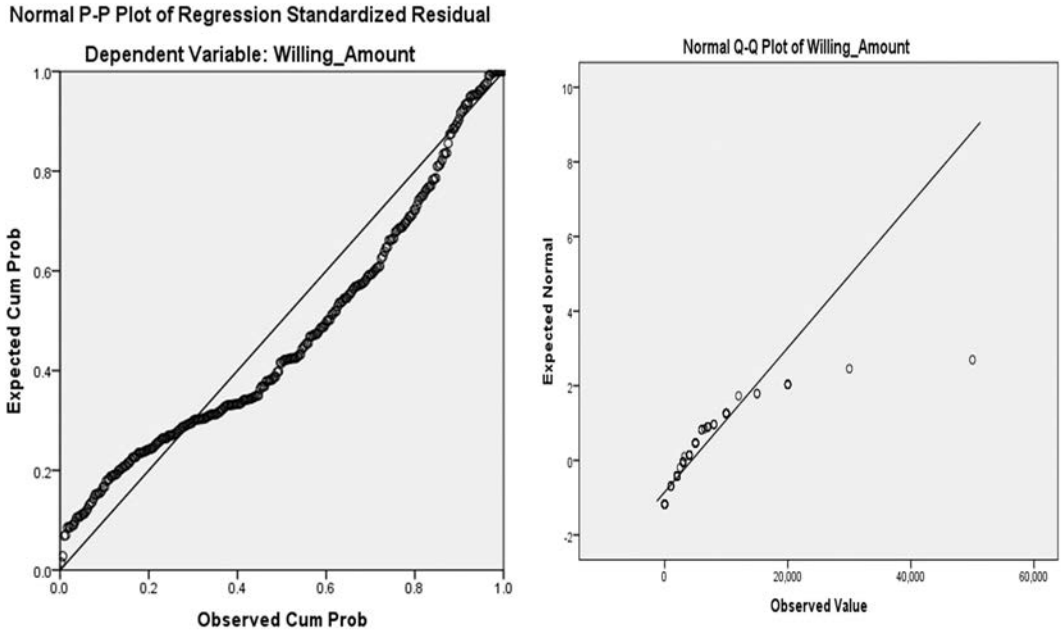

Figure 20. Normal P-P and Q-Q plots of the dependent variable *Willing Amount.*

Table 29

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Willing_Amount	.242	285	**.000**	.699	285	**.000**

The residual statistic in Table 30 shows high Mahalanobis value, which is an indication of the existence of outliers. The maximum value of the Mahalanobis distance

is 128.268. With one predicted independent variable, the degree of freedom (df) of the regression is 1as the degree of freedom is equal to the number of the predicted variables. With df 1, the critical value of the chi-square distribution at the 95% confidence interval is equal to 3.84. The maximum value of the Mahalanobis distance will be reduced to 3.84 through the transformation of the variable MAH_1 created by SPSS during the multiple regression calculation.

Table 30

Residual Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	300.54	11332.49	4022.81	1562.780	285
Std. Predicted Value	-2.382	4.677	.000	1.000	285
Standard Error of Predicted Value	428.537	2586.393	715.646	235.154	285
Adjusted Predicted Value	-426.33	12445.63	4037.13	1616.149	285
Residual	-8177.296	15803.628	.000	3765.566	285
Std. Residual	-2.133	4.122	.000	.982	285
Stud. Residual	-2.240	4.160	-.002	1.007	285
Deleted Residual	-9132.486	16089.969	-14.322	3960.451	285
Stud. Deleted Residual	-2.257	4.290	.001	1.016	285
Mahal. Distance	2.552	128.268	9.965	10.112	285
Cook's Distance	.000	.155	.005	.015	285
Centered Leverage Value	.009	.452	.035	.036	285

Note: Dependent Variable: Willing Amount.

Furthermore, the *Leverage Value* can help identify extreme values. Based on the *Leverage Value*, the extreme values are identified by multiplying by 2 the number of independent variables and divide the total by the number of cases. In the present case, it will be (2*10)/285 which is equal to 0.070. Therefore, any *Leverage* values between

0.070 and 0.452 were considered extreme values. They were also deselected from the cases under the variable *Leverage.*

Correction of the violation of the assumptions. The removal of Mahalanobis and Leverage extreme values reduced the number of cases from 285 to 268. However, the observation/independent variables ratio of 20:1 was still maintained. Furthermore, the dependent and independent variables were subjected to the square root transformation. The log transformation was not used as some variables had zero values. The correction of the violations brought some improvements to the assumptions as shown in Figure 21.

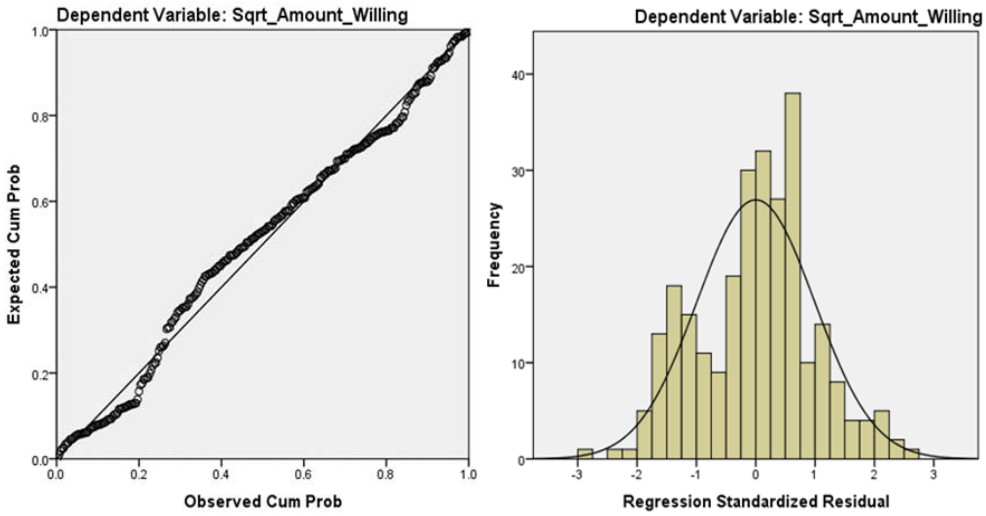

Figure 21. P-P plot and histogram of residuals after correction.

Overview of the stepwise estimation of the model. The final multiple regression models entered three predictors as shown in Table 31. The first variable to

enter the model was *Access Cost*, followed by *Airfare* and *Stay in Nigeria*. *Income* was the last independent variable that had a significant correlation with the dependent variable and entered the model.

Table 31

Variables in the Model

Model	Variables Entered	Method
1	**Access Cost**	Forward (Criterion: Probability-of-F-to-enter <= .050)
2	**Airfare**	Forward (Criterion: Probability-of-F-to-enter <= .050)
3	**Stay in Nigeria**	Forward (Criterion: Probability-of-F-to-enter <= .050)
4	**Income**	Forward (Criterion: Probability-of-F-to-enter <= .050)

Table 32 reports the summary of the stepwise multiple regression. The table shows that the entry of the predictors contributed positively to the overall model fit as the coefficient of determination (R-square), though low, increased consistently from step 1 to step 4. The entry of the variables into the model also improved the standard error of the estimate from 34.276 with the entry of first predictor to 32.806 with the entry of the last independent variable.

Table 32

Model Summary of the Multiple Regression

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.248	.061	.058	34.2757	.061	17.390	1	266	.000	
2	0.342	.117	.110	33.3085	.056	16.672	1	265	.000	
3	0.365	.133	.123	33.0667	.016	4.890	1	264	.028	
4	0.387	.150	.137	32.8060	.017	5.213	1	263	.023	1.906

Table 33 shows the evolvement of the regression coefficients. At the fourth and final step, the coefficients for the four predictors are significant at 0.05. While, *Access Cost*, *Airfare,* and *Income* have positive coefficients, *Stay Nigeria* has a negative coefficient. The predictor *Income* generated the most important magnitude, 7.272. For the coefficients shown in Table 31, the multiple regression equation was:

$$\text{WTP} = 19.546 + 0.552^{*}\textbf{Access Cost} + 0.079\ ^{*}\text{Airfare} + (-4.631)^{*}\ \textbf{Stay Nigeria} + 7.272\ ^{*}\ \textbf{Income.} \quad (7)$$

Table 33

Overall Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1	(Constant)	14.777	9.359		1.579	.116	-3.649	33.204
	Access Cost	.584	.140	.248	4.170	.000	.308	.859
2	(Constant)	-1.909	9.971		-.191	.848	-21.541	17.723
	Access Cost	.591	.136	.251	4.345	.000	.323	.859
	Airfare	.075	.018	.236	4.083	.000	.039	.111
3	(Constant)	16.360	12.893		1.269	.206	-9.027	41.746
	Access Cost	.592	.135	.251	4.383	.000	.326	.858
	Airfare	.082	.018	.258	4.428	.000	.045	.118
	Stay_Nigeria	-3.595	1.626	-.129	-2.211	.028	-6.796	-.394
4	(Constant)	19.546	12.867		1.519	.130	-5.790	44.882
	Access Cost	.552	.135	.234	4.083	.000	.286	.818
	Airfare	.079	.018	.248	4.297	.000	.043	.115
	Stay_Nigeria	-4.631	1.676	-.166	-2.764	.006	-7.930	-1.332
	Income	7.272	3.185	.137	2.283	.023	1.001	13.543

Multicollinearity. Table 34 reports the output of the collinearity statistics between the independent variables. The values of *tolerance* at the fourth and last step of the estimation of the model show that the variances of the predictors are explained by the predictors themselves and not by other variables. There is no collinearity between the independent variables in the model. The assumption of multicollinearity was met.

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Table 34

Collinearity Statistics

Model		Correlations			Collinearity Statistics	
		Zero-order	Partial	Part	Tolerance	VIF
1	Access Cost	.248	.248	.248	1.000	1.000
2	Access Cost	.248	.258	.251	1.000	1.000
	Airfare	.232	.243	.236	1.000	1.000
3	Access Cost	.248	.260	.251	1.000	1.000
	Airfare	.232	.263	.254	.971	1.030
	Stay Nigeria	-.085	-.135	-.127	.971	1.030
4	**Access Cost**	.248	.244	.232	**.983**	**1.017**
	Airfare	.232	.256	.244	**.967**	**1.035**
	Stay Nigeria	-.085	-.168	-.157	**.900**	**1.111**
	Income	.146	.139	.130	**.901**	**1.110**

Validation of the results. The researcher split the sample into two equal subsamples. Sample 1 and Sample 2 each contained 134 cases. Table 35 reports the comparative analysis of the overall model fit of the two subsamples

Table 35

Comparative Estimation of the Regression Models

Overall Model Fit					
			Sample 1		Sample 2
Multiple R			0.373		0.382
Coefficient of Determination (R Square)			0.139		0.146
Adjusted R Square			0.126		0.126
Standard error of the estimate			33.52		32.435
Analysis of Variance					
	SAMPLE 1				
	Sum of Square	df	Mean Square	F	sig.
Regression	23725.927	2	11862.9	10.55	0.00
Residual	147196.350	131	1123.636		
Total	170922.277	133			
	SAMPLE 2				
	Sum of Square	df	Mean Square	F	sig.
Regression	23360.717	3	7786.908	7.40	0.000
Residual	136764.183	130	1052.032		
Total	160214.900	133			

The results of the overall model fit of the two subsamples in the multiple regression analyses shows a high level of similarity. The multiple R, R square and standard error of the estimate values of the two subsamples are similar. Furthermore, both the values of the analysis of variance and the degrees of freedom in the subsamples are similar. Minor differences though are found in the independent variables that entered the models. As reported in Table 36, two variables entered the model with Sample 1;

while three variables were in the final model with Sample 2. Nevertheless, the estimation of the models found *Airfare* and *Access Cost* as predictors in both subsamples. The comparative analysis supports the validation of the process of the multiple regression model.

Table 36

Variables in the Model

SAMPLE 1					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	-2.617	13.532		-.193	.847
Airfare	.094	.028	.272	3.350	.001
Access Cost	.587	.177	.270	3.322	.001
SAMPLE 2					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	42.594	23.479		1.814	.072
LGA	-13.249	5.223	-.210	-2.537	.012
Airfare	.058	.024	.198	2.440	.016
Access Cost	.507	.215	.195	2.362	.020

Summary. The present chapter reviewed the results of the analysis of the data collected using the CVM. After assessing the reliability and validity of the measures, the collected data was applied to the four research questions and analyzed. Statistical

techniques including logistic regression and multiple regression were used to analyze the data with the aim of responding to the research questions. Moreover, the catchment area and isochrone analysis were used to predict the catchment of the LIA. The findings of the research were discussed in the next chapter.

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Nigeria, a federation of 36 states, has been benefiting from the favorable growth of its economy, which has been stimulating the emergence of a middle class and the development of the air transport industry. Five states of the federation built new airports without proper studies on their viability. Further, Lagos State decided to build a greenfield airport, LIA, 62 miles away from the core airport. LIA is planned to deliver services to all segments of the market. Consequently, LIA and MMIA are expected to be in spatial competition.

Meanwhile, most of the airports established by the state governments have become redundant and unprofitable as they have not been able to attract the volume of traffic necessary for their viability. Thus the purpose of the present research was to develop an empirical method for the prediction of the market share that the proposed second airport in Lagos could attain while in spatial competition with the busiest airport in Nigeria. In addition, the research identified the factors that will influence passenger choice between the two airports and two important characteristics of the predicted LIA's market share, namely: catchment area and passenger's willingness to pay. The present chapter discusses the results reported in the previous chapter with the aim of providing answers to the four research questions and making recommendations for both practice and future research.

Discussion

Research Question One: How much market share could the proposed second airport in Lagos attain while in competitive co-existence with the primary airport? Based on the contingency scenario, the present study predicted that LIA will gain a 28.9% market share. With 5,649,307 passengers enplaned at MMIA in 2014 (IATA, 2015), the predicted LIA's market share represents 1,632,650 passengers in 2014. LIA's market share was compared with the market share of several secondary airports in the United States of America, United Kingdom, and Japan. The market segmentation of Chicago Midway Airport, London Gatwick Airport, and Narita Airport consists of both domestic and international passengers and cargo. Their market segmentation is similar to the one planned for LIA by the Lagos State Government. As shown in Table 37, the market shares of Chicago Midway Airport (27.14%), London Gatwick Airport (26.09%), and Tokyo Narita Airport (33.2%) are comparable to LIA's market share of 28.9%. Thus, the market share predicted for LIA is realistic and is attainable by a secondary airport.

In fact, LIA could achieve Narita's market share of 33.27% if it could secure the patronage of airlines. Recently, the air transport industry has been witnessing airports and airlines partnering for the stimulation of demand for a win-win outcome. While the airport grants the airline a discount on its user charges, the airline commits to bringing in a pre-determined number of passengers who will pay for airport charges and patronize other airport services such as car parks. For example, in 2001, the Irish low cost carrier (LCC), Ryanair, signed an agreement with Charleroi Airport in Belgium. While Ryanair made Charleroi Airport its first operational base outside Ireland, the airport offered the

Irish LCC a discounted price for landing and ground-handling services. The airport also provided Ryanair with marketing support (Irish Times, 2014).

Secondary airports in many markets rely on LCCs to stimulate demand. However, West Africa and particularly Nigeria is yet to witness the emergence of LCCs. Lack of secondary airports, monopoly pricing at main airports, inadequate airport infrastructure and capacity, and onerous aircraft acquisition conditions have not provided the appropriate environment for the establishment of LCCs in the region. LIA will have to rely on the patronage of full service carriers until LCCs emerge in West Africa.

Table 37

Selected Airports' Market Share, 2013

City	Airport	Market Share
Chicago		
	Chicago O'Hare	72.86%
	Chicago Midway	**27.14%**
San Francisco		
	San Francisco	67.11%
	Oakland	17%
	San Jose	**15.89%**
Tokyo		
	Haneda	66.73%
	Tokyo Narita	**33.27%**
London		
	London Heathrow	47.37%
	London Gatwick	**26.09%**
	London Stansted	15.39%
	Luton	8.19%
	London City	3%

Note. Data compiled by the researcher from IATA (2015) sources.

The contingency scenario kept three important determinants of airport choice constant: airline availability, frequency, and ticket price. Those three factors are provided by the airlines. The proposed LIA may not attain 28.9% market share if it is unable to:

a) Attract the destinations offered at MMIA
b) Offer comparable number of frequencies to the destinations offered at MMIA
c) Apply levels of user charges not higher than the ones provided by MMIA depending on the type of competition between the airlines at the two airports

It is unlikely that all the flight services and frequencies presently offered at MMIA will be available at LIA. While some airlines will maintain their services at MMIA, others will relocate to LIA or operate from both airports with different frequencies. For instance, in London, while British Airways has its main hub at London Heathrow Airport, it still offers services from London Gatwick Airport. Airlines with a business model based on hubs are most likely to operate from MMIA due to the number of destinations offered from the airport. Moreover, as a greenfield airport, LIA may not be attractive to many airlines at the beginning of its operations. Therefore, the realization of the predicted market share may depend on LIA's ability to attract airlines already operating at MMIA. Success will also depend on the ability of LIA to apply the appropriate pricing structure for its associated operational charges for both the passengers and the airlines. Indeed, airlines will find it difficult to patronize LIA if the airport fees will not allow them to compete favorably with competitors operating at MMIA.

Nevertheless, over a million passengers in a year for a secondary airport in Africa can arguably be considered a good market share. As shown in Figure 22, with 28.9%

share of the Lagos market, LIA would handle more passengers than many primary airports in the region. It would be busier than numerous prominent African airports including Abidjan, Bamako, Douala, Yaoundé, and Banjul. With a market size of 1.6 million passengers per annum, LIA will be a prominent airport in the region.

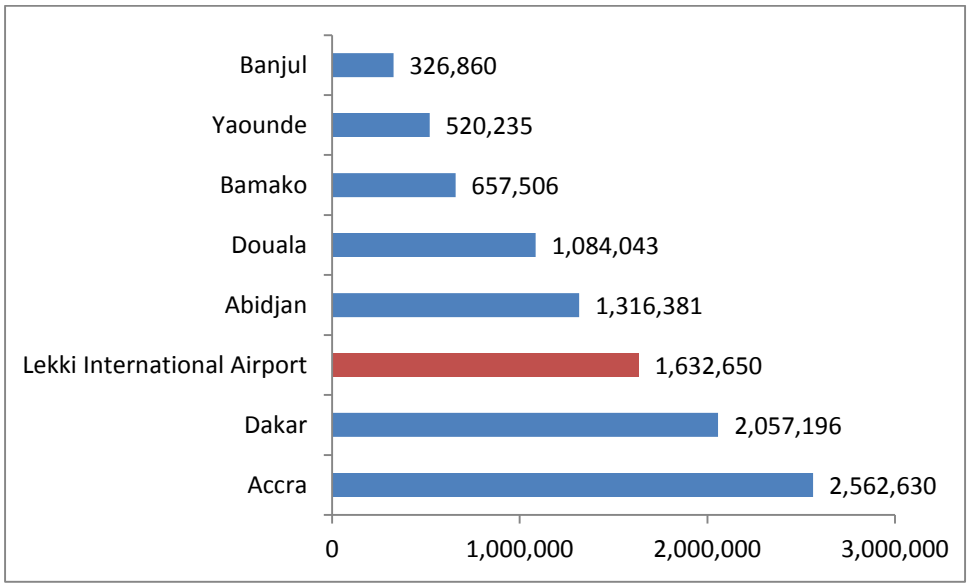

Figure 22. African airports by passengers 2014. Data compiled from IATA sources.

Furthermore, it is expected, as a rule of thumb, that an airport that handles at least one million passengers in a year could be profitably managed (Edwards, 2005). In fact, the European Commission on airports stated that regional airports in Europe needed between 500,000 and 1,500,000 passengers to be profitable (Kristoferitsch, 2005). Consequently, with an estimated market share of 1.6 million passengers yearly, LIA could be managed profitably. In fact, LIA will benefit from the size of the Lagos market which stood at 5,649,307 passengers in 2014 (IATA). However, the predicted LIA

passenger traffic may not be an absolute guarantee for profitability. Other profitability factors such as cost (initial sunk cost) need to be taken into consideration.

Research Question Two: What are the most important predicting factors for passenger preference between Murtala Mohammed International Airport and the proposed Lekki International Airport? The logistic regression model identified five variables as determinants of airport choice between MMIA and LIA, namely: (a) *Stay in Nigeria*, (b) *Access Time*, (c) *Class of Travel*, (d) *Willingness to Pay/Willingness to Accept*, and (e) *Income*. The five variables were identified as the factors that influenced significantly respondents' choice of the airport. Those determinants of airport choice in the Lagos market identified by the present study were reviewed against theory and the peculiarities of the Nigerian markets.

Three of the airport choice determinants identified (Access time, WTP, and Income) confirm the findings of previous studies. Moreover, the analysis of the direction and magnitude of the coefficients of the predictors in the previous chapter provided an insight on the level of their impact on respondents' choice of airport. The identified determinants of airport choice exercised different levels of influence on the group membership of the binary dependent variable, *Airport Choice*:

1) *Stay in Nigeria.* One of the eligibility criteria for participating in the interview was that the respondent must have stayed in Nigeria for at least 12 months. The model found that the longer a passenger stayed in Nigeria, the less impact the length of stay has on the choice of an airport. It is usually expected that the longer a person stays in an environment, the better the person's knowledge of that

milieu. The present finding is expected to be relevant to the scoping of commercial activities of the airports that will be in competition in the Lagos market. Thus, the commercial activities of the proposed airport should be geared toward passengers who have not stayed in Lagos for too long due to their higher propensity to choose between airports. The identification of this variable as a determinant of airport choice is a contribution of this research to the body of knowledge.

2) *Access Time.* In the airport choice literature, access to the airport has been measured in terms of distance, cost, and time. In the logistic regression model used for the present research question, access to the airport was evaluated in terms of access time to the airport. Several studies identified access time as a determinant of airport choice. Among the determinants of airport choice identified by Blackstone et al. (2006) in the Philadelphia region of the USA was *Distance from Residence*. The determinant *Access Time* in the present research refers to *Distance from Residence* in Blackstone et al.'s (2006) study. Hess and Polak's (2006) studies edited by Forsyth et al. (2010) summarized three parallel studies on passengers' airport choice. The three studies showed the importance of access time in the airport choice process as passengers demonstrated a strong preference for their local airports. Studies in the airport literature found that the shorter the access time or the shorter the distance from residence, the more attractive the airport becomes. The present research not only identified access time as a determinant of airport choice but it also found that the higher the access time the higher passenger propensity to choose between airports. The present

finding is consistent with theory and confirms the results of previous studies in airport choice literature (Blackstone et al., 2006). However, the magnitude of the coefficient of the determinant *Access Time* seems low. An hour change in access time affects the odds of choosing between MMIA and LIA by only 2%. The Lagos market, being slightly dominated by business passengers (58%), is expected to be time sensitive. The researcher expected a higher magnitude for the coefficient of the independent variable *Access Time*. The coefficient might have been influenced by the fact that the larger proportion of the passengers interviewed were found to stay closer to MMIA than the site of the proposed LIA. Thus, they might have answered the questions from the perspective of their access to MMIA.

3) *Class of Travel*. The model identified class of travel (Business Class or Economy Class) as a significant determinant of airport choice in the Lagos market. The coefficient of the variable *Class of Travel* had the highest magnitude in absolute value, 44.7%. The variable had the highest impact on a passenger's choice of airport even though its direction is negative. The research found that a unit change in class of travel reduces the choice between MMIA and LIA by 44.7%. Apart from frequency, offered destinations, and airfare that were held constant in the present study, passengers' class of travel is predicted to be the most important determinant of airport choice in the Nigerian market. As a new airport, LIA will stimulate passengers' propensity to choose between airports and to switch from MMIA. The present finding implies that keeping the market segmentation (Business Class and Economy Class) will be more favorable for LIA.

Consequently, LIA will need to make itself attractive to both business class and economy class passengers. Lounges and fast track lanes are some of the facilities that LIA will need to put in place to be attractive to business class passengers in addition to the economy class segment. The identification of class of travel as a determinant of airport choice is another contribution of this research to the body of knowledge.

4) *WTP/WTA.* Passenger willingness to pay higher fares to fly from the proposed LIA or willingness to accept to stay in MMIA influenced airport choice in the Lagos market. Though the variable has an impact on airport choice, its magnitude is virtually zero. It was expected that the magnitude of the WTP/WTA coefficient would be higher than zero since WTP/WTA is considered by passengers as part of the cost of travel. The dominant business passenger segment of the Lagos market (less price-sensitive) biased the model evaluation of the magnitude of the determinant WTP/WTA.

5) *Income.* In the airport choice literature, Blackstone et al. (2006) identified *Income* as a determinant of airport choice. Similarly, the present research not only identified *Income* as a predictor of airport choice, but it also found that the variable has the highest positive impact on passenger stated airport preference. The higher the change in income, the higher the likelihood of passengers' consideration of flying from MMIA or LIA. With a positive magnitude of 43%, the present research identifies that income is an important determinant of airport choice in the Lagos market. Usually, passengers fly from airports where the total cost of travel fits their income. Thus, the present result is expected to be of

strategic importance to the management of LIA. The finding should lead LIA to consider whether it should target low or high income passengers or be an airport for all types of income. The results of the present research not only confirm some of the findings of previous studies, they also identify new determinants of airport choice such as the length of stay and the class of travel of the passenger.

Research Question Three: What will be the catchment area of passengers who will prefer to fly from the proposed Lekki International Airport, Lagos? Based on a passenger's stated preference data, LIA's catchment areas for business and non-business passengers covered only eight out of the twenty LGAs in Lagos States. At least 25% of the passengers who originated from those LGAs chose LIA as first choice airport. In terms of spread, the research predicted that the proposed second airport will have a catchment area that covers 40% of the LGAs. The total number of passengers who originated from LIA's catchment area were 298, accounting for about 27% of the total number of passengers interviewed. The remaining 1.9%, to make 28.9% market share, originated from MMIA's catchment area. LIA catchment area comprises the LGA where the airport will be sited and the surrounding seven LGAs. The concentration of LIA's passengers was predicted to be in Ibeju-Lekki where the airport will be located, and Eti-Osa, the LGA beside it. The present result is consistent with theory as usually passengers prefer their local airports.

The eight LGAs that make LIA's catchment area are: *Apapa, Badagry, Epe, Eti-Osa, Ibeju Lekki, Ikorodu, Lagos Island,* and *Mushin*. Contrasting LIA catchment area with Lagos State demographics per LGA (Figure 24) shows that:

a) Ibeju-Lekki, the LGA where LIA's site will be located, is the least populated LGA in Lagos State. LIA is isolated from the dense population areas. Bonnefoy and Hansman (2004) found that the existence and proximity of secondary population concentration areas close to the airport were significant determinants of the emergence of secondary airports in the USA. It was also found that the lack of a sufficient population was one of the factors that contributed to the failure of some unsuccessful secondary airports such as Mid America and Worcester airports (Bonnefoy & Hansmann, 2004).

b) In LIA's catchment area, only *Mushin* is found among the ten most populated LGAs. The nine most populated LGAs will be located in the catchment area of LIA's competitor. LIA's catchment area covers 5,179,204 inhabitants, which represents 29.5% of the population of Lagos. The results of the catchment area analysis show that the location of LIA is isolated, and Lagos State Government will need to establish access between LIA and highly populated LGAs such as Alimosho, Ajeromi-Ifelodun, and Mushin. It should also consider the deployment of high speed rail linking LIA to the central business district, the densely populated LGAs, and MMIA. Access between MMIA and LIA is important as usually a dependence relationship develops between the core and secondary airports as operational activities at the secondary airport increase (Bonnefoy & Hansman, 2004). Furthermore, the necessity to establish access to LIA is supported by the results of the identification of the determinants of airport choice which found access time significant.

Table 38

Lagos State Demographics

	Local Government	Population
1st	Alimosho	2,047,026
2nd	Ajeromi-Ifelodun	1,435,295
3rd	Mushin	1,321,517
4th	Surulere	1,274,362
5th	Oshodi-Isolo	1,134,548
6th	Agege	1,033,064
7th	Somolu	1,025,123
8th	Eti-Osa	983,515
9th	Ojo	941,523
10th	Kosofe	934,614
11th	Lagos-Island	859,849
12th	Ifako-Ijaiye	744,323
13th	Ikorodu	689,045
14th	Ikeja	648,720
15th	Lagos-Mainland	629,469
16th	Amuwo Odofin	524,971
17th	Apapa	522,384
18th	Badagry	380,420
19th	Epe	323,634
20th	Ibeju-Lekki	99,540
	STATE TOTAL	**17,552,942**

Note. Adapted from Lagos State Government (2015), Population, retrieved from http://www.lagosstate.gov.ng/pagelinks.php?p=6

Business passengers' catchment area. Based on a business passenger's stated preference, LIA's catchment area covers eight LGAs as shown in Figure 15. While three LGAs are exclusive to LIA, five LGAs are areas of spatial competition for business passengers. In the area of spatial competition, the catchment areas of MMIA and LIA overlap, signifying that each airport recorded at least a 25% market share in each of the five LGAs. Even though the business passenger base exclusive to LIA seems narrow

with only three LGAs, the spatial completion area (five LGAs) offers LIA the opportunity to increase its business market share. Business passengers in the five LGAs where the catchment areas of the two airports overlap are likely to switch from one airport to the other if provided with the right incentive.

Non-business passenger catchment area. As shown in Figure 16, the catchment area analysis based on non-business passengers' stated preference predicts that LIA will maintain the exclusive catchment of Eti-Osa and Ibeju-Lekki as with the business passengers. As observed with the business passengers, the concentration of non-business passengers for LIA will be found in the LGA where the airport will be located (Ibeju Lekki) and Eti-Osa, the adjacent LGA to Ibeju-Lekki.

However, the isochrone shows, in Figure 16, that all 20 LGAs of Lagos State are within the non-business catchment area of MMIA including the LGA where LIA will be built. Thus, results show graphically the advantage of MMIA's favorable location and the disadvantage of LIA's isolation. Further, as shown by the non-business isochrone, MMIA, by its geographical location, can compete with LIA for non-business passengers in every LGA of the state. LIA will have to offer non-business passengers an incentive to counter MMIA's location advantage. Traditionally, secondary airports have relied on a lower price as an incentive to attract non-business traffic, which is usually price-sensitive. Since the Lagos market is dominated by the business segment, the price incentive may therefore be attractive to only 42% of the market.

In summary, the catchment area analysis predicts that the concentration of LIA passengers will be located in Ibeju-Lekki and Eti-Osa LGA. The two LGAs will be

LIA's exclusive catchment areas for business and non-business passengers. The contest for the market share is predicted to be important in areas where the catchment areas of the MMIA and LIA overlap, which will be the areas of spatial competition between the two airports. Consequently, the area of spatial competition will also be LGAs where the originating passengers are likely to switch from one airport to the other (ACI Europe, 2014). Thus, the overlapping catchment area will be a geographical region where LIA could either increase or lose market share.

Research Question Four: How much are passengers willing to pay should additional airfare be required to fly from the proposed Lekki International Airport, and what are the determinants of that willingness to pay? Even though the CV scenario presumed similarity of airfare between MMIA and LIA, passengers who chose LIA as first choice were willing to pay an additional 3000 Naira to fly from that airport. At the current exchange rate, 3000 Naira corresponds to $15. At the time of the present research, the average one-way domestic fare in Nigeria was NGN 20,000. The WTP represents 15% of the average one-way domestic fare. Passengers who chose LIA as their preferred airport identified that they are willing to pay an extra 15% of their one-way domestic fare to fly from LIA.

The median WTP, NGN 3000, is expected to provide insight on the price that will be acceptable to passengers. The WTP will be an important decision factor mostly for passengers originating from the spatial competition areas where the catchment areas of MMIA and LIA overlap. In fact, the WTP value may influence the willingness of the passengers in the spatial competition area to switch from MMIA to LIA. Consequently,

the market share of LIA may be reduced if its charges are higher than those applied at MMIA by more than NGN 3000.

Determinants of WTP. The multiple regression analysis identified four independent variables as determinants of WTP, namely *Airfare*, *Access Cost*, *Stay in Nigeria*, and *Income*. Three variables that were earlier identified as determinants of airport choice (*Stay in Nigeria, Access*, and *Income*) are also found to influence passengers' WTP. The impact of the predictors on passengers' WTP were analyzed.

Access cost. As shown in Table 31, the standardized coefficient of the predictor *Access Cost* is positive with a magnitude of 0.552. One Naira increase in access cost translates into 0.199 increase in WTP. The present result is not consistent with theory. Indeed, the direction of the predictor *Access Cost* is expected to be negative. The access cost to the airport is usually considered as a component of the total cost of travel. It is expected that a passenger who incurs a high cost to access the airport will not be disposed to pay any additional amount to fly from the said-airport.

The magnitude of the coefficient is close to zero. The impact of the present independent variable on the WTP is negligible. The coefficients being close to zero rather than being negative may be explained by the high proportion of business segment passengers in the Nigerian market because the business segment is less sensitive to price.

Airfare. The multiple regression analysis identified a positive relationship between the predictor *Airfare* and the dependent variable *WTP*, which indicates that the

higher the airfare the higher the acceptable WTP. One Naira increase in airfare increases the WTP by 0.213 Naira. Passengers who could afford to pay higher fares were more disposed to pay a higher airfare to fly from LIA. The relationship between the airfare and WTP indicates that business class and long haul passengers are expected to support a higher WTP than economy class and domestic passengers. The identification of the present predictor and its magnitude and directionality are expected to provide insight for LIA's pricing policy. LIA may consider differentiated pricing for some of their services or charges. A particular pricing regime may apply to business class and long haul passengers.

Stay in Nigeria. The standardized coefficient of the variable *Stay_Nigeria*, as shown in Table 31, was negative with a value of – 0.134. The directionality and the magnitude of the Beta coefficient indicates that a one-year increase in passenger's stay in Nigeria decreases the passenger's WTP by 0.134 Naira. The less time passengers stay in Nigeria, the more willing they are to pay an extra fare to fly from LIA. Respondents who stay longer in Nigeria are expected to have a better understanding of the environment and develop a longer customer relationship with the existing airport. They are expected to prefer their local airport. Such passengers are less disposed to pay any additional amount to fly from a different or new airport, mostly when the airfare and the frequencies at the two airports are similar. In theory, local residents are expected to have a broader base of experience and knowledge of the environment, while visitors are sensitive to access time (Strobach, 2010). The present finding of the research is consistent with theory. Moreover, the identification of the length of stay in the environment of the airport as a

determinant of WTP for airport/airline is a contribution of this research to the body of knowledge.

Income. The identification of income by the model as a determinant of WTP is consistent with theory. The positive coefficient of the predictor *Income* implies that the higher the income of the passenger, the higher the willingness to pay. Similarly, low income passengers will demonstrate a reluctance to pay a higher fare to fly from LIA. With a coefficient of 7.272, income has the highest influence on passenger WTP in the Lagos market. In setting its prices, LIA needs to take into consideration the minimum wage in Nigeria and the income distribution in the population.

Conclusions

Many of the airports recently built by state governments in Nigeria have become redundant and unprofitable due to their failure to generate enough traffic and revenue to make them viable. Therefore, the decision of Lagos State Government to build a second airport (LIA) that will be in spatial competition with the busiest airport in the federation (MMIA), led to research on the market share the proposed second airport could attain. The CVM was used to collect the data through in-person interviews conducted at MMIA. Passengers, in reaction to the CV scenario presented to them, stated their preference between MMIA and LIA. As a result, the present research predicted that the proposed second airport in Lagos, Nigeria (LIA) will gain 28.9% market share if the flights that are presently operated at the primary airport (MMIA) were also available at LIA at the same price. Based on the 2014 size of the Lagos market, the predicted market share of LIA

translates into 1,632,650 passengers. In theory, with 1,632,650 handled annually, LIA could be managed profitably. Nevertheless, the other findings of the research identified some factors LIA will need to consider for the realization of the predicted market.

The research also identified the *length of stay in Nigeria*, *access time, class of travel*, *Amount WTP/WTA* and *Income* as important factors that influenced passenger choice between MMIA and LIA. These five predictors highlight some important factors that LIA needs to take into consideration to attain the predicted market share. For instance, *Access Time* calls Lagos State Government's attention to providing quality access time to LIA, while *WTP/WTA* and *Income* refer to the application of an efficient pricing strategy.

Moreover, the isochrone and catchment area analysis predicted that the concentration of the LIA passengers will be found in Ibeju-Lekki and Eti-Osa LGAs. Nevertheless, Epe, Ikorodu, Lagos Island, Lagos Mainland, Mushin, and Apapa LGAs will also be part of LIA's catchment area. The research also found that passengers who stated their preference for LIA were generally willing to pay 3,000 Naira as an additional fare to fly from the proposed new airport. Their willingness to pay an extra 15% of the average one-way domestic fare from LIA was influenced by four important factors, namely *Access Cost*, *Airfare, Stay in Nigeria*, and *Income.* Three factors (quality of access to LIA, income distribution in the market, and of the length of stay in the environment of the airport) were identified as important determinants not only for passenger choice of airport but also for an indication of the acceptable pricing for LIA. In other words, the viability of LIA will depend on:

a) The quality of the access to the airport,

b) The adoption of an efficient pricing policy that takes into consideration the disposable income and the willingness to pay of the average passengers, and
c) Taking into consideration the knowledge and experience of the average passenger in the Lagos market.

Theoretical and Practical Implications

Contribution to the body of knowledge. The present research provides important contributions to the body of knowledge, particularly to the airport competition literature. Firstly, as a precursory study on the fledgling airport competition on the African continent, the present research predicts the African market's reaction to the development. Prior to the present research, there was a gap in the airport competition literature regarding the African experience on airport competition. The research addresses the gap, as it provides insight on the factors that will influence passengers' choice of an airport in Africa.

Secondly, the results of the research not only confirmed the findings of previous studies in airport economics literature but they also identified new determinants of airport choice. As already found in other markets and reported in the airport literature, *Access*, *Price*, and *Income* were identified as factors that also influence the passengers' choice of an airport in the Nigerian market and, by extension, in the African market. Further, the present study contributed to the body of knowledge through its identification of two new determinants of airport choice: the *Class of Travel* and *Length of Stay* of the passenger in the environment under consideration. In addition to airport choice determinants that have been identified in airport literature, the present study found that in the Nigerian market,

passengers with significantly different lengths of stay in the city or region will choose their airport differently.

Thirdly, the present study is the first that includes an analysis of the structure of the Nigerian air transport market. There was a dearth of knowledge on the segmentation of the Nigerian market in the air transport literature. The research found that, unlike in many other countries, the Nigerian market is dominated by the business segment (58%). Thus, the present research provides a new piece of knowledge on the air transport market segmentation in Nigeria; this new information is important for the understanding of the Nigerian and African market behavior.

Fourthly and importantly, the present research provides a new approach for the prediction of the market share of a proposed second airport in a competitive environment. The findings of the present research show that the combination of the CVM and isochrones analysis provides an approach for the prediction of the market share of a proposed second airport. To the best of the knowledge of the researcher, the present study is the first to use a combination of the two methods to conduct the demand valuation of a proposed second airport in a competitive African environment. The research contributes an approach that can be used not only in Nigeria but in other parts of Africa and the developing world where multi-airport systems are emerging.

Contribution to the industry. As a precursory study on airport competition in Africa, the findings of the present research will benefit the development of the air transport industry on the continent. The present recommendations emanated from the

results of the research and aim at supporting the emergence of viable secondary airports not only in Nigeria but in the whole of Africa.

Importance of market size. For core and secondary airports to co-exist in a competitive multi-airport system, the market size needs to be large enough to sustain the viability of more than one airport (Booz & Company, 2012). The consideration of the market size is important for the prediction of the viability of secondary airports at city or regional levels. As earlier reported in Figure 22, the market size of many capital cities and even countries in Africa ranges below one million passengers per annum. One of the factors that the airport planners should consider before building secondary airports is the market size of the city or region where the secondary airport will be located. The secondary airport should be able to generate enough traffic from the capacity constraint at the primary airport or stimulate its own traffic through the operation of low cost carriers.

***Attracting airlines and traffic to secondary airports*.** In the present research, attaining a market share of 28.9%, which translates to 1.6 million passengers in a year, is commendable for a secondary airport in the African environment. However, gaining a market share of over one million passengers per annum is contingent on the earlier discussed assumptions and mostly on the ability of the proposed second airport to attract airlines. Therefore, the ability to attract airlines is an important factor for the viability of secondary airports.

Secondary airports in Africa can attract airlines through the use of lower user fees. The airlines will be interested in patronizing these airports if their charges emanate from

a pricing policy based on transparency, cost-relatedness, and consultation with the users. In addition to adopting the appropriate pricing strategy, secondary airports can target airlines entering the market. They also need to focus on airlines that are unable to expand their operations at core airports due to peak hour's congestion. Moreover, as done in other markets, secondary airports in Africa pursue low cost carriers. Usually, the approach taken consists of airlines receiving discounts for establishing a base at the secondary airport. Secondary airports generate aeronautical and non-aeronautical revenues from the stimulated traffic.

However, for many airlines, airport switching comes at a cost (IATA, 2013). Network carriers are more likely to maintain their base at a primary airport where they can continue to benefit from interconnectivity and high frequency that suits their hub-and-spoke business model. Switching from one airport to the other causes the network carriers to lose the economies of scale they enjoy at the primary airport in addition to incurring the cost of relocating assets. Secondary airport planners need to anticipate the likelihood of some service carriers not switching.

Nevertheless, a secondary airport can generate traffic through public service obligation (PSO) routes. In Africa, remote regions and rural areas need to be connected to important urban centers. Usually PSO air services are initiated and funded by governments to provide connectivity to remote areas. Secondary airports can partner with governments and airlines to generate traffic through PSO air services. In addition to the PSO services, secondary airports can build market share by providing access to hub airports as well as targeting migrant and worker traffic.

Access to and from the secondary airport. In the present research, isolation was measured by two variables: Access Cost and Access Time. The study found that the two variables were determinants of airport choice and willingness to pay. It is therefore recommended that the Lagos State Government remedies the isolation of the proposed second airport during its construction. The state government will need to develop the appropriate surface transport infrastructure to make the secondary airport accessible. It may consider high speed rail linking LIA to the CBD, to the high passenger density LGAs, and mostly to MMIA. The government needs to provide high speed connection between the core and secondary airport which will facilitate connection of flights between the two facilities. Failure to remedy LIA's isolation from the strategic locations and mostly MMIA will be detrimental to the viability of the proposed new airport.

Dynamic development of secondary airports. Governments, communities, or private airport planners need to avoid over-investing initially in a secondary airport which may threaten the viability of the airport from the beginning. The failed Mirabel Airport in Montreal handled less than three million passengers with facilities that were built 20 years earlier for 10 million passengers per annum (Carr, 1994 as cited in De Neufville, 1994). The researcher recommends a dynamic development approach for secondary airports in Africa, which consists of starting with a smaller facility based on realistic passenger distribution and expanding it as the market share grows.

In the context of the present research, the Lagos State Government is planning to build LIA with a capacity of five million passengers per annum. However, the present research predicted a contingent market share of 1.6 million passengers per annum. The

Lagos State Government needs to reconsider its plan of building LIA facilities for five million passengers since the findings of the present study predict that the five million passengers represent the total market size for both MMIA and LIA. Adopting the dynamic development approach, the Lagos State Government can start with a facility for one million passengers and gradually expand it as the LIA market share grows.

Strategic direction. As they emerge in Africa, secondary airports need to determine the strategic direction that will give them competitive advantage in their competitive co-existence with core airports. They will need to determine if their strategy will focus on cost leadership, production differentiation, or a niche market. With regard to the pricing strategy, secondary airports need to ascertain if they will pursue a cost leadership approach that will allow them to offer fees that are lower than the ones applied at the core airports. Similarly, secondary airports can develop products that are different and unique to them (Graham, 2004). Finally, they can adopt a niche strategy that focuses them on particular segments of the market such as cargo (similar to Prestwick Airport in Glasgow) or type of airline (LCC).

Limitations of Results. In the framing of the sample for the present research, restrictions were set to fulfil some requirements. The eligibility conditions for participating in the interview stated that the passenger must be at least 18 years old and must have stayed in Nigeria for at least 12 months. The age restriction was set in compliance with the ethical requirements of the IRB for research that deals with human subjects. Even though the framing of the sample for the research did not include

passengers under 18, children and young adults under 18 constitute an important proportion of passengers traveling through the airports. Therefore, the application of the results and recommendations of the present research should take into consideration the fact that the research sample did not include passengers who were younger than 18 years.

Moreover, passengers who did not reside in Nigeria for at least 12 months were not eligible to take part in the interview. Passengers needed to have resided in Nigeria long enough to have the basic knowledge of Lagos and the object of the study. The framing of the sample was the application of best practices for successful CV studies and the enhancement of the validity of the results. These limitations come from the CV study design.

Therefore, the sample framing limitation should be taken into consideration in the application of the findings of the study. The valuation of the predicted market share of 28.9% in terms of passenger traffic should take into consideration the peculiarities of the sample framing. Moreover, the independent variable *Stay in Nigeria* which was identified as predictor of airport choice and WTP applied only to the type of passengers framed in the sample discussed earlier.

Moreover, airports deal with two dominant but related groups of consumers: airlines and passengers. The airports need to attract more airlines to receive more passengers to patronize its facilities. Airports need to secure the participation of both sides of the market to maximize their profits. As passengers will go to airports where there are many airlines providing a variety of services to their destinations, so will airlines also patronize airports where there are many passengers. The airport sector is a two-sided market.

The present research considered only one side of the market: the passengers. The prediction of the LIA's market share was conducted only from the perspective of the passenger. The second side of the equation needs to be considered for a complete prediction of LIA's market share. Suggestions for future research to remedy the limitations of the present are further discussed below.

Recommendations for future research. Some issues related to research in airport economics emerged in the present study and should be addressed in the future research. First, the present study considered the passenger side of the airport market. The airline side of the market was not in the scope of the research. Due to the interdependence between the two sides of the market, it is important that further research attempts to predict airline preference between MMIA and the proposed LIA.

The researcher recommends the use of the stated preference approach for the prediction of LIA's market share of airlines operating into Nigeria. Using the CVM to collect the data, the researchers will ask the airlines to state their preference between MMIA and the proposed LIA based on a well-defined contingent valuation scenario. The prediction of the airline market share, the number of destinations and frequencies that the airline will deploy in the proposed LIA, and other factors will be used to validate or recalibrate the market share of passengers predicted in the present research. In another approach, the CV scenarios of the future research on the prediction of airlines' patronage of the proposed LIA can use the findings of the present research, mostly the 28.9% market share that LIA can attain as one of their contingent assumptions.

Second, the present research identified the need for the determination of the drive time threshold for the design of the business passenger isochrones for the city of Lagos. The threshold used by the UK CAA for UK airports was one hour for business passengers. The contrast of the business passenger's catchment areas derived from stated preference data with the drawn isochrones based on the UK CAA's one-hour threshold showed important disparities. The one-hour drive time adopted for UK airports appears too conservative for the airport environment in Lagos, Nigeria. The surface transport infrastructure in Nigeria is not as developed as it is in the UK. While the two-hour drive time threshold was found adequate for the non-business passengers' isochrones, an adequate drive time threshold for business passengers needs to be identified for airports in Lagos, Nigeria.

REFERENCES

ACI-Europe (2015). Airport Economics, Finance & Ownership. *Policy Papers*. Retrieved in January 2015 from: https://www.aci-europe.org/policy/position-papers.html

Advani, A., & Borins, S. (2001). Managing airports: A test of the new public management. *International Public Management Journal*, *4*(1), 91-107.

Akter, S., Bennett, J., & Akhter, S. (2008). Preference uncertainty in contingent valuation. *Ecological Economics, 67*, 345-351.

Alberini, A., & Cooper, J. (2000). Applications of the contingent valuation method in developing countries: A survey. *FAO Economic and Social Development Paper*, 146. Retrieved from ftp://ftp.fao.org/docrep/fao/003/X8955E/

Barrett, S. D. (2000). Airport competition in the deregulated European aviation market. *Journal of Air Transport Management*, *6*, 13-27.

B.B.C. (2016). Spain's Ciudad Real Airport sold at auction for €10,000. Retrieved from http://www.bbc.co.uk/news/world-europe-33578949

Blackstone, E.A., Buck, A.J., & Hakim, S. (2006). Determinants of airport choice in a multi-airport region. *Atlantic Economic Journal*, *34*, 313-326.

Blumenschein, K., Johannesson, M., Blomquist, G.C., Liljas, B., & O'Connor, R. (1998). Experimental results on expressed certainty and hypothetical bias in contingent valuation. *Southern Economic Journal*. *65*(1), 169-177.

Bonnefoy, P.A., & Hansman, R.J. (2004). Emergence and impact of secondary airports in the United States. *Proceedings of the 4th AIAA ATIO Forum in Chicago, Illinois*. Retrieved from http://hdl.handle.net/1721.1/34958

Booz & Company (2012). *Modelling of alternative airport sites.* Report for the Department of Infrastructure and Transport Australia. Retrieved from http://www.infrastructure.gov.au/aviation/scopingstudy/files/Booz _and_Company-Modelling_of_alternative_airport_sites.pdf

CAPA (2010). *African airport sector outlook: 2010.* Retrieved from http://centreforaviation.com/analysis/african-airport-sector-outlook-2010-25761

Carson, R. T. (2000). Contingent valuation: A user's guide. *Environment Science Technology, 34,* 1413-1418.

Carson, R.T., & Louvière, J.J. (2011). A common nomenclature for stated preference elicitation approaches. *Environ Resource Econ*. doi:10.1007/s 10640-010-9450

Copenhagen Economics (2012). *Airport competition in Europe*. Retrieved from http://www.seo.nl/uploads/media/2012-47_Airport_Competition_ in_Europe.pdf

Deloitte Access Economics (2012). *Economic impact of a western Sydney airport*. Retrieved from http://www.nswbusinesschamber.com.au /NSWBC/media/Misc/Lobbying/Thought%20leadership/FINAL-Thinking-Business-Western-Sydney-Airport.pdf

De Neufville, R. (1995). Management of multi-airport systems: A development strategy. *Journal of Air Transport Management*. *2*(2), 99-110.

Economic Commission for Africa (2013). *Making the most of Africa's commodities: Industrializing for growth, jobs and economic transformation*. Retrieved from http://www.uneca.org/sites/default/files/publications/unera_ report_eng_ final_web.pdf

Forsyth, P., Gillen, D., Muller, J., and Niemeier, H. (2010). *Airport competition: The European experience.* Surrey, England: Ashgate Publishing Company.

Frontier Economics (2008, June). *Bulletin: Keeping the lid on; analyzing competition between UK airports*. Retrieved from http://www.frontier-economics.com/documents /2014/06/keeping-the-lid-on-frontier-bulletin.pdf

Graham, A. (2004, November). *Airport strategies to gain competitive advantage*. Paper presented at GARS: Slots, Airport Competition and Benchmarking of Airports, Bremen, 19-20 November 2004. Retrieved from http://citeseerx.ist.psu.edu/ viewdoc/download?doi=10.1.1.575.1436&rep=rep1&type=pdf

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). *Multivariate data analysis.* Upper Saddle River, NJ: Prentice Hall.

IATA (2013). *Passenger intelligence service* (Data file and code Web tool). Retrieved from https://pax-is.com/bsp/pages/login.jsp

Ifabiyi, I.P. (2011). Willingness to pay for water at household level in Ilorin, Kwara State, Nigeria. *Global Journal of Human Social Science, 11*, 2.

Irish Times (2014). Ryanair wins legal battle over state aid at Charleroi airport. (2014, October 1). Retrieved from http://www.irishtimes.com/business/transport-and-tourism/ryanair-wins-legal-battle-over-state-aid-at-charleroi-airport-1.1947956

Johannesson, M., Liljas, B., & Johansson, P. (1998). An experimental comparison of dichotomous choice contingent valuation questions and real purchase decisions. *Applied Economics*, *30*, 643-647.

Kroes, P.E., & Sheldon, R.P. (1988). Stated preference methods: An introduction. *Journal of Transport Economics and Policy*, *22*(1), 11.

Lagos State begins construction of the Lekki Seaport, International Airport. (2013, July 3). *CPAfrica.* Retrieved from http://www.cp-africa.com/2013/07/03/lekki-seaport-Lagos-airport

Leke, A., Lund, S., Roxburgh, C., and van Wamelen, A. (2010, June). *What's driving Africa's growth*? McKinsey & Company. Retrieved from http://www.mckinsey .com/insights/economic_studies/whats_driving_africas_growth

Levy, D.S., Hammit, J.K., Duan, N., Downes-LeGuin, T., & Friedman, D. (1995). *Conceptual and statistical issues in contingent valuation: Estimating the value of altered visibility in the Grand Canyon.* Santa Monica, CA: RAND. Retrieved from http://www.rand.org/content/dam/rand/pubs/monograph_reports /2007/MR344.pdf

Malina, R., Schwab, M., & Wollersheim, C. (2008). *Using a contingent valuation approach for evaluating the benefits of airports for regional economies.* University of Muensters, Germany: Institute of Transport Economics.

Mandel, B.N. (1999, June). *Airport choice & competition: A strategic approach*. Paper presented at the 3rd Air Transport Research Group Conference, Hong Kong.

Messonnier, M.L., Bergstrom, J.C., Cornwell, C.M., Teasley, R.J., & Cordell, H.K. (2000). Survey response-related biases in contingent valuation: Concepts, remedies and empirical application to valuing aquatic plant management. *American Journal of Agricultural Economics*, *83,* 438-450.

Mitchell, R.C., & Carson, R.T. (1987). Evaluating the validity of contingent valuation studies. *Discussion Paper*. Resources for the Future, Washington, D.C.

Neuman, W.L. (1997). *Social research methods: Qualitative and quantitative approaches*. Boston: Allyn Bacon.

Olawale, F., & Garwe, D. (2010). Obstacles to the growth of new SMEs in South Africa: A principal component analysis approach. *African Journal of Business Management*, *4*(5), 729-738.

Pavlyuk, D. (2012). Airport benchmarking and spatial competition: A critical review. *Transport and Telecommunication*, *13*(2), 123-137.

Rahim, K.A. (2008, March). *Contingent valuation method (CVM).* Paper presented at the Regional Training Workshop on the Economic Valuation of the Goods and Services of Coastal Habitats, Samut Songkram Province, Thailand. Summary retrieved from http://www.unepscs.org/Economic_Valuation_Training_Materials/03%20Techniques%20for%20Valuing%20Coastal%20Habitat%20Goods%20and%20Services/21-Contigent-Valuation-Coastal-Habitats-Reading.pdf

Raosoft (2014). *Sample size calculator.* Retrieved from http://www.raosoft.com/samplesize.html.

Shaikh, S.L., Sun, L., & Van Kooten, C. (2007). Treating respondent uncertainty in contingent valuation: A comparison of empirical treatments. *Ecological Economics, 62*, 115-125.

Starkie, D. (2002). Airport regulation and competition. *Journal of Air Transport Management, 8*, 63-72.

Starkie, D. & Yarrow, G. (2010). Market definition in the airports sector. A draft presented to the UK CAA. Retrieved from https://www.caa.co.uk/docs/5/Starkie-MARKET%20DEFINITION%20IN%20THE%20AIRPORT%20SECTOR.pdf

Strobach, D. (2010). Competition among airports and overlapping catchment areas: An application to the State of Baden-Wurttemberg. In P. Forsyth, D. Gillen, J. Muller, H. Niemeier (Ed.), Airport competition, The European experience (pp. 261-276). Surrey: Ashgate.

UK CAA (2002). *Heathrow, Gatwick and Stansted airports' price caps, 2003-2008: CAA recommendations to the competition commission.* Retrieved from https://www.caa.co.uk/docs/5/ergdocs/baarecssummarymar02.pdf

UK CAA (2011). *Empirical methods for assessing geographic markets, in particular competitive constraints between neighbouring airports.* Retrieved from http://www.caa.co.uk/docs/5/geogmarketworkingpaper.pdf

Whitehead, J.C., Groothuis, P.A., and Blomquist, G.C. (1992). Testing for non-response and sample selection bias in contingent valuation: Analysis of a combination of phone/mail survey. *Economics Letters, 41*, 215-220.

Whitehead, J.C., Blomquist, G.C., Hoban, T.J., & Clifford, W.B. (1995). Assessing the validity and reliability of contingent values: A comparison of on-site users, off-site users and non-users. *Journal of Environmental Economics and Management, 29*, 238-251.

Whittington, D. (2002). Improving the performance of contingent valuation studies in developing countries. *Environmental and Resource Economics*, *22*, 323-367.

Wiltshire, James. (2013). *Airport competition, v. 1.2.* (IATA Economics Briefing No 11). Retrieved from https://www.iata.org/whatwedo/Documents/ economics/airport-competition.pdf

Worku, G.B. (2013). Demand for improved public transport services in the UAE: A contingent valuation study in Dubai. *International Journal of Business and Management, 8*(10), 108-125.

Zyoud, H.S., AL-Jabi, S., Sweileh, W., Nabulsi, M., Tubaila, M., Awang, R., and Sawalha, A. (2013). Beliefs and practices regarding childhood fever among parents: A cross-sectional study from Palestine. *BMC Pediatrics, 13,* 66.

APPENDIX A

Permission to Conduct Research

Embry-Riddle Aeronautical University
Application for IRB Approval
Exempt Determination

Principle Investigator: Steve Hampton **Other Investigators:** Samson Fatokun **Role:** Student **Campus:** World Wide **College:** COA

Project Title PREDICTING THE MARKET SHARE OF A PROPOSED SECOND AIRPORT IN LAGOS NIGERIA **Submission Date:** 4/29/2015 **Determination Date:** 5/27/2015

Review Board Use Only

Initial Reviewer: David Ison/M.B. McLatchey

Exempt: Yes

Approved:  M.B. McLatchey

World Wide IRB Representative/Chair of the IRB Signature

Brief Description: The purpose of the research is to predict the market share that a second airport could gain in a competitive airport environment in Lagos, Nigeria. The research will also determine the most important predicting factors for passenger preference between the existing airport and the proposed second airport. Furthermore, the present research will predict the catchment area of the proposed second airport in Lagos.

This research falls under the **exempt** category as per 45 CFR 46.101(b) under:

☒(2) Research involving **only** the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures (of adults), interview procedures (of adults) or observation of public behavior. Participant information obtained will remain anonymous and confidential.

An exempt research project does not require ongoing review by the IRB, unless the project is amended in such a way that it no longer meets the exemption criteria.

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24th April, 2015

Samson FATOKUN
IATA Office
EAN Aircraft Hanger Facility
Murtala Muhammed International Airport, Ikeja, Lagos.
Tel.08039799037

Dear Sir,

Re: **AUTHORISATION TO CONDUCT A RESEARCH SURVEY AT MURTALA MOHMMED INTERNATIONAL AIRPORT IKEJA, LAGOS.**

Permission has been granted you to conduct interview with passengers for about 30 days within the International and Domestic Terminals of the Murtala Muhammed International Airport.

Please, ensure that the survey does not cause obstruction of traffic flow and facilitation of passengers during profiling.

Yours faithfully

Shin-Aba V.B
For: Airport Manager

AGREEMENT TO PARTICIPATE IN

PREDICTING THE MARKET SHARE OF A PROPOSED SECOND AIRPORT IN LAGOS, NIGERIA

STUDY LEADERSHIP. I am Samson Oladele Fatokun, a student of the College of Aviation at the Embry-Riddle Aeronautical University, Daytona Beach, Florida, U.S.A. I am conducting a research related to the future development of a second airport in Lagos, Nigeria. Dr. Steven Hampton, a faculty member of the department is supervising the research.

PURPOSE. The purpose of the study is to predict the market share that a proposed second airport in Lagos could gain in a competitive environment.

ELIGIBILITY. To take part in the study, you must be presently a passenger at Murtala Mohammed International Airport, Lagos. You must be at least 18 years old. In addition, you must have resided in Nigeria for most of the last 12 months.

PARTICIPATION. During the study, you will take part in an interview where you are expected to provide responses to the questions that will be read out to you. In addition to the demographic questions, you will be asked to state your preference between Murtala Mohammed International Airport and the proposed Lekki International Airport in a contingency of your flight being available at the same price at the proposed second airport. It will take you about 15 minutes to take part in the interview.

RISKS OF PARTICIPATION. The risks associated with your participation in the interview are minimal and are not higher than the ones you face in everyday life. The risks include the possibility of the reduction in your boarding time. You are free to discontinue the interview at any time if necessary.

BENEFITS OF PARTICIPATION. I do not expect the study to benefit you personally. However, your participation will contribute positively to the success of the present study which findings will provide valuable insights for the success of a second airport project in Lagos. This study is also expected to provide African aviation authorities with some insights on the about-to-emerge airport competition on the continent. Moreover, the study will benefit me by helping me complete my doctorate program.

COMPENSATION. There is no direct compensation to you for participating in the study.

VOLUNTARY PARTICIPATION. Your participation in the study is completely voluntary. You may stop or withdraw from the study at any time without it being held

against you. Your decision whether or not to participate will have no effect on your current or future connection with anyone at Embry-Riddle Aeronautical University.

CONFIDENTIALITY. Your individual privacy will be protected in all papers, books, talks, posts, or stories resulting from this study. We may share the data we collect with other researchers, but we will not reveal your identity with it. In order to protect the confidentiality of your responses, I will not conduct any audio or video recording of the interview. During the interview, I will not request for your name, your place of work or house address. The interview information will be reported as aggregate. All information collected during the interview will be kept confidentially.

FURTHER INFORMATION. If you have any questions or would like additional information about this study, please contact Samson Oladele Fatokun who may be reached at the following address:

First Floor, EAN Aircraft Facility Hangar

Murtala Mohammed International Airport

Ikeja, Lagos, Nigeria.

Tel: +2348039799037

E-mail: fatokuns@my.erau.edu.

The Embry-Riddle Aeronautical University Institutional Review Board has approved this project. You may contact the Embry-Riddle Aeronautical Board with any questions or issues at +1 (909) 607-9406 or at irb@cgu.edu. A copy of this form will be given to you if you wish to keep it.

CONSENT. Your signature below means that you understand the information on this form, that someone has answered any and all questions you may have about this study, and you voluntarily agree to participate in it.

Signature of Participant _____ Date _____

Printed Name of Participant _____

The undersigned researcher has reviewed the information in this consent form with the participant and answered any of his or her questions about the study.

Signature of Researcher _____ Date _____

Printed Name of Researcher _____

APPENDIX B

Pilot Survey

Lagos Airport Demand Valuation – Subsample 1

(Interview Script to be Read out to the respondents)

As you may be aware, the Lagos State Government is planning to build an international airport at Lekki-Epe area of Lagos State. I will like to ask you some questions to understand how you would value and patronize the different airports when Lagos becomes a multi-airport city.

Q1. In which country have you been living for most of the **last 12 months**?

---------- Country

Q2. For how long have you been living in Nigeria?

---------- Year

Q3. In which **Local Government Area of Lagos State** do you stay (Residence, hotel)?

---------- Local Government Show card

Q4. Have you been to the Lekki Area of Lagos?

☐ Yes

☐ No

Q5. On average, **how long** does it take you to get to this airport from your house?

---------- Hour

Q6. On average, **how much** does it cost you to get to this airport?

---------- Naira

Q7. Are you boarding a domestic or International flight?

☐ Domestic

☐ International

Q8. What is your class of travel?

☐ Business Class

☐ Economy Class

Q9. How much did you pay for your ticket including tax?

☐ One Way
☐ Return
---------- Currency
---------- Amount

Q10. What is the **purpose** of your current journey?

☐ Business

☐ Non Business

Q11. Could you indicate which airport amenity, among the following, is most important to you?

☐ Car park

☐ Lounges

☐ Waiting area before boarding

☐ Shopping area

☐ Other (…….....)

Q12. The Lagos State Government is planning to build a second international airport at Lekki-Epe area of Lagos state. The airport will be located in the export processing zone that the state government is presently building and will be connected by access roads. The airport will be owned by Lagos State but built on a Public-Private Partnership (PPP) and managed through a concession. At the completion of the project, Lagos state will have two international airports namely Murtala Mohammed International Airport and Lekki International Airport. Which of the two airports will be your first choice assuming the same flight is available at the two airports for the same price and keeping in mind that ownership, management, ease of access, distance from central business area and access from your residence may differ. Please, note that the main purpose of this survey is not to record protest vote against Murtala Mohammed International Airport or the Federal Airport Authority of Nigeria but evaluate how some factors may affect your choice of airport if Lagos State builds a second international airport in Lekki-Epe.

---------- ***1st Choice***

Q13. On a scale of **1 to 10** how certain are you of your answer to the last question, **concerning your choice of airport**?

1 stands for "**Not certain**"

10 stands for "**Very certain**".

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

For passengers whose 1st Choice is Murtala Mohammed International Airport, go to Q14 – 15; Q18 -23

For passengers whose 1st Choice is Lekki International Airport, go to Q16 -19; 18-21 and 24-25

Passengers who prefer Murtala Mohammed International Airport

Q14. If the ticket for the same flight was cheaper from the proposed Lekki-Epe International Airport than from Murtala Mohammed International Airport, **which airport would you choose?**

☐ Murtala Mohammed International Airport, Ikeja

☐ Lekki-Epe International Airport

Q15. And how much cheaper would the airfare have to be?

---------- Naira

Passengers who prefer Lekki-Epe International Airport

Q16. How **much extra money** would you be willing to pay in order to fly return from the proposed Lekki Epe International Airport to your destination airport, if necessary?

---------- Naira

Q17. On a scale of 1 **to** 10 how certain are you of your answer to the last question, concerning the amount you are willing to pay?

1 stands for “Not certain” and 10 for “Very certain”.

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

Demographics: All Passengers

Q18. What is your Gender?

☐ Female

☐ Male

Q19. What is your age?

---------- Year

Q20. What is your highest level of formal education?

☐ Primary School

☐ Secondary School

☐ OND/NCE

☐ First Degree or Equivalent

☐ Second degree

☐ Doctorate degree

☐ No formal education

Q21. Indicate from the card below your total **annual income bracket** after tax and deductions?

☐ Below N3.6Million

☐ N3.6 Million – N6 Million

☐ N6 Million – N12 Million

☐ N12 Million – N24 Million

☐ Above N24 Million

Passengers who prefer Murtala Mohammed International Airport ... Continue

And finally assuming that the same airline service is available at both airports. (as in Q12)

Q22. Since you have indicated that you will prefer Murtala Mohammed International Airport to Lekki-Epe Airport, how much cheaper would your ticket have to be to fly return from Lekki-Epe Airport to your destination airport?

---------- Naira

(If Q20 differs from Q15 then go to Q21)

Q23. To summarize, you have indicated previously (Q9) that you would expect the ticket to be (...) cheaper. You have indicated (Q11) that you would want the ticket to be (...) cheaper. Which would you say is the **more accurate answer?**

---------- Question number

Thank you for your help
End Interview for passengers who prefer Murtala Mohammed International Airport

Passengers who prefer Lekki-Epe International Airport … Continue

And finally assuming that the same airline service is available at both airports. (as in Q12)

Q24. Since you have indicated that you will prefer Lekki-Epe Airport to Murtala Mohammed International Airport, how much extra money will you be willing to pay fly return from there?

---------- Naira

(If Q24 differs from Q22 then go to Q25)

Q25. To summarize you have indicated previously (Q22) that you would be willing to pay (...) in order to fly return from the proposed Lekki-Epe International Airport. You have now indicated (Q23) that you would be willing to pay (...) to fly from there. Which would you say is the **more accurate answer**?

---------- Question number

Thank you for your help

End Interview for passengers who prefer Lekki-Epe International Airport .

Lagos Airports Demand Valuation – Subsample 2

(Interview Script to be Read out to the respondents)

As you may be aware, the Lagos State Government is planning to build an international airport at Lekki-Epe area of Lagos State. I will like to ask you some questions to understand how you would value and patronize the different airports when Lagos becomes a multi-airport city.

Q1. In which country have you been living for most of the **last 12 months**?

---------- Country

Q2. For how long have you been living in Nigeria?

---------- Year

Q3. In which **Local Government Area of Lagos State** do you stay (Residence, hotel)?

---------- Local Government Show card

Q4. Have you been to the Lekki Area of Lagos?

☐ Yes

☐ No

Q5. On average, **how long** does it take you to get to this airport from your house?

---------- Hour

Q6. On average, **how much** does it cost you to get to this airport?

---------- Naira

Q7. Are you boarding a domestic or International flight?

☐ Domestic

☐ International

Q8. What is your class of travel?

☐ Business Class

☐ Economy Class

Q9. How much did you pay for your ticket including tax?

☐ One Way
☐ Return
---------- Currency
---------- Amount

Q10. What is the **purpose** of your current journey?

☐ Business

☐ Non Business

Q11. Could you indicate which airport amenity, among the following, is most important to you?

☐ Car park

☐ Lounges

☐ Waiting area before boarding

☐ Shopping area

☐ Other (…….....)

Q12. The Lagos State Government is planning to build a second international airport at Lekki-Epe area of Lagos state. The airport will be located in the export processing zone that the state government is presently building and will be connected by access roads. The airport will be owned by Lagos State but built on a Public-Private Partnership (PPP) and managed through a concession. At the completion of the project, Lagos state will have two international airports namely Murtala Mohammed International Airport and Lekki International Airport. Which of the two airports will be your first choice assuming the same flight is available at the two airports for the same price and keeping in mind that ownership, management, ease of access, distance from central business area and access from your residence may differ.

---------- ***1st Choice***

Q13. On a scale of **1 to 10** how certain are you of your answer to the last question, **concerning your choice of airport**?

1 stands for "**Not certain**"

10 stands for "**Very certain**".

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

For passengers whose 1st Choice is Murtala Mohammed International Airport, go to Q14 – 15; Q18 -23
For passengers whose 1st Choice is Lekki International Airport, go to Q16 -19; 18-21 and 24-25

Passengers who prefer Murtala Mohammed International Airport

Q14. If the ticket for the same flight was cheaper from the proposed Lekki-Epe International Airport than from Murtala Mohammed International Airport, **which airport would you choose?**

☐ Murtala Mohammed International Airport, Ikeja

☐ Lekki-Epe International Airport

Q15. And how much cheaper would the airfare have to be?

---------- Naira

Passengers who prefer Lekki-Epe International Airport

Q16 How **much extra money** would you be willing to pay in order to fly return from the proposed Lekki Epe International Airport to your destination airport, if necessary?

---------- Naira

Q17 On a scale of 1 **to** 10 how certain are you of your answer to the last question, concerning the amount you are willing to pay?

1 stands for “Not certain” and 10 for “Very certain”.

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

Demographics: All Passengers

Q18. What is your Gender?

☐ Female

☐ Male

Q19. What is your age?

---------- Year

Q20. What is your highest level of formal education?

☐ Primary School

☐ Secondary School

☐ OND/NCE

☐ First Degree or Equivalent

☐ Second degree

☐ Doctorate degree

☐ No formal education

Q21. Indicate from the card below your total **annual income bracket** after tax and deductions?

☐ Below N3.6Million

☐ N3.6 Million – N6 Million

☐ N6 Million – N12 Million

☐ N12 Million – N24 Million

☐ Above N24 Million

Passengers who prefer Murtala Mohammed International Airport … Continue

And finally assuming that the same airline service is available at both airports. (as in Q12)

Q22. Since you have indicated that you will prefer Murtala Mohammed International Airport to Lekki-Epe Airport, how much cheaper would your ticket have to be to fly return from Lekki-Epe Airport to your destination airport?

---------- Naira

(If Q20 differs from Q15 then go to Q21)

Q23. To summarize, you have indicated previously (Q9) that you would expect the ticket to be (…) cheaper. You have indicated (Q11) that you would want the ticket to be (…) cheaper. Which would you say is the **more accurate answer?**

---------- Question number

Thank you for your help
End Interview for passengers who prefer Murtala Mohammed International Airport

Passengers who prefer Lekki-Epe International Airport … Continue

And finally assuming that the same airline service is available at both airports. (as in Q12)

Q24. Since you have indicated that you will prefer Lekki-Epe Airport to Murtala Mohammed International Airport, how much extra money will you be willing to pay fly return from there?

---------- Naira

(If Q24 differs from Q22 then go to Q25)

Q25. To summarize you have indicated previously (Q22) that you would be willing to pay (...) in order to fly return from the proposed Lekki-Epe International Airport.

You have now indicated (Q23) that you would be willing to pay (...) to fly from there. Which would you say is the **more accurate answer**?

---------- Question number

Thank you for your help

End Interview for passengers who prefer Lekki-Epe International Airport

APPENDIX C

Principal Survey

Main Survey

Lagos Airports Demand Valuation

(Interview Script to be Read out to the respondents)

As you may be aware, the Lagos State Government is planning to build an international airport at Lekki-Epe area of Lagos State. I will like to ask you some questions to understand how you would value and patronize the different airports when Lagos becomes a multi-airport city.

Q1. In which country have you been living for most of the **last 12 months**?

---------- Country

Q2. For how long have you been living in Nigeria?

---------- Year

Q3. In which **Local Government Area of Lagos State** do you stay (Residence, hotel)?

---------- Local Government

Q4. Have you been to the Lekki Area of Lagos?

☐ No

☐ Yes

Q5. On average, **how long** does it take you to get to this airport from your **house, residence or hotel**?

---------- Hour

Q6. On average, **how much** does it cost you to get to this airport?

---------- Naira

Q7. Are you boarding a domestic or International flight?

☐ Domestic

☐ International

Q8. Are you traveling in Economy Class or Business Class?

☐ Economy Class

☐ Business Class

Q9. How much did your ticket cost?

---------- Currency
---------- Amount

Q10. Is your ticket One Way or Return?

☐ One Way
☐ Return

Q11. What is the **purpose** of your current journey?

☐ Non-Business (Leisure, vacation, visit families or friends, etc.)

☐ Business (Office, work, meeting, business travel, etc.)

Q12. Could you indicate which airport amenity, among the following, is most important to you**? Please choose only one.**

☐ Car park

☐ Lounges

☐ Waiting area before boarding

☐ Shopping area

☐ Other (…….....)

Q13. The Lagos State Government is planning to build a second international airport at Lekki-Epe area of Lagos state. The airport will be located in the export processing zone that the state government is presently building and will be connected by access roads. The airport will be owned by Lagos State but built on a Public-Private Partnership (PPP) and managed through a concession. At the completion of the project, Lagos state will have two international airports namely Murtala Mohammed International Airport and Lekki International Airport. Which of the two airports will be your first choice assuming the same flights are available at the two airports for the same price but keeping in mind that ownership, management, ease of access, distance from central business area and access from your residence may differ.

---------- ***1st Choice***

Q14. On a scale of **1 to 10** how certain are you of your answer to the last question, **concerning your choice of airport**?

1 stands for "**Not certain**" **10** stands for "**Very certain**".

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

If 1st Choice is Murtala Mohammed International Airport, go to Q15 – 17 and the demographics.

For passengers whose 1st Choice is Lekki International Airport, go to Q18 -20 and the demographics

Passengers who prefer Murtala Mohammed International Airport

Q15. If the ticket for the same flight was cheaper from the proposed Lekki-Epe International Airport than from Murtala Mohammed International Airport, **which airport would you choose?**

☐ Murtala Mohammed International Airport, Ikeja

☐ Lekki-Epe International Airport

Q16. And how much cheaper would the airfare have to be for you to fly from Lekki-Epe International Airport?

---------- Naira

(If the amount is higher than N20, 000, please show card and let the passenger choose an amount from the show card)

Q17. On a scale of **1 to 10** how certain are you of your answer concerning **the amount** you will be ready to accept to fly from Lekki Airport?

1 stands for "**Not certain**"

10 stands for "**Very certain**".

☐ 1 Not certain

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

☐ 8

☐ 9

☐ 10 Very certain

Go straight to Demographics

Passengers who prefer Lekki-Epe International Airport

Q18. If the ticket for the same flight was more expensive from the proposed Lekki-Epe International Airport than from Murtala Mohammed International Airport, **which airport would you choose?**

☐ Murtala Mohammed International Airport, Ikeja

☐ Lekki-Epe International Airport

Q19. **If necessary**, how **much extra money** would you be willing to pay in order to fly from the proposed Lekki Epe International Airport?

---------- Naira

Q20. On a scale of 1 **to** 10 how certain are you of your answer to the last question, concerning the additional amount you are willing to pay to fly from Lekki International Airport, if necessary?

1 stands for "Not certain" and 10 for "Very certain".

- ☐ 1 Not certain
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9
- ☐ 10 Very certain

Demographics: All Passengers

Q21. What is your Gender?

- ☐ Male
- ☐ Female

Q22. What is your age?

---------- Year

Q23. What is your highest level of formal education?

- ☐ Primary School
- ☐ Secondary School
- ☐ OND/NCE
- ☐ First Degree or Equivalent
- ☐ Second degree
- ☐ Doctorate degree
- ☐ No formal education

Q24. Indicate from the card below your total **annual income bracket** after tax and deductions?

- ☐ Below N3.6Million
- ☐ N3.6 Million – N6 Million
- ☐ N6 Million – N12 Million
- ☐ N12 Million – N24 Million
- ☐ Above N24 Million

Thank you for your help

End Interview for all passengers

APPENDIX D

Determinants of Airport Choice

Table D-1

Iteration History of the Base Model

Iteration		-2 Log likelihood	Coefficients Constant
Step 0	1	1339.731	-.843
	2	1339.008	-.898
	3	1339.008	-.899

Note. a) Constant is included in the model; b) Initial -2 Log Likelihood: 1339.008; c) Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Table D-2

Iteration History of the Forward Stepwise Logistic Regression

Iteration		-2 Log likelihood	Coefficients Constant	Access Time	Access Cost	Stay Nigeria	Income	Class of Travel
Step 1	1	1160.462	-2.065	.015				
	2	1147.578	-2.564	.018				
	3	1147.435	-2.624	.019				
	4	**1147.435**	**-2.625**	**.019**				
Step 2	1	1097.320	-2.299	.011	.000			
	2	1052.189	-3.170	.011	.000			
	3	1049.481	-3.423	.010	.000			
	4	1049.471	-3.441	.010	.000			
	5	**1049.471**	**-3.441**	**.010**	**.000**			
Step 3	1	1087.589	-1.854	.011	.000	-.014		
	2	1040.594	-2.568	.011	.000	-.019		
	3	1037.686	-2.780	.011	.000	-.021		
	4	1037.673	-2.795	.011	.000	-.021		
	5	**1037.673**	**-2.795**	**.011**	**.000**	**-.021**		
Step 4	1	1070.939	-1.858	.011	.000	-.019	.227	
	2	1024.822	-2.581	.012	.000	-.026	.288	
	3	1021.733	-2.805	.012	.000	-.028	.301	
	4	1021.718	-2.822	.012	.000	-.028	.302	
	5	**1021.718**	**-2.822**	**.012**	**.000**	**-.028**	**.302**	
Step 5	1	1066.529	-1.851	.011	.000	-.019	.208	.465
	2	1019.916	-2.573	.012	.000	-.026	.261	.585
	3	1016.778	-2.796	.011	.000	-.028	.272	.616
	4	1016.763	-2.813	.011	.000	-.028	.273	.619
	5	**1016.763**	**-2.813**	**.011**	**.000**	**-.028**	**.273**	**.619**

Note. ~~A~~a) Method: Forward Stepwise (Likelihood Ratio); b) Constant is included in the model; c) initial -2 Log Likelihood: 1339.008; d) Estimation terminated at iteration number 4 because parameter estimates changed by less than .001; e) Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table D - 3

Classification Step 1 to Step 5

Observed			Predicted		
			First Choice		Percentage
			MMIA	LIA	Correct
Step 1	First Choice	MMIA	739	52	93.4
		LIA	224	98	30.4
	Overall Percentage				**75.2**
Step 2	First Choice	MMIA	727	64	91.9
		LIA	169	153	47.5
	Overall Percentage				**79.1**
Step 3	First Choice	MMIA	733	58	92.7
		LIA	173	149	46.3
	Overall Percentage				**79.2**
Step 4	First Choice	MMIA	730	61	92.3
		LIA	163	159	49.4
	Overall Percentage				**79.9**
Step 5	First Choice	MMIA	729	62	92.2
		LIA	164	158	49.1
	Overall Percentage				**79.7**

APPENDIX E

Descriptive Statistic of Results of the Pilot Survey

Table E-1

Market Segmentation

Segment	Frequency	Percentage
Non-Business	120	51.1
Business	115	48.9
Total	235	100.0

Table E-2

Airport Choice

Airport	Frequency	Percentage
MMIA	155	66.0
LIA	80	34.0
Total	235	100.0

Table E-3

Willingness to Pay of Respondents who Chose LIA

Naira	Frequency	Percentage
0	32	40.0
1000	3	3.8
2000	5	6.3
3000	6	7.5
3500	1	1.3
4000	3	3.8
5000	14	17.5
6000	1	1.3
6400	1	1.3
7000	1	1.3
8000	3	3.8
9000	1	1.3
10000	6	7.5
12000	2	2.5
50000	1	1.3
Total	80	100.0