SAFETY AND DISTRESS RESPONSE SYSTEM IN NIGERIA'S INTERNATIONAL AIRPORTS

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ABSTRACT

Airports require complete safety initiatives with a maximum of 20 minutes response time to distress situation. They are therefore regulated by International Civil Aviation Organisation (ICAO) standards. However, in Nigeria, airport safety and distress response have been of great concern due to inadequate infrastructure. This study, therefore, examined safety facilities and response capability to distress situations in Nigeria international airports. The effects of haphazard spatial developments within the airports and their environments were also examined.

The available infrastructure for safety and distress response initiatives were considered using ICAO check-list to determine their adequacy. Four international airports namely: Murtala Muhammed (Lagos), Aminu Kano (Kano), Nnamdi Azikwe (Abuja), and Port Harcourt were purposively selected. Three questionnaires were administered to 618 airport operators, 369 users and 462 neighbours in soliciting information on various aspects of safety and distress response initiatives including terminal buildings, navigational aids, runways and fire-fighting equipment and adequacy of staff training for operating Safety Management Systems (SMS) effectively. This was complemented with Key Informant Interview (KII) with 12 technical staff from 5 airport operators. Satellite imagery data were used to acquire spatial information on the airports. Descriptive statistics were used to analyse data on adequacy of safety facilities, staff training and distress responsiveness. Pearson correlation was used to determine the relationship between safety infrastructure and airport age. Analysis of Variance was used to determine variations in airport operators' safety awareness as recommended by ICAO. The KII data were content analysed, while raster model was used to determine the land-use pattern. Analysis were done at $p<0.05$.

Functionality of safety facilities fell short of ICAO standards in all the airports by 30%, 25%, 20% and 10% in Lagos, Kano, Port-Harcourt and Abuja respectively. A positive relationship existed between airport age and obsolescence of safety infrastructure ($r=0.12$). Lagos airport had the most obsolete safety facilities. KII also revealed breakdown of infrastructure in the airports. There were significant variations in safety awareness among airport operators ($F=11.95$). Safety awareness was highest among the staff of Federal Airports Authority of Nigeria (34.9%) and lowest among airport handling agents (12.2%). Ninety-one percent of airport operators sampled indicated distress response as being poor. Response time varied from 30 minutes in Abuja to 54 minutes in Lagos. Sixty percent of the users considered airport service quality as very low. Forty-six percent of airport operators indicated that they had no training since employed. Spatial analysis of the airports and their environment showed that Lagos and Kano airports suffered safety threats from poor waste management and chaotic traffic patterns.

Safety and distress response capacity was relatively low in all the international airports investigated. There is an urgent need for the airports to be managed in line with international standards. Staff training should also be prioritised and spatial developments around airport s need to be controlled.

Keywords: Airport safety, Distress response, Spatial development, Civil aviation standards, Nigerian international airports.

Word Count: 463

CERTIFICATION

This is to certify that this research work was carried out by Mr. Kayode, Victor Adedayo in the Department of Geography University of Ibadan.

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DEDICATION

Dedicated to the memory of my late father,

Pa Michael Ojo Kayode.
(1924-2004)

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To God be the glory……great things He hath done…….. Truly, whatever has a beginning must surely have an end. From the beginning of this research work to the end, many waters passed underneath the bridge, coupled with other storms like thunder and whirl wind that were experienced. But by His grace, I was able to whither through all. Glory be to the Lord Almighty.

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In all I still want to glorify the name of my Almighty God from whom all strength comes from and whose mercies I receive anew each morning.

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CHAPTER ONE

BACKGROUND TO THE STUDY AND STATEMENT OF RESEARCH PROBLEM

1.1 INTRODUCTION

Aviation represents one of the greatest achievements of man in attempting to overcome the challenges of the natural environment (Geary-Stevens 1993; Braithwaite and Faulkner 1998). This is to the extent that human beings have always been fascinated by flights, early attempts of which met with utter disaster. People would climb high cliffs or towers, armed with magic spells, home made wings, or a combination of the two and plunge to their deaths as they attempted to fly.

With the introduction of powered aircraft on the 17th of December 1903 in Kitty Hawick North Carolina by the Wright Brothers (Blakey, 2003), air transport emerged as a truly twentieth century mode of overcoming spatial separation of human activities, increase in economic activities (Filani 2000) and also brought out the potential that man has in overcoming challenges posed by his environment and its development (Ullman 1962, Haughton-Evans 1972 and Adeniji, 1983).

Air transport is sometimes faced with some problems such as undulating ground terrain and pothole infested runways, flooded tarmac and flying birds against moving aircraft which make it a means of transportation with the highest level of risks. Such risks also include bad and unpredictable weather, uncontrolled speed, nature of cargo being moved, which may be sometimes dangerous and hazardous, and or dubious passengers who might have ulterior motives of terror as it happened on September 11, 2001 in the hijack of aircraft in the United States and its eventual crash on the world trade centre- all posing serious threats to safety. The high level of sophistication of the equipment employed in facilitating effective air transportation system can also constitute a risk (Geary-Stevens, 1993).

Perhaps, this level of risk made Gear-Steven (1993) and Matteus (1997) to note that, aviation disaster is always the prime focus of public and political attention as well as

adverse criticism unlike those of other modes of transport. In addition to the foregoing, most widely reported aviation disasters are those that involve the aircraft (with little or no attention to some occurrences at the check-in counter, baggage hall or the tarmac), which is just an instrument in air transport facilitation. This perhaps, has made most researchers to concentrate on finding ways of reducing aircraft disasters either while taking-off, flying or landing (Braithwaite 2001; Young, Shorrock, Faulkner, Braithwaite 2004). So far, less emphasis has been given to the study of spatial aspects of such disasters, which could be very important in finding solutions to their occurrences.

Airport terminals are of importance to the aviation industry, as they provide the environment, not only for taking-off and landing of aircraft, but also for other associated activities like ramping, checking-in and disembarking of passengers, baggage handling, as well as aircraft re-fuelling. All of these are paramount to the operations of the airport system.

The need for safe processing and handling of passengers and cargo coupled with the existing response capacity and capability to curtail distress situations cannot be over emphasized. Such distress situations include occurrences that mitigate against effective use of facilities (like power failure) and operations within and around the airport, fire on the aircraft landing gear(s), fire out-break at terminal buildings or cargo warehouse, personnel slumping while on-duty, passengers slumping, natural occurrences like bad weathers or even accidents while operating equipment and so on. Thus, a reliable and sustainable safety and distress response system is important for an effective and efficient performance of any airport.

It is the objective of this research to critically examine the availability, level of functionality and effectiveness of the facilities which are available at the selected airports in Nigeria as well as the response capacity of these facilities to distress situations whenever they occur. This type of study has become quite important bearing in mind the importance now attached to airport safety worldwide, especially after the hijack of an airplane by some terrorists which was eventually flown into the World Trade Centre (W.T.O.) killing all passengers on board in the United States of America on the 11th of September 2001. It is through a thorough analysis of existing situation of facilities and response capacity that a country could develop ways of facilitating safety and of

guarding against terrorism of any type in the aviation industry, most especially at the airports.

In Nigeria, airport safety and response to distress situations and accidents have been of great concern to airport users generally and most especially the international community. This is more so in the light of the fact that the airport infrastructural facilities can not cope with the contemporary aviation requirements, haphazard land-use development within and around the airports, inconsistent and defective government policies, increasing spate of robbery within and around the airports especially at the Lagos and Kano airports and chaotic vehicular traffic characteristics around the airports.

It is against this background that this study focuses on a critical examination and analysis of airport safety and the distress response system in international airports and their environs, located in four geo-political zones of Nigeria. The study lays emphasis on the different geographical phenomena such as potential market, industrial outlay, hub and spoke structure that are prevalent in the different geographical zones, attempt a spatio-temporal analysis of airport development in Nigeria and also bring into focus how land-use around the selected airports affect operations within and around the airports.

1.2 JUSTIFICATION OF STUDY

The aviation industry has enhanced spatial interaction globally as a result of aircraft's speed and efficiency. There have been several studies on airport safety and distress response, but these have been mostly by professional consultants (Poole, 1987; Jorna, 1999; Leveson, 2002; Craig, 2004). Fewer studies have addressed the issues of airport safety from an academic perspective, some touching on it tangentially (Oduola, 2000 and Oni, 2005) in their studies on aviation accidents. Fewer still have addressed the subject of distress response as a core part of safety issues in the literature (Docherty, 1990; Frykberg, 2002 and Greater, 2006). Of these reviews, those by Baba, (2004) and Bassey, (2009) were based in Nigeria.

The prevailing conditions in Nigeria's airports however suggest the need for detailed research on airport safety and distress response. There are indications of challenges in the Nigerian aviation industry. Congestion has become an issue in many Nigerian airports with different operators scrambling for space to carry out their businesses. The situation portends chaos and cast doubts on adherence to international best practices and procedures in Nigerian airports. The situation seems to be worsening, as

recommendations on incidents and accidents are in most cases not well implemented while many members of fact-finding Committees of such accidents are often comprised of non-aviation professionals. For example, findings on the fire inferno at the Sky Power Aviation Handling Company (SAHCOL) in 2003 was neither published nor considered hitherto.

There are many other challenges facing the Nigerian aviation industry, as evidence suggests. Adekola (2002) for instance reported the tragedy that struck at the Nnamdi Azikiwe International Airport, Abuja. Two people were said to have been killed when a tree fell on them; seven aircraft were wrecked and a wing of the airport building was damaged. There was no report on this incident as to how and why the wind inflicted such a colossal damage and destruction on the airport. Dilapidated landing aids and inefficient Air Traffic Controllers are other major issues of concern. At a seminar organized by the League of Airport and Aviation Correspondents in 1993, it has been identified that the provision of adequate navigational aids is the bedrock of safety in the air (Ayinor, 1993). In spite of this, Ayinor (1993), chided the Nigerian Government for not recognizing and making adequate provisions for them.

Other safety concerns include increasing spate of theft on moving aircraft and within the terminal buildings, of equipment, attacks on personnel and so on. Benedict (1993), for example, while analyzing security lapses at the Murtala Mohammed Airport, Lagos, gave an account of four robbery attacks, within two months in 1993 that claimed many lives, pilferage of cargo at the tarmac, stealing of runway facilities and other landing aid equipment, as well as snatching of passengers' luggage off the conveyor belts. High rise buildings around the confines of airport, location of communication masts, farm lands (which can be mistaken for landing strip), abattoirs and other construction activities equally constitute hazards within and around the Nigerian airports. Some of these activities have been known to attract birds to the airport.

Given the peculiarity of the industry, the issue of safety and distress response has become so important that they cannot be over emphasized. As Blakey (2003) succinctly puts it; 'what will the chart of aviation safety in the second century of flight be?' He posited as follows that, 'we must get in front of accidents/incidents… anticipate them, … and use hard data to detect problems and disturbing trends'. Equally, Barnett (2010) noted that Nigeria has one of the poorest safety records in the world's aviation industry.

Further more, Nigeria has contributed significantly to the occurrence of aviation disasters in the world considering how regularly aviation accidents occurred in the country. This further underscores the existence of safety challenges in the aviation industry of which airports are a critical part.

This research is therefore motivated by the need to critically analyse safety parameters in and around Nigeria's airports as well as to examine the implications of these emerging trends. This is with a view to provide a basis for outlying the types of safeguards and counter measures needed to prevent adverse effects of the emerging trends of aviation safety challenges in Nigeria airports. This study, therefore, provides a geographical analysis of airport safety and distress response in Nigeria in order to fill the existing gap in knowledge.

1.3 AIM AND OBJECTIVES

The main aim of this research is to analyse safety and distress response system in Nigeria's international airports. The specific objectives of the study are to:

(i) Examine the spatio-temporal analysis of airports development in Nigeria

(ii) Evaluate land-use development patterns around the selected airports and their implications on airport safety.

(iii) Undertake an inventory of available facilities and equipment for safety and distress response within and around the selected airports

(iv) Examine the level of response to distress occurrences and management in the selected airports

(v) Examine safety culture practices in the various organizations operating within the airports.

(vi) Make recommendations to improve airport safety and distress response system in Nigerian airports.

1.4 HYPOTHESES

The study has set the following hypotheses for testing:

1. There is no significant variation in the awareness of safety issues among different organizations operating within the airports.

According to Eiff, (1999) and Cooper, (2000), all the organizations working within the airports should have a unique culture of safety in their day to day operational activities. It is expected that each staff should not only be aware of these safety measures and practices, but also operate within the confines of these procedures. This hypothesis was therefore formulated to evaluate the level of awareness of safety among the organizations within the airports.

2. There is no significant relationship between airport age and provision of effective and functional safety infrastructure.

As airport grows older, ICAO Annex 14 on Aerodromes stipulates that, facilities and infrastructures should be periodically upgraded to cater for changes and advancements in airport's infrastructural demands. Hence, this hypothesis was formulated to see how well the studied airports conform to this basic requirement.

3. There is no significant relationship between staff training and functionality of safety infrastructure.

This hypothesis was tested to show the importance of staff training in improving airport operational safety and distress response level.

4. Reponses to distress situation is a function of availability of trained personnel, infrastructure, level of preparedness and communication.

Response to distress has primarily been viewed in terms of level of preparedness, which is a function of availability of safety infrastructure, requisite skills of personnel and existing communication pattern during such incidents (Hudson, 2000; Layman 2004: Greater 2006). This hypothesis has therefore been primarily stated to examine the relevance of these variables in responding to distress situations whenever it occurs.

1.5 CONCEPTUAL DEFINITIONS

Development in organizational system studies has given rise to some concepts which need to be initially clarified before any meaningful research can be carried out in such a field. For instance, in complex organizations like the aviation system, there are concepts like; incidents, accidents, hazards, risks, run-way incursion and many more which need to be clarified to be able to put issues arising from airport system safety in proper perspective.

The United States Federal Airport Authority (FAA) Safety Handbook (2000), described **cause** as something that brings about an event; a person or thing that is the occasion of an action or state; a reason for an action or condition for an action. On the other hand, **hazards** have been seen as a potential for harm, that is, a condition, event or circumstances that could lead to or contribute to an unplanned or undesired events; a condition that is a pre-requisite to an accident (FAA order 8040.4a 2000).

Bringing about the definitions, differences and interrelationships between **accident** and **incident**, Braithwaite et al (1998) defined accident as an occurrence, which is difficult to hide as it involves serious injury or fatalities involving passenger /crew/operators and or substantial damage to buildings, facilities and equipment. Incident, on the other hand, does not mean accident but a near miss accident with minor or without consequences that could have resulted in greater loss, (Spriggs 2002). Incident is, therefore, an unplanned event that could have resulted in an accident or did result in minor damages, and which indicates the existence of, though may not define a hazard or hazardous condition. It is sometimes called a mishap. Spriggs (2002) gave the example of a safety incident report in which the driver of an inspection vehicle had to take an avoiding action when he saw an aircraft landing behind him on the runway. While accidents are difficult to hide, incidents are rather easier.

Defense, barriers and **safeguards**, according to Patanker and Unsinger (2003), are measures aimed at removing, mitigating or protecting against operational hazards. For example, the defenses, barriers and safeguards that were placed at the airport during the bombing of Pan Am Flight 103 over Lockerbie in Libya on the 21st December, 1988, were X-ray machines and experiences of the machine operators (Patankar & Unsinger, 2003). While accident trajectory is something that, if it penetrates through these defenses, barriers and safeguards (as it will be described in the Cheese Model in chapter two) could bring about uncontrolled hazards. The modes of failure propagation against these defenses, barriers and safeguards are described as causal pathways, that is, the holes in each of the dominoes/cheese as will be described in Reason's Swiss Cheese model (Reason, 2000).

The failure of the defenses and safeguards are what is described as either **latent** or **active failure**. Latent failures are usually committed by the management and the policy makers.

Though present within the system, they are usually capable of becoming active after some time. That is, it takes a longer time for latent failures to trigger an event. Still using the example of Pan Am flight 103 over Lockerbie in Scotland, even though the defenses were there, the X-ray machine could not detect a plastic explosive and nobody knew this or ever thought about it, neither did anybody consider the need to ensure that each checked baggage should be accompanied by the passenger on –board the aircraft. **Active failures** can be described as either action or inactions performed by operators, which result in events within a short time. The active failure of the Air Ontario Fokker F-23, Flight 1363 crash of March 10, 1989 at Dryden, Ontario, Canada was attributed to the crew's failure to de-ice the aircraft before takeoff in heavy snow (Helmreich, 1999).

A closer examination of these concepts indicates that they are closely related and can be misused, misplaced or interchanged for each other if not properly understood and conceptualized within the contextual usage. This research will thus be careful in putting them into use within the course of the research work.

1.6 LIMITATIONS OF STUDY.

The major limitation of the study is in the area of available literature on airport safety and distress response. This is because the issues are new phenomena within aviation development at the turn of the 21st century.

Just as Mosley (2001) and Blakey (2003) wrote that the first century of aviation was devoted to the development of aircraft and safety in the skies, the new century should be devoted to safety and distress response on the ground. Unfortunately, not much serious work/research has been done on the latter. In particular, efforts have not been directed towards serious research based on theoretical framework or on concise methodology. Rather, most available literature has been based on findings of accident investigation panel, and on the sport assessment of incidents and accidents. There are also papers delivered at conferences, seminars and workshops, which were not necessarily based on any serious academic framework, but compiled and presented by professionals and aviation stakeholders.

There was also lack of comprehensive hard data as it concerns past incidents and accidents coupled with how such occurrences were responded to. This issue became

more problematic as the few records that were available in the area of operations and administration were classified sensitive and security matter. Nevertheless, the researcher was able to penetrate some directorates and key stake holders within the aviation industry to get data eventually used for this study.

In addition, most authors of aviation safety have always considered aviation safety from their own area of perception or jurisdiction instead of viewing the aviation industry as a whole system, whereby, the sub-systems have to interrelate in order to promote a particular sustainable safety level and acceptable distress response.

Of greater concern is the non-availability of literature on African aviation industry safety and distress response. African aviation authors have concerned themselves mainly with aviation financing, privatization, cost-benefit analysis and of recent listing of most severe accidents/aircraft crashes in major African cities. Rather there should be more concerted effort to develop a theoretical approach and methodology towards promoting safety, with distress response within the African aviation industry, an endeavor that the present exercise is making.

1.7 THE STUDY AREAS AND THE SELECTED AIRPORTS

As indicated in the Figure 1.1, there were twenty airports in Nigeria at the time of study. The Northern part of Nigeria including Abuja has the highest concentration (10) of these airports situated within the locality while, the old Southern region has five airports located within the region, the old South Western region has four while only one is located within the middle belt (Makurdi).

From these twenty airports, only five (Lagos, Port Harcourt, Calabar, Abuja and Kano airports) have the status of International airport even though some airports are equally allowed to handle some special international pilgrim flights. These include Enugu, Ilorin, Jos, Kaduna, Maiduguri, Sokoto and Yola airports.

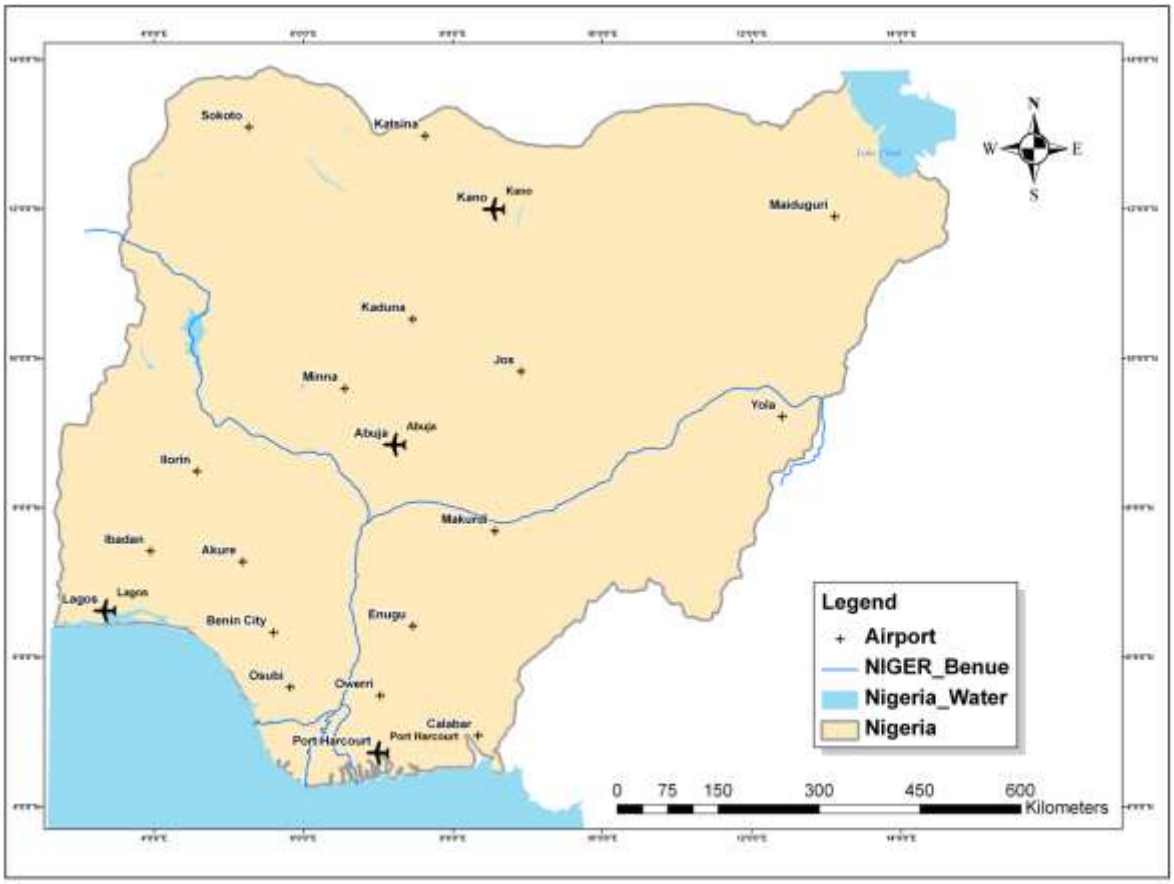


Figure 1.1: Airports in Nigeria
Source: N.C.A.A's records, 2007

Four airports were selected for this study from the twenty airports. As shown in Figure 1.2, they include Murtala Muhammed International Airport (MMIA), Ikeja, Lagos, Aminu Kano International Airport, Kano, Nnamdi Azikwe International Airport, Abuja and Port Harcourt International Airport, Port Harcourt. These airports were selected based on the fact that they are located in contrasting geographical zones of the country. For instance, the weather and climatic patterns in airport locations are quite different. It should be noted that weather plays an important role in aviation safety, especially in airport operations. As can be deduced from Appendix 4, thunder storm has been one of the major weather related problems in MMIA, while visibility has been a major weather problem in Port Harcourt airport and dust haze the major weather related problem in Kano airport.

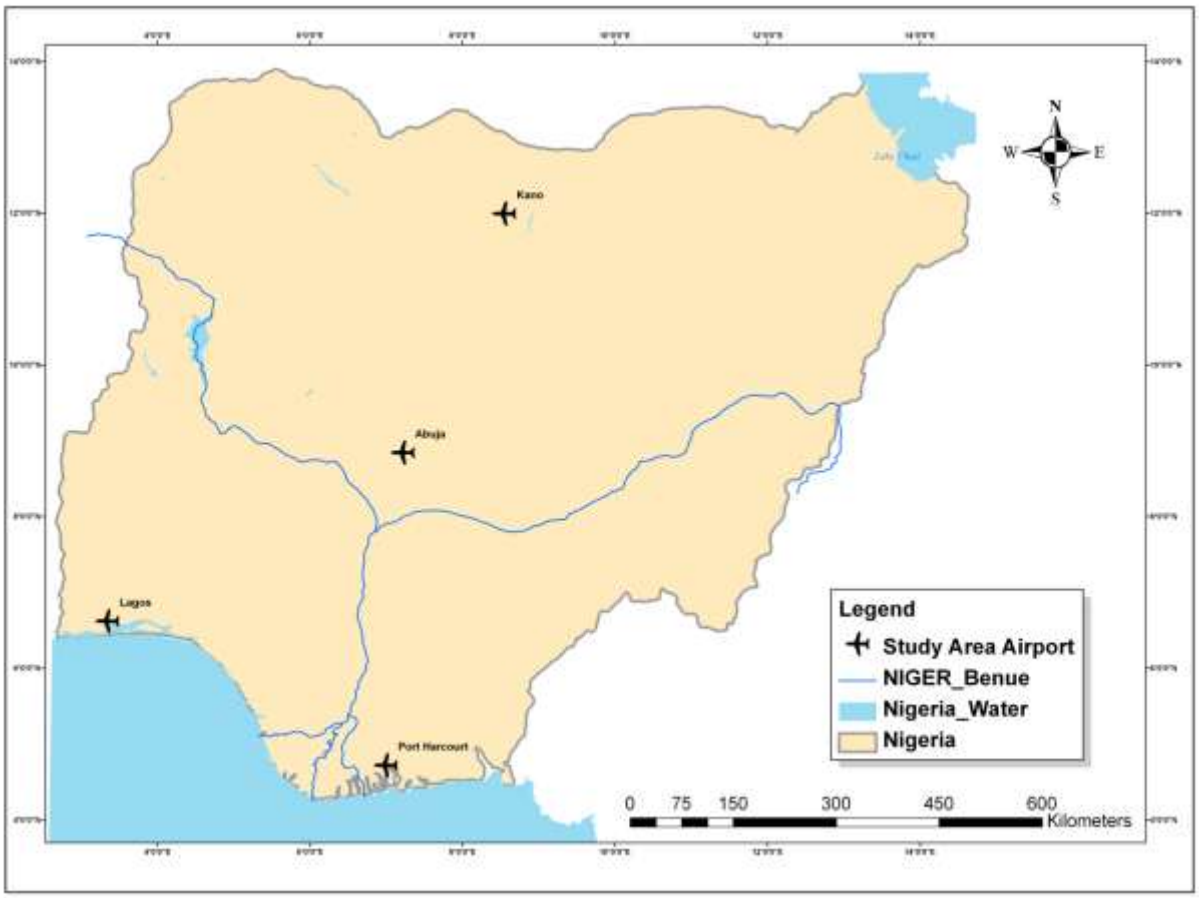


Figure 1.2: Selected Airports for the Study
Source: N.C.A.A's records, 2007

In addition, these airports were built at different times of the nation's airport development history. This allows for a comparison of emerging safety issues associated with airport development in the country. The age differentials of the airports also have some imports on the provision of facilities, some of which are meant for safety. Thus, the newer airports are expected to have more and serviceable facilities that conform with requirements of modern airports than the older ones. This would again have implications on the level of safety at the airports.

In selecting the airports for the study, other factors that were also considered include the volume of traffic in terms of the number of aircraft that landed and took off, passenger and cargo throughput that these airports have handled in the past. Between 2002 to 2007, Lagos airport handle an average of 34% of total aircraft that landed and take-off within this period and 41% of passengers. Within the same period, while Abuja airport handled an average of 18% and 24% of total aircraft and passenger respectively, Kano airport handled 03% and 04% of total aircraft and passengers while Port Harcourt airport handled 14% and 10% of total aircraft and passengers respectively. These figures are as presented on Tables 1.1 and 1.2. It should be noted that all these four airports selected for the study handles both domestic and international airports.

Table 1.1: Percentage Accounted for at the Selected Airports in Total Passenger Movement within all Nigerian Airports 2002-2007

	2002		2003		2004		2005		2006		2007	
	ARR.	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**
Total	2600211	2578256	2979041	2926030	3209220	3185215	3369684	3334377	3252983	3260522	3344996	3361792
ABUJA	22.26	22.28	23.81	24.15	24.60	25.23	24.35	24.96	24.67	24.68	24.87	25.15
KANO	2.62	2.69	2.84	2.82	3.18	2.66	2.93	2.40	2.47	2.28	2.40	2.28
MMIA	41.30	41.43	38.60	39.60	38.69	39.03	40.11	40.11	43.52	43.99	43.01	42.83
PHC	13.43	13.64	15.16	13.70	12.45	12.46	13.49	13.80	8.55	9.07	5.03	5.24

Key:
ARR – Arrival
DEP – Departure
Source: Authors Field Survey 2007

Table 1.2: Percentage Accounted for at the Selected Airports in Total Aircraft Movement within all Nigerian Airports 2002-2007

	2002		2003		2004		2005		2006		2007	
	ARR.	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**
TOTAL	74823	74730	82685	82675	90538	90421	80987	80501	78132	78283	75808	75562
ABUJA	17.52	17.37	18.35	18.28	19.49	19.55	19.43	19.70	20.29	20.22	20.72	20.79
KANO	1.92	1.90	2.32	2.32	2.25	2.15	2.32	2.15	2.46	2.44	2.81	2.53
MMIA	31.79	32.15	29.34	29.59	31.13	31.33	32.46	32.19	34.50	35.00	36.71	37.00
PHC	16.84	16.59	19.21	18.95	16.46	16.22	17.17	17.08	11.71	11.43	7.92	8.05

Key:
ARR – Arrival
DEP – Departure
Source: Authors Field Survey 2007

1.7.1 MURTALA MUHAMMED INTERNATIONAL AIRPORT, IKEJA, LAGOS

Few years after the 1925 first flight to Kano by the Royal Air Force (RAF), the British Overseas Airways Corporation (BOAC) took over aviation and flight services to Nigeria in the cities of Kano, Lagos and Calabar. Since then aviation and flight activities have started to take place in Lagos.

Through the various development plans, improvement has always been made on the landing strip in Lagos. But it was not until the 15th of March 1979 that a standard airport was commissioned in Lagos known as the Murtala Mohammed Airport named after General Murtala Mohammed the Military Head of State who was killed in a coup in 1976. Over the years, this airport has so grown to the extent that the use of all the facilities that were installed are now been overstretched.

The airport which is code named LOS by IATA has two asphalt built runways IL/19R and IR/19L code named DNMAX by ICAO. All the land areas around the airport premises has been fully built up comprising various land uses made up of residential, commercial, telecommunication mast erection, roads and farming. Some encroachment on airport land are already identified. Hence, it can now be said that the Lagos Murtala Mohammed Airport is situated within the urban city. The airport lies approximately on latitude $06^{o}34^{'}29^{''}$ North and longitude $03^{o}19^{'}07^{''}$ East of the equator with a grid coordinate of between 867637 to 867707 and 315504 North to 315610 East (Okhai 2004, Wikipedia 2006).

The airport has the capacity to handle twelve numbers of BY37 – B747 and six B707. Nevertheless, sometimes around the year 2000, the airport handled one concord jet brought in by a group of renowned business men and women around the world.

The location of the Lagos airport within the metropolis is as shown in Figure 1.3. Surrounding this airport are the heavily built up areas of Ikeja, Agege, Mafoluku and Osodi. The predominant land uses around these areas are mainly residential combined with commercial. Over the years, these areas have become heavily built up due to the economic activities which have been attracting more population to the metropolis. A close observation shows that there is a conglomeration of industries within the Ikeja area more than the other areas around the airport while abattoirs and dump sites were equally noticed within these surroundings of Lagos airport.

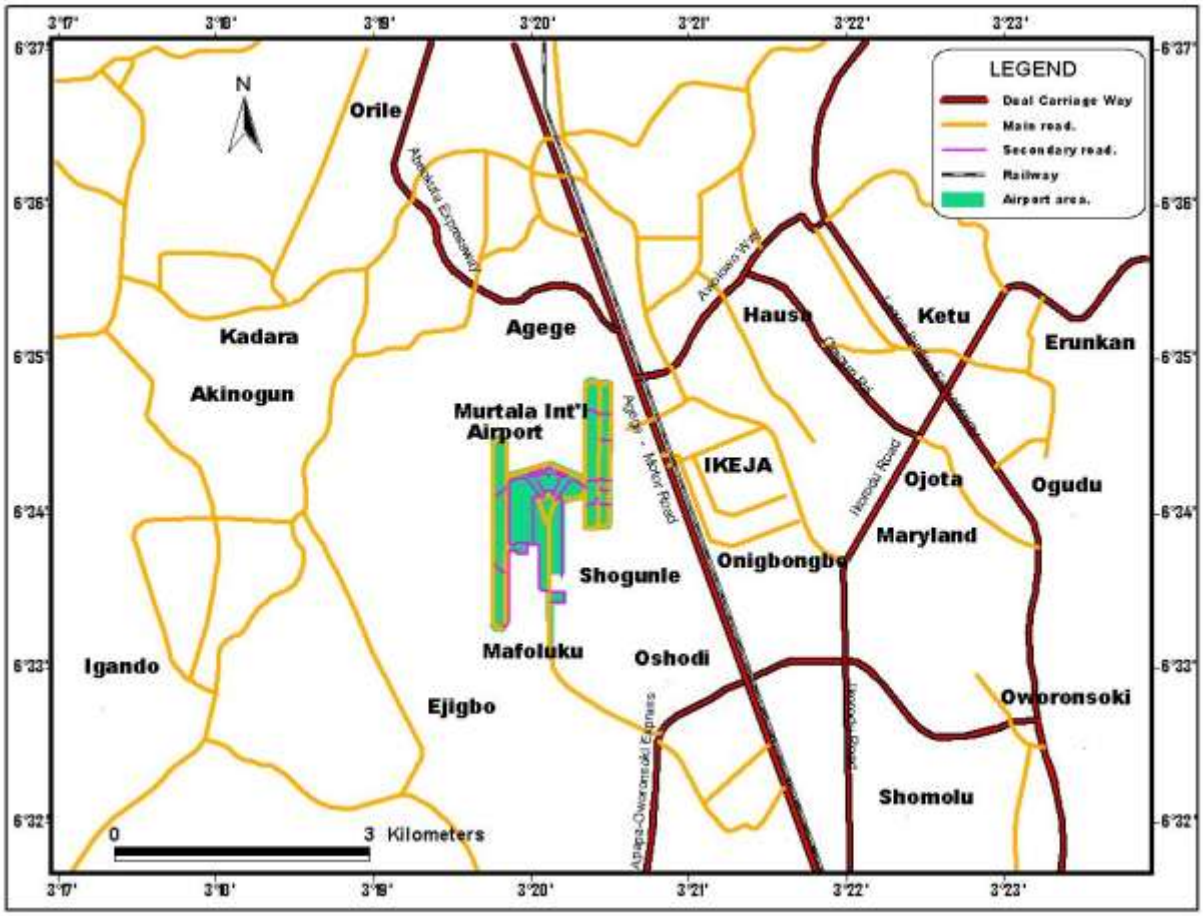


Figure 1.3: Locational Map of Murtala International Airport, Lagos.
Source: Author , 2007

A detailed safety facility and structural location map of Lagos airport is as shown in figure 1.4. This is with a view to point out where the activities that contribute to the airport system are located. From the figure, the control tower is positioned between the two runways (the 18R runway which is basically meant for international flights and the 18L which serves mainly the domestic flights) within the airport. The cargo apron is situated beside the 18R runway due to the fact that all the cargo flights that land and take off from this section of the airport are international flights. Those flights that ferry cargo within Nigeria are the same local flights that carry passengers. Also, the fire service is located very close to the cargo apron while the fuel farm is equally located not too far from it. Both the domestic apron/terminal and the presidential lounge are sited within the local wing of the airport. All other facilities like the landing instruments, blast pads, and compass calibration pads with their sizes are as shown in the figure. But conspicuously missing is the airport hanger due to the fact that it is no more in existence.

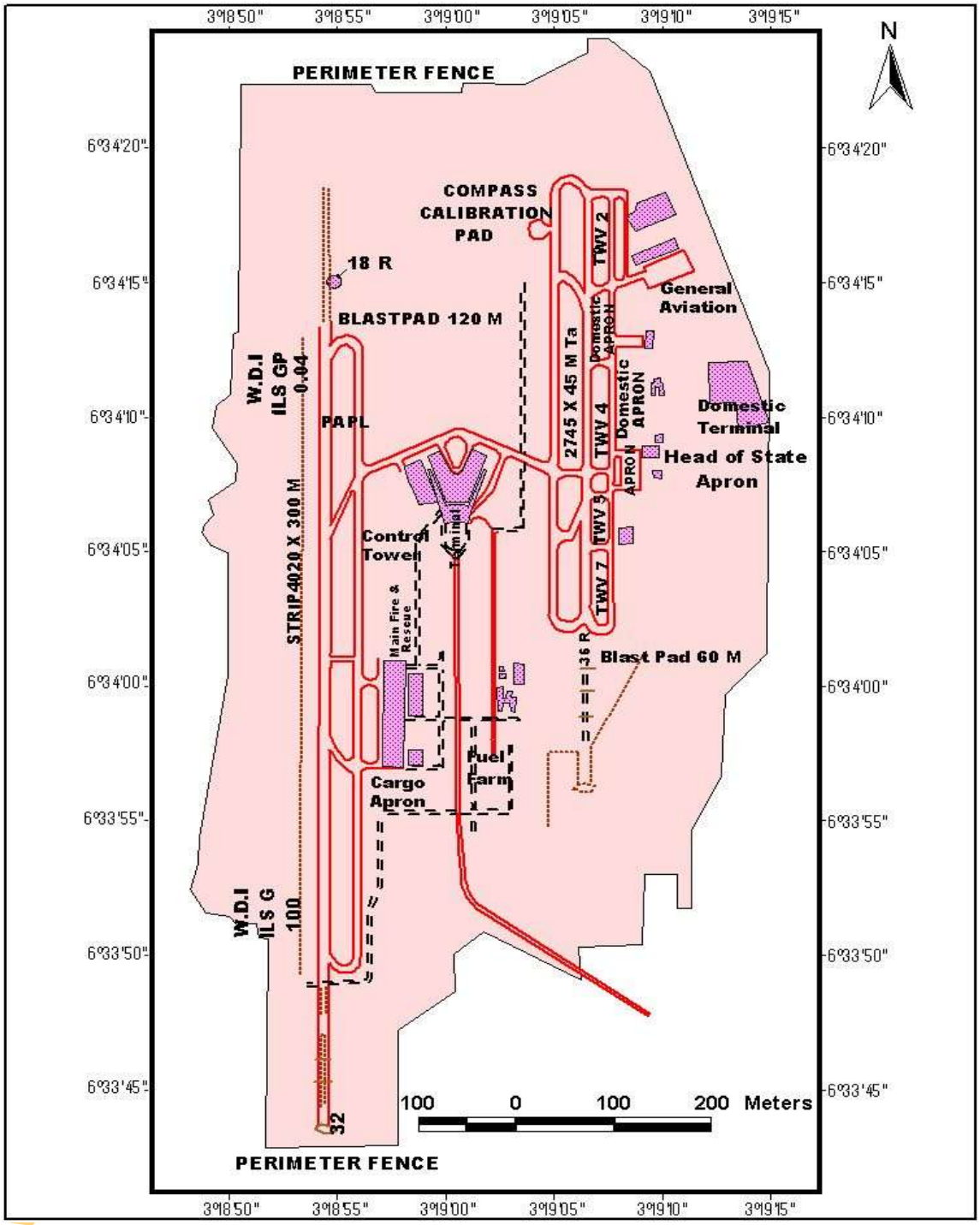


Figure 1.4: Detailed safety facility and structural location map of Murtala International Airport Ikeja, Lagos.
Source: FAAN 2007.

1.7.2 ABUJA AIRPORT

The Abuja International Airport which was named after the first President of Nigeria, Dr. Nnamdi Azikwe was officially opened twelve years ago. This was during the reign of General Abacha when the political seat of Nigeria was moved to Abuja. It was particularly built to facilitate and boost political activities in Abuja which is now the Federal Capital of Nigeria. Nnamdi Azikwe International Airport is surrounded by rocky hills with very few water bodies. The airport which lies on reference coordinates of latitude $09^{o}\ 00^{'}15^{''}$N and longitude $07^{o}\ 19^{'}07^{''}$E is about 37kms away from the main city of Abuja. The ICAO code name for this airport is DNAA while IATA code name is ABV with a reference temperature of $35^{o}6^{o}$C ($96^{'}$E). The runway elevation for the available two runways are 331m and 342m with a blast pad of 70m asphalt concrete and aprons of 360m x 70m and 360m x 130m concrete upon which a flexible remote aircraft parking is installed. The capacity of these aprons can conveniently handle seven of B747 aircraft and ten of B737. To the extent that the airport is far from the main city, the surroundings of the airport are not yet heavily built-up.

As shown in figure 1.5, the airport is surrounded by several small villages like Tungan Wada, Fura, Rubuchi, Galadima among others whose inhabitants are predominantly farmers. Invariably, the major activities around this airport is farming and grazing. A related activity to farming is bush burning which is very common around this particular airport and have some consequences on safe airport operations.

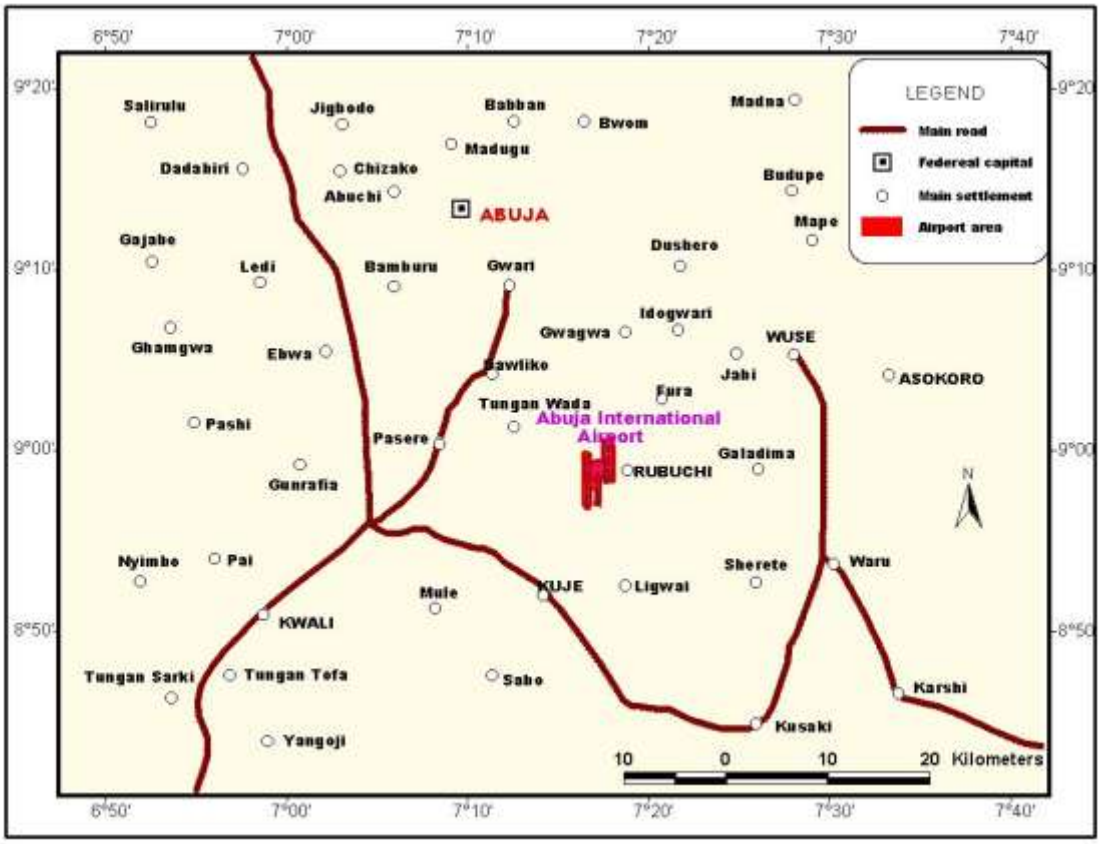


Figure 1.5: Locational Map of Nnamdi Azikiwe International Airport, Abuja.
Source: Author, 2007

1.7.3 KANO AIRPORT

The ancient city of Kano was actually the first place to experience landing and taking off of aircraft in Nigeria. This was when the Royal Air Force (RAF) fighter plane flew into the ancient city in 1925 from Khartoum, Sudan. It was the horse race course in Kano that was used for this flight.

Due to seemingly increase in the need for easy accessibility by colonial masters, there was need for increase and improvement for aviation facilities. Thus, the development of aerodromes of which Kano was part of the locations considered.

The then Kano aerodrome started to have its airport status after independence during the First National Development Plan of 1962 – 1968. Over the years, the airport has grown to achieve an international airport status which can boast of facilities to be deployed to receive and depart Boeing 737 and Boeing 747 types of aircraft.

Malam Aminu Kano International Airport with ICAO code of DNKN named after a prominent politician during the second republic, was officially commissioned on the 2nd of August 1981 to purposefully cater for the flying needs of the commercial activities of the North while at the same time reduce the over reliance on Murtala Mohammed Airport by the Kano business men, politicians, expatriates and pilgrims.

The airport which was formally some distance from the urban center is now being surrounded by various land uses like residential, commercials, and farm lands. It lies approximately on latitude 12^{o}52$^{'}$57$^{''}$ North and longitude 08^{o}31$^{'}$30$^{''}$ East of the equator. The reference temperature is 33.1^{o}C. It has two runways made of asphalt concrete with a blast pad of 128m built of asphalt concrete also in addition to a sizeable apron of 700m x 170m built on concrete and fitted with remote parking.

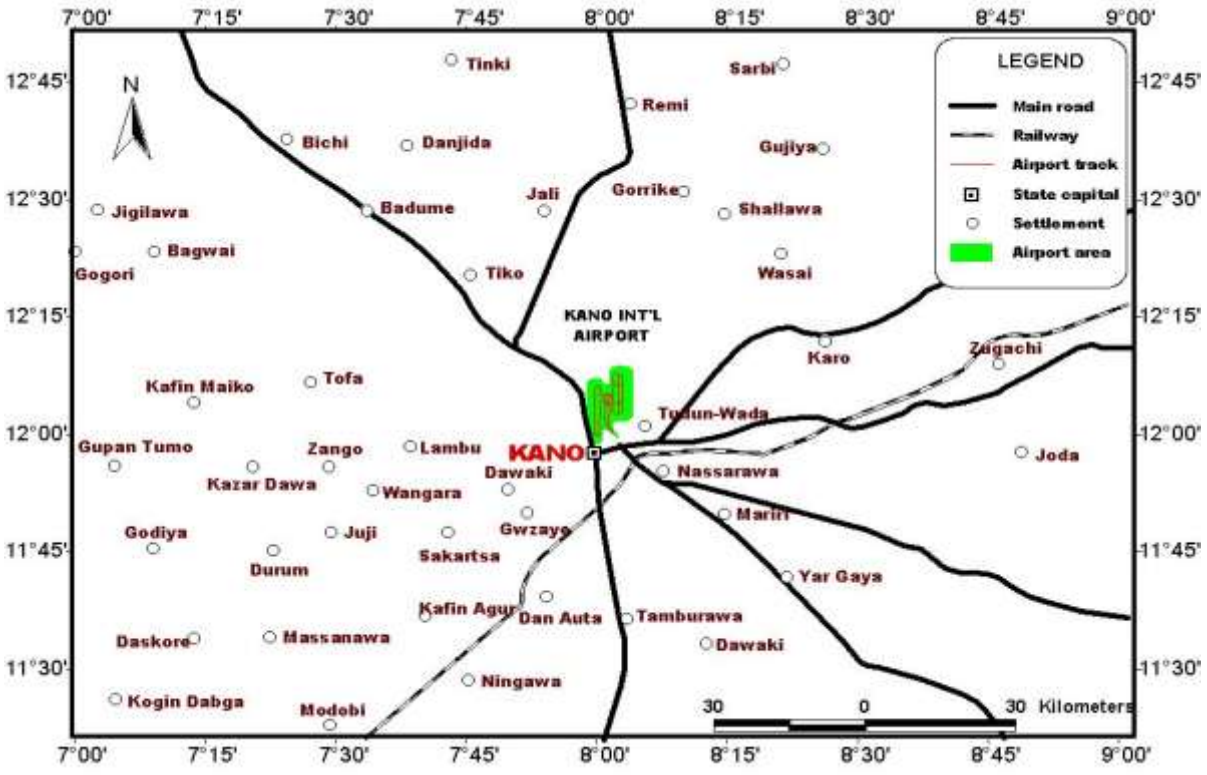


Figure 1.6: Locational Map of Malam Aminu Kano International Airport Kano.
Source: Author, 2007

1.7.4 PORT HARCOURT INTERNATIONAL AIRPORT, PORT HARCOURT

Port Harcourt was one of the locations considered to have an airport during the First National Development Plan of 1962 – 1968. The airport was commissioned on the 29th of July 1981. It is about 32kms away from the main city and lies on latitude 05°00'55"N and longitude 07°15'30"E of the equator with a reference temperature of 32.5°C (84oF). The IATA code name for this airport is PHC while the two existing runways are code named DNPO by ICAO. The elevation for these runways are 22.86m for runway 03 and 24.68m for runway 21 which were both made of asphalt concrete of 3000m x 60m in dimension, designed to accommodate B747 aircraft operations.

To the extent that this airport is far from the main city of Port Harcourt, it is surrounded mainly by uncultivated vegetation and open spaces which have given opportunity for grazing.

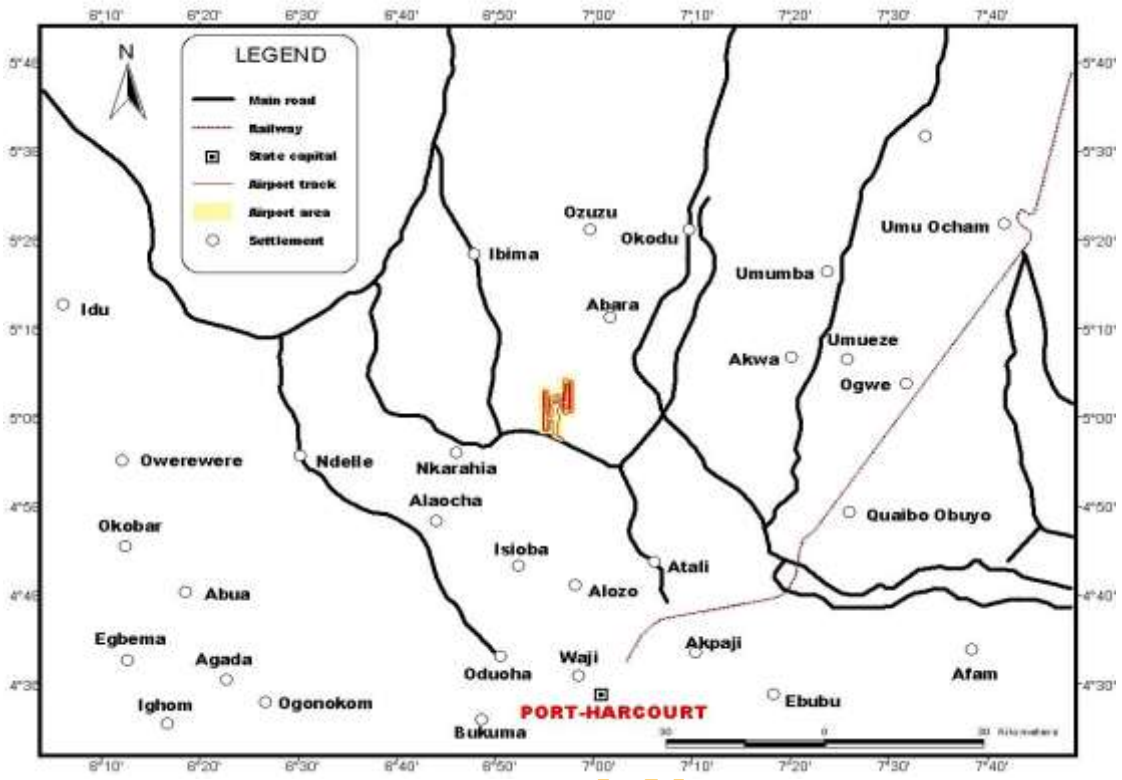


Figure 1.7: Location Map of Port Harcourt International Airport, Port-Harcourt
Source: Author, 2007

1.8 OUTLINE OF THESIS

The thesis is divided into eight chapters. Chapter one provides the background to the study, statement of research problems, justification for the study, aim and objectives, the research hypotheses and a brief description of the study areas. Chapter two discusses the conceptual framework for the study and a review of the existing literature in the area of airport safety. Chapter three focuses on the details of the methods used in carrying out the research. These include the types of data that were collected for the study, the sources, data analysis and the specific methods used in testing the hypotheses stated for the study.

In chapter four, a spatio-temporal analysis of airport development in Nigeria was undertaken. It includes a comprehensive overview of airports development in Nigeria and a catalogue of incidents and accidents in Nigerian airports over the years. In addition, the trend in the utilization of the four selected airports over the years is examined coupled with the analysis of other land uses. Chapter five presents the analysis of available facilities and structures for safety and distress response in Nigerian airports. This includes also an evaluation of some past incidents and accidents within the Nigerian airports.

Chapter six brought into focus the analysis of culture of safety among organizations working in and around the airports. In particular, an identification and analysis of the culture of safety of the various organizations operating within the airports with particular reference to the level of understanding of this culture by their employees are undertaken.

Chapter seven contains an evaluation of airport distress occurrences and its management with the available facilities and equipment for safety and distress response within and around the selected airport was carried out over time. Also, an appraisal of the level of response to distress situations, accidents and other incidents whenever they occur within and around the airport was carried out.

The last chapter (chapter eight) provides a summary of major findings, conclusions, recommendations and suggestions. In addition, areas for further research into aviation studies in general and airport safety in particular are outlined.

CHAPTER TWO

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 THEORETICAL FRAMEWORK

Incidents and accidents within airports tend to result from complex interactions of diverse activities. Improvements in airport safety will require an understanding of how these activities interrelate to cause incidents and accidents. A proper research into airport safety and distress response system thus calls for a framework that will allow for an analysis which promotes understanding of how these various activities by different organizations within the airports are performed independently and interdependently towards promoting safety within and around the airport. This therefore necessitates a holistic approach to the research. This section therefore, reviews the relevant theories and models for studying airport safety and distress response system. These include the Systems Theory, Causal Analysis, and the 'Swiss Cheese' Model.

(i) SYSTEMS THEORY

Hall and Fagen (1956) defined a system as a set of objects together with relationship between the objects and between their attributes. It is this relation between the different component parts which makes the application of a system concept useful. It will allow for the analysis of the effect, which an action by a component will have on others and also on the system as a whole. Kayode (1988) added that a systems approach offers a framework in which to elucidate the mechanism whereby the dynamics of various components in the system are linked. That is, it offers an approach to the interactive mechanism among sub-systems at various levels in the operational and administrative decision making hierarchy within an airport and its environment.

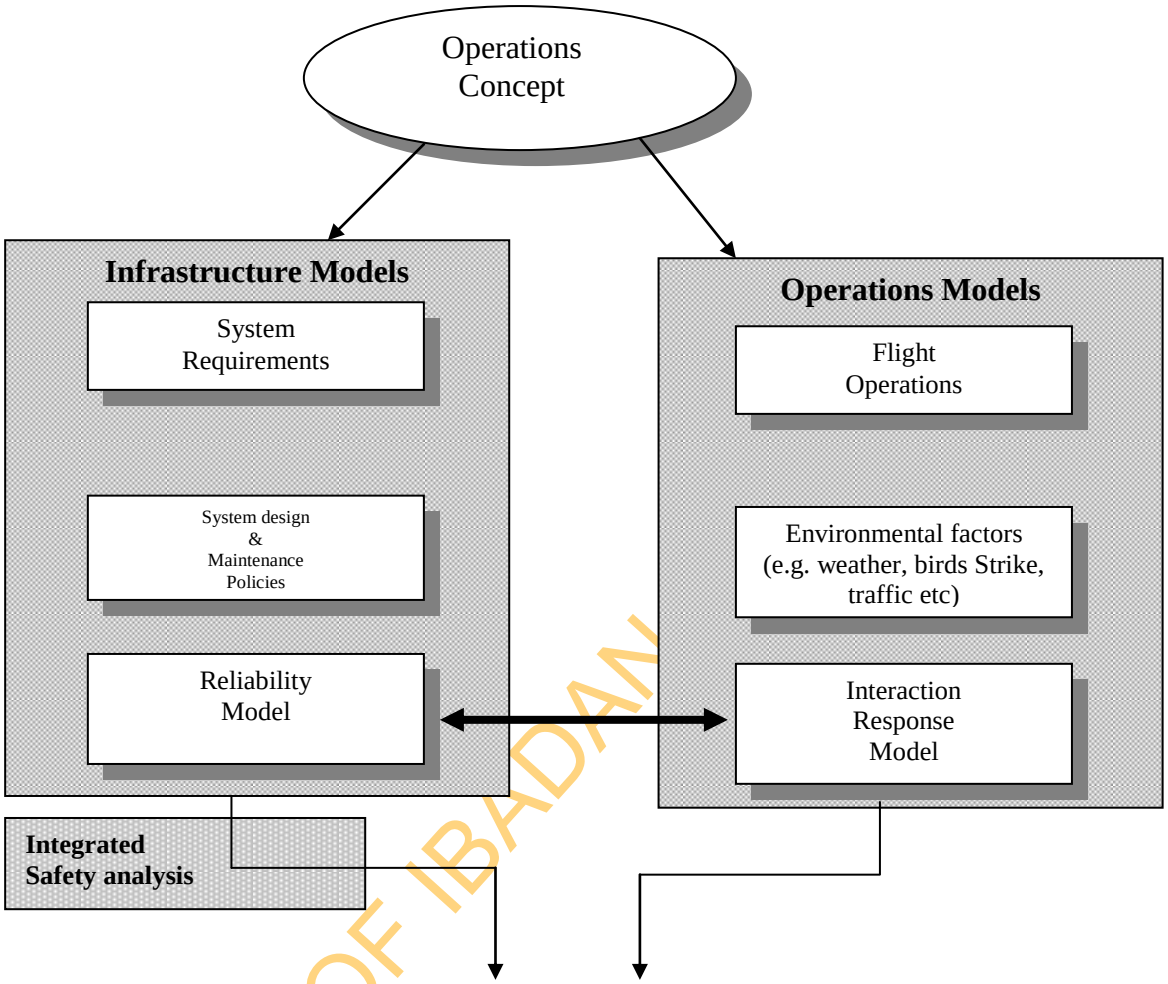
Some literature have pointed out existing flaws in the systems theory. Hoos (1972) for example, pointed out some looseness in the concept usage where each discipline has its own idea, definitions, principles, assumptions and hypotheses.

However, the ability of the systems framework which allows for proper analysis of interrelationships among sub-systems nevertheless makes it relevant to this study. Kostiuk et al (1998) had indicated that the systems theory will be adequate to analyze

aviation safety as the aviation system include both air and ground sub-systems within the framework which can allow the performance of sensitivity analyses to identify weak points in the system operation and design.

In their Integrated System Safety Analysis, Kostiuk et al (1998) espoused that system theory does not only allow for understanding of interrelationships and interfaces among sub-systems, but additionally allows for the understanding of dynamics within the system. This assertion was based on their study of the continued growth of air traffic which invariably increases demand on traffic management and airport facilities. They were able to bring into focus the relationships between emerging trend in aviation demands and the available aviation facilities. This is with a view to ensure safety within the system.

Adapting the systems theory to aviation studies, Kostiuk et al (1998) captured the environment in which aviation is operating as well as its interaction with that environment with response level representing the execution of the rules and procedures that have been developed for the system concept. This is illustrated in Figure 2.1 with the use of infrastructure trait metrics and operations safety metrics.



- Infrastructure trait metrics
- Operations safety metrics

Figure 2.1: Integrated Safety and Reliability Modeling and Evaluation
Source: Kostiuk et al (1998)

The primary objective of any system safety is incident prevention. Such system thus requires to be proactively identifying, assessing and eliminating or controlling safety-related hazards to acceptable levels. This translates to a control of situations, events or circumstances that could lead to or contribute to an unplanned or undesired event.

As indicated in Figure 2.1, operations within the system safety called for the design of sufficiently effective infrastructure to achieve these set of objectives. Kostiuk et al (1998) expressed this design in terms of the interaction and interfaces among people, procedures, tools materials, equipment, facilities, software and the environment. For instance, among the infrastructure within the airport system is the infrastructure needed for the system to perform effectively and efficiently, such as constant power supply. Essentially, power supply to the terminal building, tarmac, run-way, control tower etc is paramount for effective and safe operational practices. In addition, it must also adequately provide for the new emerging trend within the system.

In essence, an integrated safety system modeling allows for determining or predicting adequate provision of the system infrastructure requirements, which is a bedrock to determining the level of safety within the system. There is also the system design and maintenance policies, which are supposed to keep the system safety design in its real state for the purpose of achieving its set objective. These policies according to Kostiuk et al (1998) are in form of Standard Operating Procedures (S.O.P); safety rules, national and international regulations and standards (e.g. I.C.A.O. Standards, International Ground Handling Standards) and local operating standards. For instance, if landing equipment are not properly maintained and are obsolete, both landing and taking-off of aircraft will be highly unsafe at the airport. A recent reference was in January 2005 when there were series of arrival and departure delays with flight cancellations at Nigerian airports due to bad weather of about six hundred meters visibility. This should not have posed serious threat if modern landing equipment were available according to set standards. Reliability determination of these infrastructural variables to operations within the system should therefore be considered.

Within the operations models as indicated in Figure 2.1, the first variable within the system to be is flight operations. These are all the activities that take place from when the aircraft touches the ground to the point at which it takes off. It includes fuelling, catering,

passenger, cargo services and ramping with other associated activities. Environmental factors are also to be considered as physical events or phenomena that can mitigate against flight operations. These are weather condition, birds, and conflicting land-use among others. The relationship between flight operations and environmental factors are expressed through the third variable, which is the interactional-response model. This is an expression of how operations within the system safety react to changes in the environment while at the same time maintaining the system safety objective.

It should however, be noted that the loop between the interaction –response model and reliability model is on one hand, an indication that an adequate response of flight operations to environmental factors is a function of how reliable the variables within infrastructure models are. While on the other hand, infrastructure reliability could be determined through a positive interaction-response within operations model. System safety level can thus be determined through this loop.

An emerging trend in Integrated Safety Analysis therefore, is the development of some models which allow for further understanding of this analysis. For instance the development of a reliability model of the system derived for an operational concept. This will invariably allow for predictability of outcomes of various interactions among the different operating units within the aviation system. To this extent, Sivenson et al (1997), Kostiuk et al (1998) and Leveson (2002) defined airport safety system as a function of the integration of the reliability model and the interaction response model. Where the interaction response model provides information regarding the frequency of encounters between sub-system and the predicted outcome of such encounters, the reliability model on the other hand provides as a function of time, probabilities associated with the critical systems available and distress state. Thus, scaling the operations safety metrics from the interaction-response model by the system state probabilities form the reliability model creates the system – level safety statistics. This is expressed diagrammatically in Figure 2.2.

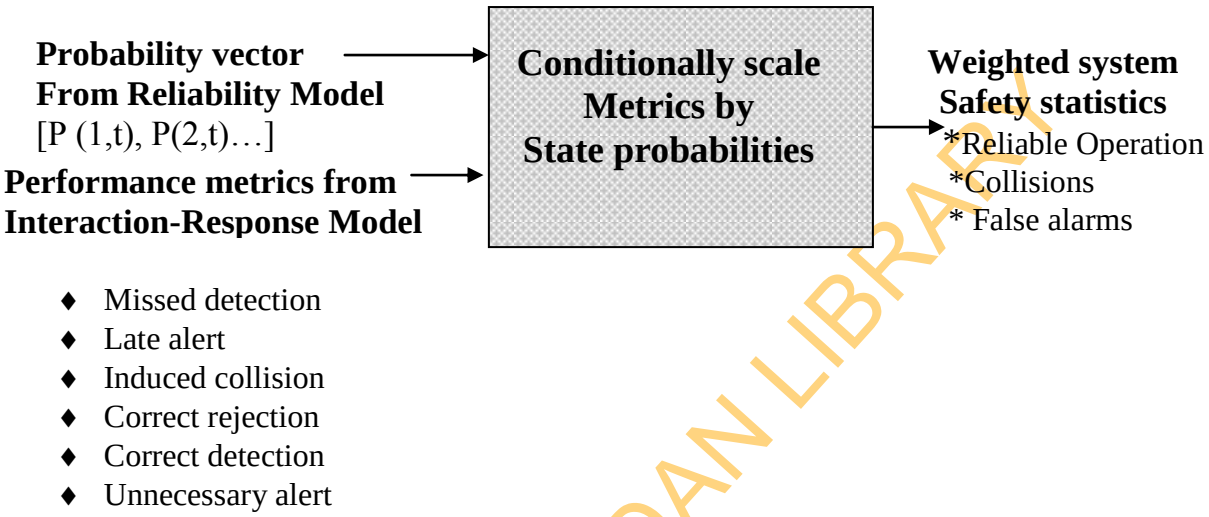


Figure 2.2: Combining Model Outputs
Source: Kostiuk et al (1998)

The interaction response model provides information regarding the frequency of encounters between sub-systems and the predicted outcome of such encounters. This is also a function of the system's alerting strength and ability to resolve encounters (incidents/accidents). Considering interaction between the meteorological unit, control tower, the airline and the handling company, a false interaction (or false alarm) between these subsystems will invariably lead to a distress state within the system. For instance, if a false information and signal about weather is passed on to the control tower and further to the airline and the handling company, an incident or accident like unnecessary alert could occur.

An example was the information gathered by the researcher on what led to the fatal accident and serious damage to Hydro Air on the 13th of December 2003 in Lagos airport. It was a case of faulty interaction between the airport surface maintenance unit, Apron control and control tower about the only runway at the international wing of the Muritala Mohammed Airport, Lagos, which was not good enough for aircraft to either land or take –off due to maintenance works and potholes on the runway. This singular act led to Missed Detection of the correct run-way to be used by the pilot and eventually colluding with the potholes on the bad runway which the pilot was wrongly directed to.

To compliment the on-going, Shepherd el al (1996), Sivenson et al (1997) and Leveson (2002) added that for a thorough analysis of airport system safety to be undertaken, it must address the problem from a variety of perspectives with each analysis impacting safety in different ways. Three different perspectives were outlined (Figure 2.3). The first relates to operational scenario environment, within which the system is expected to function. The environment or scenario that by its nature provides opportunities for unsafe operating conditions and has adverse impact on system safety should be identified. For instance, there are runway incursion by wild-life or pastures, power supply outages within the airport, non-adherence to safe operating procedures and practices by airport operators, birds flying against moving aircraft etc. Thereafter, approaches to modelling and understanding the adverse impacts of this operational scenario on system safety should be developed. The second safety perspective outlined relates to the system's elements functionality; that is, the availability and reliability of the functions performed by the hardware, software and human components of the system. Failures or degradation in the performance of elements of safety-critical system components will have an impact

on safety. Model of the reliability of those elements must be developed to determine the impact on system safety.

Finally, the rules and procedures under which a system operates can have a significant impact on a system's safety. For example the defects of the Nigeria Aviation Regulation of 2008. Approaches must be developed to analyze the impact of those rules and procedures on safety for all modes of operation within the system.

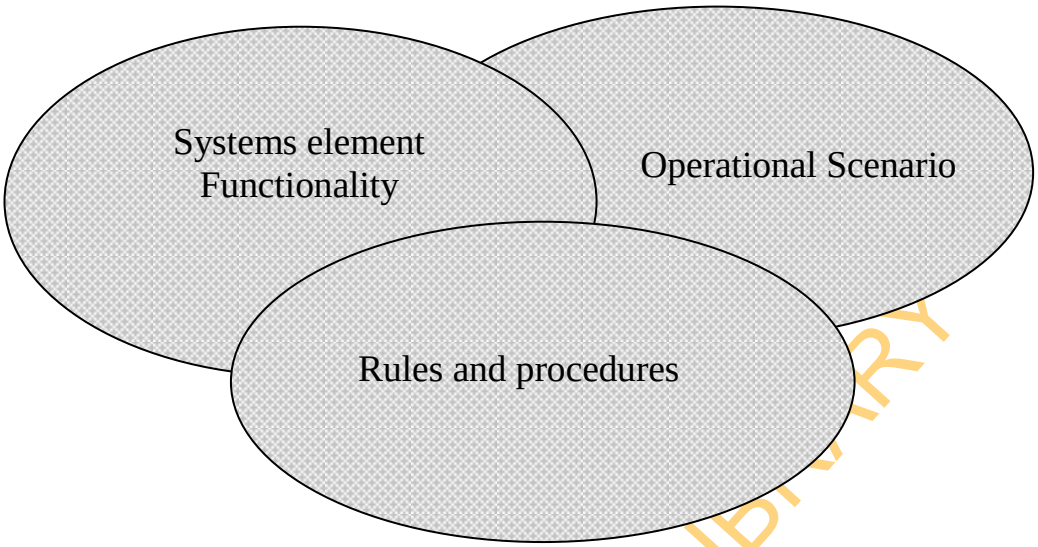


Figure 2.3: Perspectives of a System –Level Safety Analysis
Source: Shepherd et al (1996)

There are, however, connections between these three elements as shown in Figure 2.3 which indicates an interface between them. Any wrong connection or combination between the elements and (or) within any of the elements will wreck havoc on the system safety. For instance, though the stipulated rules and procedures/regulations must be strictly adhered to while performing various tasks within the system, adherence to this element must not be too rigid to the extent that it could be difficult to lay-off with a view to avert accident or reduce its impact. For example, a Bellview Airline's pilot in February 2005 had to drain off all the aircraft's fuel into the ocean as the only option in averting the impending disaster that might occur due to the landing gear of the aircraft not coming out normally. This is to the extent that, the aircraft could ultimately be controlled into terrain rather than landing normally on the runway without the landing gear and eventually leading to a more devastating distress occurrence. With plenty of aviation fuel in the aircraft, the aircraft will be more amenable to fire disaster from sparks that will eventually arise when it is not controlled to terrain but on the tarmac. There is therefore the rationale to reduce aviation fuel with a view to reduce the impact of the just around the corner disaster.

The interaction of models that qualify each one of these three elements creates an analysis capability that is now system-wide and responsive to on-going change in the definition and requirements of the system operational concept.

System theory has, with other related models as discussed, proved to be a suitable framework to understanding interrelations among operating units within a complex organization. Considering the fact that an airport is a system made up of several interrelated parts and environment which must function together simultaneously and which is to prevent accidents towards enhancing the efficiency of the airport system, the above discussed framework will, therefore, be adapted in the course of this research.

Despite its relevance to this study, system theory may not be adequate enough as it only explains the interrelationships among the operating units without a focus on hazards that could lead to accidents or incidents. Consequently, the need to inclusively explore the relevance of causal analysis in the research.

(ii) CAUSAL ANALYSIS MODEL.

Causal analysis models are theoretical representations of the causes that may lead to either incidents or accidents. Their purpose is to help understand the complex reality of accident causation (Hiddleston (2003) and Spouge (2004). For instance, in aviation parlance, there is bound to be an incident or accident when the available infrastructure and facilities are neither effective nor efficient enough to cater for the airport operational needs and requirements.

The arrows in the graphs as shown in Figure 2.4 represents causal relations, while the parents of a node X, pa (x), are the nodes that have arrows into it, that is, pa (survival) = (poison and antidote). Poison and antidote which can either remove or ensure each others potency is the node 'X' while survival is the parent, that is, the resultant of the relationship between poison and antidote. Likewise, striking of matches (node 'X') where there is oxygen (node 'X') will result into match light (pa). It therefore connotes that, nodes do not represent events but variables for events. Pearl (1999) indicated that a causal model should include specifications of values for these variables. That is, the relative level of significance of each variable to describe the relationship within the causal laws (events). This is to allow the analysis of how strong each variable is pertaining to the occurrence or event.

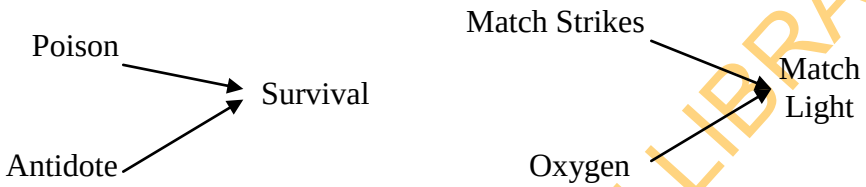


Figure 2.4: Causal Model Presentation
Source: Pearl, J. (1999)

Causal models are, however, very complex for the fact that they can invariably reveal many causes that will lead to a particular accident than would be revealed in any single accident. Aviation accidents tend to result from complexities of diverse-like causes. According to Spouge (2004), further improvement in aviation safety and distress response will require an understanding of how these variables combine to cause accidents and incidents.

In a bid to properly conceptualize the analysis of causality in aviation system, Beaubien & Baker (2002) and Spouge (2004) attempted to model this concept into sets of models. The first shows a causal model of hazard/ variables that may combine to cause individual categories of accident. Consequence model, which is the second, points out the possible outcomes from causal model and estimates of accident's overall risk/effects on the system safety. While the third, safety management model, indicates the influences of safeguards intended to prevent accidents or mitigate their consequences. Spouge (2004) made a representation of these models as indicated in figure 2.5, while making his demonstration model to the Netherlands Ministry of Transport and other parties in the aviation industry. This, he developed with the aid of an accident type known as "*Control Flight into Terrain"* (CFIT). This is an in-flight collision with terrain, water or other types of obstacle, without prior loss of control.

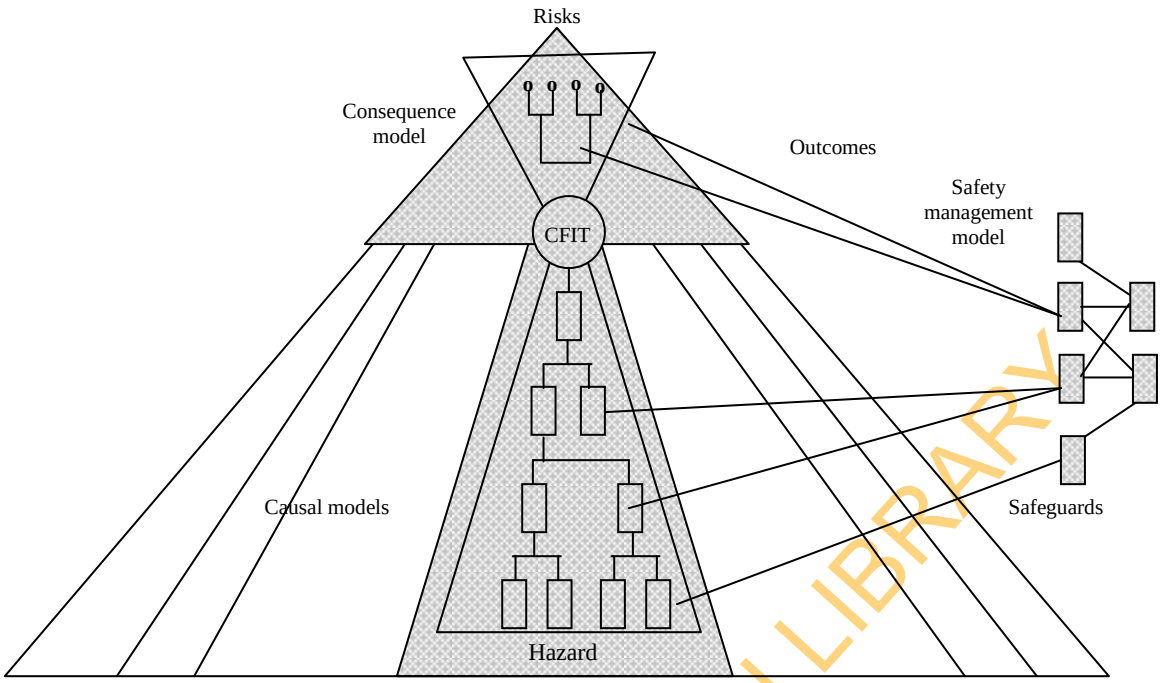


Figure 2.5: A Causal Analysis Model Structure
Source: Spouge , J. (2004)

Though the model structure outlines accident categories, which are related to aircraft alone, it can equally be adapted to other accident categories within and around the airport.

Spouge (2004) went further by breaking down the model structure into three as follows:

***(a) Causal Model*:** The variables technical and operational causes of CFIT are represented as the simultaneous failure of all the main safeguards against this type of accident. The safeguards and means of control over the aircraft trajectory are described as the flight crew, the flight management system or air traffic control. The major reactive warnings are air traffic control monitoring, visual observation of the ground by the flight crew and the aircraft's Ground Proximity Warning System (GPWS). The causal model of CFIT is thus expressed in the form of a fault tree, with CFIT at the top and the necessary technical and operational causes developed underneath as shown in Figure 2.6.

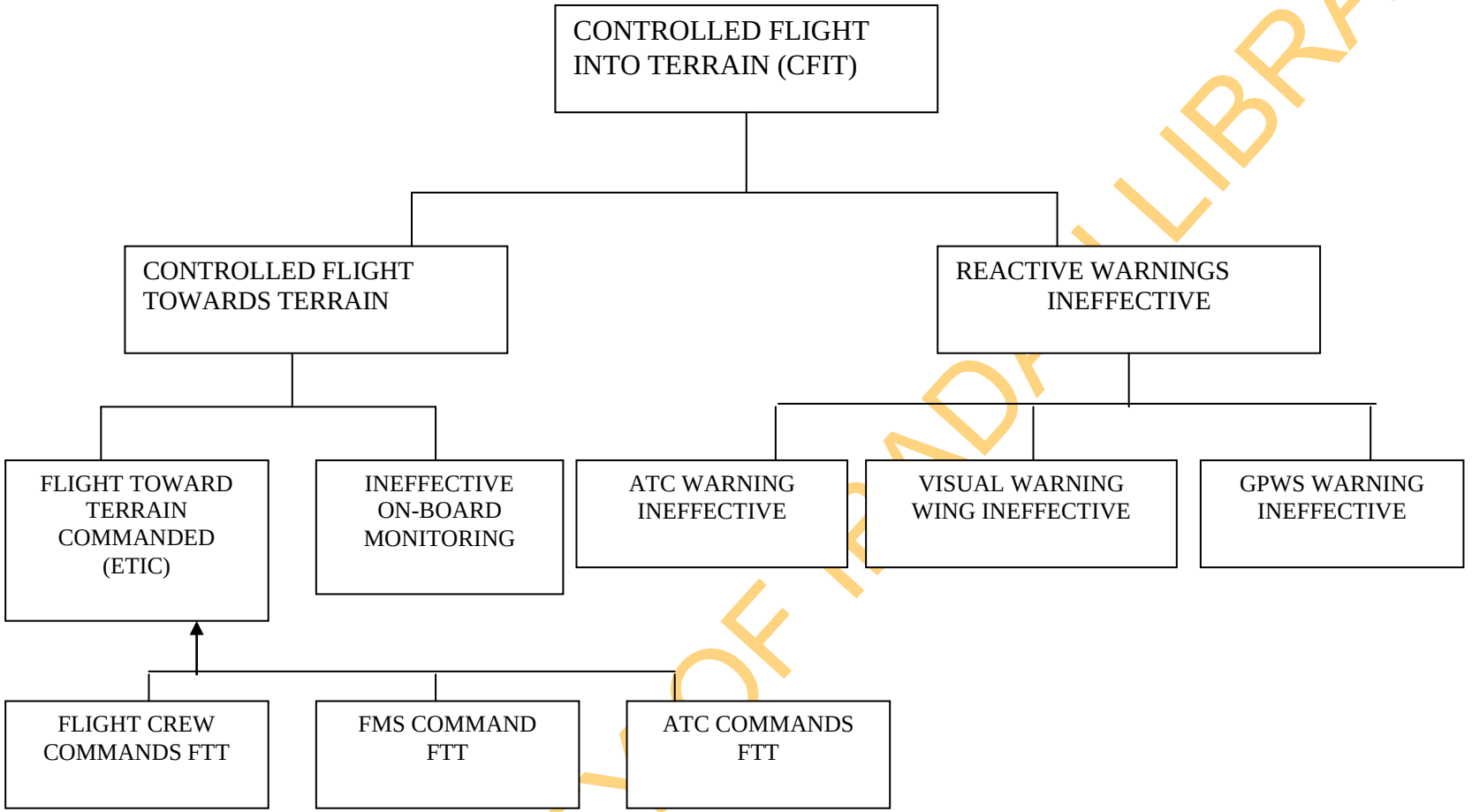


Figure 2.6: Causal Model
Source: Spouge (2004)

It should be noted that causal model excludes deliberate flight towards terrain which can be categorized under hostile attack in the complete model structure in Figure 2.6. For example, the September 11, 2001 attacks of World Trade Center (W.T.C.) in the United States of America can not be categorized under causal model as this is a deliberate (and not safeguard failure) control into terrain. This scenario is different from the United State's Airways which crashed in to the Huddson River on the 15th of January 2009 after its engine ingested at least one bird after take off. The only option left for the pilot as there was no enough time to turn back to the airport of origin after ingesting the bird(s), was, to safely land the aircraft on any available terrain (CFIT) which was the Huddson River.

The model has categorized causes of FCIT into technical and operational with a systematic review of safeguards against CFIT, failure of which will result in a corresponding accident.

(b) ***Consequence Model:*** This is the possible outcome(s) from failure of safeguards against occurrences. It is usually based entirely on historical accident experience.

(c) Safety Management Model: It consists of a hierarchical description of the safety management activities that might influence the building blocks (interaction) in the causal and consequence model. It is premised on the fact that, of many other high-hazards, low-risk systems, the aviation system has developed such a high degree of technical and procedural protection that is largely proof against single failure, either human or mechanical. Therefore, aviation system is more likely to suffer organizational accident (Reason 1990 and Helmreich 1999). Some of these management activities according to Reason (1990), Spouge (2004) and Hudson (2004) include safety leadership, safety promotion, planning and scheduling of resources, training, operating procedure, communication and co-ordination, inspection and maintenance, management of change, emergency response, incident/accident investigation, audits, risk assessment and evaluation and improvement. Features of the organization's activities in these areas can pave way for the organization's future safety improvement (Spouge 2004).

However, to the extent that causal analysis is relevant to airport safety, it concerns itself only with the active failure within the system. That is, the front line or immediate

cause(s) of the accidents, which is usually being committed by field personnel and always result in events within a short time. On the other hand, both latent and local triggers of accident causation were not given pre-eminence in the analysis. In view of this, therefore, causal analysis will be complimented with Reason's Swiss Cheese model so as to be able to get into the real basis of airport safety issues in this research.

(iii) REASON'S "SWISS CHEESE" MODEL

Previously referred to as 'Domino *Theory*; which promotes the idea that like dominoes stacked in sequence, mishaps are the end result of a series of errors made throughout the chain of command (OPNAVINST,2001). Later modernized by Reason as "Swiss Cheese" model, it traces the root causes of accident(s) to organizational errors arising in the upper levels of any organization (Reason, 1995). In other words, every accident or incident, no matter how minor, should be explained beyond group, team or individual operator performance, and must also be seen as an organizational failure. In essence, Reason's 'Swiss Cheese' model provides a framework for an event causation sequence beginning with organizational decision and terminating in an event.

Reason's 'Swiss Cheese' model of accident causal chain is depicted as in Figure 2.7

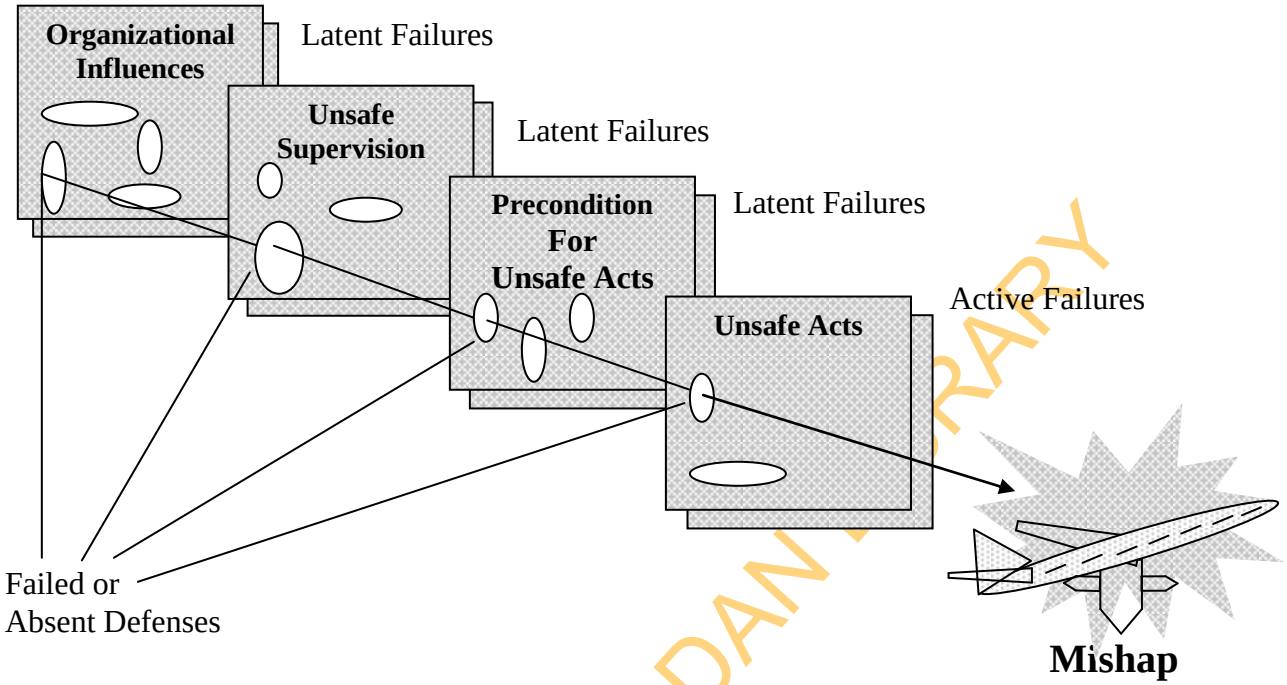


Figure 2.7: Reason's 'Swiss Cheese' model of accident Causal Chain
Source: Luxhoj, J.T.& Kauffeld, K (2003)

Tracing the causal chain backward from the mishap, the unsafe acts (active failures), which are the areas where most accident/incident investigations start and end in order to uncover causal factors, come first. These include the unsafe acts of operators (air crew, air traffic control, ground staff, facility personnel etc) that actively cause the mishap (Luxhoj & Kauffeld 2003). This is immediately followed by the three latent conditions and failures, which are preconditions for unsafe acts, unsafe supervision and organizational influences, as indicated in Figure 2.7. Each of these chains of events is also referred to as defenses against mishap. These are further explained with Figures 2.8 and 2.9.

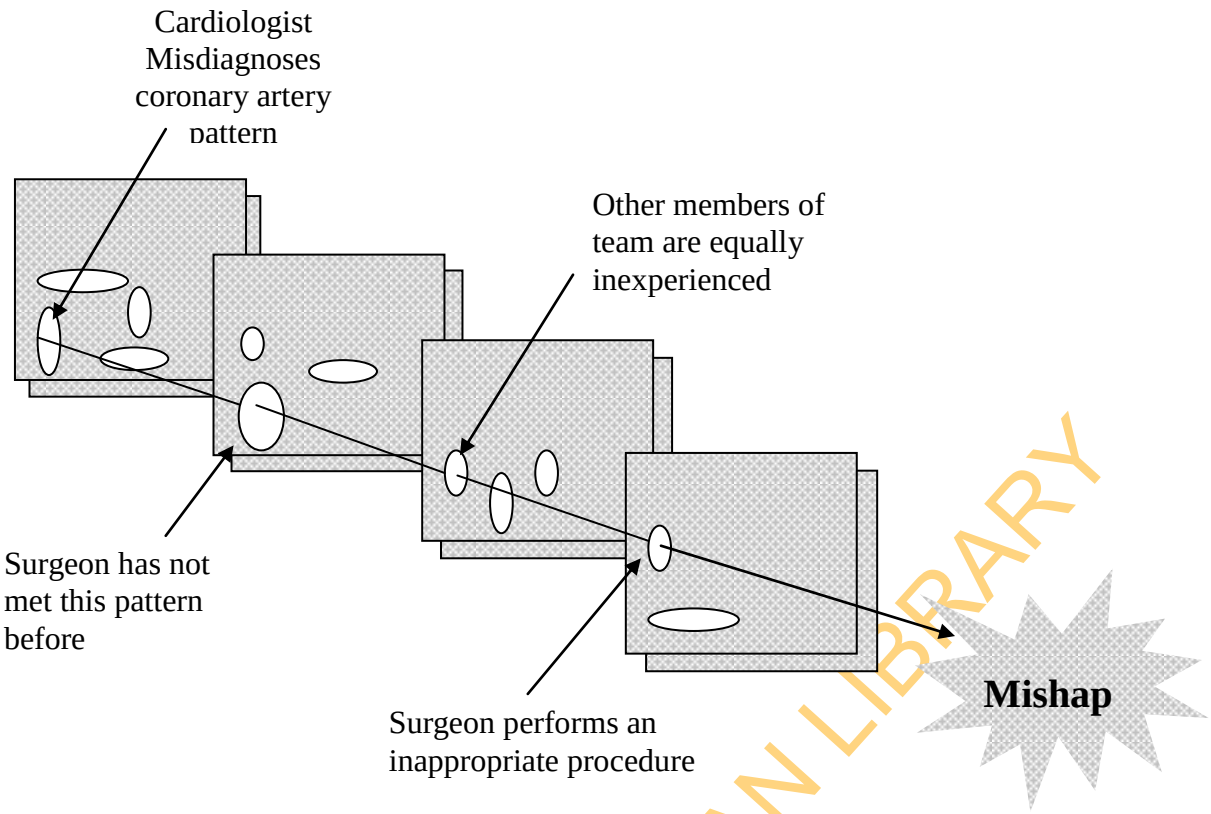


Figure 2.8: Typical Major Event Scenario
Source: Reason, J. (2000)

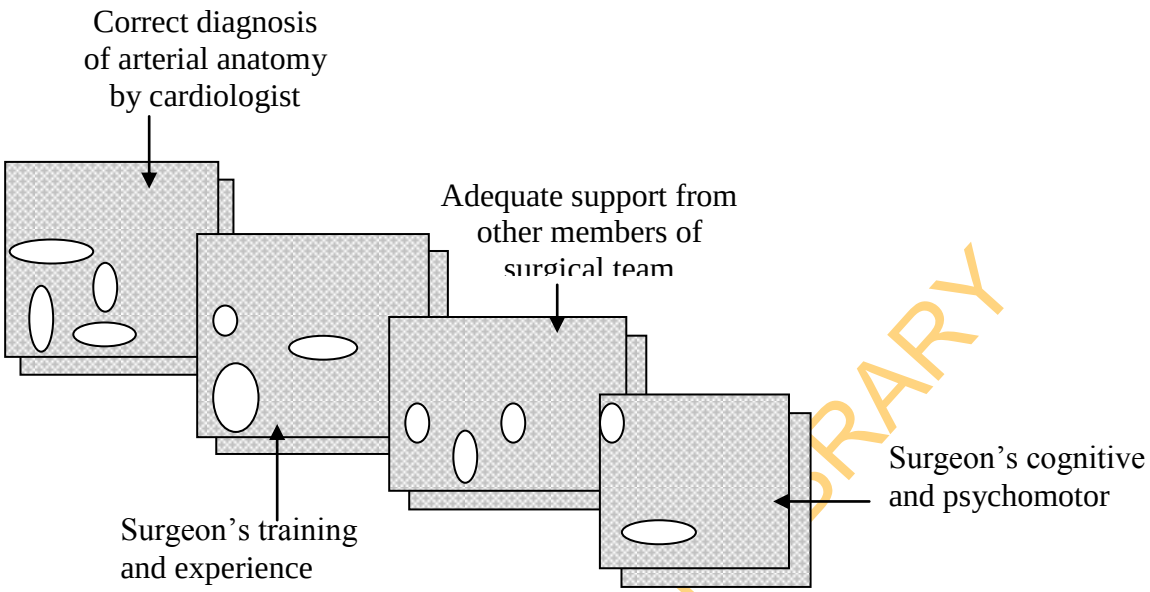


Figure 2.9: A Typical surgical defenses /barriers
Source: Reason's J. (2000)

Reason's model has become very useful to aviation safety to the extent that it forces accident investigators to address latent failures and conditions within the causal sequence of events (OPNAVINST, 2001); Patanker & Unsinger (2003) and Luxhoj & Kauffeld, (2003). As such, for any accident investigation process to be effective in improving aviation safety it must address causal factors at all levels, that is, investigation must find it necessary to identify the 'holes in the cheese', as in Figures 2.8 and 2.9. Towards identifying the holes, OPNAVISNT (2001), using Reason's concept of active and latent failures /conditions, developed a basic taxonomy known as the Human Factors Analysis and Classification System (HFACS). This is due to the assertion of Luxhoj and Kauffeld (2003) that between seventy and eighty percent of aviation accidents can be attributed, at least in part, to human error. The four levels of these failure/conditions were described as unsafe acts, preconditions for unsafe acts, unsafe supervision and organizational influences. These were further broken down as in Figure 2.10.

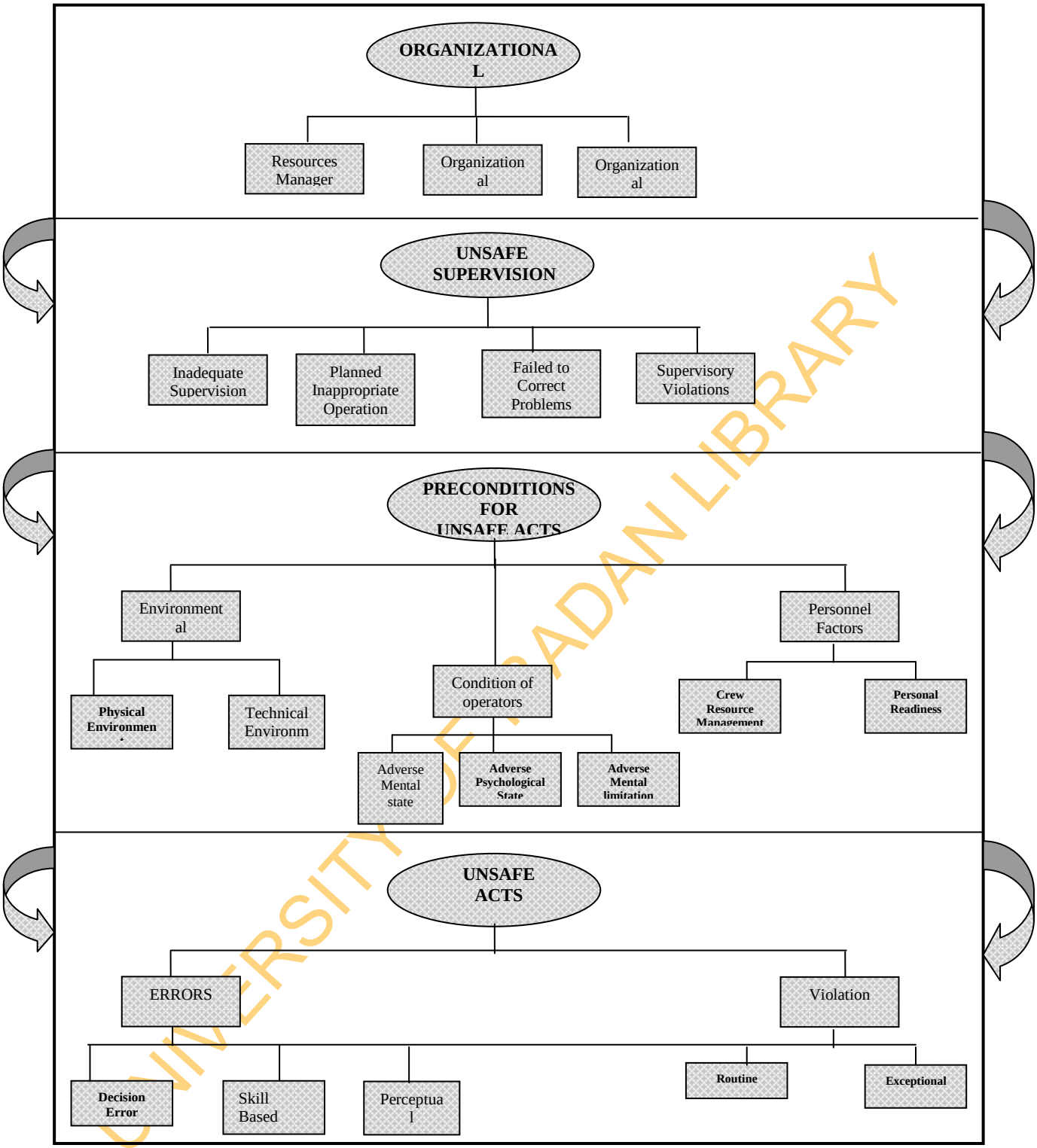


Figure 2.10: Four Levels of Human Factors Analysis and Classification Analysis (HFCS) Taxonomy
Source: OPNAVINST (2001)

Unsafe acts which is the taxonomy's first level in Figure 2.10 take two forms: errors and violations. These are active failures, which often are the last event before the mishap. In determining the unsafe act that the crew committed before the mishap, the investigators must find out if it is errors (skill-based, decision or perceptual or violations (routine or exceptional). However, simple focusing on unsafe acts is like focusing on a symptom without understanding the underlying cause(s) (Opnavinst (2001); Hudson, (2004); hence, investigation must dig deeper into why an unsafe act took place.

The second level of the taxonomy is the preconditions for unsafe acts. This has two forms as substandard conditions of operations (in terms of adverse mental state, adverse physiological state and physical /mental limitations) and the substandard practices of operators (crew resources management and personnel readiness). Paramount to aviation safety is mental alertness, physiological and physical fitness, coordination ability and personal agility. Any derogation from all these will lead to accident, that is, the aviation operator must be mentally and physically able without any stress or disability of any form and must be able to coordinate activities within the system.

In Figure 2.10, Opnavinst (2001) indicated that mishap can be equally traced to unsafe supervision. A situation such as the supervisors willfully disregarding existing rules and regulations, like permitting an individual to operate an equipment without current certification, or unable /refused to correct safety related operational deficiencies among subordinates is regarded as unsafe supervision. It could also be in form of improper pairing of operators where, individuals with marginal skills are paired together or the supervisor not having leadership trait not being able to provide adequate guidance/ direction for subordinates.

Fallible decisions of upper-level management (taxonomy's level four in Figure 2.10) directly effect supervisory practices, as well as the conditions and actions of operators. These latent conditions involve issues related to resource management, organizational climate and operational processes (Opnavinst, 2001 & Baron, 2004).

Some of management deficiencies that effect organizational safety have been outlined by Hudson (2004) and Qantas (2004) as follows:

- Inadequate safety management system.
- Lack of management commitment
- Incompatible goals – scheduling pressures vs safety.
- Poor authority and responsibility
- Inadequate communication
- Poor risk management
- Inadequate resource management
- Poor training
- Inadequate design
- Inadequate specification /requirement
- Unsuitable materials, equipment and facilities
- Inadequate monitoring and measurement
- Poor management of change
- Poor contractor/supplier management
- Inadequate provision of resources
- Poor documentation.

As noted by Opnavinst (2001), mishaps are rarely attributed to a single cause or in most cases a single individual cause rather than attributing it to the end of a series of latent failures from the organizational influences which precedes active failures. Reason's model thus traces the root causes of an accident to the taxonomy's fourth level towards indicating that accidents are based upon more than just an individual operator's performance.

In a complex market or industry like the aviation industry, most especially the airport system, which is the subject of this research, Reason's model will be useful not only in the area of detecting the multiple factors that interact to cause accident or mishaps, but will equally be relevant in timely detecting of defective defenses or safeguards. That is, Reason's model will allow airport accidents to be envisaged so that proactive safeguards and defenses could be put in place.

The three theories /models outlined above were thus utilized in this research, employing each in the area where it was most relevant within the airport system and at the same time, complimenting each other in their areas of weaknesses/ disadvantages.

2.2 LITERATURE REVIEW

Airport, according to the New Webster dictionary (1994), is an expanse of level ground (or water) with control buildings, hangars, workshops etc, equipped to deal with aircraft, servicing and repairs. It also includes its buildings and facilities in terms of hard-surfaced landing strips, a control tower, hangars and accommodations for airport personnel, passengers and cargo.

Realizing the shape of things to come in terms of interactive activities and dependence within and around the airport, Parasuraman et al (2002) and Lacagnina (2007), using some European airports as case studies opined that, the safety and efficiency of airport ground operations represent important areas of concern in an era of rapid growth in air travel and demand for air related services. Invariably, airports will experience increase in traffic volume in terms of activities within and around the airport, operational activities at the ramp due aircraft influx, upsurge in population at both arrival/departure halls, additions to vehicular movements around the airport among others. Therefore, safety becomes the first commandment and permanent requirement in aviation (Read 2001, and AHM 2003). Both in the air and on the ground, safety first is the rule. Airport and airside safety rules and procedures ensure safety handling. Therefore, safety regulations should be understood and always adhered to within and around the airport. Safety should not be seen as an additional burden on the aviation industry but rather as an effective means of gaining acceptance for the sustainable development of airport and aviation (Ale et al, 2002).

Several authors have attempted to define airport safety from their own understanding and perception. For example, McDonald and Ryan (1992), Helmreich & Merritt (1996), Eiff (1999) and Copper (2000), defined safety from the perspective that every member willingly upholds the group's safety norms and will support other members to that common end. Whereas, McDonald & Ryan (1992) consider safety as attitudes, roles, social and technical practices that are concerned with minimizing the exposure of employees, managers, customers and members of the public to conditions considered

dangerous or injurious. Safety culture according to Eiff (1999) exists within an organization where each individual employee, regardless of his position, assumes an active role in error prevention and that role is supported by the organization.

According to Cooper (2000), safety is a sub-facet organizational culture, which is thought to affect members attitude and behaviour in relation to an organization's ongoing health and safety performance.

From the above, airport safety could be viewed from the perspective of an enduring value and priority placed on both airport employees, airport users and public safety by everyone in every group, at every level of all organizations within the airport. It also refers to the extent to which individuals and groups can be committed to personal responsibilities for safety, act to preserve, enhance and communicate safety concerns, strive to actively learn, adapt and modify behaviour based on lessons learned from incidents and accidents.

Such definitions preclude that an organization's commitment to safety is, therefore, ultimately reflected by the efforts it put into ensuring that every aspect of its operations, such as equipment, processes and procedures, provision and distribution of facilities, training and work schedules are routinely evaluated and if necessary, modified to improve safety.

Considering airport safety as everybody's business and team work, Russel (1999) Haruna (2000), Awobokun (2001), Blakey (2003) have shown that:

- all personnel within all organizations in the airport must work to prevent accident and injuries;
- they must accept that risks, accidents and injuries have causes that can be eliminated or constantly reduced;
- accept that health and safety are essential parts of doing their work; and
- all personnel must have a clear understanding of their own skill, ability and limitations, and should have the capacity of carrying out their responsibilities.

Poole (1987) and Reason (1990) added that to ensure airport safety, there must be proper coordination of activities relating to passengers and other users and the responsibilities of different agencies within the airport must be spelt out clearly and unambiguously.

In another vein, Craig (2004) sees airports as amazing "mini-cities", providing services to all sorts of people and companies in completely different ways. Such services include accessible roadways, public transportation and parking lots, areas for ticketing, check-in counter, baggage handling, security for keeping passengers safe coupled with other customers' services like bureau de change, bank and postal services. Hence, the need to ensure passenger and cargo safety as they flow in and out of sections and facilities devoted to these activities is paramount to airport objectives. Airlines need spaces for airplanes, facilities for routine maintenance, jet fuel and places for passengers and flight crews while on ground, loading and unloading of cargo airplanes.

For a safer airport, Craig (2004) and Baron (2004) discussed issues relating to the construction of runways that would allow for safe landing and take-off of aircraft. Such issues include estimated frequency of use and weight of the aircraft, number and types of landing gears and the prevailing wind patterns.

With the aim of promoting a safer airport, Ground Handling International at its conference in (2002) and Lacagnina (2007), focused on how to make the ramp (a section of the airport where airplanes are parked for ground handling services) a safer environment. It pointed out that airports are becoming busier and busier everyday and the ramp is becoming cramped. Several activities such as loading and unloading, of baggage's, fueling of aircraft, providing catering services, and spaces for equipment used by cleaners, engineers and de-icers, are invariably increasing the probability for disaster occurrence at airports. To the extent that if one party engaged in one of these activities is not aware of the procedures and processes of other parties, the likelihood of the occurrence of an incident or accident becomes significantly high.

Several authors have therefore, concluded that for airport handlers to work within a safe environment, they must be fully aware of the part being played by others in the different geographical locations of the airport. (Tumba, 1993 and Leveson 2002).

Human factor also affects airport safety. Russell (1999), Read (2001) and Akerele (2002) noted the significance of human factor after a study of the report of investigations on Pan Am Flight 103 bombing over Lockerbie, Scotland in Dec 21, 1988. The report indicated among other things, the latent failures of the airport security system, whereby, airport security did not consider the need to ensure that each checked-in bag was associated with a passenger on-board that aircraft nor considered that baggage x-ray machines were not designed specifically to detect explosives. Perhaps, if the security personnel have had this at the back of their mind and frisked passenger bags manually, the Pan Am flight 103 bombing might not have occurred. To ameliorate this, some authors have posited that there must be clearly defined objectives and purpose of airport safety, standard setting, training, audit performance measurement against gargets and above all, thinking about why the performance is where it is and doing something about it.

Contributing further to the concept of human factors as they affect airport safety, Rao & Raov (1990) and Mohammed (2003) drew conclusions from the lessons of Frank Lorenzo. Lorenzo was the Chief Executive of Continental Airlines during the 1980's who was not interested in the welfare of the employees (Baron 2004). Experienced staff were fired and replaced with less experienced employees with very low wages, working for longer hours, taking shorter breaks and not offering them the opportunity to have planned off days. However, Lorenzo's tactics could not be sustained because of extensive resentment by employees with a corresponding negative effect on quality of services and non-adherence to organizational standards and procedures. Lorenzo decided to sell off his interest in continental shortly thereafter.

Rao & Raov (1990) and Mohammed (2003) did not only advocate for adequate availability of manpower but added that, employees must be properly educated, knowledgeable, skilled, informed and experienced. This is to the extent that dynamic human resources are inevitable to the industry in order to survive the dictates of the twenty-first century. They recommended the preparation of strategic plans and policies on human resource development for systemic implementation in the industry in order to succeed and survive in the industry's technology and knowledge based driven twenty first century. This, they concluded is required to put all airport safety action plans among other things into proper perspective for implementation. Mohammed (2003) opined that, perhaps, if the security personnel on duty had been able to handle the screening

equipment/machine at Lagos airport properly, the passenger that entered Air France aircraft in 2002 with a short pistol and live ammunition would have been detected before getting to the airline's security that eventually detected the passenger.

Every concern expressed about an airport relating to noise and safety could be eliminated with responsible and advanced land-use planning put in place before a problem arises (AOPA 1995, Jorna, 1999 and Gioia, 2003). The Orange County in the United States of America, for example in 1995, set up an Airport Land Use Commission (ALUC) to look into the land-use pattern around the county's airport. The objective of this Commission was to come up with a white paper that would safeguard the general welfare of the inhabitants within the vicinities of the airport and to ensure the continued operation of the airport. Specifically, the plan sought to protect the public from the adverse effects of aircraft accidents and to ensure that no structure or activity adversely affect navigable airspace. The implementation of this plan would forestall urban encroachment on airport space and allow for its continued operation.

Recognizing the cost implications and funding of Future Air Navigational System especially in the counties of Africa, coupled with its role in aviation and airport safety, President Bush of the United States of America adopted the concept of 'safe skies" programme (Mosley, 2001). This is to promote safe, secure and dependable air transportation in the counties of Africa. Tumba (1993) on his part advocated for privatization and commercialization of African countries' airports so as to make enough funds available to execute airport safety programmes.

Realizing the importance of safety issues at their conference in 1999, and the necessity to promote a safer aviation industry, the African Ministers in charge of aviation, agreed as follows:

- re-affirm their obligations to each other to protect the safe and security of civil aviation acts of unlawful interference;
- will conform to the provisions of the various conventions on aviation safety in accordance with ICAO provisions and especially with Annex 17 of the Chicago convention on international civil aviation;

- shall give consideration to any request from one another for special safety and security measures to meet a particular threat;
- reaffirm their obligation to comply with the civil aviation safety standards and practices recommended by ICAO.

The major concern of Bantock (2004), in airport safety is in the area of instant location, detection or prediction of accidents and incidents within the airport. He likened airports to industrial plants in the chemical and nuclear industries where standards for incident location detection and prediction need be set. In order to effectively and efficiently manage airport safety and security, Bantock (2004) suggested the use of highly sophisticated Computer Aided Dispatch (CAD) system with built in, extremely detailed intelligent mapping. This allows security and communication personnel to view all airport facilities and keep track of all events and operations using detailed airport's geographical location data such as room and door numbers, baggage claim areas, suspicious bags, parking lot etc.

Perhaps that was why Ale et al (2002) warned that, safety around the airports should not be seen as an additional burden on the aviation industry, but an effective means of gaining acceptance for the sustainable development of airports and aviation.

Using the same comparative background as Bantock (2004), Gouweleeuw (1995), Jorna (1999) and Ale et al (2002), noted that, risks around airports are comparable to major hazard sites such as chemical plants given the evidence that major airports present similar levels of third party risks.

Third party risks can be defined in terms of injuries, loses and other dis-comforts inflicted on persons living or working within the immediate vicinity of the airport due to operational accidents and incidents that occur at the airports. Piers (1993), Couwenberg (1994) and Ale et al (2000) opined that individual risk for the entire area around the airport can be calculated. Form this, risk contour will be generated and plotted on a geographical map for the purpose of generating a comprehensive, transparent, predictable and controllable policy.

Further concern for third party risk made Aircraft Owners and Pilot Association (AOPA, 1995) and Jorna (1999) to note that airport safety, noise and land-use planning have always gone hand in hand. The problem is that, in the past, most airport sponsors and

officials just did not understand this interaction; hence the need to address the safety management in and around the airport.

Considering safety around the airport, Gioia (2003) added that it is in the public interest for airport developer's authorities to provide for the orderly development of their airports and the areas surrounding these airports so as to promote the overall goals and objective of airport's noise standards and to prevent creation of new noise and safety problems. There should also be the protection of public health and safety by ensuring the orderly expansion of airports and adoption of land –use measures that minimize the public exposure to excessive noise and safety hazards within areas around airports to the extent that these areas are not allowed to be devoted to incompatible uses.

Seally (1966), in appreciating the speed as well as distance and time reduction in air travel, highlighted some problems associated with aircraft safety when viewed against the backdrop of the airport's surface features. He consequently highlighted the salient factors to be considered before locating airports. These include the physical conditions such as the soil type and formation, terrain, wind direction, economic, social and political factors.

Considering wildlife threat to airport safety as part of locational impositions, McKinnon (1996), Linnell et al (1996), Jeffrey (1996) and McKee et al (2010) took a cursory look at hazards birds and mammals pose to aircraft, particularly in the vicinity of airports. Accordingly, attention must be focused on knowing the various types of those birds that exist at airport sites, airport site features that attract birds and consequently devise control measures to minimize bird strikes. It is also essential to know the migratory patterns and other behaviours of birds like feeding and roosting areas and take actions to avoid bird strike in-flight.

Using airports in Canada and Europe for their different studies, McKinnon (1996), Jeffrey (1996) and Moffat (2006) found out that some large flocking birds have begun to stay all years, ignoring traditional winter migrations and they are becoming increasingly successful at adapting to human landscape with high degree of resistance to human activities or control by traditional wildlife management. This adaptation by birds poses a great risk to airport safety.

In order to reduce the risk of birds within and around airports, McKinnon (1996), Jeffrey (1996), Moffat (2006) and McKee et al (2010) stated that the type of birds, their physical and behavioural pattern must be identified. This could be through:

(a) **Keratin Electrophoresis:** a process used to identify species of birds from small amounts of features material. The principle behind it is that, features are made of Keratin, which is a protein substance similar to human hair and fingernails – each bird has its own protein pattern.

(b) **DNA Sequence Analysis:** it is an examination process conducted through a small sample of bird remains. DNA sequences are specific to individual bird species, which make identification of birds possible (Hermans et al, 1996).

(c) **Bird Remains Identification System (BRIS):** this is computer information and interactive system which enable users to conduct quick geographic searches and descriptions and to view colour pictures and distribution maps of birds species. Through this system, users can also develop insights into bird behaviours including flight behaviour, migration routes and peak periods of activity out of which strike prevention measures could be developed (Prast et al 1996).

(d) **Bird Density Determination:** This is a computerized topographic system, which provides details on the relative density of the bird tissue. The resulting digitized density data can be used in the evaluation of engine fan blades and their ability to withstand bird strikes.

With the above identification methods, McKinnon (1996), Jeffrey (1996) and McKee et al (2010) concluded that the only effective way of controlling wildlife remains the use of conventional techniques such as habitat management, pyrotechnics and trapping through persistent motivation and encouragement of airport wildlife control officers in effective and efficient adoption/usage of these stated techniques.

Defuseco (1996) in another related study added that, the hazards pose to airport safety through bird strike could be equally controlled by using Geographic Information System (GIS). This is more so because the GIS can identify specific areas within the airport and its environs where birds pose potential hazards to aircraft.

Focusing on distress responses, rather than the concept of safety, Hudson, 2000, Onyeyiri (2003), Leyman, 2004 and Greater 2006 tried to bring about a relationship

between preparing for distress situation and effective response to distress situations. They explained distress (emergency) preparedness as the state of readiness of personnel assigned to deal with specified types of distress in an organization. This also includes availability and serviceability of modern equipment to be employed by the personnel. Distress situations common to aviation system were thus outlined as follows: aircraft accident which could be on or off the airport, full emergency, unlawful interference, bomb threat to aircraft or airport building, ground incident (like equipment to equipment, equipment/personnel, personnel or passenger developing strange ailment and so on, structural fire, local/civil standby/disorder (like civil strike), dangerous goods incidence and weather standby or natural disaster among others.

The International Civil Aviation Organization (ICAO), noting that distress situation is inevitable in aviation practices, in addition to the threat it places on the airport system and its immediate vicinity, entrenches in its Annex 14 within the International Aviation Agreement (IAA) that, each airport shall establish an emergency plan that is commensurate with the level of aircraft operations and other activities at the airport that can partake in distress response situation.

In other words, a coordinated distress response programme should be put in place between the airport and the surrounding community with a view to reducing and minimizing the effects of distress whenever it occurs with respect to the preservation of life and maintenance of aircraft/airport operations. The programme shall entail an agreed and recognized structure of command during an emergency and also guarantee immediate response of medical services, rescue and fire fighting services, law enforcement and other persons and agencies within the airport and its immediate vicinities. Hudson, 2000, Onyeyiri (2003), Baba (2004), Leyman, 2004 and Greater 2006 added that this programme should at the same time take into consideration a comprehensive airport emergency plan which takes care of pre-planning before emergency, operations during emergency and post – emergency activities.

Contributing to distress response, Frykberg (2002) and Cone & Koenig (2005) acknowledged that, inappropriate allocation of allocation of scarce resources can significantly affect the overall outcome of response to distress situation. Hence it is substantially imperative to develop strategies for managing and rationing the available

resources so as to make response to distress situations effective and efficient. These strategies should have the ability to sort and classify casualties within the periphery of accident site to determine the order of priority for immediate treatment and evacuation. Frykberg (2002 & 2005), Cone & Koenig (2005) and Iserson & Moskop (2007) thus espoused in their articles the 'Triage Principle'. This describes the strategies embraced to sort and classify casualties within a distressed environment to determine the order of priority fro treatment and evacuation with the ultimate aim of ensuring maximization in addition to improving effective resource utilisation as well as allocation.

Bassey (2009) added by explaining this principle through a table shown on Table 2.1. He (Bassey 2009), categorise casualties into four using roman numerical figures, the type of care needed, corresponding tag colours and symbols for easy identification.

Table 2.1: Triage Principle Casualty Distribution.

Priority	Care Type	Tag Colour	Symbol
I	Immediate	Red	Rabbit
II	Delayed (Urgent)	Yellow	Turtle
III	Minor (Can Wait)	Green	Ambulance/X
IV	Deceased (Delayed)	Black	Nil

Source: Bassey 2009

Bassey (2009) added that for a distress response plan to be effective, there must be a designated triage officer, proper coordination, timely dispatch of the injured as described in Table 2.1, as well as mutual aid agreement beside immediate action with collaborating hospitals.

In their different presentations, Onyeyiri (2003), Baba (2004), Leyman, 2004 and Greater 2006 indicated that in an event where the airport authorities can not cope with the magnitude of expected response to an on-airport distress, it is essential that the airport authority arrange mutual aid agreement with surrounding jurisdictions and define the responsibilities of each party in such a joint action and or response. . It could therefore be deduced that the comprehensive plan for airport emergencies should include parties within the vicinity of the airport where the following shall be undertaken;

- clarification of the responsibility of each party.
- establishment of an unambiguous chain of command;
- designation of communications / priories;
- designation of an emergency transportation coordinator and indication of the organizational structure of the emergency transport facilities;
- predetermination of the authority and liability of cooperating distress response personnel and ;
- prearrangement for the use of rescuer equipment from available sources.

Onyeyiri (2003), Baba (2004), Leyman, 2004 and Greater 2006 also explained that availability of an up to date grid map explaining in details the land-use within and around the airport is germane to effective response to distress situation either within the airport or its vicinity. Knowledge about the distance and bearing between some specific uses, topography, swampy and forest areas within and around the airport coupled with their characteristics are all inevitable. Exposition of rescue and search personnel and some other personnel of the airport authority to all the above details are also very paramount.

To be able to determine the level of response preparedness for airport distress, Docherty (1990) categorized airport into 10 categories. The base used is the overall length of the longest aircraft normally using the airport and their maximum fuselage width. This is with a view to determine the level of quantity and quality of equipment, facilities and

personnel that shall be provided within a particular category of airport to respond to distress situation whenever it occurs. The categorization is as stated in Table 2.1

Table 2.2: Airport Categorization

Airport Category	Aero plane over –all length	Maximum Fuselage width
1	0 up to but not including 9m	2m
2	9m up to " " " 12m	2m
3	12m " " " " 18m	3m
4	18 " " " " 24m	4m
5	2 m " " " " 28m	4m
6	28m " " " " 39m	5m
7	39m " " " " 49m	5m
8	49m " " " " 61m	7m
9	61m " " " " 76m	7m
10	76m " " " " 90m	8m

Source: Docherty (1990)

Docherty (1990) added that the third factor to be considered while categorizing airport is the frequency of movement of the largest of the aircraft using the airport. These aircraft movements can be calculated over the busiest consecutive three months of the year, where aircraft movement is defined either as a landing or a take-off. In assessing future response readiness to distress situation in an airport, therefore, this should be calculated on the best available predictions and forecasting estimates.

2.3 CONCLUSION

It could be rather tasking getting literature on airport safety and distress response which are very recent phenomena in transportation geography. Just as Parasuraman et al (2002) and Lacagnina (2007) noted that the safety and efficiency of airport ground operations represent important areas of concern in an era of rapid growth in air travel and demand for air services, so also, Mosley (2001) and Blakey (2003) indicated that attention should be shifted in this new century from aircraft safety in the skies to safety and distress response on the ground. This assertion has led most practitioners and stakeholders in the industry to organize seminars, workshop and conferences with regard to airport safety. Paper and monographs delivered at such occasions were mostly not based on any serious and rigorous academic exercise. Most authors have often been taking a cursory look at an aspect of the airport which catches their interest. For instance, Poole (1987) and Cooper (2002) tried to look at the role that organizational concept plays in the issue of airport safety while, Rao & Raov (1990) and Reason (1990) espoused the concept of human factor. The threat that wild life especially birds pose to airport operation is the area that interests Mackinnon (1996) and Jeffrey (1996). Of greater concern, is that there have not been any serious academic researches on any of the African airports. Little wonder, Agbeyegbe (2002) while reacting to the fire inferno at Sky Power Aviation Handling Company Limited (SHACOL) cargo warehouse in 2002 stated that comprehensive airport distress response plan is still lacking at the Nigerian Airports.

This study therefore, constitutes a research into the safety and distress response of Nigeria's international airports in a holistic manner placing emphasis on the linkages and interfaces (through the infrastructure and operation models) among the various operating units within the system. The study adapted major theoretical frameworks, which had been used in investigating and understanding aircraft accidents. With this, the researcher

was able to understand why and how some accidents and incidents occur with the aim of forestalling such occurences.

CHAPTER THREE

METHODOLOGY OF STUDY

3.1 TYPES OF DATA COLLECTED

The data collected for this study are those that deal with basic issues for promoting safety as well as improving response to distress situations whenever and wherever they occur within and around the airport. These data were used to systematically address the issues arising from the research objectives.

They include data on:

(i) The growth and change in the pattern of land-use within and around 5km radius of the airports since their inception, including farm land, buildings and other physical developments like mast erection etc. Data were equally collected on the effects of this conflicting land –uses on safe operations within the airports.

(ii) The availability of safety facilities and equipment within and around the airports. This made it possible to measure the appropriateness, reliability and robustness of equipment and how user-friendly the available equipment are.

(iii) Existing culture of safety within and among the organizations within and around the airports, the extent of the personnel's understanding of this culture, contents and substances of safety operating practices and procedures of various operational units, airport operational rules and goals for safe performance, methods of resolving conflicts among inevitable choices of safety and other goals, and allocation of critical responsibilities and resources among personnel. Of importance also are data on communication flow/mode and coordination within and among operating organizations within and around the airports and on the competence of staff to perform and make critical decisions on safety matters.

(iv) The response level to distress situation whenever and wherever they occur at the airports. This included data on past incidents and accidents that have occurred since inception of each airport and how such were responded to.

(v) On third party risks, data were collected on the effects airport operations have on those living and working around the airports. This was complimented with data on

why the inhabitants chose to live and work there and whether if they have options or if given necessary incentives they would prefer to re-locate.

3.2 SOURCES OF DATA

Data were collected from the various operating organizations within and around the selected airports for the study. These are the Federal Airports Authority of Nigeria (F.A.A.N), the Nigerian Civil Aviation Authority (N.C.A.A), the Nigerian Airport Management Authority (N.A.M.A), the Nigerian Aviation Handling Company Plc (N.A.H.C.O) and the Sky Power Aviation Handling Company Limited (S.A.H.C.O.L). Others are the Nigerian Customs Services (N.C.S), the Nigerian Immigration Service (N.I.S.), the International Airline Operators, the Nigerian Drug and Law Enforcement Agency (N.D.L.E.A) and courier operators within the airport. Data were also collected from those living and working around each selected airport. Some non-governmental organizations that deal with airport safety were also contacted. They include Airport Safety Initiatives and Aviation Round Table (a Non-Governmental Organizations), labour unions within the airport and the press. Lastly, airport users equally contributed to data collection.

Data from F.A.A.N. were those that related to available landing facilities, security within terminal building, fire fighting equipment facilities, equipment for responding to various types of incidents and accidents. Data were also collected on how F.A.A.N. has been able to control all operating units within the airport to compliance with safety standards as required by I.C.A.O regulations. Data from N.A.M.A were those related to landing and taking-off of aircraft within the Nigerian airspace, equipment for affecting these, navigational aids and weather forecasting equipment among others.

N.C.A.A. is the authority that ensures that all civil aviation standards are conformed to by all operating organizations within and around the airport. To this extent, all relevant data that are germane to this were collected from the authority. The Search and Rescue Department which operates within the purview of the authority formed the pivotal source of data relating to distress situations.

The data collected from Nigerian Aviation Handling Company Plc (NAHCO) and Sky Power Aviation Handling Company Ltd (SAHCOL) includes facilities for safe handling

of passengers, cargo and mail. It also took into cognizance issues relating to management and staff auditing.

Data from the Apron Control, which is in charge of the run-way, tarmac and the vicinities of the airport, included the quality and maintenance of the run-way and tarmac, wild-life control, grass cutting, removal of unserviceable aircraft within the airport, checking the spate of uncompleted buildings, lightening system among others.

The Airline officials were the sources of data to assess how safe the airports are in supporting and promoting their various operational activities. This was complemented with information that was gathered from passengers, customs' clearing/shipping agents as representatives of importers/exporters and traveling agencies in terms of feed-back from their passengers/clients.

The customs, immigration services, the Nigerian Drug and Law Enforcement Agency and quarantine services equally provided information as regards safety within the airport.

Through satellite imageries, available literature, master plan and direct observation, data on land-use pattern within and around the airports were collected. Data as regards conformity with safety standards by airport operators and other operating units within and around the airports were deduced through comparing existing situation in each airport with the requirements of I.C.A.O.

Data as it concerns the number of buildings within 5km radius of the selected airports were collected from the respective Local Planning Authorities.

3.3 METHODS OF DATA COLLECTION

Data collection was mainly through primary and secondary sources. Secondary data were sourced from manuals and records of relevant operating organizations within and around the airports as they relate to safety and distress response. On the other hand, primary data collection involved the use of structured questionnaires to collect information from different organizations within the selected airports. Questionnaires were administered to staff of all the major service providers within the airport. These are mainly the Federal Airport Authority of Nigeria (FAAN), the Nigerian Civil Aviation Authority (NCAA),

the Nigerian Aviation Handling Company Limited (NAHCO), the Sky Power Aviation Handling Company Limited (SAHCOL) and others like the Catering services (ASL), airport lounge services, duty free shops, trolley services, car hire services, Nigerian Drugs and Law Enforcement Agency (NDLEA), Nigerian Immigrations and Nigerian Customs. This was complemented by Key Informant Interview (KII).

Towards making the data collection scientific, 10% of the total work force of various organizations working within the airport was taken as the sample population. Table 3.1 shows the population of total work force of organizations within the selected airports, the distribution of questionnaires as administered to various service providers within the selected airports was additionally presented on the table. FAAN which has presence in all the airports of the Federation (being the authority in charge of the nation's airports) and consequently the highest number of staff equally have the highest number of questionnaires (290 questionnaires or 46.8% of the entire questionnaires) that were administered. This was followed by NAHCO/SAHCOL being the two handling companies responding to 22.0% of the administered questionnaires. Other categories was made up of catering services, airport lounge providers, duty free shops, trolley/car hire services and other government agencies like customs, immigration and drug agency accounted for 15.3% of the respondent.

Table 3.1: Determining the Sample Size for Airport Operators

		Lagos	Abuja	Port-Harcourt	Kano	Total	Percentage
Organisations' staff strength per station as at year 2007.	NAHCO/SAHCOL	1126	95	67	67	1355	
	FAAN	2310	263	145	172	2890	
	NAMA	237	100	69	69	475	
	NCAA	238	134	74	49	495	
	OTHERS	595	139	104	113	951	
	TOTAL	**4506**	**731**	**459**	**470**	**6166**	
Questionnaire distribution to staff of organisations at different stations.	NAHCO/SAHCOL	86	20	14	16	136	22.0
	FAAN	183	42	30	34	289	46.8
	NAMA	30	07	05	06	48	7.8
	NCAA	32	07	05	06	50	8.1
	OTHERS	60	14	10	11	95	15.3
	TOTAL	**391**	**90**	**64**	**73**	**618**	**100.0**

Source: Computed from Airport Operators' Data Base, 2007

Another set of questionnaires were administered to those living and working around the selected airports for the study. 10% of the enumerated numbers of buildings as obtained from the respective Local Planning Authorities were randomly selected for this purpose. Presented in table 3.2 are the numbers of enumerated residential and commercial buildings within 5km radius of the selected airports coupled with the sample size.

Analyses of the administered questionnaires presented in Table 3.2 revealed that majority of the respondents came from Lagos. This is due to the fact that, Lagos airport has a larger concentration of people working and living around the airport than others that were selected for the study. Hence, respondents there accounted for 198 or (42.9%) of the total respondents. Kano had the second highest number of respondents, accounting for 96 or (20.8%). A lesser number was gotten from Abuja and Port Harcourt. They contributed only 92 or (19.9%) and 76 or (16.5%) respectively. These figures are justifiable, given the spatial distribution of population and activities around each of the selected airport involved in the study.

Table 3.2: Enumerated Buildings within 5km Radius of Selected Airports and Sample size.

Location	Number of Existing Buildings	Sample Size	Percentage
Lagos	1984	198	42.9
Abuja	917	92	19.9
Kano	958	96	20.8
Port-Harcourt	763	76	16.5
Total	**4622**	**462**	**100.0**

Source: Computed from Local Planning Authorities' Data Base, 2007

Questionnaires were also administered to the users of the airport facilities which were predominantly the traveling passengers due to the large population of passengers that pass through each of the selected airports compared to other identified users. Other identified users of airport facilities are airline operators, the customs' clearing agents and traveling agents.

The 2006 passenger throughputs in the selected airports were used as the data base for determining the sample size of this category of respondents. This is due to the fact that, it was the latest completed data base of passenger throughput within the selected airports. As shown in Table 3.3, the average passengers that passed through each of the selected airports were determined through the addition of total embarked and dis-embarked passengers. The data informed the decision to select 216 respondents which constituted 1% of the average passengers per day. Also, the percentage that each selected airport accounted for in the total sample population was shown on the table.

Table 3.3: 2006 Passenger throughput in selected airports* and Sample Size.

Airport	EMB	DIS-EMB	Total	AV/DAY	Sample Size	Percentage
ABUJA	937,225	938,528	1,875,753	5,139	51	23.6
MMA	2,533,689	2,468,386	5,002,075	13,704	137	63.4
P/H	353,003	344,854	697,857	1,912	19	8.8
KANO	151,406	190,085	341,491	936	09	4.2
Total	**3,975,322**	**3,941,853**	**7,917,175**	**21,691**	**216**	**100**

Key:

EMB = EMBERKATION; DIS-EMB = DIS-EMBERKATION;

AV/DAY= AVERAGE PER DAY; PN= POPULATION

***The analysis of this data was used to determine the sample size**

Source: Computed from NCAA Year Book, 2007.

As part of the users of airport facilities, 30 questionnaires as shown on Table 3.4 were administered to three members of staff of 10 major international airline operators. The airlines chosen are as follows: Lufthansa Airlines, British Airways, Air France, Alitalia, KLM, Kenya Airways, Ethiopia Airlines, Emirates Airways, Virgin Atlantic and Qatar Airways. Of the 3 questionnaires to each of the 10 airlines, 1 was administered to the management staff while the other two were administered on supervisors and junior staff members that work at different locations of the selected airports.

Also, from Table 3.4, it was indicated that, 102 questionnaires were administered on the customs' clearing/shipping agents (as the representatives of importers and exporters) within the selected airports. In view of the volume of activities at the Lagos airport compared to others, 60 questionnaires were administered there while 14 questionnaires were administered in each of the remaining selected airports. Lastly, 6 questionnaires were administered to traveling agents within Lagos airport while 5 questionnaires were administered in the other airports of study. These were equally indicated on Table 3.4.

Table 3.4: Questionnaires Distribution among Airport Facilities' users.

Type of User	Sample PN Size	Percentage
Passengers	216	58.5
Clearing Agents	102	27.7
Airline Operators	30	8.1
Traveling Agents	21	5.7
Total	**369**	**100**

Source: Field Survey, 2007

The questionnaires for the three sets of respondents (i.e. the service providers, those living and working around the airports and users of the facilities within the selected airports) as described above were carefully selected to address the issues raised in each objective of the research.

(i) With respect to data for evaluating the master plan, this was collated through secondary method where some relevant manuals like International Civil Aviation Organization (I.C.A.O.) standards and regulations and each airport's master plan were consulted.

(ii) Also some farmers around each selected airport were interviewed to know why they chose to farm around each airport.

(iii) On safety equipment, I.C.A.O. Annexes were reviewed to determine the standards that should be attained based on airport category. While also, the data of available safety equipment within the selected airports were reviewed. Questions were additionally asked on the functionality of these equipment and facilities to cope with the contemporary and emerging airport operational situations.

(iv) Data on organizational safety culture were collated through the use of structured questionnaires administered to members of staff (management, supervisors and junior staff) of organizations operating within each of the airports. This was meant to obtain information from the officials on their level of knowledge of safety culture or if they can identify such and whether it is equally part of their organizational principles or practices, and how such is being communicated down the line. The workers on the other hand were given questionnaire as regards their understanding of what safety culture and practices are, their understanding of what is being communicated to them from organizational officials, safety issues arising from such communication, usage and other related questions.

(v) In appraising the level of distress response, the researcher first perused past records of how incidents and accidents were responded to, as well as analysis of KII with a view to bringing into focus either lapses or excellence that emanates from these. An appraisal of data on available facilities and equipment for distress response was undertaken, while taking into cognizance the I.C.A.O standards/requirements for airport categorization. Questionnaires were used to determine workers' qualification, age, fitness, gender, understanding of the job and ability to take critical decisions among others. KII on the extent to which other agencies that are known for distress response activities (e.g. medical, fire service,

police etc) around the airport had been included in past activities was additionally considered. This also entailed knowing their past and present relationship with airport authorities.

(vi) Third party risk assessment involved asking questions on how airport operations affect the activities and well-being of those working and living around the vicinity of the airport. This also includes knowing how past incidents and accidents have affected their communities. Questions asked has to do with age, gender, occupation, qualification, why and for how long respondents have been working or living around the airport and on whether, if given an option they will want to live or work elsewhere.

3.4 DATA ANALYSIS

Data collected from difference sources were analyzed using both descriptive and quantitative statistics. Descriptive statistics involved the use of frequencies, simple percentages, measures of central tendencies to present the data collected. The use of tables and charts were also employed to enhance easy understanding of data presentation. Additionally, more robust and rigorous quantitative statistical analyses were used in analyzing some of the data collected and specifically, in testing the hypotheses stated for the research. The quantitative statistical analysis involved the use of Pearson Product moment correlation for testing two of the hypothesis while multiple regression model and the analysis of variance (ANOVA) were applied for testing the other two hypotheses. The data collected through KII were content analysed while the satellite imagery data were analysed using the appropriate GIS software (Arc View).

3.5 HYPOTHESIS TESTING

Hypothesis 1: There is no significant variation in the awareness of safety issues among different organizations operating within the airport.

The analysis of variance was used to test this hypothesis. The data used for this test was derived from responses obtained from the questionnaires administered to personnel of various organizations within the selected airports. The questions on the awareness and understanding of safety issues in and around airports were designed in a Likert Scale format (a unidimensional scaling method rated on a 1-5 scale). Where 1 (strongly

disagreed) was the lowest and 5 (strongly agreed) was the highest. Also where 'yes' and 'no' were the responses, 1 and 0 were used respectively for the analysis.

Hypothesis 2: There is no significant relationship between airport age and provision of effective and functional safety infrastructure. It is assumed that as airport age increases so also do airport activities in terms of passengers and cargo throughput, airplane landing and take off increases. This hypothesis, therefore, measures whether or not airport safety facilities are correspondingly increasing over time. This hypothesis was tested using the simple Pearson Product Correlation.

$$r_{xy} = \frac{x_i y_i\ [\sum x_i](\sum y_i)/n}{[x^2 - [\sum x_i)^2\ [y^2 i - [\sum y_i)^2/n]} \qquad [x^2 i - [\sum x_i)^2/n]\ [y^2 i - [\sum y_i)^2/n]$$

where Y = airport age (when airport was commissioned)

X = Availability of effective/functional safety infrastructure.

Hypothesis 3: There is no significant relationship between staff training and functionality of safety infrastructures. This hypothesis was tested to show the importance of staff training in improving airport operational safety and distress response level. The simple Pearson correlation analysis was used to test this hypothesis. Staff training was measured in terms of frequency of training i.e., the number of training courses attended in the last five years. Functionality of infrastructure was measured in terms of whether infrastructure was functional or not.

Hypothesis 4: Distress response capability is significantly dependent on age of infrastructure at the airport, level of preparedness, effectiveness of safety infrastructure and equipment and level of training of staff responsible for tackling distress situation.

A simple multiple regression model was used to analyse this hypothesis

$$R^2 = \frac{a\sum y + b_1 \sum x_1 y + b_2 \sum x_2 y - \frac{(\sum y)^2}{n}}{\sum y^2 - \frac{(\sum y)^2}{n}}$$

Derivation of the Variables Used for this Model;

This was based on the data generated from the survey questionnaires administered as well as key informant interviews to the airport service providers (i.e. staff of organizations working within the airports) especially those that are concerned with everyday operations.

Response Capability is defined in terms of the time taken by rescue operation to arrive at occurrence location. This response time according to ICAO Annex 14 on Aerodromes should not be more than 20 minutes from time of occurrence.

i) Staff training was measured in terms of the number of training /courses respondents have attended in the last five years;
ii) Age of the safety infrastructure, measured in terms of when the airport was commissioned;
iii) Functionality of the infrastructure, measured in terms of whether the infrastructure is functional or not;
iv) Effectiveness of these infrastructures, measured in terms of infrastructural functionality and importance of training.

Level of Preparedness was derived from:

i) The importance organization placed on the issue of training;
ii) Adherence to airport master plan;
iii) Functionality of the infrastructure.

Effectiveness of infrastructure was measured in term of;

i) Number of training attended by respondents in the last five years;
ii) Functionality of infrastructure.

Training of Personnel measured in terms of:

i) Importance organization placed on training;
ii) Number of training respondents has attended in the last five years.

Communication, measured in terms of:

i) Mode of intra and inter organizational communication;
ii) Interpersonal relationship among staff.

CHAPTER FOUR

SPATIO-TEMPORAL ANALYSIS OF AIRPORT DEVELOPMENT IN NIGERIA

4.1 AN OVERVIEW OF AIRPORTS DEVELOPMENT IN NIGERIA

Aviation activities in Nigeria started with the epoch making Royal Air Force (RAF) fighter plane which landed at the ancient and walled city of Kano to survey the trouble laden city in 1925. The commanding officer flew the British fighter-aircraft from the Royal Airforce (RAF) squadron based in Khartoum Sudan. The pilot made a breath-taking but safe landing on the horse race course in Kano (NAMA Handbook 2002, Iyayi 2005). For the reasons of non-availability of air routes, maps navigational aids, radio communications and airfield /airport the flight operation was regarded as a particularly hazardous one.

Very little is known of the early commercial aviation in Nigeria but available records have it that a gentleman called Bud Carpenter, owned a private de-Havilland Moth aircraft, which he frequently flew between Kano and Lagos (Iyayi, 2005). He always used the rail tracks as his guide and this meant additional distance for him.

Meanwhile, the flight of the Royal AirForce was to become an annual event starting from Cairo, which was another base, down through the Nile to Khartoun and then Maiduguri and Kano. The British Overseas Airways Corporation (BOAC) later replaced the services of Royal AirForce, having been given the statutory rights to fly to the Sudan, Kano, Lagos and Calabar.

With the end of World War II, coupled with contemporary need of easy accessibility to the colonies of British authority, (Nigeria, Ghana (Gold Coast), Sierra Leone and the Gambia), it thus became a necessity to connect these countries together through the establishment of a regional airline known as West African Airways Corporation (WAAC) which was established through Articles 77 and 79 of the Chicago Convention of 1944. This led to a considerable increase in aviation activities in Nigeria, thereby creating the need for aerodromes. This was also coupled with the Imperial Airways' regular flight of passengers and airmails between the United Kingdom and Nigeria in 1935.

By 1935, the Air Ministry in London sent a delegation to Nigeria to carry out a survey on probable geographical locations that could be used as landing grounds. Geographical locations like Lagos, Kano, Kaduna, Minna, Maiduguri and Oshogbo were thus chosen. Invariably, this can be seen as the beginning of airports development in Nigeria.

Apart from the reasons of effective administrative control of Nigeria's geographical land area and spread of missionary work which prompted the colonial administrators to give prominence to landing grounds/airfields, Iyayi (2005) indicated that there was also the need for more and improved airfields as back-ups for the effective prosecution of the World War II (from 1939-1945).

With the World War II over, the RAF and the US Air force which joined the RAF on the Nigerian route due to its (Nigerian airspace) strategic importance withdrew their operations. The remnants of civil aviation administration were therefore transferred to the Public Works Department (PWD) which applied the British Air Navigation Order (ANO) as the legislative instrument to maintaining the aerodromes. The department of Post and Telegraphs (P & T), using obsolete equipment left over from the war, provided radio services (NAMA 2002; FMA 2001). Noticing the inadequacies in Nigeria Civil Aviation coupled with the fact that the financial cost implication of World War II on their economic capacity, the colonial government appointed Squadron Leader H.C. Brilliant as the controller of civil aviation for the entire West Africa in 1948, though with only advisory powers. But in 1950, another Briton Wing Commander E.H. Coleman was appointed to replace S/L H.C. Brilliant. He was given an executive power to establish the first civil aviation administration in Nigeria (NAMA 2002).

Nigerian independence of October 1960 brought in its wake the eradication of colonial and imperial vestiges which in turn led to the withdrawal of the British administrative control of Nigeria's civil aviation administration. It was at this point of total vacuum in Nigeria's civil aviation administration and development that the government of the Federal Republic of Nigeria saw the strategic importance of the transport sector to all other sectors of the economy, a need that is far different from the recognized needs of the colonial master.

The first National Development Plan (1962 – 1968) though has as its goal on transport as "economic efficiency and coordinated transport", did very little to airport development

when compared to other sectors within the transport industry. Emphasis was laid mainly on Lagos, Kano and Port Harcourt airports.

The runway of Lagos airport was lengthened from 7.600ft to 10,000ft (19,000m to 25,000m) to allow for operational efficiency and removal of weight limitations. The airport terminal was also reconstructed to accommodate increase in international traffic. Kano airport runway was to be extended for reasons of defense and as a possible alternative airport to that of Lagos. Also considered was the airstrip of Port Harcourt which was lengthened to 7.500ft (18,750m) in order to allow for expected international traffic increase.

The establishment of the first Ministry of Aviation in 1964 marked the beginning of control of aviation industry by Nigerians, Dr. K.O. Mbadiwe was then appointed as the Minister. This Ministry was responsible for the development of airports, management of airspace and maintenance of relationship with International Civil Aviation Organisation (ICAO). The Ministry was also to incorporate the Civil Aviation Department (CAD) which functioned partly as executive and partly as regulatory. It functioned as executive in terms of provision of aeronautic communication, navigation and landing facilities, aeronautic information services, air traffic control as well as search and rescue. The regulatory functions included, licensing of aerodromes, calibration of facilities, certification of aircraft, licensing of aircrew, issuance and renewal of operating licenses and the monitoring and investigation of aviation hazards. All these facilities and services were expected to conform to international standards and recommended practices of ICAO which the Federal Government of Nigeria was obliged to uphold as a member.

The policy goal of the Second National Development Plan (1970 – 1974) was a post war reconciliatory plan "to bind the component regions in the country together". This was to the extent that the civil war adversely affected civil aviation facilities in three major areas:

(a) some of the airports were hastily extended for military use;
(b) there was direct destruction of airport buildings and installations as these constituted targets for aerial strikes; and
(c) due to lack of proper maintenance during the war years, a good number of airports and landing strips had deteriorated to dangerous levels. (2nd National Development Plan)

Drawing attention to these problems facing the aviation sub sector, the plan noted that the aviation sub-sector was one of the areas in which, both in financial and physical terms, expenditures fell far short of expectations and actual requirements. It noted that the country's airports in runway length and instrumentation fell far below international standards (Transport-Aviation & Tourism 1988 & Uwadiae, 2005)

In addressing these problems, the Government, therefore launched the Aerodrome Development Programme in the Second National Development Plan. There was also the plan to construct an ultra modern international airport at the Old Ikeja airport with the setting up of an autonomous organization to be known as the Lagos International Airport Authority responsible to the Ministry of Transport. The Government in 1971 therefore, commissioned a Dutch firm of management consultant known as Borenschot-Moret-Bosboom (BMB) to conduct a study of the proposed Lagos International Airport Authority with the following terms of reference.

(i) to appraise the existing airport organizational structure, personnel and operations,

(ii) to recommend the form of autonomous organization best suited to Nigeria's needs for a new Airport Authority with full powers to operate and maintain the new international airport,

(iii) to recommend the powers and responsibilities to be vested in the Airport Authority.

(iv) to examine the relations between the autonomous Airport Authority and the Minister of Transport and between this Authority and the organization to be established to manage and operate other commercial airport of Nigeria.

(v) to identify the specialized personnel that the autonomous Airport Authority would require and

(vi) to recommend a detailed, phased programme of training in Nigeria and abroad of qualified Nigerians that would eventually take over the operation of the Airports Authority not later than 1975. (Transport-Aviation & Tourism 1988)

In their report, submitted in 1972, the management consultant found out that the level of aviation activities in the country had expanded beyond the scope of the existing

arrangement. It thus recommended the establishment of an autonomous statutory corporation whose operation would be nationwide in scope rather than that which was limited to the proposed Ikeja International Airport (Transport-Aviation & Tourism 1988).

By 1973, the Federal government found out that the then Ministry of Civil Aviation which was the custodian of Nigerian Airports could not cope further with the increasing air traffic situation. This situation was also enmeshed with inadequate and obsolete airport facilities, obvious enough to give the Federal Government of Nigeria serious concern for a comprehensive intervention.

This great concern made the Government to accept the recommendations of the management consultants and started what later became the Nigerian Airports Authority (NAA) in 1973 (with a management team from Borenschot-Moret-Bosboom) under the Federal Ministry of Transport and Civil Aviation (Transport-Aviation & Tourism 1988, NAMA 2002, Uwadiae 2005).

What was later known as the Nigerian Airports Authority effectively came into operation through Decree (Act) No. 45 of 1976 during the execution of the Third National Development Plan (1975-1980). Under this decree, the Nigerian Airports Authority was empowered to function as follows:

(i) to develop and maintain at airports, all necessary services and facilities for the safe operations of aircraft, excluding navigational aids, telecommunication facilities and air traffic control services.

(ii) to provide accommodation and other facilities for the effective handling of passengers and freight.

(iii) to provide and develop facilities for surface transportation within airports.

(iv) to carryout at airports, either directly or by an agent or in partnership with another such economic activities as are relevant to air transport operations and

(v) generally, to create conditions for the development, in the most economic and efficient manner, of air transport and the services connected with it.

However, the Nigerian Airports Authority began its operations in July 1978 when the first Board of Directors was inaugurated. There were only five divisions then within the Authority namely: Technical Development, Personnel, Commercial, Finance and Operations. Operational activities which began at the authority marked a giant stride in Nigerian airport development. This is to the extent that, the airports which were hitherto being controlled, managed and maintained by foreign expatriates were now managed by Nigerians.

The Fourth National Development Plan of 1981 – 1985 thus provided and mandated the Airport Authority to develop the capacity to maintain all facilities and equipment of the Nigerian airports to full international standards on a permanent basis. The Plan, therefore made available the sum of three hundred and seventy-six million naira (N376m) only for the Authority to execute all its programmes.

This sum was inclusive of the two hundred and fifty million Naira (N250m) only allocated to complete the fifteen medium to large international standard civil airports to be constructed during the third National Development Plan period. The airports include among others: Lagos, Owerri, Jos, Ajaokuta, Akure, Minna, Onitsha, Ilorin, Bauchi, Enugu, Kaduna, Katsina, Gusan, Makurdi and Abeokuta. Though, out of all these, those of Abeokuta, Gusau and Ajaokuta were yet to be implemented.

A thorough analysis of these Development Plans indicated that Government realization of importance and relevance of efficient air transport system started during the Third National Development period. This was demonstrated through its commitment to aerodrome development program coupled with the size of the air transport investment during the plan period in terms of construction of fifteen civil airports of medium to large international standards.

Another major implication of this development plan was the observed increase in aviation activities in Nigeria. This can be viewed from the rapid increase in the linkages among the various airports as shown from Figures 4.1 to 4.3. By 1984 during this plan period, the aircraft routes within the Nigerian air space have nearly quadrupled when Figures 4.1 and 4.2 were compared. While by 2007 as indicated in Figure 4.3, the aircraft routes did not only increase but also, it was observed that the airports in Nigeria increased from 14 as it were in 1984 to 21.

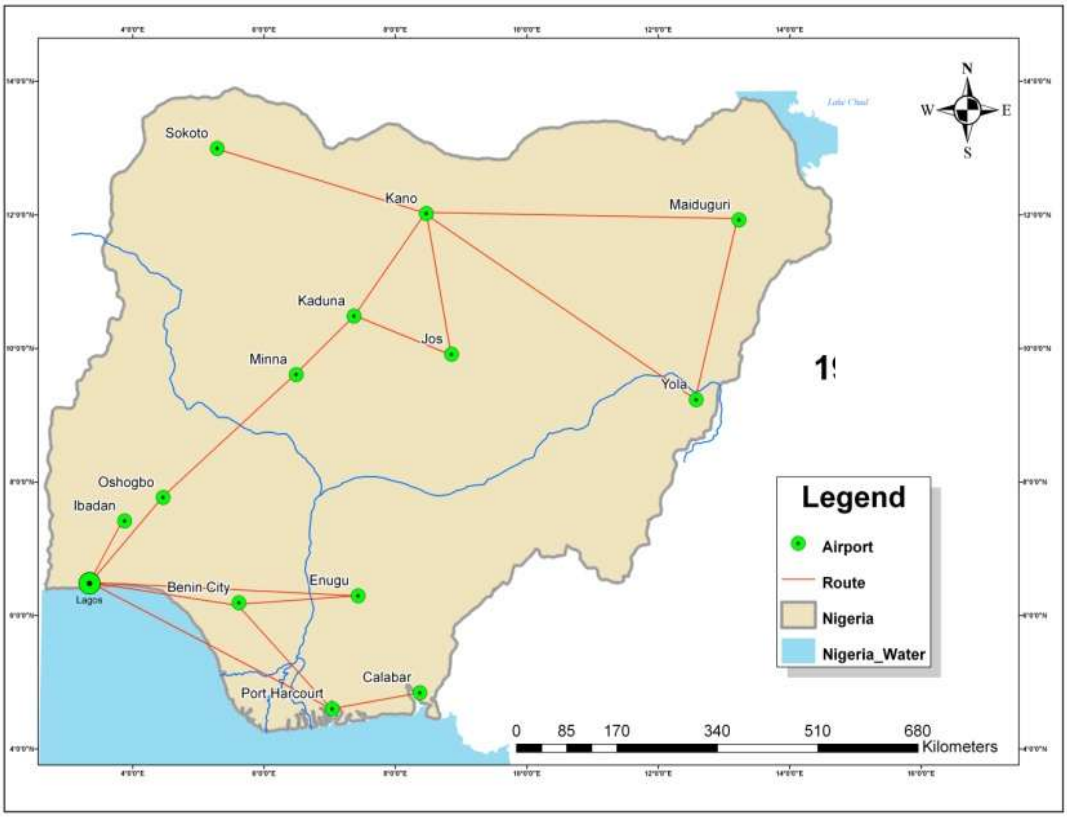


Figure 4.1: Aircraft routes within the Nigerian Airspace in 1975
Sources: Filani, 1975

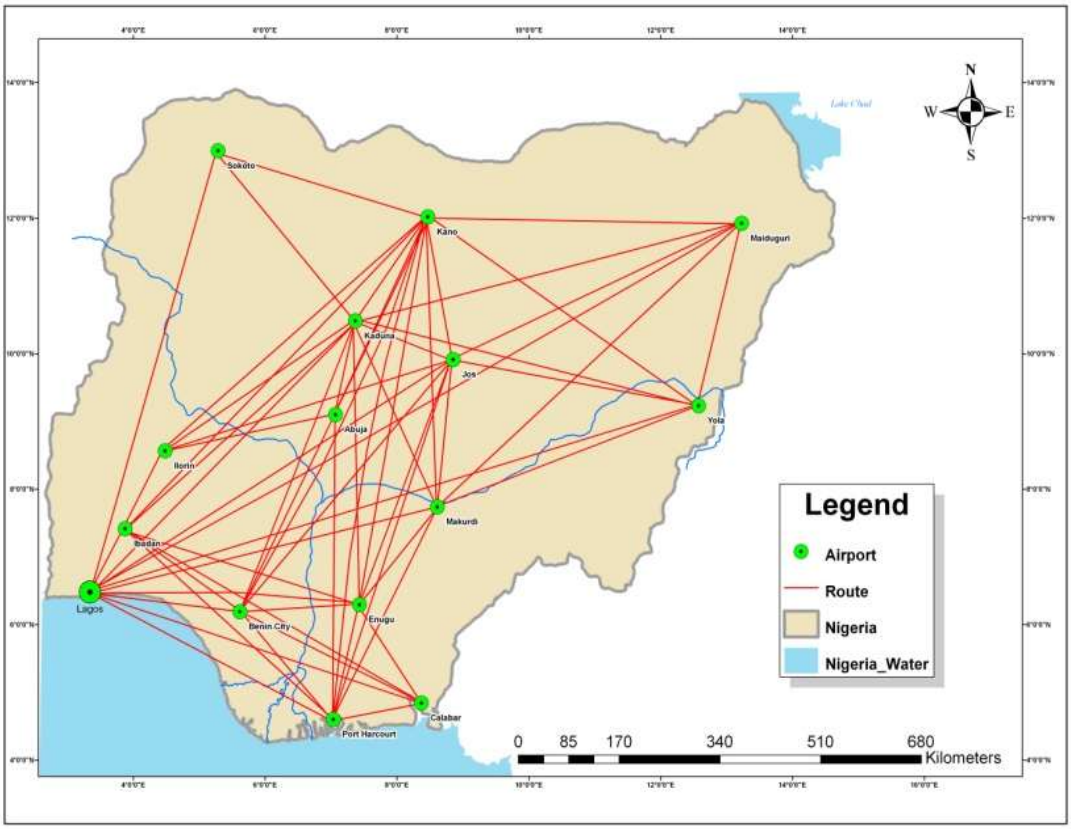


Figure 4.2: Aircraft routes within the Nigerian Airspace in 1984
Sources: Akpoghomeh, 1984

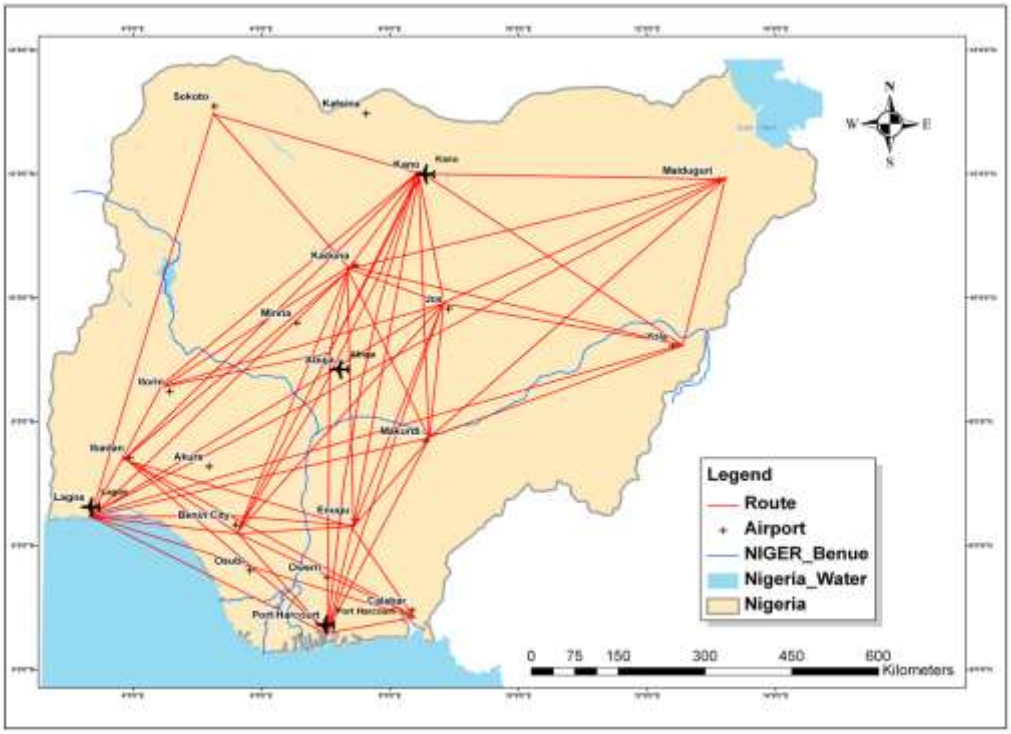


Figure 4.3: Aircraft routes within the Nigerian Airspace in 2007
Source: Author, 2007 (Adapted from N.C.A.A. records).

After the Fourth National Management Plan, there was no significant event recorded as regards airport development in Nigeria until 1989 when the first Civil Aviation Policy which gave birth to Federal Civil Aviation Authority (F.C.A.A.) was formally documented. Although the F.C.A.A. effectively took off in March 1989 when Air Commodore Kola Falope (Rtd) was appointed as its pioneer Managing Director, the enabling Act that created it was not promulgated until 1990 through the Federal Government Extra-Ordinary Gazette No. 21, vol. 77 of the 11th April, 1990 (FMA (2001), NAMA 2002).

The Extra-Ordinary Gazette which created Federal Civil Aviation Authority equally created four main Directorates within the Authority namely – Safety Services, National Air Traffic Services, Corporate Affairs and Finance and Administration. Its responsibilities were to be safety and economic regulation of the industry as well as the provision of air traffic services, aeronautical information services and aero-telecommunication services. (FMA 2001, NAMA 2002, Transport Aviation & Tourism 1988).

The Aviation Reforms of 1995, however, scrapped the Federal Civil Aviation Authority (FCAA) and realigned some of its functions with those of the Ministry of Aviation and Nigeria Airports Authority (NAA). The realignment of functions led to the establishment of the Directorate of Safety Regulations and Monitoring (DSRAM) and the Directorate of Economic Regulation and Monitoring (DERAM) in the Aviation Ministry and the creation of the Federal Airports Authority of Nigeria (FAAN) as a parastatal of the Ministry. The Authority (FAAN), at the wake of this reform absorbed both the all important Directorates of National Air Traffic Services (NATS) and Aero Telecoms of the defunct Federal Civil Aviation Authority.

The 1995 Aviation Reform created a structure that turned out to be at variance with the approved Aviation Policy as well as the recommendation of the International Civil Aviation Organisation (ICAO) and other international organizations. This situation is coupled with some developments in the domestic and international aviation such as the increasing activities of Handling Companies, Cargo Consolidators, Tour Organisers and the implementation of a new African Air Transport Policy Yamoussoukro Declaration (FMA 2001).

Additionally, the task given to Federal Airports Authority of Nigeria (FAAN) through the Civil Aviation Reform of 1995 was too enormous that the needs of Nigerian airspace could not be appropriately and effectively harnessed. Emphasis was placed on airports development and maintenance to the detriment of airspace infrastructure. This led to the safety of the airspace being called to question. For example, there was no life cycle support for existing equipment nor was there a strategy for the introduction of new Air Traffic Services (A.T.S.) technology (NAMA 2002).

It is pertinent to note here that, from this point, the Nigerian civil aviation administration has started the creation of structures which are at variance with world aviation bodies' requirements while at the same time detrimental to safe airport operation and distress response. Some important aviation safety units like the Air Traffic Services (ATS) and communication were merged with FAAN in the wake of the 1995 aviation reforms. The pre-occupation of FAAN thus becomes so enormous to the extent that coordination, management and proficiency of these activities was at the verge of collapse. Aviation standards were jettisoned, airports became so prone to accidents and incidents, unserviceable aircrafts litters major airports and above all, there was nothing like restricted areas.

All these were happening because there was no agency established to act and be responsible for checks on the administration, operation and management of the airports. It was this that ICAO fore saw when in Annex 14 (AERODROMES), it provided for functional separation between aviation service providers and regulators. This was aimed at facilitating and building checks and balances towards promoting and guaranteeing operational safety and quick distress response within the aviation industry. ICAO Annex 14 provided that, each member nation shall establish Civil Aviation Authority which shall have the sole responsibility of licensing and certifying all the existing airports within such country while at the same time, ensure compliance of the sector to ICAO annexes and recommended practices.

In view of all these inadequacies of the Aviation Reforms of 1995, there was invariably the need to review the 1989 Aviation Policy in 1998. This was to the extent that Government had then realized the need to separate the organizations controlling airports and air traffic services. The major highlights of this reviewed policy are as follows:

(i) Creation of Nigeria Civil Aviation Authority (NCAA) out of the Directorate of Safety Regulations and Monitoring (DSRAM) and part of the Directorate of Economic Regulations and Monitoring (DERAM) in the Ministry of Aviation. The Authority is vested with the economic and safety regulation of the industry. It is equally to ensure compliance of the industry with government policies and ICAO standards and recommended practices (SARPs)

(ii) Creation of Nigerian Airspace Management Agency (NAMA) out of the Federal Airports Authority of Nigeria (FAAN) with the aim of providing and be responsible for navigational facilities (en-route and airport), air traffic services, Aeronautical Information Services (ALS) and aeronautical search and rescue.

(iii) Re-focusing of Federal Airports Authority of Nigeria which is now to be responsible for airports development and management.

(iv) The Nigerian College of Aviation Technology (NCAT) was also established to provide various professionalized aviation training for skilled personnel required in the industry.

(v) Establishment of the Nigerian Meteorological Agency (NIMET) which will be responsible for the provision of weather reports to flights through the Air Traffic Services of Nigeria Airspace Management Agency (FMA 2001)

The Policy equally provided that the Federal Ministry of Aviation will be responsible to the Government of the Federal Republic of Nigeria for all matters concerning civil aviation, while, the Ministry will be in charge of policy formulation and overall management of the aviation industry. The Ministry is to have three specialized departments as follows:

(i) Accident Investigation and Prevention Bureau (AIPB)
(ii) Department of Safety and Technical Policy (DSTP) and
(iii) Department of Air Transport Management (DATM)

Though the 1998 reviewed Policy was expected to last for 10 years, it could not, due to some obvious developments in the industry. These include, government privatization and liberalization policies, the unified insurance liability scheme (the 1999 Montreal Convention), the Yamoussoukro Decision of 14th November, 1999, the Banjul Accord

Group Agreement to liberalize air transport in West Africa, the Open Skies agreement that Nigeria signed with the United States of America and the desire of foreign carriers to operate into multiple points in Nigeria (FMA 2001).

Also, while the 1998 civil aviation reforms mandated the Nigeria Civil Aviation Authority to ensure compliance to government policies and international standards by aviation stake holders, it did not provide for which agency or authority between the NCAA and FAAN should be responsible for the certification and licensing of Nigerian airports. This observed situation in the regulation have caused series of rivalry between the two authorities to the extent that it adversely affected the development of aviation in Nigeria especially in the area of infrastructural development and maintenance of the existing ones. For instance, since the MMIA was put in place, about 31yrs ago as a copy of Schiphol Airport, Amsterdam, and no major rehabilitation have been effected on the airport, let alone reconstruction. The implication is that the facilities designed for the aviation activities of the late millennium have not changed shape, even though the time for that has been long overdue. Like wise the other airport. This made the outside world to label Nigerian airports unsafe until recently.

All these led to the review of the 1998 Civil Aviation Policy in July 2001 so as to be able to cope and effectively accommodate the needs and dictates of these contemporary developments in the industry. This is more so with a view to incorporate into this new Policy the contemporary developments in the international and domestic aviation industry.

Notwithstanding, the fact that the first comprehensive Nigeria Civil Aviation Regulation (NCAR) of 2009 was put together by NCAA, (though with the approval of the National Assembly), the concept of functional separation was still missing as it was in the earlier reform. This trend in aviation regulations is inimical to safe operations and distress response within the airport. The rivalry became so intense to the extent that FAAN which is solely responsible for airport development and maintenance is claiming to have certified and licensed all Nigerian airports, the NCAA which is recognized and empowered by ICAO to perform such functions is asserting that, no airport in Nigeria is

certified nor licensed. This was corroborated by the spokesman of NCAA (Adurogboye 2007) and the the Director General of NCAA (Dr. Demurin 2011) when they asserted that 'no airport in Nigeria is certified by the authority'. They added that all the airlines and other aviation stake holders are aware of this. Airlines are therefore expected to operate on what is on ground as the status is known by all stakeholders. Likewise, Virgin Nigeria in 2008 refused to relocate to MMAII because it claimed that the airport was unsafe for its operations. This is more so that an IATA technical mission to the Murtala Mohammed International Airport, Lagos noted that the MMAII Apron is too small for the intended scale of operations. Perhaps if NCAA had been allowed to leave up to its responsibilities, all these inadequacies would not have arisen.

Probably, the spate of incident/accident occurrences with its attendant low level of response can be understood partly in this policy inadequacy. Lines of responsibilities and coordination were not adequately spelt out in the 2009 aviation regulation. For instance, it did not specify which agency will be responsible for licensing and certifying the airports, coordination of emergencies whenever it occurs was not sufficiently outlined. Though, the Nigerian Airspace Management Agency (NAMA) has within it Search and Rescue (SAR) unit, the unit's activities and coordination are still within the ambits of National Emergency Management Agency (NEMA). It did not recognize that aeronautical occurrences are usually on a large scale calamity which needs a proactive response with standardized communication system and dedicated facilities.

Another noticeable feature and bane in the Nigerian Aviation Regulations and reforms over the years is the policy inconsistencies which were seen to have originated out of insincerity of purpose. This assertion can be better understood when viewed in terms of the implication these policy changes has on aviation safety and its compliance with international regulations and recommended practices. Going by the ICAO regulations that each National Civil Aviation authorities should license and certify airports within their countries, and then there is no airport in Nigeria that is licensed. All airports including the four major ones MMIA, Nnamdi Azikwe, Aminu Kano and PH are all operating at the risks of patronizing airlines. This is to the extent that the act setting up the FAAN also gives it the right to certify airports just like the NCAA. The FAAN being the custodian of all the airports in Nigeria thus certified all the airports though this was not acceptable by ICAO when it came to audit Nigerian airports in 2009. Discussions

with a senior official of NCAA indicated that, the category 1 granted to Nigerian airports by ICAO in 2009 can therefore be seen to have political under tone. Since none of these airports is certified nor is there any policy or steps under way to ensure this. Even when ICAO asked for the licenses of the airports, according to the senior official of NCAA discussed with, the DG of NCAA could not provide it. All he could show was the Nigeria Civil Aviation Regulations of 2009 which does not contain regulations as to how airports are to be certified rather dealing with issues of training and airworthiness. In fact, the then late President Yaradua was made to write a letter of undertaken to the then President of USA (President Bush) that the National Assembly will amend NCAR 2009 to correct the airport certification conflict between FAAN & NCAA before the CAT 1 was awarded to Nigeria.

Likewise, the FCAA which was created by an Extra-Ordinary Gazette in 1990, need not to be scrapped by the aviation reforms of 1995 and to now be re-created again as NCAA through another aviation reform in 1998. Similarly, it was misnomer for government to allow virgin Nigerian Airways at its formation stage in September, 2004 to operate all its flights (local, regional and international) from the international wing of the Lagos and Abuja airports (Oluwole, 2008). All over the world, the trend is for domestic airlines to operate from the domestic terminals of any airport. As in the case of Virgin-Nigeria Airways in Nigeria therefore, there is a serious threat to both security and safety at these airports for domestic, regional and other international passengers to mix-up.

4.2 TRENDS OF UTILIZATION OF SELECTED AIRPORTS

Over the years, there has been a tremendous increase in demand for air travel in Nigeria with a corresponding increase in the use of airport facilities. So also has the intensity of land-uses within and around the airports. With respect to facilities, these include those that handle both passengers and cargo movement and the attendant aircraft handling facilities. As shown in Tables 4.1 to 4.3 (see also Figures 4.4 to 4.6), passenger movement, freight movement and aircraft movement witnessed rapid growth due largely to globalization and increase in economic activities with the outside world.

As shown in Table 4.1, there has been a significant upward trend in the number of passengers embarking and disembarking in the selected airports. For instance, from about one million passengers embarking and disembarking respectively in Lagos airport

in 1997, this figure rose to more than 2.5 million respectively in 2006. This significant increment in the trend of passenger movement was also obtainable in Abuja International airport. This situation can be attributed to the fact that both airports serve as political and economic nerve centers of the country. This is to the extent that upsurge in passenger movement is usually experienced especially at Abuja airport during pre and post election years. At the Murtala Mohammed Airport Lagos, yearly increases experienced can be attributed mainly to both globalization and growth in economic activities in the country. While both political and economic activities can best describe the increases in passenger movement at the Mallam Aminu Kano Airport that of Port Harcourt could best be explained with increases in economic activities especially in the oil and gas industry. This becomes more pronounced with the radical reduction in passenger movement in the years 2004-2005 when there was a very serious crisis by the Niger-Delta militants.

With reference to other airports in the country, and as shown in Appendix II, these airports too experienced upward trend in the number of passengers that passed through them between 2002-2005 with a visible reduction in patronage between 2006 & 2007 perhaps, due to the series of serious crashes of Bellview and Sosoliso airlines in 2005. It was only at the airports of Benin, Calabar and Imo that despite the crashes of 2005, reduction in patronage was not witnessed (Appendix II).

With respect to freight movement, a cursory look at Table 4.2 again shows that there was a very significant upward movement in freight especially imports in MMA between 1997 and 2005. From a total of about three million freight in 1997, it increased to almost fifty and half million in 2005, which could be deduced to importation of G.S.M. telecommunication equipments and facilities, importation of election materials and more money being injected into the economy. The only other airport where there was appreciable number of import was in Port Harcourt International airport. But the volume of freights was lower than ten million within the period. However, in 2004, there was a high level of importation through Abuja airport perhaps due to changes in customs importation policies which led to the diversion of importation through Abuja airport. Another reason for this might not be unconnected with the preparation for the All African Games (COJA) in 2005. Table 4.3 which refers to aircraft movement equally depicts increases along the same trend like Tables 4.1 & 4.2.

Though the selected airports of study had been experiencing increases in their operational activities over the years, there had not been a corresponding significant increase or changes in the available operational facilities and equipments. Rather than improving on the available facilities in terms of acquiring more modern ones and making the existing ones serviceable, they become more than ever over stretched and deteriorated due to lack of adequate and necessary maintenance. A good example of this was the thirty years old radar at the Muritala Mohammed Airport Lagos (though a Total Radar Coverage of Nigeria was recently commissioned in October 2010) with its attendant in-effectiveness coupled with the dilapidated landing and weather forecasting facilities that characterize these airports. Also the increases as a consequence put pressure on the available equipment and facilities especially in the area of available space at the tarmac, ramp and terminal building. Aircraft are seen these days roaming over airports especially at Lagos due to insufficient landing facilities. While at the ramp, operational chaos is always the other of the day with operators and airport users scarping for space in the terminal buildings.

Another noticeable effect of increase in airport operational activities is the pressure it exerts on the environment within and around the airport. Within the airport, the airport operators that are springing up have to look for spaces to accommodate their operational demands and dictates. As operational equipment like tractors, aircraft tugs, baggage/cargo containers and push back, among others, are being hazardously parked and arranged on the tarmac by these emerging airport operators, they at the same time put up building structures to accommodate their official activities. All these more often negate the original master plan of these airports.

Additionally, various land use activities have sprang up around the airport over time due to increases in airport activities. These include residential, commercial, artisans and farmers. The effect of this is that, the buffer zone around the airports is reduced and a condition for wild life habituation (like abattoirs, dump/junk sites among others) emerges among others.

The essence of all these is that, while the increases in airport activities and operations with their attendant effect are rapidly growing, the airport authorities have not taken seriously how to control and manage their various effects in their different forms and shapes. This control includes among others, replacement of out dated facilities, adequate

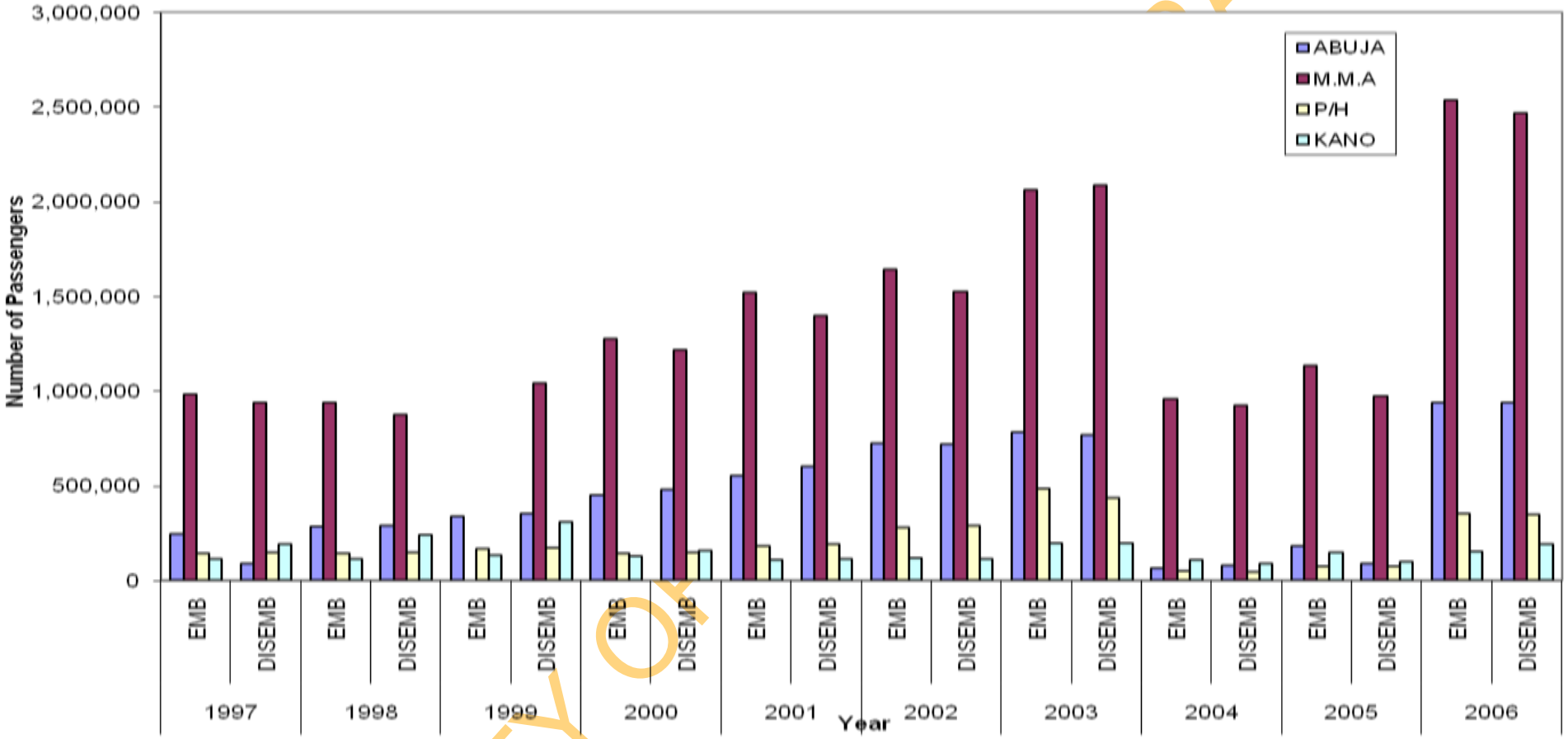
training of staff to cope with contemporary operational demands, proactive planning and projection of airport operational activities, embarking on environmental impact analysis before various developmental projects are executed and adequate comprehensive developmental control of airport surroundings.

Table 4.1: Passenger Movement through Airports (1997 to 2006)

Airports	1997		1998		1999		2000		2001	
	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB
ABUJA	**2,841,922**	**89,627**	**281,726**	**288,678**	**336,681**	**350,784**	**449,888**	**478,251**	**550,897**	**600,659**
M.M.A	**982,546**	**940,440**	**940,006**	**873,425**		**1,042,036**	**1,272,941**	**1,216,249**	**1,517,277**	**1,399,672**
P/H	**143,607**	**148,622**	**142,852**	**145,170**	**165,536**	**172,448**	**139,787**	**144,537**	**180,165**	**188,182**
KANO	**111,133**	**188,638**	**111,682**	**239,700**	**130,262**	**309,169**	**128,160**	**155,342**	**106,674**	**111,474**
Total	**4,079,208**	**1,367,327**	**1,476,266**	**1,546,973**	**632,479**	**1,874,437**	**1,990,776**	**1,994,379**	**2,355,013**	**2,299,987**

Airports	2002		2003		2004		2005		2006	
	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB	EMB	DISEMB
ABUJA	**721,877**	**720,411**	**780,721**	**768,609**	**63,293**	**79,120**	**182,639**	**85,542**	**937,224**	**938,528**
M.M.A	**1,641,556**	**1,526,694**	**2,063,870**	**2,084,937**	**957,564**	**922,559**	**1,132,726**	**969,875**	**2,533,689**	**2,468,386**
P/H	**279,166**	**286,747**	**483,789**	**434,488**	**47,488**	**45,718**	**74,695**	**74,599**	**353,003**	**344,854**
KANO	**116,209**	**113,241**	**193,510**	**195,778**	**108,707**	**89,299**	**144,902**	**95,800**	**151,406**	**190,085**
Total	**2,758,808**	**2,647,093**	**3,521,890**	**3,483,812**	**1,177,052**	**1,136,696**	**1,534,962**	**1,225,816**	**3,975,322**	**3,941,853**

NOTE:
EMB: EMBARKATION
DISEMB : DISEMBARKATION
Source: NCAA Yearbook, 2007



NOTE:
EMB:EMBARKATION
DISEMB : DISEMBARKATION

Figure 4.4 Passenger Movement through Airports (1997-2006)

Table 4.2: Freight Movement through Airports (1997 to 2005)

Airports	1997		1998		1999		2000		2001	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
ABUJA	**35,673**	**65,752**	**10,542**	**163,520**	**157,152**	**253,558**	**94,454**	**118,327**	**136,435**	**248,864**
M.M.A	**2,600,520**	**462,470**	**3,951,124**	**11,305,549**	**5,701,608**	**12,621,944**	**10,413,020**	**17,081,870**	**4,280,761**	**36,023,486**
P/H	**922,135**	**29,763**	**42,463**	**3,549,370**	**120,705**	**2,724,429**	**1,189,450**	**1,803,607**	**637,013**	**1,414,538**
KANO	**766,377**	**1,558,270**	**12,45,792**	**3,319,483**	**1,451,076**	**2,882,408**	**967,355**	**1,736,184**	**984,156**	**6,566,846**
Total	**4,324,705**	**2,116,255**	**5,249,921**	**18,337,922**	**7,394,541**	**18,482,339**	**12,664,279**	**20,739,988**	**6,038,365**	**44,253,737**

Airports	2002		2003		2004		2005	
	Export	Import	Export	Import	Export	Import	Export	Import
ABUJA	**99,990**	**2,172,313**	**297,931**	**2,639,754**	**162,686**	**2.355,173**	**473,146**	**1,737,651**
M.M.A	**5,915,810**	**38,967,552**	**6,379,977**	**43,009,617**	**5,205,022**	**43,170,924**	**19,501,130**	**54,931,532**
P/H	**74,860**	**3,373,893**	**538,684**	**7,440,846**	**634,541**	**5,860,176**	**Nil**	**5,355,223**
KANO	**685,969**	**615,505**	**244,643**	**318,839**	**124,303**	**425,770**	**1,247,899**	**728,811**
Total	**6,776,629**	**45,129,263**	**7,461,235**	**53,409,056**	**6,126,552**	**51,812,043**	**21,222,175**	**62,753,217**

Source: NCAA Yearbook, 2006

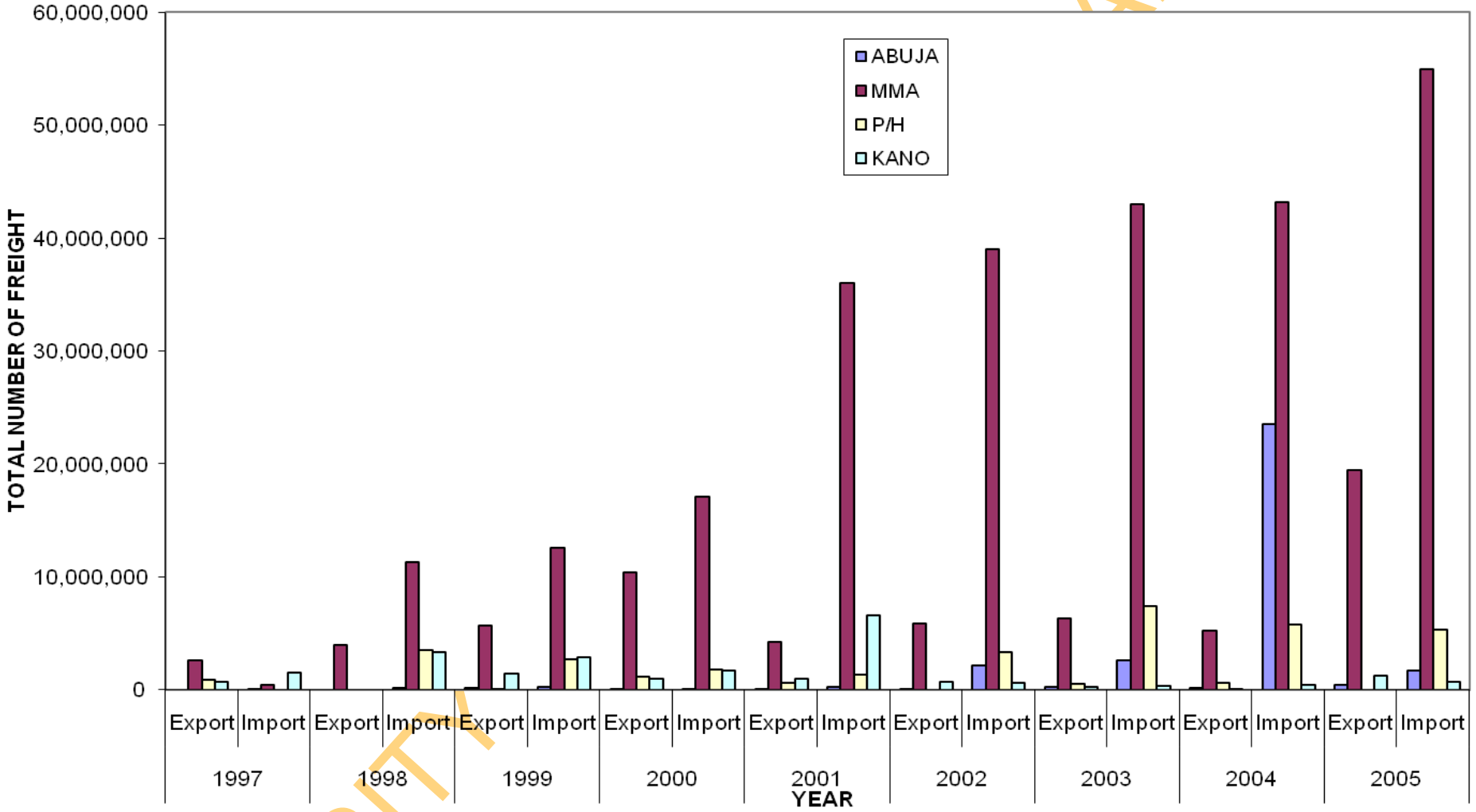


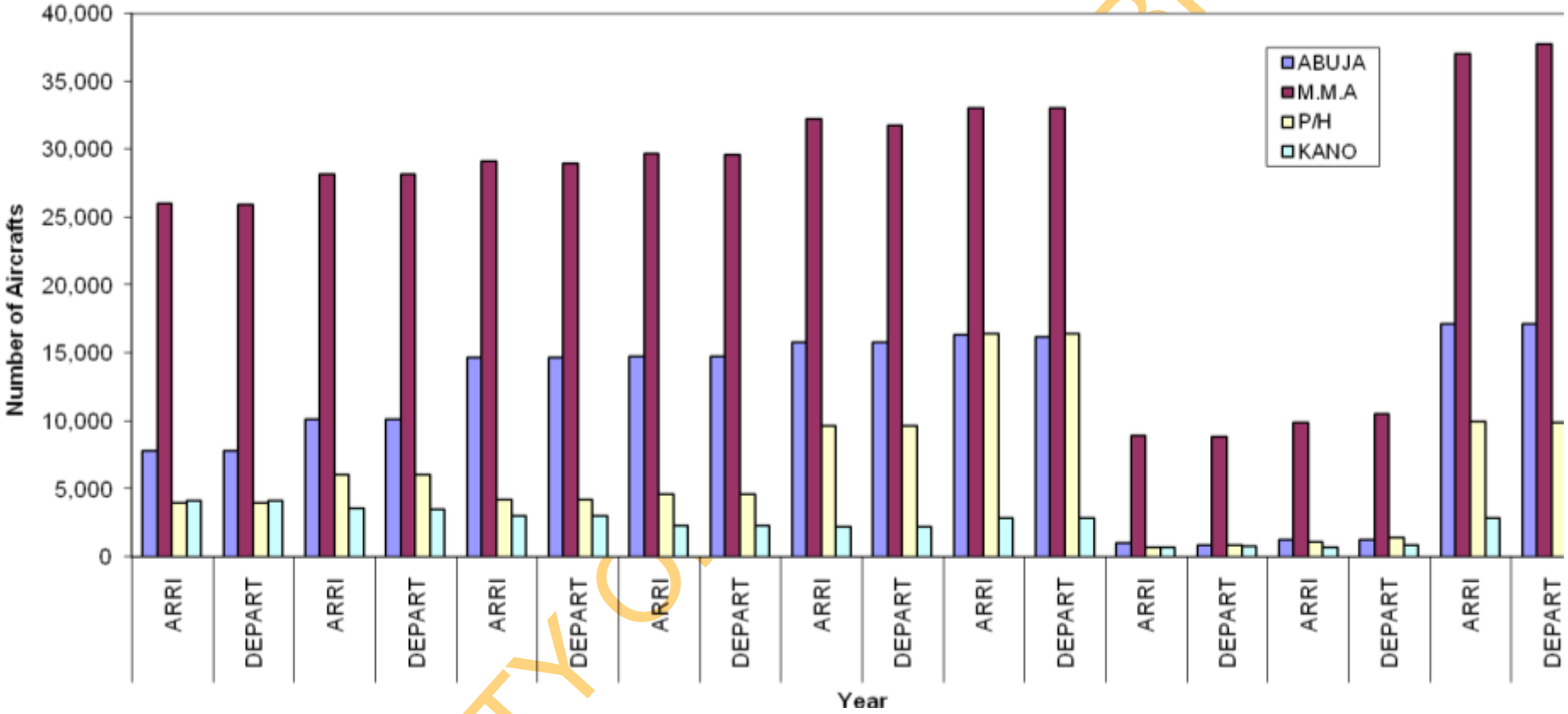
Figure 4.5: Freight Movement through Airports (1997-2005)

Table 4.3: Aircraft Movement through Airports (1998 to 2006)

Airports	1998		1999		2000		2001		2002	
	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE
ABUJA	7,837	7,837	10,128	10,130	14,677	14,677	14,740	14,740	15,839	15,836
M.M.A	26,033	25,919	28,162	28,148	29,111	2,199,021	29,694	29,643	32,281	31,754
P/H	3,996	3,984	6,102	6,079	4,268	4,258	4,625	4,663	9,700	9,681
KANO	4,140	4,116	3,565	3,507	3,071	3,061	2,290	2,285	2,231	2,238
Total	42,006	41,856	47,957	47,864	51,127	2,221,017	51,349	51,331	60,051	59,509

Airports	2003		2004		2005		2006	
	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE	ARRIVAL	DEPARTURE
ABUJA	16,341	16,242	1,039	912	1,271	1,288	17,173	17,184
M.M.A	33,064	33,043	8,927	8,858	9,912	10,529	37,084	37,792
P/H	16,476	16,470	731	874	1,112	1,419	9,967	9,880
KANO	2,897	2,887	749	838	732	899	2,851	2,854
Total	68,778	68,642	11,446	11,482	13,027	14,135	67,075	67,710

Source: NCAA Yearbook, 2007



NOTE:

ARRI: ARRIVAL
DEPART: DEPARTURE

Figure 4.6: Aircraft Movements through Airports (1998-2006)

4.3 LAND USE ANALYSIS OF SELECTED AIRPORTS

This section analyses the growth in the built up areas around the selected airports between 1984 and 2004 (twenty years interval) as well as the analysis of the pattern of land uses within a five kilometer radius around the airports using geo-referenced satellite imageries. The growth is measured in form of percentages between the selected years. In addition, the detailed land use types around the selected airports like commercial, residential and water bodies are shown in detailed maps constructed also from satellite imageries. This analysis is supported by graphical analysis in the form of charts.

For the Lagos airport, the changes that were tracked are vegetation and built up areas during the years under consideration. For vegetation, the percentage change between 1984 and 2004 was -59.60%, implying a considerable reduction in the areas covered by vegetation (Table 4.4). On the other hand, there was 33.49% change in the built up areas around the airport, indicating an increase in the areas covered by buildings and related land uses (Figures 4.7, 4.8 and 4.11).

For Kano airport, the changes that were tracked include vegetation, water bodies and built up areas. With respect to vegetation and water, there were negative changes (-11.96% and -95.05% respectively) indicating a considerable reduction in both landuse types over the given period (Table 4.4). This is not the situation with the size of the built up areas which showed a significant increment over those years (46.10%) (Figures 4.9, 4.10 and 4.12).

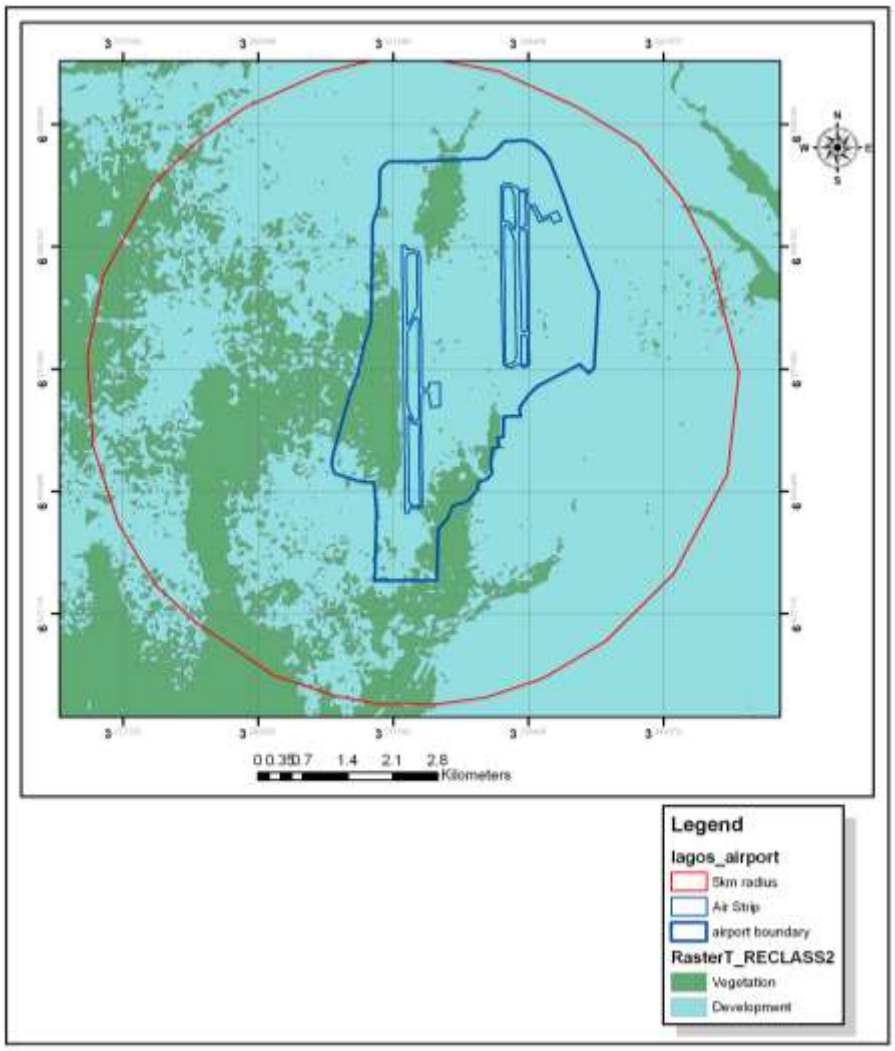


Figure 4.7: Land Use around Lagos Airport-1984
Source: LANSAT, 2007

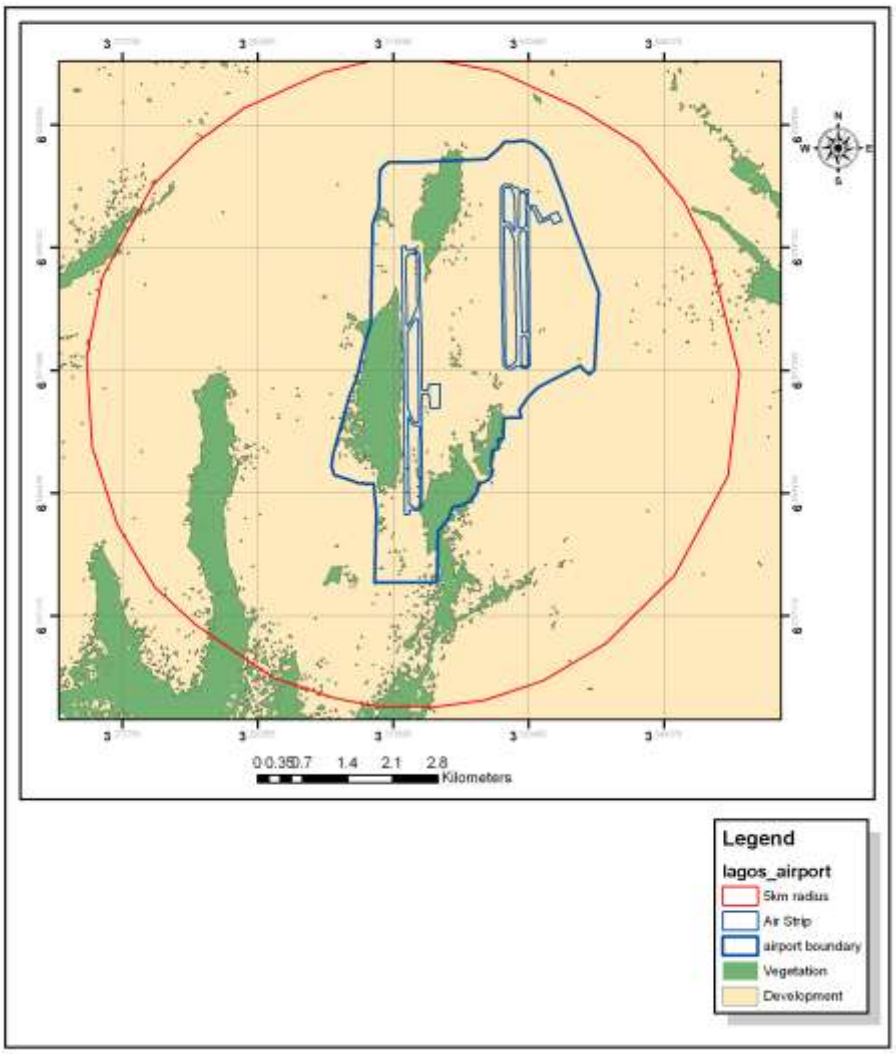


Figure 4.8: Land Use around Lagos Airport-2004
Source: LANSAT, 2007

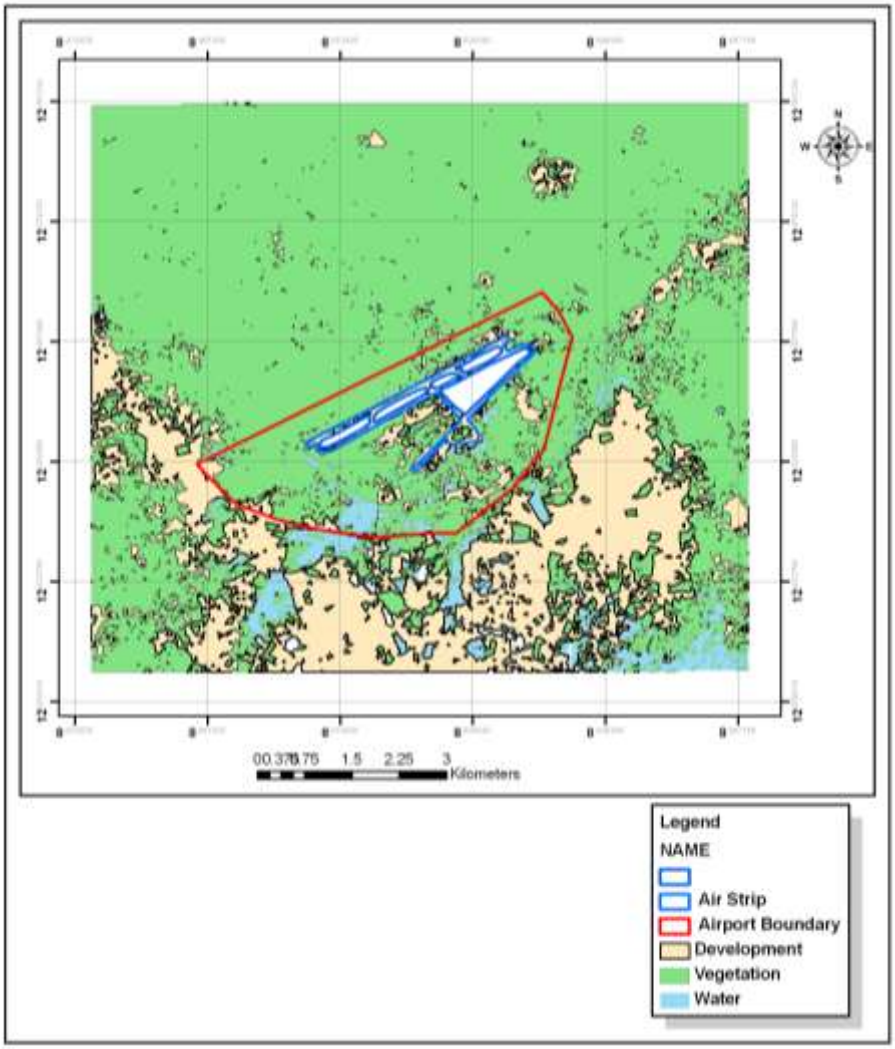


Figure 4.9: Land Use Around Kano Airport-1984
Source: LANSAT, 2007

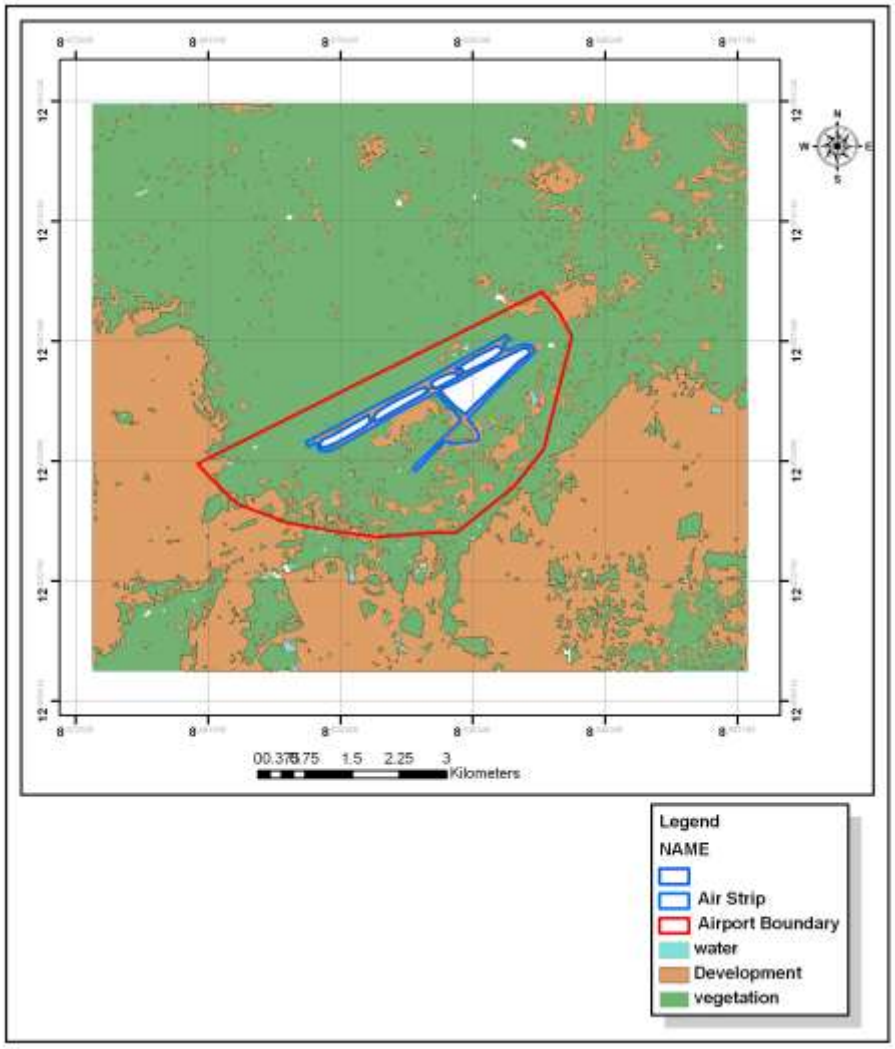


Figure 4.10: Land Use Around Kano Airport-2004
Source: LANSAT, 2007

Table: 4.4: Landuse Growth (km) in Lagos and Kano (1984-2004)

Lagos	**1984**	**2004**	
Vegetation	0.0063224	0.0025543	-59.60
Buildings	0.0112508	0.0150189	33.49
Kano			
Buildings	0.0020028	0.002927	46.10
Vegetation	0.0052655	0.0046355	-11.96
Water	0.0002907	0.0000231	-92.05

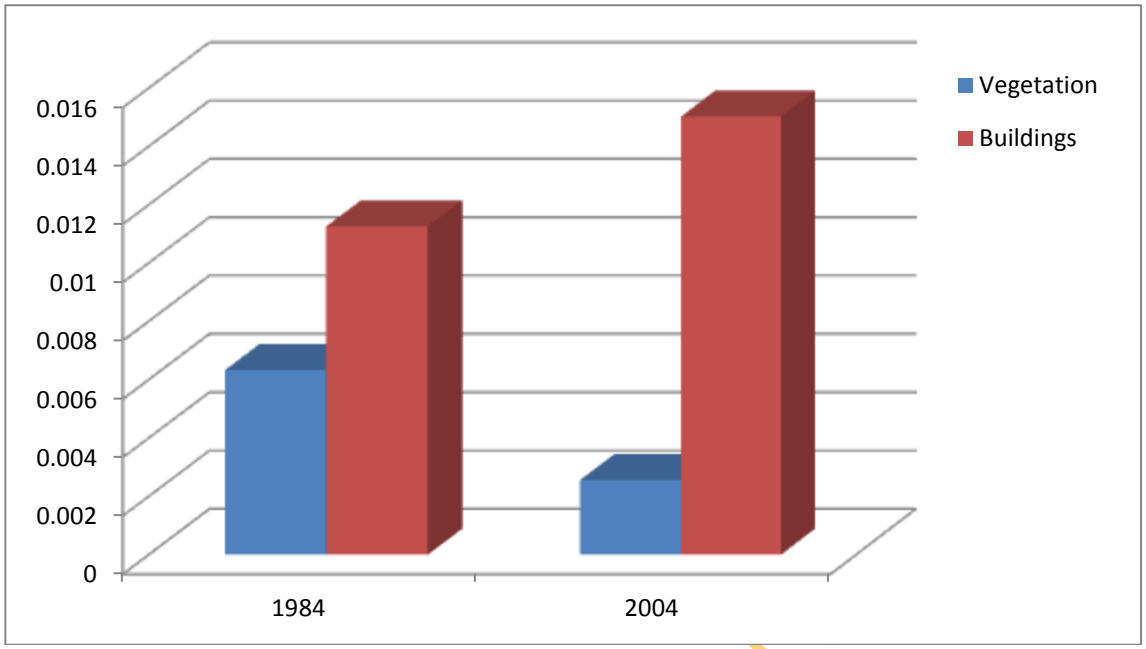


Figure 4.11: Landuse Growth (km) in Lagos Airport, 1984 – 2004
Source: Author's Analysis of Landuse map 2007

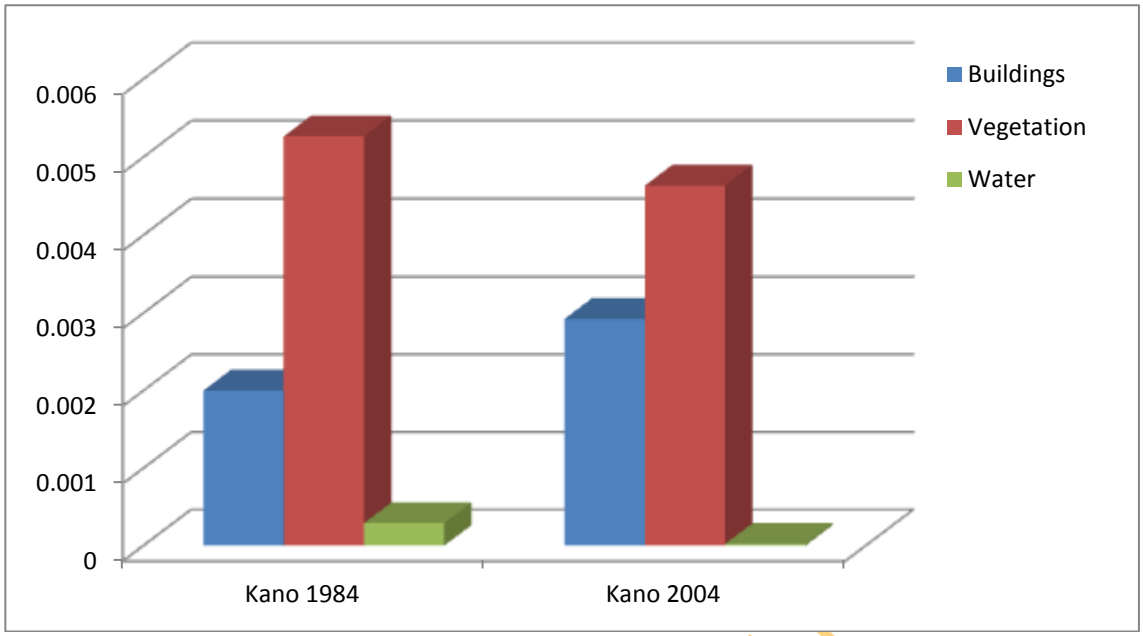


Figure 4.12 : Landuse Growth (km) in Kano Airport, 1984 – 2004
Source: Author's Analysis of Landuse map 2007

The analyses show that there has been a significant increase in the size of the built up areas in both Lagos and Kano with its attendant implications for airport operation and safety. The increase in the size of the built up area if not checked can lead to encroachment on airport buffer zone with a number of consequences including obstructions on airport runway as it happened in Port Harcourt airport when a cow strayed into the runway. This has also led to distortion of the natural habitation of the buffer zone vegetation around the selected airports. Consequently the wild animals within this vegetation would always want to find their ways towards the airport thereby disrupting the operations. There has been recorded incidences of tortoise, crocodiles, monkeys and snakes, among others causing avoidable disruption to operations within the airports.

Furthermore, increase in the built up areas which is a concomitant effect of rapid urbanization has consequently increase population growth around the airports. The corollary of this is a threat to airport operations through the increase in waste generation and disposal, construction activities and development of abattoirs all of which are attractions to birds' habitation. The direct evidence of this has been the series of recorded bird strikes incidences in recent times, sometimes leading to serious damages to aircrafts.

Further detailed analysis of the land use types around the selected airports was made through a geo-referenced satellite imagery which was captured in 2005 in order to show the varieties in different land use types with particular reference to residential, commercial, water bodies and vegetation because of the effect they have on airport operations. The mapping and graph results are as presented in figures 4.13 to 4.24 while the percentage allocations to different uses are presented in tables 4.5 to 4.8.

Within and around the Lagos airport, the built up areas show that those of residential, industrial, commercial and administration occupy 29.99%, 0.44%, 1.23% and 2.92% respectively. The built up areas around the Lagos airport has increased by 33.49% from 1984 to 2004 (Table 4.4). The water bodies which include marshy areas and canal represent 15.98% and 0.25% respectively.

For Kano airport the residential area occupies 16.78% of the land use, commercial (11.04%), vegetation (47.56%) and open space (4.71%). Thus in Kano airport despite

reduction in vegetation as indicated in land use growth on figure 4.12, the percentage of vegetation is still high (Table 4.4) and good enough for safe airport operations.

The Abuja airport has 1.54% as residential though most residential buildings around the airport are also used as shops; open space takes 1.3% and vegetation is 58.36%. This distribution is due to the fact that the Abuja airport is still far from the main town as shown on figure 1.5.

For Port Harcourt airport, residential land-use occupies 19.65% around the airport while vegetation occupies 10.69%, marshy, 4.15% and open space, 37.99%. That open space has a higher percentage around the airport which can lead to further increase in residential and commercial development in the future and which can subsequently impair safe airport operations.

The implication of the above land use analyses around the selected airports is that, without adequate and effective control of land use around them, all available land masses can be encroached upon by those living and working around the airports. This will eventually have a negative effect on safe airport operations. For instance, over the years, there has been series of land use developments around Lagos airport which are threatening safe airport operations. Of greater concern are the activities of the peasant farmers who always engage in bush burning and hunting activities around the air fields without due consideration to the operational equipment stationed on this fields. If this trend around Kano airport is not controlled, it can lead to the chaotic situation which is being experienced around Lagos airport at present.

Figure 4.13: Ikeja Airport Satellite Imagery (2005)

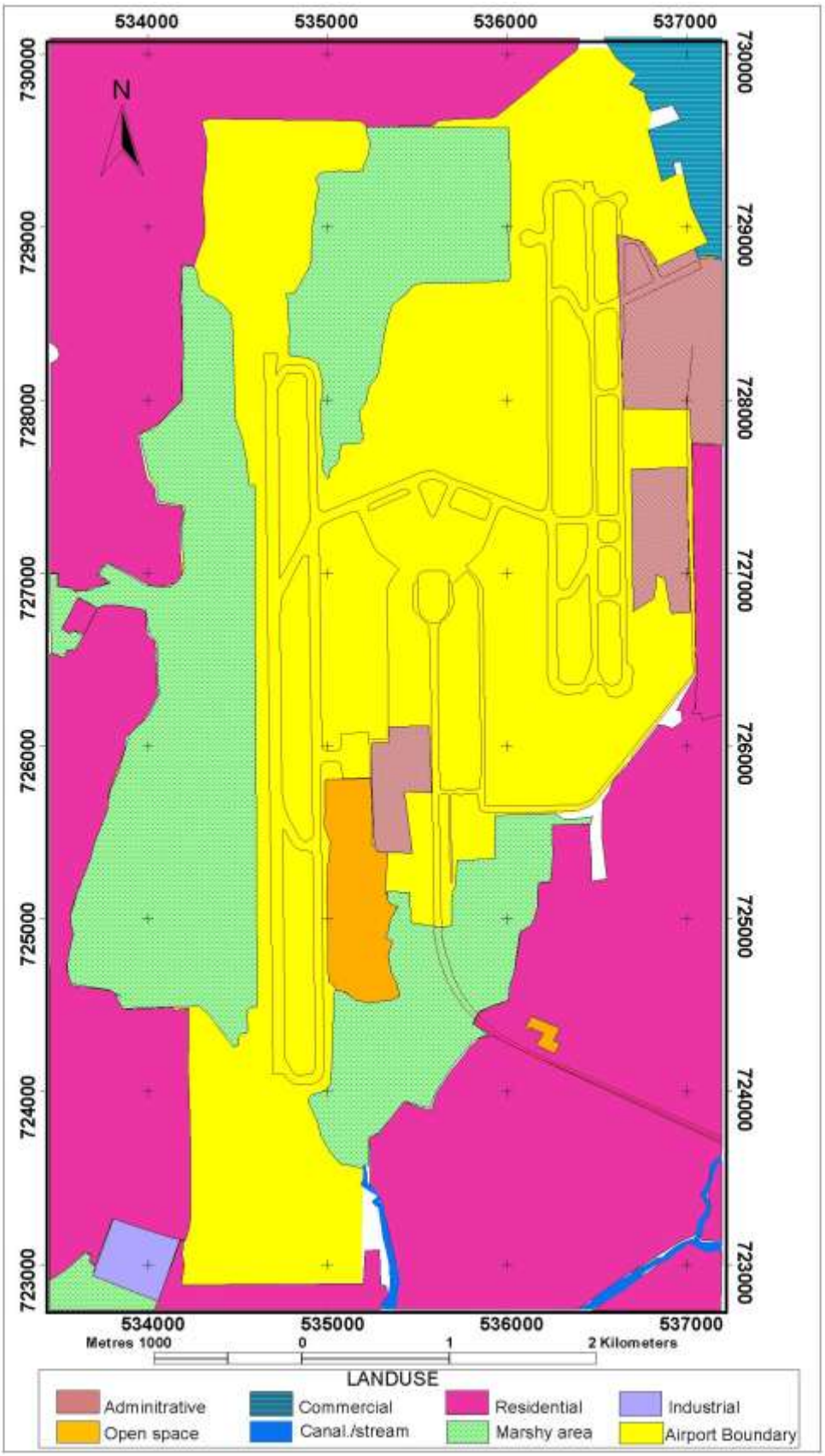


Figure 4.14: Ikeja Airport Satellite Imagery Land use Analysis Map (2005)

Table 4.5 : Ikeja Airport Satellite Imagery Land use Analysis (2005)

Landuse Type	Area (km^2)	Percentage
Residential	9.53	29.99
Open Space	0.41	1.26
Marshy	5.10	15.98
Industrial	0.14	0.44
Commercial	0.40	1.23
Canal	0.08	0.25
Administration	0.94	2.92
Airport Area	13.37	48.16
Total	**31.97**	**100.0**

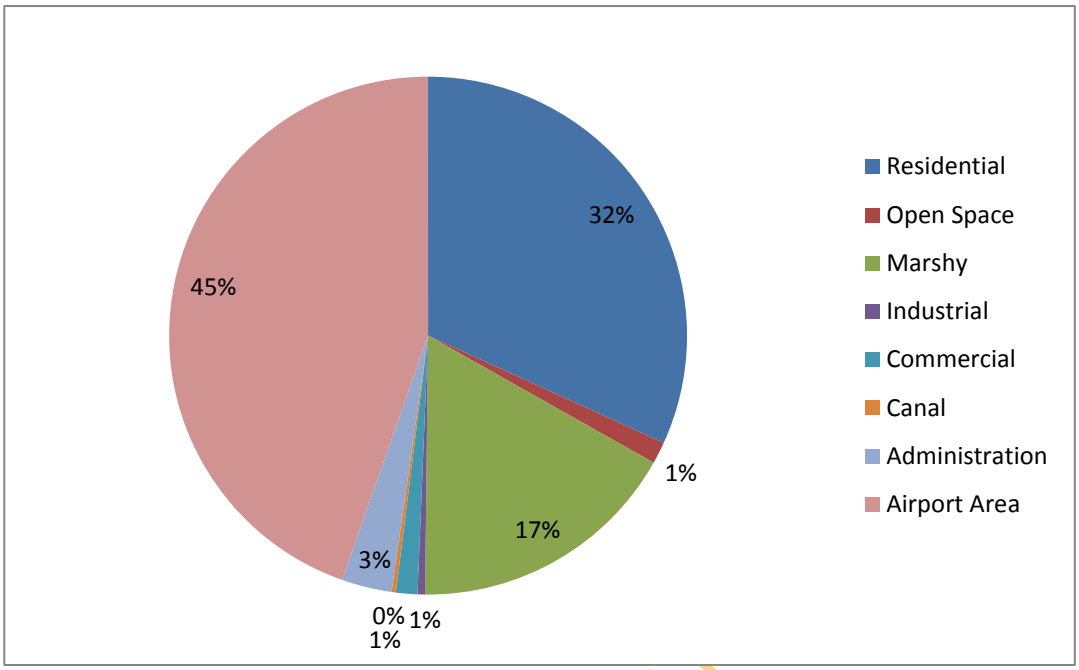


Figure 4.15: Percentage of Land use Area Distribution of Ikeja Airport (2005)

Figure 4.16: Kano Airport Satellite Imagery (2005)

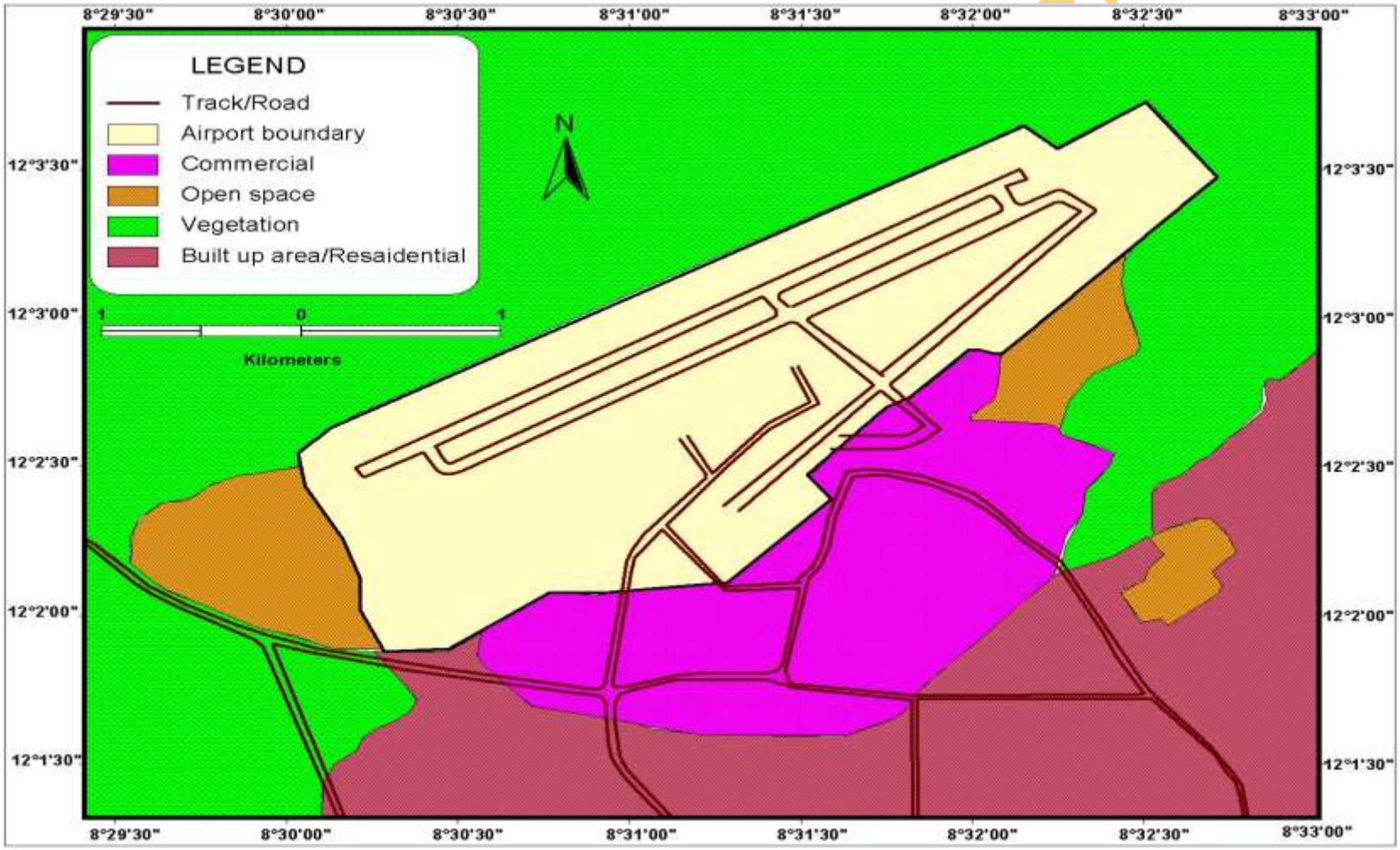


Figure 4.17: Kano Airport Satellite Imagery Land use Analysis Map (2005)

Table 4.6: Kano Airport Satellite Imagery Land use Analysis (2005)

Landuse Type	Area (km^2)	Percentage
Airport Area	6.38	19.9
Buildup Area	5.38	16.78
Commercial	3.54	11.04
Open Space	1.51	4.71
Vegetation	15.25	47.56
Total	**32.06**	**100.0**

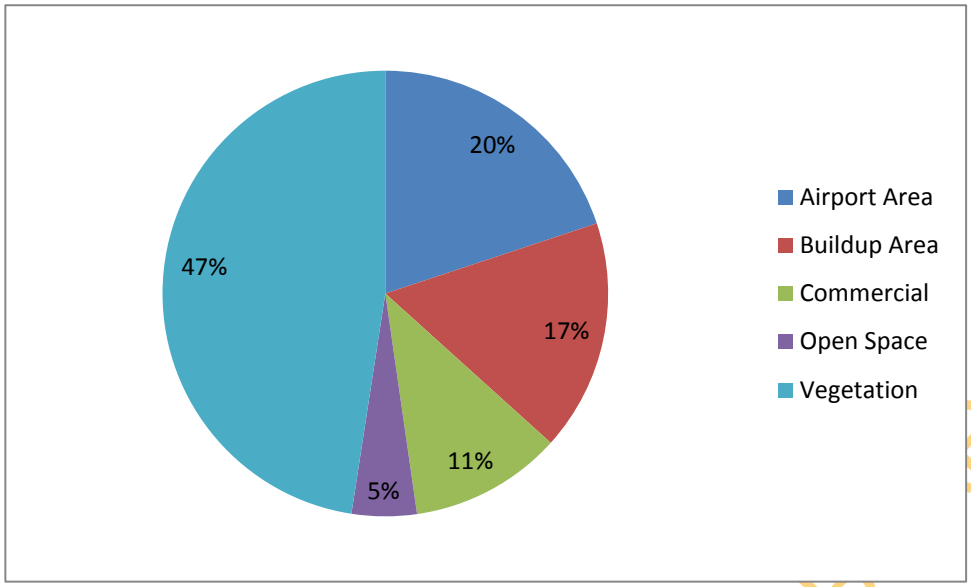


Figure 4.18: Percentage of Land use Area Distribution of Kano Airport (2005)

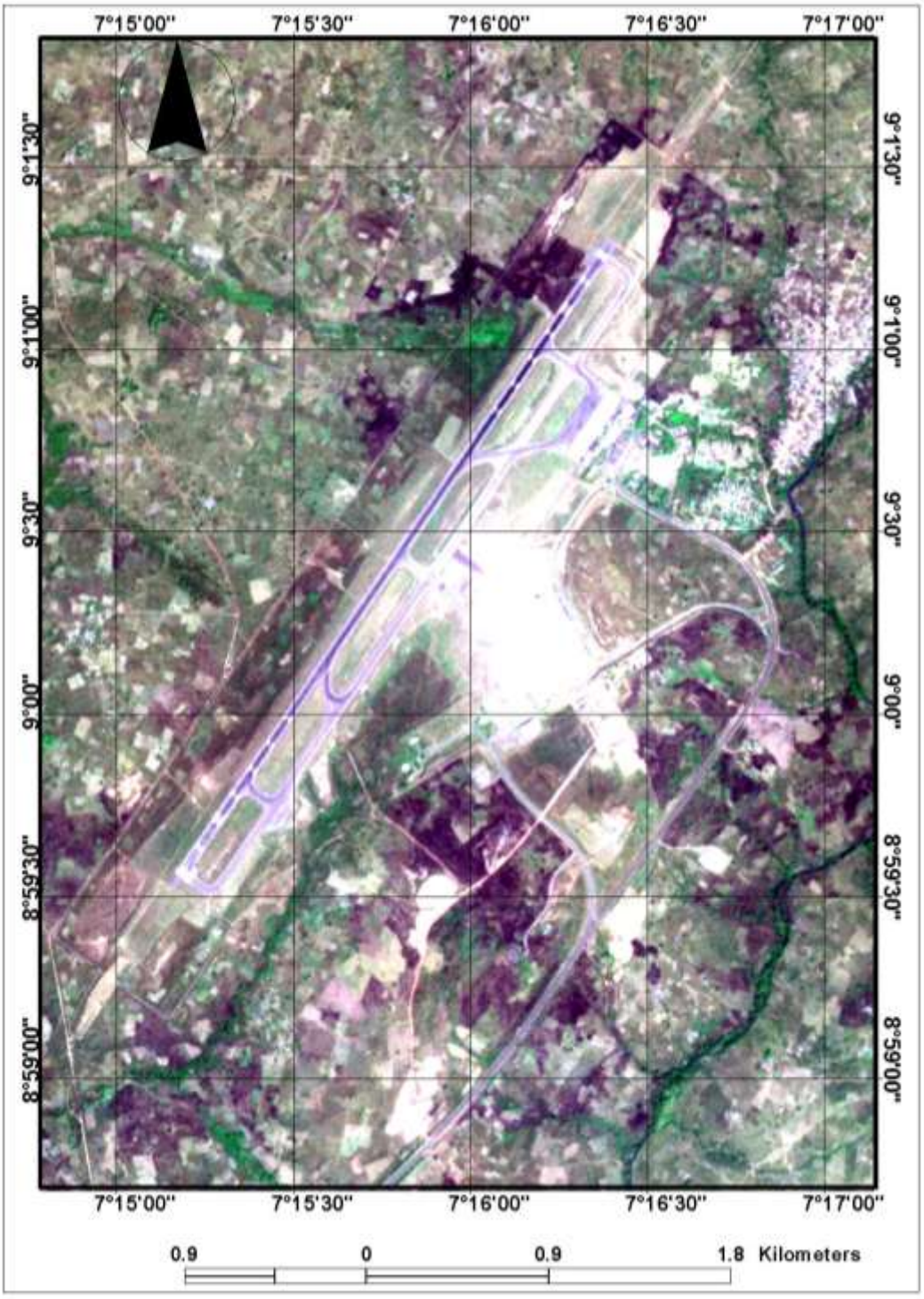


Figure 4.19: Abuja Satellite Imagery (2005)

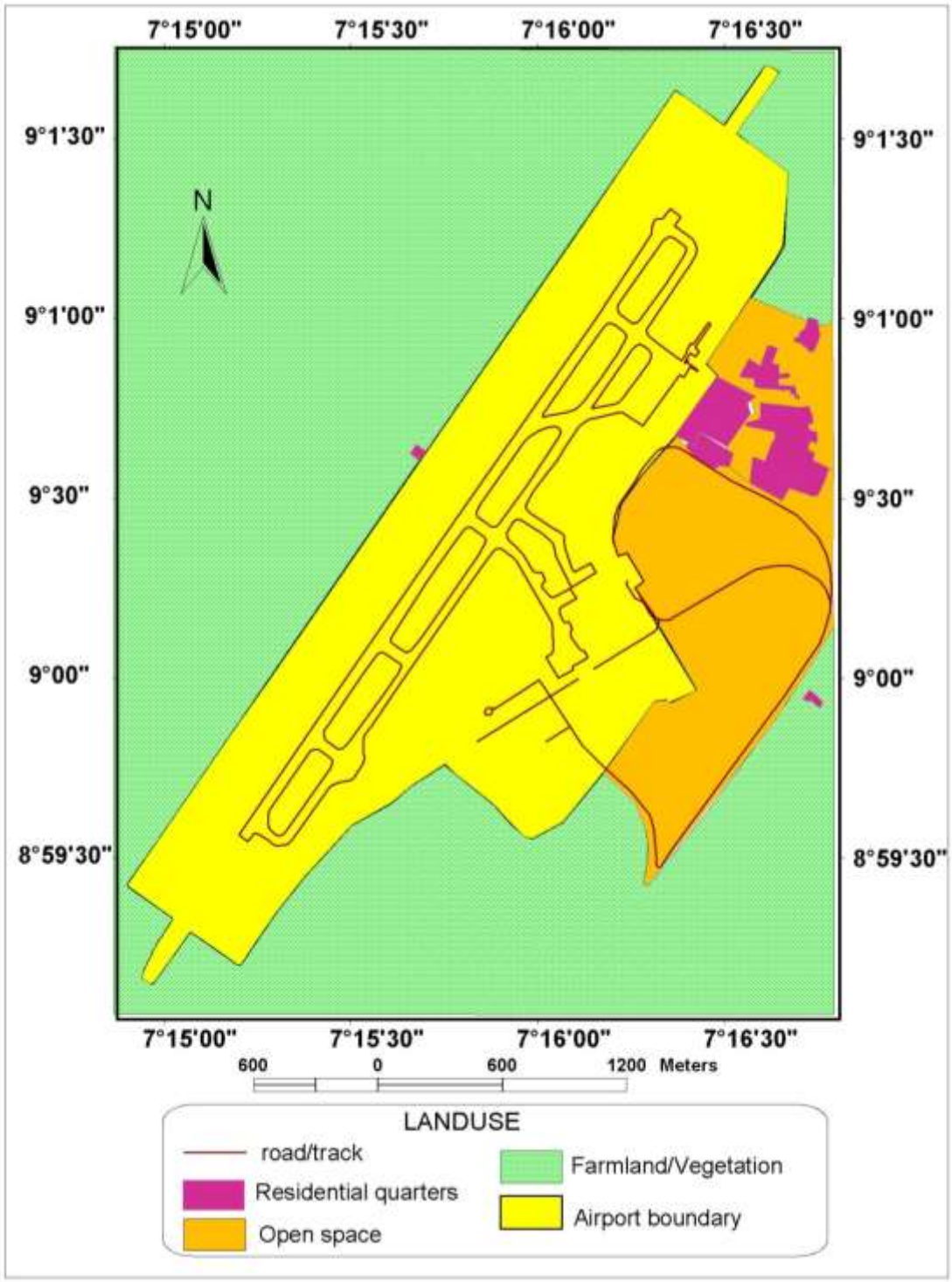


Figure 4.20: Abuja Satellite Imagery Land use Analysis Map (2005)

Table 4.7: Abuja Airport Satellite Imagery Land use Analysis (2005)

Landuse Type	**Area (km^2)**	**Percentage**
Airport Area	4.88	30.23
Residential	1.59	10.28
Open Space	0.25	1.13
Vegetation	9.42	58.36
Total	**16.14**	**100.0**

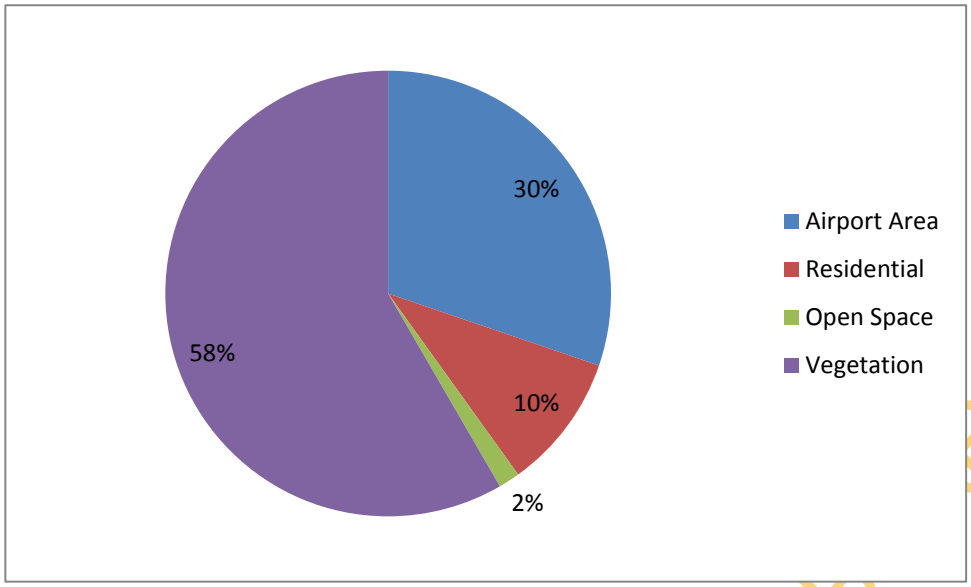


Figure 4.21: Percentage of Land use Area Distribution of Abuja Airport (2005)

Figure 4.22 Port Harcourt Airport Satellite Imagery - 2005

Figure 4.23: Port Harcourt Airport Satellite Imagery Land use Analysis Map (2005)

Table 4.8: Port Harcourt Airport Satellite Imagery Land use Analysis (2005)

Landuse Type	Area (km^2)	Percentage
Airport Area	1.26	27.51
Residential	0.90	19.65
Open Space	1.74	37.99
Vegetation	0.49	10.69
Marshy	0.19	4.15
Total	**4.58**	**100.0**

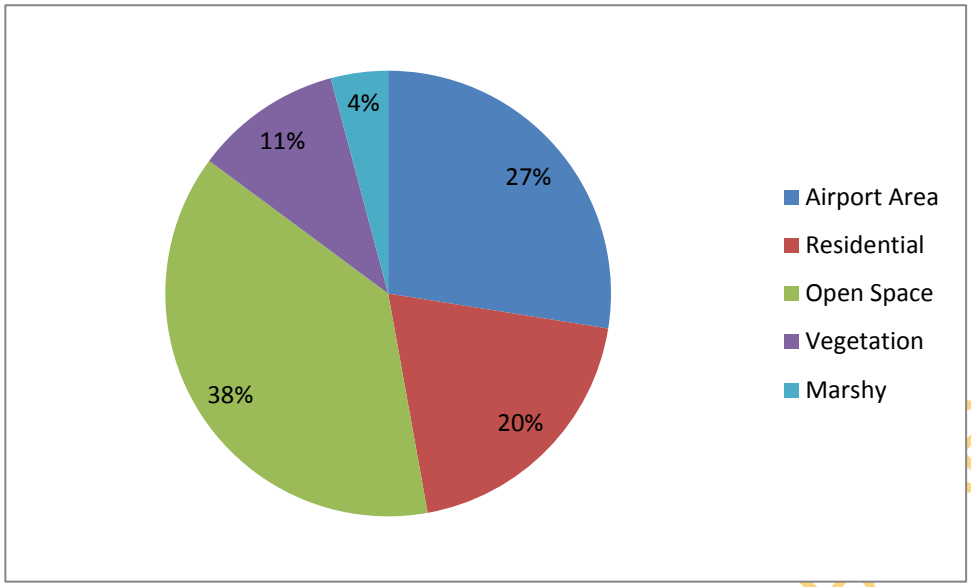


Figure 4.24: Percentage of Land use Area Distribution of P/H Airport (2005)

CHAPTER FIVE

ANALYSIS OF AVAILABLE FACILITIES AND INFRASTRUCTURES FOR SAFETY AND DISTRESS RESPONSE IN NIGERIAN AIRPORTS

5.1 INTRODUCTION

This chapter concentrates on the analysis of the existing safety and distress response facilities and structures at the Nigerian airports. While efforts were made to outline these facilities and structures in the selected airports of study as presented on table 5.1, the facilities and structures relating to other airports in Nigeria were presented in the appendix. In addition to this, an over view of ICAO dynamics in ensuring safety and improving distress response level at airports was revealed. Since availability of safety facilities and structures does not in itself prevent the occurrence of incidents and accidents, the study therefore appraised and evaluated some of the incidents and accidents that have occurred in the past within these selected airports.

5.2 INCIDENTS AND ACCIDENTS IN SELECTED AIRPORTS AND ITS ENVIRONS

Nigeria has witnessed a number of incidents and accidents since aviation activities started in the country ranging from aircraft accidents, birdstrike, fire inferno to equipment collusion on the tarmac. This has resulted in tremendous loss of lives, properties, equipment and facilities within and around the airports. As revealed in Table 5.1, airline disasters started in the country as far back as 1969 at Ikeja airport involving a DC 10 Hajj plane crash which resulted into a loss of about 87 lives. This was followed by the catastrophic and well broadcasted air crash which occurred in 1992, involving a Hercules C130 which crashed into the Ejigbo swamp killing all the senior military personnel on board. There was so much out cry on this accident that sabotage was alleged on the form and character of the accident.

The defunct Harka Airline crash of 1995 was novel and dramatic as the aircraft splitted into two with the front fossil crossing from the airport premises through the adjacent road to the nearby neighbourhood of Mafoluku and killing fifteen passengers on board. There was also another crash that occurred in Port Harcourt in 2005 involving Sosoliso airline killing all the school children on board and other prominent Nigerians. This

occurrence was preceded by another crash involving a Bellview airline which nose dived and culminated into been wholly submerged in the ground at Lisa village in Ogun State. These two tragic and pitiful occurrences were so touching that Nigerians started calling for the removal of the then Aviation Minister. With the crash at Abuja in 2006 of ADC airlines, where ninety-six passengers died including the Sultan of Sokoto with nine sustaining injuries, the then Aviation Minister was redeployed to another ministry.

As shown in Table 5.1, after the first crash of 1969, where eighty seven passengers died, the next recorded crash was in 1983 involving a Nigerian Airways F-28 at Enugu airport killing fifty three passengers on board. In 1994, there was only one recorded air crash involving Nigeria Airways cargo plane which occurred in Lagos. 1996 witnessed an upsurge of six plane crashes in the history of airline disasters in Nigeria. The most tragic of which was the ADC aircraft which crashed into Ejirin waters at Epe killing all one hundred and forty three on board including a popular social critic Claude Ake. There was also the Nigerian Airways plane that crashed in Kaduna killing seventy seven passengers with one hundred and twenty nine sustaining injuries. By 1997, only one aircraft crash was recorded in Calabar involving a BAC 1-11 aircraft with one casualty. In 2000 and 2005, three aircraft crashes each were recorded, while in 2006 only two were recorded. One of these involved a Dornair 228 Military aircraft which occurred at Benue killing all the eighteen senior Military personnel on board.

Likewise, in 2008, the Federal Airport Authority of Nigeria recorded seven accidents within the Nigerian airports. The only recorded death was the one that occurred at the Lagos airport where a fuel bowser belonging to African Petroleum with registration number AP-12 caught fire on the tarmac. One of the attendants died due injuries sustained after been crushed by the rear tires of the truck. Another fatal recorded fatal accident was that of Virgin Nigeria flight number B733 with registration number 5N-VND which occurred at Port Harcourt airport runway 21. There were 117 passengers on board while 15 passengers sustained injuries. There was also a training aircraft TB9 with registration number 5N-CBC which skipped off the runway after landing at Zaria airport. No casualty was recorded. All these occurrences are as recorded on Table 5.1.

However, the response capacity to distress situations at the selected airports was found to be below the 20minutes expected time of response from the time of alert. The aggregated average time of response within the airports were given as: 54minutes in Lagos,

43minutes in Kano, 35minutes in Port-harcourt and in Abuja, 30minutes. These variations could be adduced to the demographic and vehicular traffic characteristics within and around the airports, availability of functional infrastructure among others.

Table 5.1: Major Airline Disasters in Nigeria (1969-2006)

Year	Names of aircraft	No of People Died	Important personnel involved	Place of crash
1969	DC 10 Aircraft	87	-	Ikeja Airport
1983	Nigeria Airways F-28	53	-	Enugu
1992	Hercules c130	163	Military Personnel	Ejigbo Swamp
1994	Oriental Aircraft	5	Football Players	Algeria
1994	Nigeria Airways cargo plane	2	-	Lagos
1995	Harka Airline	15	-	Lagos
1996	Nigeria Airways	77 died & 129 escape with injuries	-	Kaduna
1996	Presidential plane	14	Son of former late president	-
1996	Nigeria Airways	No Causalities were recorded	-	Warri
1996	EAF plane	-	-	-
1996	Domier Aircraft	12	Konu Mohammed Wasi	Jos
1996	Boeing 727(ADC)	143	Social science & critics (Claude Ake)	Epe
1997	BAC-1-11	1	-	Calabar
2000	Sky power Express	2	-	-
2000	Network Aviation	1	Captain Biodun Olusola	Igbogbo
2000	EAS Plane	150	Minister of Sport (Ishaya Mark Aku) & wife of the past FCT Minister (Jerry Useni)	Kano
2005	Bell view Airline Boeing 737-200	117	-	Lisa

2005	Private Airline	-	-	Kaduna
2005	Sosoliso Airline	106	School children & Pastor Bimbo Odukoya	Port Harcourt
2006	Dornar 228 Military Aircraft	18	Military Personnel	Benue
2006	ADC	96 dead &9 Sustained Injuries	Sultan of Sokoto	Abuja

Source: Compiled from different sources by the author (2007).

The spate of disasters did not only include plane crashes but also several other cases on incidents including Flight Control Into Terrain (FCIT) of Chanchangi aircraft in 2005, fire disasters as it occurred at Sky Power Aviation Handling Company (SAHCOL) and Kano airport, bird strikes (see Table 5.2), explosions, wind storms, stray wildlife at the runways, among others. Out of all these other incidents and accidents described, of greater concern to this research, is bird strikes within and around the airports. This is due to its nature and character of occurrence.

One of the major outcomes of bird strikes is that it often leads to aborted take off which constitute a great threat to safety and most often severe damage to aircraft. For instance, as shown in Table 5.2, bird strike once led to complete grounding of an aircraft while at the same time leading to enormous cost of aircraft repairs. Though, bird strike does not occur very often, each time that it happens, it poses a significant threat to airport safety.

However, it is very difficult to have a reliable estimate of cost of bird strike to the civil aviation due partly to poor reporting standards, airline operators not wanting to make public bird strike experience coupled with inability to separate bird strike damage cost of flight delays and total cancellation.

Table 5.2: Recorded Bird Strike Incidences from September 2006-2008.

S/No	Date	Time	Operator	Reg/no	Aircarft Type	Effect on Flight	Down Time
01	23/09/06	0941hrs	Aero-contractor	YU-ANJ	Boeing 737	(i) About seven engine blades damaged at engine No.2. (ii) Aborted take-off	72hrs.
02	09/11/06	0640hrs.	MK (Afrijet)	9G-MKP	Boeing 747-200	(i) Engine dome damaged. (ii) Returned to MMA for precautionary landing.	48hrs.
03	01/12/06	1534hrs.	Chanchangi	5N-BIG	Boeing 737	(i) Twisted engine blade at position 19 of engine No. 2 (ii) Aborted take-off.	72hrs.
04	29/04/07	1610hrs.	NICON	5N-BMG	Boeing 737	(i) About twelve blades damaged at engine No. 1. (ii) Aborted take-off	Grounded to date.
05	12/09/07	0950hrs.	Virgin Nigeria	5N-VNF	Boeing 737	No damage, aircraft returned for routine safety check.	2-3hrs.
06	28/11/07	0910hrs.	Aero-contractor	5N-BHZ	Boeing 737	Two blades were damaged in engine #1.	24hrs.
07	17/10/08	1205hrs.	ARIK	5N-JED	BOMBADIER	No noticeable damage to the landing gear	-

Source: FAAN Duty Log-Book (2006-2008).

The research found out that Nigerian airports are becoming increasingly prone besides being vulnerable to bird strike because of the presence of factors and conditions that allows for habitation and roosting pattern of various types of birds around the airports. These are dump sites that are within the airport, anthill sites that are very close to the apron, unkept water bodies within and around the airports excavated ground, farm lands among others. Some of these are as presented on Plates 1-3 below.

Plate 1: An Anthill Located Close to the Lagos Airport Apro
Source: Field Survey, 2007

Plate 2: Dump Sites Located Inside the Lagos Airport
Source: Field Survey, 2007

Plate 3: Bird Habitat/Water-Body—Close to the Lagos Airport Runway
Source: Field Survey, 2007

Findings equally revealed that it is not all incidents and accidents that are reported as required by airport operators due to the fact that affected airlines do not want to be seen as being prone and vulnerable to accidents and incidents in a manner that, so as not to lose their clients and patronage to other competitors. Such attitude according to research findings is more prevalent among the airline operators and the aviation handling agents. Hence, putting their company's economic considerations first before the over all airport's safety culture requirements.

Another finding was that employees of organizations operating within the selected airports do not like reporting occurrences because of the fear of whatever punishment that might ensue due to such occurrence. Once an occurrence is reported, there is the notion among employees that, they will be reprimanded by their management.

The implication of this is that, there will be very little occurrences recorded (about 35%) which invariably makes it to become increasingly difficult for the various occurrences to be mitigated. This is to the extent that, once an occurrence is not reported, it can not be investigated neither will the causal system failure(s) be identified with a view to put up a safe guard against such causal system failure in future. Hence, the airport will keep on experiencing the same causal system failure over and over again.

5.3 EVALUATION OF INCIDENT AND ACCIDENT OCCURENCES AT THE NIGERIAN AIRPORTS

A critical evaluation of the records obtained from the Federal Airport Authority of Nigeria (FAAN) as regards the occurrences at the Nigerian airports indicated that, there was no recorded occurrence through out the year 2007. This is an indication to the fact that proper records of incidents and accidents are not usually being kept by the authority. This becomes more worrisome in view of the fact that, it is what FAAN reports to other stake holders within the industry that will be regarded as official. For instance, other service providers within the airport like the Nigerian Aviation Handling Company PLC (NAHCO) recorded the accident of the car bomb blast of the Chief Security Officer of FAAN in 1996 couple with another armed robbery event at the Lagos airport in 1995. In both occurrences, the security officer was killed in the explosion while 6 people were also killed in the robbery operation with unspecified amount of foreign currency carted away. It should be noted again that, the incident of the stolen INEC DDC machines at the Lagos airport is yet to be adequately documented.

There was also the incident of Chanchangi aircraft which occurred at Lagos airport but was recorded by the airline itself and NAHCO as the handling agent. This aircraft was about to land at the airport when the pilot realized that the front landing gear was faulty. When the pilot informed the control tower, he was advised to pour away all its fuel on the ocean so that the flight can be controlled into terrain (CFIT). Before the flight turned back to the airport, arrangements have been made for adequate response.

Besides improper recording of incidents and accidents, an analysis of occurrences at Nigerian airports indicated that, lack of facilities for distress response has contributed to the fatalities of these occurrences. For instance, there are no facilities at the airport to respond to occurrences which have taken place within the vicinity of water bodies. The Hercules C130 which crashed into Ejigbo swamp in 1992 could not be responded to until after over 12 hours due to lack of response facilities. Likewise the ADC which crashed into Ejirin waters at Epe in 1996. All the dead passengers could not be rescued as some of them had been washed away by the ocean due to late response. The Beachcraft that got missing within the Nigerian airspace in 2010 could not be found until after 6 months due to lack of facilities to determine the last spot where it was before disappearance. Perhaps, if it had been detected earlier, the only pilot inside would have survived the crash. The Bellview aircraft that crashed at Lisa village in Ogun State of Nigeria was first sort after at Kishi village in Oyo State.

The accident of Jet fuel bowser AP-12 where one death was recorded could also be adduced to the poor state of facilities at the Nigerian airports. There is the possibility that, if the fuel hydrant facility was in order, there would have been no need to put the fuel bowser into use.

In addition, unprofessional act of staff had in the past led to incidents and accidents at Nigerian airports while at the same time led to delayed responses. The Cargolux airline crash at runway 18R at Lagos airport in 2002 was caused by the air traffic controller on-duty who mis-directed the pilot to land on a closed runway. Investigation revealed that, the controller did not check his log book on resumption of duty to know that the runway has been closed and also, was asleep when the aircraft arrived. In the same vein, the air traffic controllers were not immediately susceptible to the exact point of crash that the Bellview aircraft occurred to the extent that, this could not be determined until after

about 36 hours. Also, the fire inferno which occur at Sky Power Aviation Handling Company Limited (SAHCOL) was caused by unprofessional handling of a classified dangerous good by the fork lift driver.

Management decisions have been indicated to have equally contributed to airport occurrences and delayed responses. The fire inferno at Kano airport in February 2011 would not have been so fatal if FAAN management has not withdrawn the motorcycles which the air field guards are using in alerting response officials whenever fire is being noticed on the air field. Three people were recorded dead on this accident while a newly purchased Fire Service water bowser was burnt coupled with unspecified air field equipment that were also burnt.

Related to the above is inadequate provision of security on the part of FAAN who is supposed to ensure this within the Nigerian airport. the bomb blast of the Chief Security of FAAN in 1997, the airport armed robbery of 1995 and the carting away of INEC'S DDC machines at the Lagos airport in 2011 are all attestations to the inadequate security within the airport environment.

5.4 ANALYSIS OF SAFETY FACILITIES AND INFRASTRUCTURE IN SELECTED AIRPORTS

Table 5.3 shows the available facilities and structures at the airports that are necessary for safe operation within the airports and which at the same time allow for quick response to distress situation. The availability and functionality of these facilities are also relevant to categorizing the airports. However, the availability of these facilities does not necessarily translate into efficient and effective functionality.

The incessant power outages that characterize the airports of study especially that of Lagos, Abuja and Kano despite the availability of public power supply and provision of internally generated power supply (power generating plants) shows that, though some of these facilities exist, but they are sometimes not functional.

Abioye (2008) wrote that severally the Lagos airport runway was made dysfunctional due to epileptic power supply to the airport. When there is no power supply, aircraft cannot land on the runway and hence will be diverted to another airport. Without electricity, the radar and communication system will not work and all airport facilities

become dysfunctional.

Also, there has not been any major renovation work done in any of the terminal buildings of the selected airports since they have been commissioned let alone expanding these facilities to accommodate the increase in the number of operators as well as users experienced over the years. Eze (2008) noted that the Lagos airport which was commissioned in 1978 is now experiencing so much pressure on its facilities far above what the designers of the airport terminal had in mind when they built it. At the time of construction, the population of Lagos was less than 2 million which today is estimated to be about 15 million. The traffic volume at that time which has grown 10 times could not be compared to what is being experienced now. Equally, the Nigerian climate does not suit the design of the terminal because it did not encourage ventilation; more so that there was no frequent power outage then as is being experienced now. In the same way, the meteorological facilities have become characterized with low capacity performance thereby reducing the precision in weather forecasting.

In aircraft fuelling, the safest method that can be applied is through the fuel hydrant. This is a mode where pipes are laid from an aviation fuel farm to the airport at which a hydrant head is installed at each aircraft parking bay on the ramp. It is from this hydrant head that a hose will be plugged to the aircraft for re-fuelling. The only alternative to the fuel hydrant is the fuel bowser, which entails the movement of fuel from the aviation fuel farm to the airport with the aid of vehicular trucks.

Though all the airports of study have the fuel hydrant facility, but virtually all are not working. In Port Harcourt airport, the aviation fuel farm has not been fully developed to be able to supply the airport aviation fuel through the fuel hydrant, likewise Kano airport due un-repaired blockages and leakages. While the Abuja airport is working up to 65% capacity, Lagos airport is not having up to 30% capacity. That is why aviation fuel vehicles are regularly observed on the adjoining airport roads. This situation in Lagos is of more concern due to the fact that the airport is within a metropolis which has a high vehicular traffic characteristic. Very often these trucks frequently break down on these roads leading to heavy traffic build-up which is not conducive to users of the airport. Similarly, these fuel bowsers can catch fire at any point in view of the high inflammable product that it conveys. This was just as it happened in February, 2008 when a bowser

belonging to African Petroleum with registration number AP-12 had an accident and caught fire at Lagos airport.

Besides, the fire hydrants and tenders at the airports are likewise not effective coupled with lack of sufficient well trained manpower and equipment in its fire department that could effectively avert fire disaster if any. Eze (2008) noted that, the fire department which is the pivot of rescue operation and fire prevention at the Nigeria airports is highly neglected. The department is also grossly understaffed while training is not regular and comprehensive coupled with lack of experienced fire men. In fact, Abuja airport was down graded in 2007 from Category 8 to Category 7 due to inadequate fire cover and Notice to Airmen (NOTAM). The fire cover and tenders' numbers were not enough to keep it on level 8 (Eze 2008).

Similarly, the category lightening are the different types of light which should be installed on the runway based on the types of aircraft that uses the runway. The category of each airport determines the runway lightening. These lights must always be checked up to ensure functionality so as to forestall mis-directing pilots to serious mishap. The category lightening for Kano airport is 2 while Lagos, Abuja and Port Harcourt has 2, 1 and 2 respectively.

The VASI and PAPI are slope guide equipment that help the pilot in understanding the airport glides while landing. For efficiency and safety reasons, the equipment must be checked constantly and calibrated twice a year. The research found out that, the Nigerian Airspace Management Authority who is in charge of this equipment always ensure that the equipment is been kept within the dictates of international recommended practices.

Moreover, both the aprons and runways that were built at the inception of these airports are the ones that still exist till date. New ones have not been built nor existing ones expanded/upgraded rather, resurfacing. Meanwhile, there had been an increase in the number of aircrafts that uses these facilities over the years. This is detrimental and contrary to safe operations and recommended practices. This can be adduced to one of the reasons why many aircrafts roam around the airports' airspace without being allowed to land during busy periods.

In fact, IATA report on the Lagos airport according to Riley (2008) indicated that the

apron of MMAII is too small for its intended operation in view of the fact that the concessionaire company has used part of the areas earlier designed and used for aircraft parking for a multi-story car park. This inadequate jet blast is identified as safety hazard by ICAO as the apron is not protected by jet blast protectors, stressing that jet blast after push back may raise debris that could damage other aircraft on the apron.

The Aviation Round Table Group (a group of aviation stake holders) disclosed through Omoh (2008) that coordinates of airports' navigational aids and runways have changed over the years due to annual variations. This is connected to old and obsolete topographical data in Nigerian airports that are inimical to ensuring safety of the air space. Most of the aeronautical charts used by the air space managers are incomplete without a modern standard Geographic Information System (GIS) maps especially the Digital Elevation Models.

In all, in line with the ICAO standards, analysis of the Key Informants' interviews revealed that the level of safety at the Lagos airport fall short by 30%, Kano 25%, Abuja 10% and Port-Harcourt 20%. This is an indication that safety facilities at the Nigerian airports are still very poor, which invariably is at variance with ICAO standards and recommended practices.

Table 5.3: Airport Safety Facilities and Structures

ICAO CODE	AIRPORT NAME			
	MALAM AMINU KANO INTERNATIONAL AIRPORT KANO DNKN	**MURTALA MOHAMMED AIRPORT LAGOS NO. 1 DNMM**	**NNNADI AZIKIWE INTERNATIONAL AIRPORT ABUJA DNAA**	**PORT HARCOURT INTERNATIONAL AIRPORT DNPO**
REFERENCE COORDINATES	LAT. $12^0$52'57"N; LONG. $08^0$31'30"E; RW 05-23, 06-24	LAT. $06^0$34'29"N; LONG. $03^0$19'07"E; BOTH RUNAWAY	LAT. $09^00$0'15"N; LONG. $07^0$19'07"E; BOTH RUNAWAY	LAT. $05^0$00'55"N; LONG. $08^0$15'30"E; RUNAWAY 03-21
REF. TEMPERATURE	33.1^{0}C (91^{0}F)	31.3^{0}C (83^{0}F)	35.6^{0}C (96^{0}F)	32.5^{0}C (84^{0}F)
CAT LIGHTNING	(2) 06 24 (1) 05 23	2 FORR RUNAWAY 18R/36L	1	2
CAT FIRE	7	9	7	8
RUNAWAY ELEVATION	4695MM (1565FT)	15.3M (15FT) 19.2M RUNAWAY (64FT) 18R/36L	33.1M (1087FT) 342M (1123FT)	22.86M (75FT FOR 03 24.68M (81FT FOR 21
AIRCRAFT FUEL	BOWSER HYDRANT	BOWSER HYDRANT	BOWSER HYDRANT	BOWSER HYDRANT
RUNWAY ORIENTATION	06 24 05 23	18R/36L	04 22	03 21
RUNAWAY DIMENSION	3300*60M 2600*45M ASPHALT CONCRETE	FOR 18R/36L 3900*60M ASPHALT CONCRETE	3600*60M ASPHALT CONCRETE	3000*60M ASPHALT CONCRETE
POWER SUPPLY	NEPA AT 33KVA, STANBY GENERATORS 1*1000KVA, 1*800KVA, 1*640KVA, 2*500KVA, 1*315KVA	NEPA AT 33KVA, 2*625KVA, 11KVA, 2*250KVA, 5*2250KVA GENERATORS	3*800KVA, 4*1250KVA GENERATORS	NEPA AT 33KVA, 3*381KVA, 4*500KVA GENERATORS
VASIS PAPI	PAPI	18R 3BAR 36L-3BAR	PAPI	PAPI
APPROACH LANDING	VOR/DME CAT 2 RWY, 06 24 ILS CAT 2 RWY 05 23 (SIMPLE APPROACH)	ILS CAT 2 VOR/DME	VOR/DME RADAR/ILS	CAT 2, ILS CAT2 LOCATOR VOR/DME
BLAST PAD	128M ASPHALT CONCRETE	120M ASPHALT CONCRETE	70M ASPHALT CONCRETE	120M ASPHALT CONCRETE
EXISTS	2NO. HSTO 90^0 2NO. LINKS, 23M AT 90^0 2NO. INTR. CONNECTING TWY (628*23M)	2END TAXIWAY 2 HSTO 30^0 PARALLEL TAXIWAY INTER CONNECTING TAXIWAY	1NO. HSTO 30^0 430*23 (10.5M) 1NO. 90^0 LINKS 300*23M(10.5M)	2NO. HSTO 30^0 LINKS 2NO. 90^0 30M LINKS 1NO. PARALLEL 3000*30M TWY
APRON	CONCRETE 700M*170M REMOTE PARKING	ASPHALT CONCRETE 240*60M, 240*65M 305*70M AVID REMOTE PARKING	360*70M CONCRETE 360*130M FLEXIBLE REMOTE PARKING	85*70M(GAT) AREA ASPHALT CONCRETE, 180*100M HELICOPTER ASPHALT CONCRETE, 320*120 GEN. REM. PARKING
SHOULDERS	7.5M	7.5M	7.5M	300*10.5M
DESIGNER PAVEMENT STRENGTH	LCN 90 LCG 2	LCN 110 LCG 1	LCN 100 LCG 1-2	LCN 100 LCG 1-2
DATE AFT COMM	2 AUG. 81	12 APRIL 79	1 OCT. 82	29 JAN. 81
DESIGNED CRITICAL AIRCRAFT	B747	B747 CONCORD SST	B747	B747
DISTANCE FROM TOWN	2KM NORTH	8KM NORTH	37KM	32KM
TERMINAL BUILDING	COMPLETED	COMPLETED	INTER. TERMINAL COMPLETED TEMPORARY CARGO SHED	COMPLETED
ACCESS WAY	ONE DUAL CARRIAGE WAY TRUCK C.	ONE DUAL CARRIAGE WAY 1 UTILITY RD.	TRUCK A. RD.	DUAL CARRIAGE WAY
GROUND TRANSPORT	BUS, TAXI & CAR HIRE	CAR HIRE AND BUS	SHUTTLE SERVICE & CAR HIRE	TOWN TAXI & BUS
WATER SUPPLY	BOREHOLE	BOREHOLE	BOREHOLE, DAM, PUBLIC WATER	BOREHOLE
TELEPHONE	064/6331978	0114931140-9	09-8100082/09-8100010	084/321903(A/M) 231904 (ASM 232680
APRON CAPACITY	B737, B747, (11 A/C)	TERM(1)-12 (B737-747) TERM(2)-6 (B707)	7B747 10B737	(PABX) 321985 GAT 2, B737 10B737
TERMINAL BUILDING CAPACITY	INT. 520 DOM 120 HAJJ 520	3675 PAX	320 PAX	700 PAX
OPERATING HOURS	24HRS	24HRS	24HRS	24HRS
AERO-NAUTICAL SATELLITE TEL.	CONTROL O F CENTRAL AERONAUTICAL SATELLITE TELS. COMM. & CONTROL WEST AFRICA	AVAILABLE	AVAILABLE	ALCATEL SATELLITE TX/RX SATCOM ALEN 1B RADIO AFIN

Source: Federal Airport Authority of Nigeria (FAAN), 2008.

5.5 ICAO EFFORTS IN ENSURING AIRPORT SAFETY AND QUICK DISTRESS RESPONSE IN THE AVIATION SECTOR.

Airports are safety oriented areas; hence, it should be highly regulated by a set of international standards that should not be compromised. A summary of these standards as entrenched by ICAO are as presented in Table 5.4. Strict adherence to these standards does not totally eradicate (rather it can reduce it) incidents and accidents. If not, the crash of Air France Concorde flight number 4590 at Charles de' Gaulle airport in 2001 would not have occurred to the extent that all that needed to be done had been taken care of for years.

Table 5.4: Description of ICAO Annexes

Annex 1	Personnel Licensing
Annex 2	Rules of the Air
Annex 3	Meteorological Services for International Air Navigation
Annex 4	Aeronautical Charts
Annex 5	Units of Measurement to be Used in Air and Ground Operations
Annex 6	Operation of Aircraft
Annex 7	Aircraft Nationality and Registration of Marks
Annex 8	Airworthiness of Aircraft
Annex 9	Facilitation
Annex 10	Aeronautical Telecommunications
Annex 11	Air Traffic Services
Annex 12	Search and Rescue
Annex 13	Aircraft Accident and Incident Investigation
Annex 14	Aerodromes
Annex 15	Aeronautical Information Services
Annex 16	Environmental Protection
Annex 17	Security: Safeguarding International Civil Aviation Against Acts of Unlawful Interference
Annex 18	The Safe Transport of Dangerous Goods by Air.

Source: The Convention on International Civil Aviation 2008

To compliment the above Annexes, there are also some other entrenched documents such as:

Doc.9137-AN/898----------Birds Control at the airports.

Doc.9157-AN/901----------Aerodrome Design manual

Doc.9136-Part2----------Pavement Surface Condition

It should however be noted that, despite all the above Annexes and documents, a state of perfect safety should not be seen as a state that can be attained. Each day within different airports comes with its own operational complexities and ever changing multiplicity of threats which should be tackled as they emerge and become visible. Those who believe they have achieved a state of being safe risk falling foul of complacency.

It was against this inevitability of occurrences at airports that made ICAO to recommend that each member nation should therefore establish a National Accident Investigation Agency. This agency will always take charge and inquire into the immediate and remote causes of any occurrence and at the same time make recommendations to mitigate against future occurrence. This was why the Accident Investigation Bureau (AIB) was established through the Nigerian Civil Aviation Regulation (NCAR) of 2009.

Despite all these incident and accident circumventor annexes, regulations and recommended practices, it is still not humanly possible to completely and perfectly wipe out incident and accident occurrences within the aviation industry. Rather, occurrences and impacts can only be minimized. It is therefore pertinent and appropriate to have a critical analysis of such occurrences within the Nigerian airports.

5.6 CONCLUSION

This chapter has been able to illustrate the extent of availability of safety facilities and structures within the Nigerian airports. There was also an appraisal of ICAO Annexes and documents which were agreed to by member nations to promote and enhance

safety in addition to ensure an appreciable level of distress response at airports. Also brought into focus was an analysis and review of incidents and accidents within the Nigerian airports with a view to access the contributions of poor facilities, deficient management decisions and again to have an over view of distress response capabilities within the Nigerian airport context.

In the final analysis, the chapter has indicated that, efforts should be made by all stake holders within the industry to always be ahead of occurrences by making available functional facilities and structures at all times. Inclusively, it should be ensured that operations within the airport are embedded within the purview of ICAO Annexes and recommended practices while at the same time ensure that management decisions are made towards guaranteeing and promoting a safer airport environment where response to distress occurrences is paramount whenever it occurs.

CHAPTER SIX

ANALYSIS OF THE CULTURE OF SAFETY IN THE SELECTED AIRPORTS

This chapter discusses airport safety issues as they relate to operational procedures and practices among the different operators in the selected airports. This was carried out through the aid of structured questionnaires about how staffs are employed, type of available training opportunities, availability of functional safety equipments, mode of information dissemination, the type of existing relationship between staff, among others. It also discusses the perception of airport safety by those working and living around the airports as well as the users of airport facilities. Issues included in the questionnaire comprise the length of time respondents have been living or working around the airports, the nature of work they do, type of structure they have, their experiences in terms of distress exposed to as people working or living around the airports. This is also complemented by the information gathered from airport users through questions like how often they use the airport, their nature of business at the airport, who their service providers are, level of service delivery, availability of safety equipment, how they think safety can be improved at the airport of their operation coupled with other questions that are relevant to the discussion. The chapter is divided into three sections each focussing on the analysis of responses of the three categories of respondents (airport service providers, airport users and those living/working around the selected airports). In each of the section, the socio-economic profiles of the respondents are discussed briefly followed by their responses to the safety issues posed to them.

6.1 SAFETY ANALYSIS AMONG ORGANISATIONS IN THE AIRPORT

This section analyses the various variables that are considered to be contributory to safety level or otherwise at the selected airports. The analysed data were obtained from those that are working with those organisations situated within the airports.

6.1.1 SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS WORKING WITHIN THE SELECTED AIRPORTS

This sub-section enabled the exposition of the nature and character of the work force within the selected airports in terms of the ratio of male to female, educational

qualifications, financial and marital status among others. All these were of immense importance to the research as it allowed for analysis of airport safety and distress response system based on the character and the nature of the work force.

As shown in Table 6.1, male workers constituted the highest percentage of respondents (64.9%) while females constituted the remaining 35.1%. Operations at the airport entail mostly activities that require physical energy, stamina, fitness and alertness. These are baggage handling, equipment/facility operators, tractor and vehicle drivers, maintenance, and security among others. These factors greatly explain why a greater percentage of respondents are male.

Additionally, for the mere fact that, airport operations are a twenty four hour service which entails shifting schedules among the work force, female workers were not seen to be conducive for employment due to night duty activities.

The table further indicated that the highest proportions of the respondents are aged 40 – 44 years (25.1%). This was closely followed by those aged 35 – 39 years (20.7%). The lowest proportions of those interviewed are those below 24 years. This cohort constitutes only 4.0%. These ages between 25years – 49years were considered to fall within the most active population in demographic studies.

More than two thirds (71.8%) of the respondents are married. 15.5% are single, while the remaining 12.6% are divorced, widowed or separated. The educational status of the respondents reveals that majority of the airport staff have at least an HND or first degree certificates. This number, as shown in Table 6.1, represents a proportion of 40.8%. The survey also revealed that, 39% have obtained a Master's degree certificate, 14.6% had OND/NCE/TCII, 2.9% with WASCE/GCE/SCE, and 1.6% had only a primary education. The lowest proportion of the respondents is those with only trade test certificate. They constitute only 1.1%.

While it is expected that the respondents' education will translate into a well informed and an acceptable level of aviation professionalism, the reverse is the case. This is because most of the educated employees were employed to do the manual jobs like baggage handling while there are some supervisors and managers that have lower educational qualifications. As noted, this situation has created some level of apathy,

alienation and lack of commitment to job functions and details during operation. This is inimical to aviation safety and distress response especially when there is a mismatch between qualification and highly technical job functions.

Additionally, this table highlights the length of stay of the respondents within their present places of work. Those who have worked with their present organization for a period of 6-10 years constitute the highest percentage of the total number of respondents (38.0%). This was followed by those who have spent between 11-15 years (32.5). The lowest proportions of the respondents are those who have spent more than 20 years (4.9%). In all, up to half of the total numbers of respondents have spent more than 10 years in their various organisations.

The implication of this is that respondents were able to give vivid information regarding the issues concerning their organisations as they relate to airport safety and distress response. It is also expected that the airports will be having workers of proven integrity with enough experience to carry out their day to day airport operational activities.

As further shown in Table 6.1, close to two thirds of the respondents earn between N35, 000 and N65, 000 monthly. The table also revealed that those that earn more than N65, 000 are relatively small and constitute only 4.5% of the total number of respondents. On the other hand, only 4.4% earn less than N15, 000 monthly. The distribution of income shows that the income distribution among the employees in the various organisations is fairly well distributed.

This invariably should make staff to be committed to their work schedule. Experience during the research period showed that, some of the few that are at the top and earns higher salaries are not supposed to be there compared to some at the middle level if merit is to be considered. And again, there are series of entitlements like bulk payment of housing allowance, children's school fees subsidy among others which are being enjoyed by those at the top but are not available to the majority of workers.

These denials to this category of workers who are seen as the core operational staff always lead to industrial unrest, lack of dedication and devotion to operational duty which are all detrimental to safety and distress response.

Table 6.1: Socio-Economic Characteristics of Respondents Working Within the Selected Airports

Variables		Frequency	Percentage
Sex	Male	401	64.9
	Female	217	35.1
	Total	**618**	**100.0**
Age	< 24 years	25	4.0
	25 – 29	99	16.0
	30 – 34	85	13.8
	35 – 39	128	20.7
	40 – 44	155	25.1
	45 – 49	96	15.5
	50 – 54	27	4.4
	55 years and above	3	0.5
	Total	**618**	**100.0**
Marital status	Single	96	15.5
	Married	144	71.8
	Separated	26	4.2
	Divorced	16	2.6
	Widow/Widower	36	5.8
	Total	**6.8**	**100.0**
Education status	Primary Education	10	1.6
	WASSCE/GCE/SSCE	18	2.9
	Trade test	7	1.1
	OND/NCE/TC II	252	14.6
	HND/FIRST DEGREE	252	40.8
	Master Degree	241	39.0
	Total	**618**	**100.0**
Duration of years with present organizations	<5 years	95	15.4
	6 – 10	235	38.0
	11 – 15	201	32.5
	16 – 20	57	9.2
	Above 20	30	4.9
	Total	**618**	**100.0**
Income	No response	3	0.5
	<N15, 000	27	4.4
	N15, 000 – 25, 000	79	12.8
	N 25, 001 – 35, 000	105	17.0
	N35, 001 – 45, 000	131	21.2
	N45, 001 – 55, 000	193	31.2
	N55, 001 – 65, 000	53	8.6
	N65, 001 – 75,000	18	2.9
	Above N75, 000	10	1.6
	Total	**618**	**100.0**

Source: Field Survey, 2007

6.1.2 ANALYSIS OF VARIABLES THAT CONSTITUTE SAFETY ISSUES WITHIN THE SELECTED AIRPORTS.

These are variables within the airport operational environment that were considered to be of value and importance to safety and quick response to distress situations within and around the airports. They include among others the method and style of staff recruitment, training issues in terms of knowledge of job function and understanding, communication style and inter/intra staff relationship and availability of serviceable equipment and infrastructure. The analysis of some of these variables is as presented in Table 6.2.

The predominant method of job advertisement by the various organizations surveyed is through personal contact as more than 60% of the respondents indicated this. Another significant proportion said the major mode of advertisement for jobs is by internal communication (30.9%). Only 8.3% indicated that external advertisement by means of news media, mainly print, constitute a way of advertising for jobs in their organisations. These results were further confirmed through the key informant interview.

This is an indication that majority of the work force at Nigerian airports were employed through the basis of whom you know rather than allowing merit to take credence. A major effect of this is that staff will always owe allegiance to whoever has brought them to the company rather than to the company's rules, regulations and procedures, a situation that is inimical to safety. This also breeds high level of indiscipline and financial recklessness. As a result, Rindams (2008) advocated for experienced and well trained personnel to be allowed to take up higher positions of responsibilities within the aviation industry. Aviation deals with life and safety. Hence, it should discourage the illogical political appointment of non-experts to key and sensitive positions within the sector as the heads of departments/parastatals because they are not competent nor have the requisites required for such specialised activities within the industry.

Equally, Table 6.2 shows that most of the employment interviews within the organizations in the airport are done by the management staff. This is usually by way of hand picking their choice persons. More than 55% of the respondents alluded to this. On the other hand, the Personnel Department which is supposed to be responsible for interviewing people for jobs in the respective organisations is not always allowed to do their job of staff recruitment as indicated by 31.9% of the respondents. Only a small proportion of 3.9% indicated that, all the above mentioned methods of interview are

being implemented by all the organizations. Personnel departments of various operating organisations corroborated this analysis. The implication is that if management consistently handpicks employees for jobs or positions within their organisations, it will invariably reduce efficiency and effectiveness of favoured staff within the organisations and this sometimes lead them to compromising safety where it matters. This is to the extent that the loyalty of the staff will automatically tend towards the person that brought him rather than the over all objectives of the company. This is in addition with the fact that, the same management that has the powers to employ also have the same power to fire at will. This is known as Management malaise in organisational theory. This can invariably lead staff to be alienated from their job function.

It was also noted that all organisations operating within the airport have their aprons tied to the Federal government through the Ministry of Aviation. This made it possible for the government to always appoint the headship of these organisations. A corollary of this is that each successive head will want to dispense off some of the old staff and bring in his/her own 'loyal' staff. This invariably leads to high turn over of staff, lack of professionalism through loss of experienced staff coupled with incessant rift between old and new/'loyal' staff.

The Hydro Air accident that occurred in 2001 was due to the laxity of the inexperienced staff on duty then at the control tower. The inexperienced staff was yet to know that whenever staff resumes, and especially when in doubt about the condition of available facilities, the necessary unit should be contacted for appropriate briefing. Rather than contacting the apron control for the level and extent of repairs on the runway which was under repairs, Hydro Air cargo was made to land on this out of use runway by this inexperienced officer and this eventually led to the crash.

Table 6.2 further indicated that airport organizations do not place much importance on training and retaining of their staff. Only 11.0% of the respondents said their organisations place importance on training and retraining while the largest proportion of the respondents (89%) held a contrary opinion. Demurin (2008) substantiated this result by expressing that the neglect of personnel training in the aviation sector coupled with dearth of professional staff turn-over in recent years will result in acute shortage of man power to run the rapidly growing sector if not checked. The implication of lack of

training is that staff will not be conversant with the techniques and technicalities underlining their job functions. Also, it will be difficult for them to align with new developments in the aviation industry as they relate to safety and distress response. The knowledge of the use and handling of modern airport safety equipment like the Total Radar Coverage (TRACON) will be very poor among the various personnel responsible for handling these safety and distress response equipment. This makes Nigerian airports unsafe and prone to lack of adequate response to distress situation whenever it occurs. This could be corroborated with the analysis which further revealed that, 40% of those interviewed have attended only one safety related course in the last ten years. Added to this is another 22.5% who have never attended any safety related course in the last ten years.

Due to the complexities of operations in the airport, personnel in certain specialised departments like control tower, aircraft dispatchers, load controllers, aircraft fuellers among others, are expected to possess a valid license with a view to operate efficiently and effectively. For this reason, the study sought to find out if the respondents in the various organisations possess such valid license. As further shown on Table 6.2, only 20.9% of the respondents indicated that they have what they called operational licensing in their various organizations while the largest proportion of the respondents (74.3%) said they do not have valid operating license.

Again, this finding has implications on safety in that, in a situation whereby employees do not have valid licence and adequate knowledge of the equipment, facilities and procedures, there is bound to be impairment on safety. A situation where staffers are operating or carrying out their duties out of context and ignorance can pose a serious hazard to airport operations while at the same time can make response to distress situation ineffective. The fire inferno at SAHCOL in 2002 was caused by the forklift driver who was licensed to drive a forklift but was not licensed to handle dangerous goods (explosives) which fell from his forklift and exploded.

Table 6.2: Respondents Assessment of Safety Issues as it Affects Operations.

Variables		Frequency	Percentage
Mode of Advertising vacancies in Organisations surveyed.	Internal	191	30.9
	External	51	8.3
	Personal contact	374	60.5
	Others	1	0.2
	All of the Above	1	0.2
	Total	**618**	**100.0**
Mode of Interview for Employment	Personnel Department	197	31.9
	Through External Consultant	51	8.3
	Management Handpick	346	55.9
	All of the above	24	3.9
	Total	**618**	**100.0**
Importance attached to the issue of training and re-training.	Very High	23	3.7
	High	45	7.3
	Undecided	97	15.7
	Low	155	25.1
	Very low	298	48.2
	Total	**618**	**100.0**
Number of training attended in the last ten years.	1	247	40.0
	2-5	119	19.3
	6-10	113	18.3
	None	139	22.5
	Total	**618**	**100.0**
Possession of valid professional license on task performance	Possesse	129	20.9
	Do not possess	459	74.3
	No response	30	4.9
	Total	**618**	**100.0**

Source: Field Survey, 2007.

The questionnaire further probed into the specific type of courses they have attended. As shown in Table 6.3, the training courses mostly undertaken by the people were those which concern computer applications, representing 29.4%. Another 26.1% were involved in training on safety.

One interesting fact that emerged from this analysis was that most of the organisations place emphasis on 'do it quick' culture above that of safety. This fact became pronounced during the research period when it was observed that the airline operators always prefer the handling agents to push their aircraft back on scheduled time without having due cognisance to safety requirements and procedures for aircraft dispatch like proper screening of passengers and their luggage before boarding.

Furthermore, table 6.3 also shows that organisations within the Lagos airport places significant emphasis on management courses (15.4%) and safety related courses (15.6%). This is probably due to the fact that we have most of the management staffs in Lagos as all the airport operators have their head offices in Lagos. These management staff always sends themselves on various management courses (as shown on management training records of most operating organisations) at the detriment of safety related courses meant for the core operational staff. Safety and quick response to distress response is consequently impaired especially at other stations.

While emphasis is placed more on computer application (7.3% and 5.8%) by organisations operating within Kano and Abuja airports respectively, aviation management/professional courses are being mostly appreciated at Abuja (1.2%) and Port Harcourt (1.1%). This is an indication that, highly educated staffs are concentrated at Lagos airport. Training relating to airfield watch was indicated only at Kano airport (2.7%) probably due to the incessant fire out break

Table 6.3: Nature of training courses attended by Respondents (Airport Operators)

	Locations				Total	
	Abuja (%)	Kano (%)	Lagos (%)	Port Harcourt (%)	No	percentage
Nature of training						
None						
Safety	6.3	1.4	15.6	2.8	87	26.1
Computer Applications	5.8	7.3	11.6	4.7	98	29.4
Drug Control and Trafficking	1.8	0.8	0.3	1.1	13	4.0
Security	3.6	2.7	2.4	1.5	34	10.2
Aviation Management Courses	1.2	0.7	-	1.1	10	3.0
Airfield Watch	-	2.7	-	-	09	2.7
Medical Training	-	1.5	-	-	05	1.5
Management Courses	4.8	2.0	15.4	-	74	22.2
Disaster Prevention Courses	-	0.9	-	-	03	0.9
Total	**23.5**	**20.0**	**45.3**	**11.2**	**333**	**100.0**

Source: Field Survey, 2007

Information dissemination is very vital to the smooth running of any organisation. It becomes even more important when the issue of safety is involved. In view of this, questions were posed to respondents regarding the mode of information dissemination system being practised in their various organisations. As shown in Table 6.4, 50.2% of the total respondents acknowledged that information is being disseminated within their various organizations through memo and complemented with departmental meetings. This was corroborated by the information obtained from some of the officials of operating organisations interviewed during the study. But going by location, the respondents in Lagos rated information dissemination through memo high, with a percentage of 40.3 while 4.4% of the respondents claimed that information is only being dished out to them during their departmental meetings. 2.1% indicated they get information only on their boards through posters. Further investigation shows that, 0.8% of the respondents get their information during general meetings and 0.3% said that there is no specific standard through which information is disseminated to them. Above all, 42.2% of the people indicated that information is being disseminated to them using all the above mentioned procedures. The crosstab statistics on Table 6.4 gives a detailed summary of the analysis of the results discussed.

The implication of these various responses is that, information passed down might not be explicit enough to those concerned as half of the respondents indicated that memo method of information dissemination is mostly adopted. Feedback in communication is not often used. If there is no adequate response from the information passed down, there is no way the management will know whether the information is properly understood or if there are some grey areas to be further explained to the employee.

However, a break down of the responses across the different airports considered shows that the situation is better off in Abuja, Kano and Port Harcourt airports where 6.3%, 9.7% and 4.7% respectively using all the highlighted techniques of information dissemination which is higher than the use of memo. This is unlike Lagos airport which has adopted the use of memo [40.3%] than any other method. Perhaps this is due to the fact that there are more staff at the Lagos airport than others which makes the management of larger staff more cumbersome at meetings.

Inclusively, Table 6.4 gives a detailed analysis on how promotions are carried out at various organisations operating within the selected airports. The table shows that 49.4% of promotions were carried out through the selection by the top management while personnel department accounts for only 10.7%. Another 29.1% of respondents indicated that promotion exercises were carried out using all the techniques indicated in the table.

The implication of this finding is that, staff that is not favoured by the management will always have a sense of apathy and alienation from their job functions, disloyalty, sense of job insecurity and other vices. All of these are antithetical and hazardous to safe airport operation and quick response to distress situation whenever it occurs.

However, a different observation was recorded at the Kano airport when further investigation was carried out on the various operating companies within it. Unlike others, emphasis was given to the use of all the indicated methods of promotion (5.5%) than the management selective promotion being used mostly by the companies operating at the other selected airports.

The respondents were also interviewed on when each of them last had a promotion in their various organizations. A total of 19.3% as shown in Table 6.4 with a majority from Lagos (24.9%) said, they had their last promotion less than five years ago.

Majority of the respondents (55.7%), however, had it between the periods of 6 – 10 years while 1.6% had it between 11-15 years and only 0.3% had it during subsequent years.
The trend of staff promotion sequence portrayed in this analysis does not foster nor nurture safety and quick response to distress situations at the selected airports.

It was also pointed out in Table 6.4 the number of years that the respondents had been deployed into their present job function. About 23% of the respondents indicated that their period of deployment period has been between 1-3 years, while a larger percentage of 36.6% indicated between 4-6 years. Another 23.8% indicated 7-10 years while the remaining 15.3% have had their promotion for more than 10 years ago.

With the results espoused in this table, there is the tendency therefore that, airport staff ought to have the requisite experience needed to ensure safety and quick response to distress situations at the selected airports.

The relationship of the respondents with their superiors and or subordinates was again analysed in Table 6.4. It shows that 66.5% of them relate formally with their superiors and or subordinates, while 2.4% relates informally with their superiors and subordinates. 30.4% indicated they relate formally and informally with their superiors and subordinates.

The implication of a higher percentage of respondents relating formally with their superiors/subordinates is that it breeds a high level of inflexibility in operational activities coupled with administrative bottlenecks which constantly serve as impediments to smooth and safe operations and quick response to incidents and accidents whenever they occur. That is, high degree of formality can naturally breed secrecy which can in turn impede information flow among staff. Hiding of vital information which are germane to operational safety are the order of the day especially by the junior staff of organisations operating within the selected airport of study. Removal of vital safety operational documents and lack of proper report of operational incidents are all part of the consequences of high level of informal relationship among and between staff. Expectedly, most staff did not want to understand safety within the airport as everybody's business.

The data presented in the last column of table 6.4 reveals the relationship between the respondents and their colleagues. It shows that the respondents relate both formally and informally (73.3%) with their colleagues depending on operational demands. This is an indication that there is more cordiality among colleagues than among superiors and subordinates. Thus, unlike the situation where formal relationship exists, an informal relationship breeds cordiality and responsibility which is necessary for effective and safe airport operations coupled with quick response to distress situations.

Table 6.4: Respondents Assessment of Other Safety Issues as It Affects Operations/Staff

Variables		Abuja %	Kano %	Lagos %	Port-Harcourt %	Frequency	Percentage
Mode of Information Dissemination	Through memo	5.5	0.8	40.3	3.6	310	50.2
	Departmental meetings	1.8	0.6	0.8	1.1	27	4.4
	Notice Boards	0.6	0.2	0.6	0.6	13	2.1
	General meetings	0.3	0.2	-	0.3	05	0.8
	No standard	-	0.3	-	-	02	0.3
	All of the Above	6.3	9.7	21.5	4.7	261	42.2
	Total	**14.5**	**11.8**	**62.4**	**11.3**	**618**	**100.0**
Style of Promotion in Organisations	No response	0.6	0.3	2.6	0.8	27	4.4
	Top management decision	6.0	2.6	35.9	4.9	305	49.4
	Personnel dept prerogative	3.7	1.9	2.9	2.1	66	10.7
	Promotion committee	-	1.0	2.3	-	20	3.2
	Recommendation	1.1	0.3	-	-	09	1.5
	Exams/Interviews	-	0.2	1.6	-	11	1.8
	All of the Above	3.1	5.5	18.0	2.6	180	29.1
	Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**
Year of last Promotion	No response	5.2	0.6	16.8	3.7	143	23.1
	<5years	9.1	9.2	24.9	6.0	119	19.3
	6-10years	0.2	1.8	19.9	0.6	344	55.7
	11-15years	-	-	1.6	-	10	1.6
	others	0.2	0.2	-	-	02	0.3
	Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**
Year of deployment into present job function.	1-3years	1.6	0.6	6.5	1.1	150	23.4
	4-6years	2.1	3.4	7.8	1.5	226	36.6
	7-10years	1.5	1.5	3.9	1.6	147	23.8
	10&above	0.8	1.6	1.0	0.3	95	15.3
	Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**
Superior/Subordinate relationship	No response	0.3	-	-	0.3	04	0.6
	Formal	11.5	9.5	37.7	7.8	411	66.5
	Informal	0.3	1.0	0.8	0.3	15	2.4
	Combination	2.4	1.3	24.8	1.9	188	30.4
	Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007.

From the results presented in Table 6.5, it is glaring that the largest proportion (54.2%) of the respondents from airport service provider companies has the notion that their organisations do not have documented safe operating procedures. Only 1.8% agreed that their organisations have a documented safe operating procedure. Only NAHCO officials were able to show a well articulated documented operational procedure. The remaining 44% cannot express themselves on this issue.

Operating procedure stipulates the accepted safety standards of carrying out various operational activities within and around the airports. This document also explains the accepted best practices in responding to distress situations whenever they occur.

It therefore portends a hindrance to safe operations (a situation where operations are carried out in a haphazard manner) and quick response to distress situations when the type of frequency analysis presented in Table 6.15 occurs. During the course of study at the selected airports, operational staff was observed not to have a clear cut pattern of service delivery rather; an exhibition of inconsistencies was noticed.

Table 6.5: Availability of documented Safe Operating Procedure

	Locations				Total	
	Abuja (%)	**Kano (%)**	**Lagos (%)**	**Port Harcourt (%)**	**No**	**percentage**
Available	0.3	1.1	-	0.3	11	1.8
Not Available	6.0	2.6	43.0	2.6	335	54.2
Don't know	8.3	8.1	20.2	7.4	272	44.0
Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

Table 6.6 shows the results that a larger proportion of the respondents are aware that their companies have a vision and/or a mission statement. Only 1.5% is not aware of their organisation's vision or mission statement.

This is an indication that most staff of organisations operating within the selected airports knew what the aim and objectives of their companies are. Hence they are expected to know what is required of them during and after operations, which must be in line with the companies' vision and mission statements. Ironically, the reverse is the case due to some other variables whose contributions to operational safety are stronger and more significant than this variable under investigation. For instance, we have management malaise, pressure on clients' target against safety, personnel inadequacies among others.

When further questioned on how these documents (Safe Operating Procedure and Vision/Mission Statements) were made known to staff, a considerable percentage (38.2%) could not give any account on this. A substantial proportion (31.4%) indicated that staff is supposed to read these documents at the management office. Others claimed that these documents are accessible at personnel department for the staff, while 10.5% said such documents are kept at each department's office for the staff to read. A summary of the detailed analysis is presented in Table 6.6.

The major implication derived from the results presented here is that when important documents are not properly presented to staff, there is no way they would know the importance of such documents neither would they be exposed to the dictates and requirements outlined in these documents to allow for safe airport operations and quick response to distress situations. Furthermore, placing of these documents in management office for staff to access was found out to be detrimental to staff exposition to these documents in view of the existence of formal relationship between superiors and subordinates as shown earlier in Table 6.4.

The analysis further shown on this Table 6.6 on whether compliance to procedure is enforced in the different organisations shows that a substantial large proportion of the respondents (90%) indicated that compliance with safe operating procedures is not

enforced. The implication of this is that even though there is safe operating procedure, since there is no enforcement, the rate of incidents and accidents can hardly be curtailed. This situation has led various organisations within the airports to perform their duties without due regard to other organisations' operational demands. This was found to be very hazardous to safe airport operations and response to distress occurrences. The accident that occurred between a tractor and Allied Air Cargo at the cargo ramp of Lagos airport was that the tractor operator failed to observe that the aircraft had not indicated that it has parked properly. The operator thus used the high loader to damage the aircraft by the side (Research observation, 2008). Another damage done to the terminal building by another equipment operator was due to non compliance to safety procedure (Research observation, 2008).

Non enforcement of or compliance to safety procedure is also a signal that the required level of supervision is lacking within the organisations. Most of the supervisors interviewed during the course of study can not perceptibly explain what it entails to be a supervisor. They are either not at their duty post or can not attend to emerging issues, probably due to inadequate knowledge of such a matter or they are attending to trivial personal issues. When subordinates are not properly supervised, they are bound to make costly mistakes as it happened at SAHCOL fire inferno, to Allied Air cargo tarmac incident and the collusion of handling equipment with the terminal building.

A similar observation on this variable was personnel inadequacies, whereby, the mental and physical alertness of staff was not considered before placing such staff on a particular job function. It will be very difficult to make such a staff whose state of health is not sound to comply with safe operating procedures.

Table 6.6 also shows that the respondents who claimed that they know the job function of their companies as regards airport operation recorded the highest percentage (68%) while those who said no constituted for only 32%. This should invariably promote high level of performance among airport staff.

Finally, Table 6.6 shows that a larger percentage (70.4%) of the respondents is of the opinion that the airports do not have adequate and functional safety infrastructures and

equipment. Not until recently when the Total Radar Coverage of Nigeria (TRACON) was commissioned, the available radar was about 30 years old and breaks down incessantly as revealed in this study; many of the facilities at the control tower are outdated including weather forecast equipment. This situation is further compounded by the incessant power outages being experienced at the selected airports, especially in Lagos Abuja and Kano. Substantiating this analysis, Usim in his article in the Saturday Sun of October 11, 2008 captioned: "Scandalous! Muritala Muhammed Airport operates with one runway for both local and international flight for almost two years", wrote that, looking at the deteriorating facilities at the Muritala Muhammad Airport, which serves as a gateway to outside world, the awful experiences from the malfunctioning toilets, sluggish conveyor belts and squeaking elevators, leaking roofs, poor air-conditioning system, poor lightening of the broken down runways and aprons, one wonders if the airport should still be wearing its toga of being recognized as an International airport of repute. He added that, a concerned passenger, especially one that is coming from Europe, will completely be hearth – broken with the state of broken down facilities at the airport. Worse still, rot appears to be the rule rather than the exception.

Similarly, for the incessant recorded distress occurrences at the Nigerian airports in recent times for example, if the facilities had been there, it would not have been difficult to locate the Bellview aircraft that crashed into Lisa village in Ogun State of Nigeria in 2005 and to discover on time the crash point of the missing Beech craft of March 15, 2008 which could not be found until after about six months.

Table 6.6: Assessment of Safety Culture Procedure within the Selected Airports

Variables		Frequency	Percentage
Availability of Vision/Mission statement	Available	365	59.1
	Not available	09	1.5
	Do not know	244	39.5
	Total	**618**	**100.0**
Method of Disseminating Vision/Mission Statements and Safe Operating Procedures	No response	236	38.2
	Reading at Management office	194	31.4
	Reading at dept office	65	10.5
	Kept at Personnel office	39	06.3
	Organising training/courses	75	12.1
	Others	09	1.5
	Total	**618**	**100.0**
Enforcement of Compliance with Safe Operating Procedures	Do enforce	62	10.0
	No enforcement	556	90.0
	Total	**618**	**100.0**
Knowledge of Job Function	Knowledgeable	420	68.0
	No knowledge	198	32.0
	Total	**618**	**100.0**
Whether safety infrastructure are functional	Functional	183	29.6
	Not functional	435	70.0
	Total	**618**	**100.0**

Source: Field Survey, 2007

Table 6.7 shows how the respondents perceive the relevance of their job function to the overall airport operations. Over 90% believe their job function to be relevant. On the other hand, the remaining small proportion of the respondents cannot see the relevance of their job function to the overall airport operation. The implication to be drawn from this result is that seeing the importance of their job function to the overall airport operation would make staff to be committed and dedicated to their job. Since they know their various job functions, staffs are supposed to know what to do at the right time, all of which will be healthy to safe airport operations and quick distress response.

Table 6.7: Assessment of respondents' job function relevance to airport operations

	Locations				Total	
	Abuja (%)	**Kano (%)**	**Lagos (%)**	**Port Harcourt (%)**	**No**	**%**
Very relevant	6.3	7.1	28.3	3.1	301	48.7
Relevant	6.3	3.1	33.8	5.1	277	44.8
Not very relevant	0.6	0.6	0.2	0.6	13	2.1
Not relevant	-	1.0	-	-	6	1.0
Don't know	1.3	-	1.0	1.1	21	3.4
Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

Respondents were asked if they have other companies whose functions complement theirs as regards airport operations. Table 6.8 indicates that 54% of the respondents across the four airports surveyed said that they do not have any other company whose functions complement theirs, while 46% responded that they have such companies. This pattern of response can best be understood if some of the various organisations are viewed in the light of their interwoven and oversight type of functions. For instance, NAMA, NCAA and FAAN are authorities within the aviation industry which play regulatory roles, though at varying degrees. Also, organisations like NAHCO and SAHCOL are both handling agents to various airlines, performing the same functions for these client airlines. Respondents' understanding that their roles are complementary to other organisations' roles imply that staff will want to be thorough in carrying out their activities as any lapse will invariably affect the activities of others. However, considering the large number of respondents who do not see their activities as being complementary to other organisations' activities, the impact of this could be detrimental to the smooth and safe airport operations. This could in turn jeopardise quick response to incidents and accidents at the airports whenever they occur.

Another finding is the very glaring situation at the departure areas where there are many government agencies like National Drug Law Enforcement Agency (NDLEA), Customs, State Security Service (SSS), and Immigration Service etc, all cluster at the check-in area and wanting to perform their duties at the same time. This makes such an area to be crowded, chaotic and stuffy, all of which are inimical to smooth passenger processing and the attendant safety implications.

Table 6.8 shows that only a negligible 13.9% of the respondents claimed that the activities within the airport are well planned.

Detailed enquiry into the activities carried out within the airports shows that the respondents have different assessment of their perception of the organized or planned nature of the various activities carried out within the selected airports. More than two thirds (86.1%) as shown in table 6.8 is of the opinion that the activities carried out within the airport are not well planned. This assertion could be attested to when one considers the haphazard situation at the tarmac. For example, where staff of various organisations are in the habit of wanting to perform their duties at the same time without due consideration to other staff who need to perform their own activities too. Conflict in role

performance may then occur leading to a situation that will constitutes a serious threat to airport safety and distress response.

The apron ramp (where aircraft park for ground operations) especially at Lagos and Abuja airports has become so cramped and congested. A situation which arose out of government deregulation policy of airline ownership, without adequately providing for the effect it was to have on the meagre available facilities and infrastructure. Both the airline operators and the handling agents are always scrambling for space to perform their duties without considering safety implications but rather on-time departure schedules.

Table 6.8 further indicated that only 16.3% acknowledged that the location of various activities within the airport allows for proper relationship. While the largest proportion (83.7%) claimed that the location of various activities within the airport does not allow for proper relationship. The fact that a very large proportion of the respondents indicated that the location of activities at the various airports does not allow for proper relationship implies that efficiency of strategic facilities may become reduced. For instance, in a situation where the aircraft handling agents need the services of airport fire service, it is always pretty difficult getting to them as their office is quite a distance from aircraft handlers' offices. This is particularly serious when the intercom systems of the airports are not working. Also, the incessant power failure in the selected airports renders escalators useless. This makes it difficult getting messages from or across to some organisations like meteorological services, apron control, control tower which are located at higher floors of the airports' buildings. All these cannot promote safe operations and quick distress response within and around the airports.

The analysis of whether the respondents are aware of airport master plan or not as also presented in Table 6.8 revealed that more than 90% of them claimed to be aware of the existence of this important document, while only 7% said they are not aware of the existence of the airport master plan.

Furthermore, the respondents who claimed that the airport has a master plan were questioned if the master plan is operational. From Table 6.8, only 25.2% of them

disclosed that the master plan is being operated while a larger percentage (74.8) claimed that though there is a master plan, it is not being operated.

This lack of implementation of the airport master plan is manifested in the rate at which some structural developments are spuriously springing up at the selected airports especially Lagos. For instance, the hotel being built in front of the new terminal 2 of MMA, is among the many new structures that have sprung up in the last few years which are not in the original master plan. An analysis of the locations of these structures indicated that they negate the safety principles of airport management and safe operations. This is to the extent that, it was observed that rather than expand the apron to accommodate more aircraft in the wake of aviation deregulation policy, part of it was it was used to build an elevated car park; thus leading to congestions at the ramp. This observation was equally noted by an IATA spokes man Lorne Riley in 2007 and Sanusi (2008). This congestion often leads to various degrees of damages at the ramp where tractors were found to be colluding with aircraft or even ground handling equipments colluding with each other and sometimes leading to serious personnel injuries or death (NACHO LOG BOOK 2004).

It was also observed that series of encroachments had occurred on the selected airports' vacant lands. For instance, there are farm lands, grazing and dump sites within the environment of the airports, coupled with high rise buildings, erected communication masts and abattoirs. All of these have given a conducive requisite for wild life habitation. There are recorded cases of cows crossing the aircraft runway, rodents destroying airport power cables and also birds striking moving aircraft. Additionally, it was revealed during the study that the master plan on some other important aspects of the airport were not implemented such as drainage and water supply system, terminal building expansion, wild life and bird control among others.

Table 6.8: Respondents Views on Effectiveness of Available Infrastructure.

Variables		Frequency	Percentage
Availability of Complementary companies	Available	284	
	Not available	334	
	Total	**618**	
Whether activities within the airport are well planned.	Well planned	86	13.9
	Not well planned	532	86.1
	Total	**618**	**100.0**
If various units' location allows for adequate operational relationship	Allows	101	16.3
	Does not allow	517	83.7
	Total	**618**	**100.0**
Awareness of airport master plan	Aware	575	93.0
	Not aware	43	7.0
	Total	**618**	**100.0**
Whether a Master plan is being operated.	Operated	156	25.2
	Not operated	462	74.8
	Total	**618**	**100.0**

Source: Author's Survey, 2007

With a view to complementing the issues discussed on Table 6.8, respondents' understanding was sought on how safety infrastructures are being effectively positioned within their operational areas in the airport. As shown on Table 6.9, a larger percentage of those that are undecided about the positioning of the safety infrastructures confirm the fact that either the infrastructures are not available or the respondents are not aware of where they are placed. This further explains the less emphasis placed on the culture and awareness of safety in the selected airports.

Table 6.9: Positioning of Safety Infrastructures within Airport operational areas

Responses	Locations				Total	
	Abuja (%)	Kano (%)	Lagos (%)	Port Harcourt (%)	No	percentage
Well positioned	0.3	0.2	2.1	0.3	18	2.9
Undecided	14.0	11.2	57.3	9.7	569	92.1
Not well positioned	0.3	0.5	3.9	0.3	31	5.0
Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

The research sought to find out if operating organisations within the airports place emphasis on safe operation by their staff. Table 6.10 shows that nearly all the respondents believe that their organisations do not place emphasis on safe operations. Only a very small proportion (3.7%) claimed that their organisations place emphasis on safe operations. This result corroborates the earlier discussions on airport planning and safety issues as most organisations don't actually place emphasis on safe operations just as the attitude of staff is to perform their assigned task and take their time off. Hence, the observed lack of clear cut pattern of service delivery, but rather exhibition of operational inconsistencies by staff. What most organisations at the airport preach to their customers as regards service delivery is different from what actually exist on the field. More importantly, safety campaign is not given prominence at work place.

From the above, it could be deduced that the various organizations within the airports do not observe or put into practice operational culture of safety. This has led to a direct consequence in which staff carry out their various functions without due regard to the safety of other operators within the airport. This situation is more pronounced between the airline operators and the handling agents, a condition whereby the airline ground operators will be urging the handling agents for an on-time scheduled departure (as this affects their revenue) of their aircrafts at the detriment of operational safety procedures. An informant (a technical staff with Nigerian Airspace Management Agency NAMA) succinctly put it that the access radio frequency within the Nigerian airspace is presently under serious pressure due to increase in the demand for use. It is the same radio frequency capacity that has been in use some 30years ago that is still in place till today despite the over 300% increase in the number of aircrafts that ply the Nigerian airspace. This has made it difficult for pilots to effectively access radio frequency transmission.

Table 6.10: Views on whether organizations place emphasis on safe operations

Responses	Locations				Total	
	Abuja (%)	Kano (%)	Lagos (%)	Port Harcourt (%)	No	percentage
Emphasises	0.3	1.0	2.1	0.3	23	3.7
No Emphasis	14.2	10.8	61.2	10.0	595	96.3
Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

The variation in the awareness of safety issues among the personnel in the different organisations working within the airports was further investigated through the hypothesis which was stated as: 'there is no significant variation in the awareness of safety issues among different organizations operating within the airports'.

All organizations surveyed at the airports have one role or the other to play to ensure safe operations. The safety issue touches on service providers' staff members, passengers, aircraft handling and cargo safety including all the operational procedures that go with it. As presented in Table 6.11, the level of safety awareness, which is critical to the actualization of safe practices, varies among the organizations surveyed. In all, the level of awareness of safety is generally high among all the organizations. This response accounts for close to half (43.0%) of the total response to this question. The reason for this high level of awareness can be attributed to the fact that the issue of safety is now being increasingly discussed due to the incessant incidents and accidents in and around the airports especially the recent prevalent air crashes in Nigeria.

Table 6.11: Variations in Safety Awareness among Organisations at the Airports

			Organisations at the airport					
			NCAA	NAMA	FAAN	NAHCO	others	Total
Safety awareness	very low	Count	19	11	30	43	30	133
		% of Total	3.1%	1.8%	4.9%	7.0%	4.9%	21.5%
	Low	Count	11	13	44	32	24	124
		% of Total	1.8%	2.1%	7.1%	5.2%	3.9%	20.1%
	High	Count	7	12	170	50	27	266
		% of Total	1.1%	1.9%	27.5%	8.1%	4.4%	43.0%
	very high	Count	14	10	46	11	14	95
		% of Total	2.3%	1.6%	7.4%	1.8%	2.3%	15.4%
Total		**Count**	**51**	**46**	**290**	**136**	**95**	**618**
		% of Total	**8.3%**	**7.4%**	**46.9%**	**22.0%**	**15.4%**	**100.0%**

Source: Field Survey, 2007

However, this level of awareness varies among the various organizations. For instance, the level of awareness of safety was very high among the staff of the Federal Airport Authority of Nigeria (FAAN) (7.4%). This can be adduced to the fact that FAAN is the controlling authority of all the agencies working within the airports and their vicinity. To this end, FAAN among other things enforces compliance to safety procedures and practices among the service providers within the airports. The Nigeria Civil Aviation Authority (NCAA) is next in ranking to FAAN. It accounted for 2.3%. Again this can be due to the fact that NCAA is the organ responsible for the formulation of safety standards, guidelines and practices for the operators within the airports and their environs.

On the other hand, very low level of safety awareness was found among the handling agents represented by Nigerian Aviation Handling Company (NAHCO). This should not be the case bearing in mind the importance of activities that these handling agents perform within the airport system. These include among many others handling of aircraft, dangerous and hazardous cargo, perishables and valuables, passengers, all of which entails and require high level of procedural safety awareness. Any shortfall in any of them can be disastrous to the airport operations and users. The fire incident at SAHCOL and the crash of Hydro Air cargo plane was due to this reason of low level of safety awareness. The reason for this low level of safety awareness could be due to lack of adequate communication of safety procedure and practices coupled with inadequate training on modern safety equipment/facilities to the affected operational staff.

The Analysis of Variance (ANOVA) was used to further test if the observed variations in the level of safety awareness among the various operating organizations at the airport are significant. For this test, the 'F' value obtained as shown in table 6.12 is 11.954. This value was found to be highly significant, therefore rejecting the null hypothesis which stated that there is no significant variation in the level of safety awareness among the operating organisations within the airports.

Table 6.12: Result of Analysis of Variance of Safety Awareness among Organisations at the Airports

Safety awareness

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	44.152	4	11.038	11.954	.000
Within Groups	566.031	613	.923		
Total	**610.183**	**617**			

Source: Field Survey, 2007

Table 6.13 shows the respondents' opinions on the availability of safety infrastructure and equipment in the selected airports. Nearly all the respondents (95.5%) are of the opinion that the provision of safety infrastructure in the airports is poor. In other words, there is low level of availability of these infrastructure and equipment for safety and distress response in the selected airports of study. These infrastructure include until October 2010, Total Radar Coverage of Nigeria (TRACON), serviceable fire fighting equipment, medical facilities, hand gloves, safety boot, ear muffler against aircraft noise, nose muffler against hazardous cargo coupled with having specialised professionals to handle specialised aspects of airport operations. Further investigation revealed that the level of safety at the Lagos airport fall short by 30%, Kano 25%, Abuja 10% and Port-Harcourt 20%.

It was observed during the study that whenever rain falls, especially at Lagos and Port Harcourt airports, both the apron and the runway facilities are usually water logged. This situation was found out to be due to lack of or little knowledge by the airport authorities about the hydrological features of the airport areas which has not allowed for an effective and adequate drainage system. This could also be a result of where the landuse regulations within the airports have been negated. This circumstance is equally related to the observed situation at the Meteorological Department of all the selected airports where it was found out that the Department lacks the appropriate instrument to accurately determine and measure both the airport weather conditions (like cloud cover, dust/harmattan haze, lightening and thunderstorm), wind direction and pressure at any given period of operation. The major implication of these findings is that the airports are vulnerable to incidents/accidents impairing quick and effective distress response.

Table 6.13: Views on the Availability of safety infrastructures and Equipment

Responses	Locations				Total	
	Abuja (%)	Kano (%)	Lagos (%)	Port Harcourt (%)	No	percentage
Available	0.5	3.0	-	1.0	28	4.5
Not Available	14.1	8.7	63.3	9.4	590	95.5
Total	**14.6**	**11.7**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

The relationship between age of airports and the provision of safety infrastructure is examined here. The rationale for doing this is that, it is assumed that as airports' activities increase over time in terms of traffic volume (passengers and freight throughput), there should also be a corresponding increase in the provision of safety infrastructural facilities. This is because if infrastructural provision does not keep pace with the increased volume of activities, this could jeopardise safety due to overstretch and pressure on the existing facilities. To do this, a correlation analysis was used to test the hypothesis which states that 'there is no significant relationship between airport age and provision of safety infrastructure'. For this hypothesis, airport age was measured in terms of the year the airport was commissioned, while safety infrastructure was measured in terms of the availability of safety infrastructure, i.e. whether or not they are available (Table 6.28).

As indicated in Table 6.14, the correlation value (r) obtained for this test is 0.12, implying that there is a positive relationship between the airport age and provision of functional safety infrastructure. But as seen from the result, the r value is very low. This in essence means that there has been an insignificant increment in the provision of safety infrastructure overtime. The significance of the r value (.003) further confirms the weak relationship between airport age and the provision of safety infrastructure. In other words, infrastructural development within the selected airports has not kept pace with the emerging situations in the contemporary aviation sector. According to a front page report of the Punch of 2nd February, 2008 with a caption: "Challenges of MMIA", it was reported that, the Lagos airport which was built at about 31 years ago, modeled after Schipol airport in Amsterdam, is yet to witness any major rehabilitation let alone reconstruction. This finding was further confirmed by most of the key airport operators' technical staff that were interviewed. The implication for this is that, the facilities at this airport since inception can not be expected to be effective or efficient enough to cope with the contemporary aviation requirements (like increase in passenger, aircraft and cargo throughput) within that airports.

Table 6.14: Relationship between Airport Age and Provision of Infrastructure

		Airport Age	Whether the Infrastructures at the airport are functional?
Airport Age	Pearson Correlation	1	.118**
	Sig. (2-tailed)		.003
	N	618	618
Whether the Infrastructures at the airport are functional?	Pearson Correlation	.118**	1
	Sig. (2-tailed)	.003	
	N	618	618

Source: Field Survey, 2007

The result of the hypothesis shown on Table 6.14 confirmed the actual situation with regards to the provision of safety infrastructure in the selected airports. Most of the safety infrastructures in all the airports are becoming obsolete and inadequate thereby reducing their effectiveness and functionality. This is further compounded by the fact that government policy on deregulation in the aviation sector has not taken care of provision for more and modern safety infrastructure to cater for the significant increase in the number of airline operators that resulted from deregulation.

The issue of staff training was also examined here to see if the level of staff training could positively impact on safety viz-a-viz the existing level of effectiveness and functionality of available infrastructure at the airports. Basically, it is assumed that, if adequate and modern safety facilities are provided without well trained man power to operate them, optimal level of functionality of these facilities will not be achieved. In doing this, staff training and functionality of safety infrastructures were correlated. Staff training was measured in terms of the number of training courses attended by respondents in the last ten years (Table 6.2) while the functionality of safety infrastructure was measured in terms of whether the existing safety infrastructure is functional or not (Table 6.5). As shown in Table 6.15 a low positive correlation ($r = 0.12$) exists between staff training and the effectiveness and functionality of the existing infrastructures at the airports. This means that there is a direct relationship between staff training and the functionality of safety infrastructure. The implication of this is that the existing low level of staff training may further reduce the effectiveness of the existing facilities. In essence, staff training and provision of adequate functional infrastructure must correspondingly increase to be able to achieve a high level of infrastructural functionality.

Table 6.15: Relationship between Functional Infrastructure and Staff Training

		No. of training/courses been to in the last 5 years	Whether the Infrastructures at the airport are functional?
No. of training/courses been to in the last 5 years	Pearson Correlation	1	.124**
	Sig. (2-tailed)		.002
	N	618	618
Whether the Insfrastructures at the airport are functional?	Pearson Correlation	.124**	1
	Sig. (2-tailed)	.002	
	N	618	618

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

Source: Field Survey, 2007

6.2 SAFETY CONCERNS AMONG THOSE LIVING AND WORKING AROUND THE AIRPORTS

This section presents a discussion of the analysis of responses to safety issues by those working and living around the airport.

6.2.1 SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS.

Table 6.16 shows that, there are more females (63.6%) than males (36.4%) living around all the airports.

With respect to age distribution respondents within age brackets (40 – 44) constitute the majority (30.5%). This is closely followed by age brackets (30 – 34) and (35 – 39) with 24.7% and 15.8% respectively. Respondents within the age brackets (<24), (25 – 29), (45 – 49), (50 – 54) and (above 50) accounted for 8.7%, 6.7%, 8.9%, 1.7% and 3.0% respectively.

The above age distribution suggests that most of the respondents are the active population, within the ages of 30 – 44 years.

Analysis of marital status presented in table 6.16 reveal that 61.9% are married, 15.6% are single, 9.7% are separated, 6.5% are divorced and 6.3% are widows and widowers. This shows that, people of reproductive age (married) dominates the population.

Further, Table 6.16 shows the academic qualification of respondents. The qualification of respondents ranges from primary education to post graduate degrees. About 7% of the respondents had no formal education. 2.2% had just primary education. 14.5% are holders of WASCE/GCE/SSCE certificates, 8.2% had obtained a pass in a trade. 31.8% are either holders of OND/NCE or TC II, 23.6% are either holders of HND or First degree certificates and 11.0% had post graduate qualifications. Only nine persons (1.9%) did not belong to any particular category or they refused indicating their academic qualifications. The different categories reflect the level of mental reasoning of the respondents, which in turn could influence their reflections on what judgement they passed on pertinent issues, whether subjectively or objectively. Most of the respondents can easily express themselves and to that extent, they were able to give a vivid account of their understanding to most of the questions posed to them.

Table 6.16: Socio-economic characteristics of respondents living and working around the selected Airports.

		Frequency	Percentage
Sex	Male	168	36.4
	Female	294	63.6
	Total	**462**	**100.0**
Age	< 24 years	40	8.7
	25 – 29	31	6.7
	30 – 34	114	24.7
	35 – 39	73	15.8
	40 – 44	141	30.5
	45 – 49	41	8.9
	50-54	8	1.7
	55 years and above	14	3.0
	Total	**462**	**100.0**
Marital status	Single	72	15.6
	Married	286	61.9
	Separated	45	9.7
	Divorced	30	6.5
	Widow/widower	29	6.3
	Total	**462**	**100.0**
Level of education	No response	9	1.9
	No formal education	31	6.7
	Primary education	10	2.2
	WASCE/GCE/SSCE	67	14.5
	Trade test	38	8.2
	OND/NCE/TC11	147	31.8
	HND/First Degree	109	23.6
	M.SC Degree and Above	51	11.0
	Total	**462**	**100.0**

Source: Field Survey, 2007

6.2.2 SAFETY VARIABLES AROUND THE SELECTED AIRPORT.

This section contains consideration and analysis of variables that could impair safety and quick response to distress situation around the selected airports of study. These include among many others the types of structures around the study areas, activities that are carried out with traffic characteristics around the selected airports of study, and threats that such activities could pose to airport operations.

Most of the respondents as presented in Table 6.17 had lived in their various locations for between six and ten years accounted for 29%, 18% had lived there for between one to five years, 27% had lived there for a period of between eleven and fifteen years while 14% and 12% have been living there for a period ranging between sixteen to twenty years and above respectively. Although, length of stay in a place for upward one to ten years is long enough for any meaningful observation, longer period of above 20 years could give an edge over the previous groups. This is because issues bordering on giving judgement on trends of changes could better be captured by longer periods of stay.

It was also illustrated on Table 6.17 the distribution of types of activities being carried out around the airports. The respondents show that dwelling represents the highest, totalling 52.4%, followed by office/industrial complex and artisan yards with 15.3% and 15.6% respectively. Others are shops, 12.1% and farming/Grazing 4.6%.

The activities which are predominantly residential with comparatively high population of unskilled labourers and their attendant waste generation which is usually characterized by poor disposal, has led to the development of features that allow for habitation of wild life around the airports. These include dump sites, abattoir development, unkept water bodies and land excavations among others. There are recorded cases of bird strikes, tortoise found crawling on run ways, cattle crossing the run ways and even snakes found within the operational areas of the airports, all of which are detrimental to safety.

An analysis of the land use activities around the four airports were made in order to understand its effects on safe airport operations.

Analysis of building types on table 6.17 indicated that out of the total number of 462 respondents on building (structures) types, 17.5% live in bungalows, 74.3% in two storey buildings, 2.6% were high rise buildings, 2.1% were masts and others 3.5%.

Analysis of the perception of respondents on the impact of surrounding activities on airport operations is additionally shown in Table 6.17. More than two thirds (84.6%) of the respondents are of the opinion that these activities do not constitute any hindrance to airport operations especially in the area of safety. Only 15.4% are of the opinion that they could impact airport operations negatively. For instance, many of the respondents believe that domestic activities and their movement in and out of their houses do not constitute any infringement to airport operations. However, the illegal disposal of waste that ends up in the illegal waste dumps around the airports constitutes a threat to safe airport operations. It should be noted that a significant proportion of these waste is generated by house holds in these residential areas.

However, when asked if they observed any health problems, especially chest or ear related within their community, most of the respondents replied in the affirmative. Above 95.9% acknowledged that they had obvious chest/ear problems while only a few, (4.1%) said they were not experiencing any health related problems especially chest/ear problems (table 6.17).

Further analysis as shown in Table 6.17 reveals that there are serious health problems that pervade those that live work around the selected airports. The most prevalent of these is ear pains or dis-order (46.9%), while asthma/chest pains (22.9%) and cancer (21.2%) were also identified to be noticeable serious problems. Ulcer (6.7%) was equally identified as one of the heath problems being experienced by respondents. Though some of these responses like ulcer, asthma and cancer need further medical investigation to determine the contributions of airport operations to these identified ailments.

Table 6.17: Effects of Airport Operations on Those Living and Working within Airport Vicinity.

Variables		Frequency	Percentage
Length of stay in surveyed location	1-5years	83	18.0
	6-10years	134	29.0
	11-15years	125	27.0
	16-20years	65	14.0
	Above 20years	55	12.0
	Total	**462**	**100.0**
Type of activities identified around the airport.	Dwelling	242	52.4
	Office/Industrial complex	71	15.3
	Shops	56	12.1
	Artisan yards	72	15.6
	Farming/Grazing	21	4.6
	Total	**462**	**100.0**
Type of identified structures	Bungalow	81	17.5
	Two storey buildings	343	74.3
	High rise buildings	12	2.6
	Mast	10	2.1
	Others	16	3.5
	Total	**462**	**100.0**
Whether activities carried out within the vicinity affects airport operation	It affects	71	15.4
	Not affecting	391	84.6
	Total	**462**	**100.0**
Whether residents observed any form of health hazards/problems	Observed	443	95.9
	Total	**462**	**100.0**
Perceived health hazards around the airport.	Air pains	217	46.9
	Ulcer	31	6.7
	Asthma/Chest pain	106	22.9
	Cancer	98	21.2
	No response	10	2.2
	Total.	**462**	**100.0**

Source: Author's Survey 2007.

Further investigation was undertaken to find out if the activities carried out around the airport such as farming, residential and commercial land use, could constitute a threat to airport operations. Again, as shown in Table 6.18, 96.8% claimed that such activities do not constitute a threat to airport operations, while only 3.2% acknowledge that the activities constitute a threat to the operations of the airports.

This response could be due to the respondents' lack of knowledge of the multiplier effects that their activities within and around the airport constitute to airport operations. For instance, an ordinary abattoir operator may not know that his activities attract birds to the vicinity of the airport which poses a threat to flying airplanes while residents around same airport know nothing about the dump sites which arose from their waste generation, all of which influences wild life habitation.

Consequently, respondents were therefore asked about their opinion on how airport environment could be improved for safety purposes. The result was as presented on Table 6.18. More than half (53.2%) were of the opinion that good management that is devoid of the observed management malaise and proper monitoring of airport operations would improve safety in and around the airports. Another significant proportion (22.1%) indicated that improvement of distress response system by government and relevant agencies would significantly improve airport safety. This is to the extent that government should always analyse critically the impacts of aviation policy statements before embarking on such. The earlier deregulation of air transport by the Federal Government of Nigeria which led to the springing up of various sorts of airline operators that constituted a menace (in terms of airport ramp congestion and inconsistencies in passenger/cargo flight operation) to the Nigeria aviation industry can not be divulged from this assertion.

Further investigation into the suggested airport safety improvement measures revealed that provision of adequate modern facilities and proper maintenance is necessary to enhance safety at the airports, so also is the creation of specialised safety agencies. These responses were given by 11.9% and 3.5% of the total number of respondents respectively.

There were however variations in the opinions of respondents across the four locations. For instance, whereas good and proper management constituted the major measures suggested by the respondent around the Lagos and Kano airports, provision of modern facilities and maintenance were the major safety improvement measures suggested by respondents in Abuja and Port Harcourt airports.

Table 6.18: Improvement on Airport Safety Operations.

Variables		Locations				Totals	
		Lagos %	Kano %	Abuja %	Port-Harcourt %	Frequency	Percentage
If activities constitute a Threat to Airport Operations	Threatens	2.4	0.2	0.4	0.2	15	3.2
	Do not Threaten	40.5	20.6	19.5	16.2	447	96.8
	Total	42.9	20.8	19.9	16.4	462	100.0
On how to improve Airport Operations for Safety.	Good Management and Proper Monitoring	16.7	4.3	0.9	0.2	246	53.2
	Privatisation of all Airport Agencies,	2.2	-	-	-	10	2.2
	Provision and Maintenance of Facilities.	3.0	4.3	2.4	2.2	55	11.9
	Improvement of Disaster Management by Government	3.2	3.5	0.2	0.2	102	22.1
	Provision of more Agencies to ensure Safety.	1.7	1.7	-	-	16	3.5
	No response	16.0	6.9	16.5	13.9	33	7.1
	Total	**42.9**	**20.8**	**19.9**	**16.5**	**462**	**100.0**

Source: Field Survey, 2007.

6.3 SAFETY CONCERNS AMONG THE USERS OF THE AIRPORTS

This section aims at evaluating the concerns of selected airport users as regards the level of safety and response to distress situations. Such variables that are considered include the demographic characteristics of respondents, quality of service delivery, and opinion on airport's safety condition, whether user's service providers have adequate and appropriate facilities and how conducive the airport environment is in carrying out their operational activities among many others.

6.3.1 DEMOGRAPHIC CHARACTERISTICS OF USERS IN SELECTED AIRPORTS

Table 6.19 which shows the sex distribution of respondents reveals that females constitute the highest number of 51.2%. The remaining 48.8% are males. The age of the respondents is fairly well distributed among the age cohorts. However, those in the age bracket 45-49, 50-54 and those above 55 years are fewer constituting only 7.9%, 1.6% and 4.3% respectively.

More than half of the respondents are married (58.8%), 24.1% are single while the remaining 17.1% are separated, divorced or widowed (table 6.19)

About one third of the respondents have first degree/HND, 19.2% have National Diploma and National Certificate of Education. The lowest proportions of the respondents are those with no formal education (4.9%). This categorization shows that the respondents are knowledgeable and able to understand and respond to the issues under investigation.

Table 6.19: Demographic Characteristics of Respondents at the Selected Airports

Variables		Frequency	Percentage
Sex	Male	180	48.8
	Female	189	51.2
	Total	**369**	**100.0**
Age	<24 years	49	13.3
	25 – 29	46	12.5
	30 – 34	82	22.2
	35 – 39	56	15.2
	40-44	85	23.0
	45-49	29	7.9
	50-54	6	1.6
	Above 55 years	16	4.3
	Total	**369**	**100.0**
Marital status	Single	89	24.1
	Married	217	58.8
	Separated	24	6.5
	Divorced	22	6.0
	Widow/Widower	17	4.6
	Total	**369**	**100.0**
Education level	No formal Education	21	4.9
	Primary education	18	5.7
	WASCE/GCE/SSCE	30	8.1
	Trade test	56	15.2
	OND/NCE/TC II	71	19.2
	HND/First Degree	130	35.2
	MS.C Degree and above	43	11.7
	Total	**369**	**100.0**

Source: Field Survey, 2007.

6.3.2 SAFETY CONCERN AMONG AIRPORTS' FACILITITIES USERS.

It was earlier presented in Table 3.4 that, passengers constitute more than half (58.5%). This is understandable considering the fact that passengers are the major users of the airports. There is always a continuous flow of passengers in the airports. Next are the customs' clearing agents which constituted 27.7%, airline operators (8.1%) and travelling agents (5.7%).

About two thirds of the respondents have used the airports' facilities for about 10 years (table 6.20). Specifically, 27.6% have used the airports for 5 years or less while another 39.1% have also used it for not less than 10 years. The implication of this is that most of the respondents are well aware of the happenings within the airports and the environment. This will invariably make their contributions very meaningful to issues raised on safety and distress response.

Table 6.20 further shows that a large proportion of the respondents (42.3%) visit the airports every day. These are mostly the customs' clearing agents, airline operators and also the travelling agents. Those that responded to once a week (11.9%) and fortnightly (6.2%) are mostly those business travellers that often come around the airport to check on their customs' clearing agents on either their import or export. On a quarterly basis, about 22% do visit the airports while 4.9% visits the airport once every month. This distribution is significant to this study to the extent that this larger proportion that visits the airports daily to give a good account of various occurrences that happen daily at the selected airports.

All the respondents, according to Table 6.20 indicated that they interact with the officials of FAAN or at least use their facilities. This is because FAAN is the owner of the terminal buildings and all the land mass upon which airport activities/operation take place. Equally, the passengers, importers and exporters can not carry out their activities at the airport without having dealings with government officials like the Customs, Immigration and NDLEA among others.

A significant proportion (85.2%) of respondents indicated that whenever they come to the airport, they always have to use either NAHCO or SAHCOL facilities. This is because both agencies are the only handling companies (in terms of passenger and cargo handling) operating within the airports. Others are the catering service (9.3%), aircraft fuellers (3.4%) and others like lounge providers, duty free shops, trolley and car hire services (2.1%).

Likewise, Table 6.20 shows that most of the respondents are very conversant with the most critical areas of the airports with respect to safety issues. These areas are the terminal buildings where passengers and aircraft are handled always and cargo handling areas (NAHCO/SAHCOL). These two areas of the airports are more prone to both incidents and accidents.

Majority of the respondents (76.2%) as also revealed on Table 6.20 said that their airport service providers do not have competitors while the remaining 23.8% said their service providers have competitors. This result has some implications. For instance, as there are no competitors, service delivery by providers is likely to be low because the providers know that the users have no other alternative than to patronise them.

Respondents were further asked if they would have preferred their service providers to have competitors. More than two thirds, (77.0%) of the respondents answered in the affirmative. They would prefer that their present service providers have competitors so as to, among other reasons, improve on their present level of service delivery. They stressed the importance of quality of service, efficiency and effectiveness in addition to time saving in the process of transacting business.

Respondents were asked to rate the quality of service they enjoy from their various providers. In all cases, more than three quarters said the service providers have not been providing them with high quality service (table 6.20). On the other hand, about half of the respondents (49.9%) said the services they enjoy from their service providers have been of low quality, and sometimes very low.

Equally, the opinions of the respondents with respect to their evaluation of safety conditions within the airports are presented in table 6.21. Most of the respondents strongly agreed that carrying out activities at the airport could be very cumbersome, hazardous and unsafe.

Table 6.20: Respondents' Assessment of Airport Service Delivery

Variables		Frequency	Percentage
Length of use of the airport	1-5years	102	27.6
	6-10years	144	39.1
	11-15years	66	17.8
	16-20years	29	7.8
	Above 21years	28	7.7
	Total	**369**	**100.0**
Frequency of visits to the Airport	Everyday	156	42.3
	Once in a week	44	11.9
	Fortnightly	23	6.2
	Once in a month	18	4.9
	Quarterly	81	22.0
	Others	47	12.7
	Total	**369**	**100.0**
Facility Provider frequently used by respondents	FAAN (Terminal Building)	*	*
	NAHCO/SAHCOL	314	85.2
	Clearing agents	34	09.3
	Aircraft Fuellers	12	03.4
	Government agencies	*	*
	Others	09	02.1
	Total	**369**	**100.0**
Awareness of competitors	Aware	88	23.8
	Not aware	281	76.2
	Total	**369**	**100.0**
Preferring a competitor	Prefer	284	77.0
	Do not prefer	85	23.0
	Total	**369**	**100.0**
Level of quality service delivery	Very high	34	9.2
	High	50	13.6
	Average	101	27.3
	Low	117	31.7
	Very low	67	18.2
	Total	**369**	**100.0**

Source: Field Survey, 2007

Table 6.21: Opinion on safety conditions within the Airport

Conditions	SD		D		N		A		SA	
	FX	%	FX	%	FX	%	FX	%	FX	%
Carrying out activities at the airport could be very cumbersome	33	8.9	39	10.6	19	5.1	156	42.3	122	33.1
Carrying out activities at the airport is very hazardous	76	20.6	52	14.1	57	15.4	102	27.6	77	20.9
Customer's non adherence to rules and regulations	30	8.1	37	10.0	7	1.9	161	43.6	130	35.2
Airport operators do not have a specific standard	49	13.3	36	9.8	16	4.3	158	42.8	95	25.7
Airport operators generally do not have regards for their customers	60	16.3	46	12.5	9	2.4	149	40.4	98	26.6
Airport operators are very carefree in rendering their service.	47	12.7	36	9.8	15	4.1	161	43.6	102	27.6
I can contribute meaningfully to make things better at the airport	21	5.7	15	4.1	3	0.8	119	32.2	207	56.1
Airport operators need my co-operation and contribution to make things work better.	21	5.7	15	4.1	3	0.8	119	32.2	207	56.1

Source: Field Survey, 2007.

NB: SD = Strongly disagree; D = Disagree; N = Neutral;
A = Agree; SA = Strong Agree; NR = No Response;

More than two thirds of the respondents (82.7%) are of the opinion that the service providers which they patronise do not have adequate and appropriate facilities to deliver their services (Table 6.22).

Furthermore, respondents were asked whether they are satisfied with the level of service delivery they presently enjoy from their providers. From the results on Table 6.22, more than three quarters (82.1%) said that they are not satisfied with the level of service delivery while only 17.9% said they are satisfied.

Table 6.22 further revealed that 87.5% of respondents indicated that the environments of the selected airports are not conducive for them in carrying out their various activities. As shown earlier, both the crowd and touts at the selected airports are not being effectively controlled and in addition there is the incessant power failure at these airports.

The users were thus asked to suggest ways to make the selected airports safer and highly responsive to distress. As shown in table 6.22, three prominent measures suggested by the respondents include improvement in the provision and maintenance of the existing operational facilities (92.1%), training and re training of staff (85.9%), and deployment of specific professionals to be handling specific duties, especially those related to safety (82.9%). Other measures suggested include having a well spelt out operational procedures which should be adequately communicated to staff and conforming to specified standard in carrying out activities.

Table 6.22: Respondents' Assessment of Airport Operational Effectiveness.

Variables		Frequency	Percentage
Whether available facilities are adequate	Adequate	64	17.3
	Not adequate	305	82.7
	Total	**369**	**100.0**
Satisfaction with service delivery	Satisfied	66	17.9
	Not satisfied	303	82.1
	Total	**369**	**100.0**
Whether airport environment is conducive for their activities	Conducive	46	12.5
	Not conducive	323	87.5
	Total	**369**	**100.0**
Suggestions on how to make airport operations more attractive.	Improvement on operational facilities	340	92.1
	Allowing professionals to undertake some specific functions e.g. control tower, meteorology, security, handling and others	306	82.9
	Efficient planning of activities.	276	74.8
	Having a well spelt out procedures	294	79.7
	Conforming to specific standards in carrying out activities.	291	78.9
	Provision of effective health services.	224	60.7
	Various airport agencies like FAAN, NAHCO/SAHCOL, NAMA, NCAA should improve on their services/activities.	246	66.7
	Training and re-training of staff on customer care and satisfaction.	317	85.9

Source: Field Survey, 2007

The respondents were further asked the reasons for their responses on Table 6.22 as regards level of satisfaction with service delivery. Most of them, as presented on Table 6.23, said that they have reservations as regards institutional frameworks and provision of effective operational facilities within the selected airports. For instance, there is great reservation on crowd and touts control (86.7%) while 80.2% indicated that provision of adequate and effective operational facilities meant to ensure optimal services were lacking. Thus a large number of the respondents therefore found the airports as not being conducive to carrying out their activities.

Table 6.23: Reasons for the level of satisfaction with Airport service delivery

	Available		Not Available	
	Fx	**%**	**Fx**	**%**
Provision of adequate and effective operational facilities	68	18.4	296	80.2
Constant power supply	96	26.0	269	72.9
Constant water supply	95	25.7	271	73.4
Crowd and tout control	45	12.2	320	86.7
Adequate security	116	31.4	251	68.0
Clean environment	162	43.9	206	55.8
Friendly government agencies like customs and immigration	98	26.6	269	72.9

Source: Field Survey, 2007

CHAPTER SEVEN

ANALYSIS OF DISTRESS OCCURRENCES AND RESPONSES IN THE SELECTED AIRPORTS

This chapter discusses response preparedness, responsiveness and capabilities to distress occurrences in the selected airports. It analyses the responses of both the operators and users coupled with those living and working around the airports.

7.1 ANALYSIS OF DISTRESS AND RESPONSE AMONG AIRPORT SERVICE PROVIDERS

The research attempts to analyse the level of distress capability within the selected Nigerian airports. This is done through the analysis of available infrastructure meant for this purpose and evaluation of past distress occurrences within these airports.

On Table 7.1, it was shown that more than two thirds of the respondents said that they have witnessed at least one incident/accident in the airports. Informal discussions with some of them revealed that they have witnessed far more incidents in the past five years than before. The witnessed occurrences include, in order of importance, air crashes, missing aircraft from the airspace, fire outbreaks, flight controlled into terrain, missed approach by in-coming aircraft, equipment to equipment collision, and vehicular accidents among others.

In view of the past experiences of respondents as it concerns distress management, as revealed on Table 7.1, more than four fifth (85.8%) are of the opinion that the existing safety infrastructure are not adequate in managing distress situations whenever they occur. The few available infrastructure and equipment are not compatible enough with modern aviation needs and the complexities of distress occurrences. This therefore can be attested to when considering the number of months that it took the aviation authorities in locating the Beech craft plane that got missing in the Nigerian airspace on its way to Obudu Ranch, Cross Rivers State in February 2008. Bassey (2009) inclusively corroborated this finding in his article: Emergency Medical Response: The Nigerian

Perspective. He (Bassey 2009) described the emergency response in the four major Nigerian airports of Lagos, Abuja, Kano and Port-Harcourt as appalling. This is to the extent that there is no assigned airport triage officer, emergency resuscitation equipments are inadequate, pre-designated area in the airport vicinity for temporary morgue is non-existent, airport clinics are not well equipped due insufficient funding, communication facilities are either inadequate or not functioning, lack of adequate training, non-existence of mutual aid agreement with outside emergency response agencies along side absence of or poorly carried out emergency drills. This is why the average response time at the selected airports as revealed by the study was 54 minutes in Lagos, 43 minutes in Kano, 35 minutes in Port-harcourt and 30 minutes in Abuja which is contrary to 20 minutes response time as recommended by ICAO.

Table 7.1: Respondents' Assessment of the Adequacy of Available Airport Infrastructure to Manage Distress.

Variables		Frequency	Percentage
If Respondent ever witnessed any incident/accident around the airport in the last five years.	Have witnessed	476	77.0
	Have not witnessed	142	33.0
	Total	**618**	**100.0**
Adequacy of available infrastructure to manage such distress situation.	Adequate	88	14.2
	Not adequate	530	85.8
	Total	**618**	**100.0**

Source: Field Survey, 2007

The respondents also stated that apart from infrastructure being grossly inadequate, the few available ones are not effective (Table 7.2). These ineffective ones may be due to the fact that, infrastructure are either outdated, not serviceable or even not having highly qualified and trained staff to manage them. This makes it highly difficult to effectively and efficiently respond to any distress situation whenever it occurs. Inadequate and outdated distress response equipment will eventually lead to inefficient and ineffective response to distress situations whenever it occurs.

Table 7.2: Respondents' opinions on the effectiveness of safety infrastructure in terms of coping with emerging situations in Nigerian airports.

Responses	Locations				Total	
	Abuja (%)	Kano (%)	Lagos (%)	Port Harcourt (%)	No	percentage
No response	0.6	0.3	-	0.3	8	1.3
Not effective	2.3	2.3	2.9	1.5	357	57.8
Fairly effective	7.9	6.6	16.2	5.7	194	31.4
Effective	2.9	1.6	38.0	2.6	47	7.6
Highly effective	0.8	1.0	6.1	0.3	12	1.9
Total	**14.6**	**11.8**	**63.3**	**10.4**	**618**	**100.0**

Source: Field Survey, 2007

Furthermore, respondents were asked to evaluate the management of the incidents/accidents that they ever witnessed at the airports. Nearly all the respondents (90%) said that the incidents/accidents witnessed were not properly managed. When further queried on why they have such an opinion, some of the reasons given include inadequate facilities, lack of expertise, communication gap, staff attitude in respect of what to do, lack of understanding and cooperation among the relevant agencies within and outside the airport, among others.

Some of these reasons given were examined to determine how they affect the level of distress response capability within and around the airports. This was done by testing the hypothesis which was stated as; 'response to distress situation is not significantly dependent on age of infrastructure at the airports, level of preparedness, effectiveness of safety infrastructure and equipment and level of training of staff responsible for tackling distress situation'. As shown in Table 7.3, the R value obtained from the analysis which is 0.9 is an indication that response capability is highly dependent on the independent variables. The F value obtained from the analysis of variance is significant at .05 (F = 371.03)

Table 7.3: Regression Analysis for Distress Response Capability.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.900(a)	.810	.808	.49317

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	631.673	7	90.239	371.027	.000(a)
	Residual	148.361	610	.243		
	Total	780.034	617			

Source: Field Survey 2007.

An explanatory approach further used to analyze this particular model confirmed the result obtained above. Data used for the independent variables were derived from the results obtained from the questionnaire survey as well as key informant interview. A summary of results obtained for each of the independent variables as earlier discussed in section 6.1, are presented below.

The age of infrastructure reveals that most of the existing infrastructures were installed when the airports were commissioned (see Table 5.1). As a result, most of these infrastructures are old and mostly obsolete without any significant upgrade. The level of preparedness was also found out to be very low when the importance that airport organizations places on training (Table 6.2) was considered, adherence to airport master plan (Table 6.8) and functionality of infrastructure (Section 5.1 and Table 6.5) were all considered.

Airports' infrastructures were discovered not to be effective because, while staff were neither well trained on how to handle these infrastructures nor retrained (Tables 6.2), these infrastructure at the same time are obsolete. The communication mode was equally revealed not to be adequate for quick response to distress situation as previously shown and discussed on Table 6.4.

The various discussions on these variables which are germane to high level of response capability to distress situation indicates that, ability to respond adequately to occurrences at our airports are dismally poor. In view of the hypothesis that we are discussing therefore, it follows that these variables have significant role to play in adequate and timely response to distress situation whenever they occur.

Based on the attested poor management of distress response, respondents were further asked to suggest measures that could be put in place to allow for a better distress response and management of incidents/accidents in the nearest future. A detailed summary of their opinions are provided in Table 7.4. By far, staff training and retraining, employment of capable and effective staffs coupled with provision of modern facilities were among the most important measures suggested by the respondents. Other measures include composition of well informed Safety Committee whereby relevant agencies outside the airport would be co opted was also largely suggested. The respondents additionally suggested that there should be in existence a distress response committee

which should also consider outside relevant agencies like the Nigerian Police, medical personnel, Fire Service etc as members. This committee should as a matter of necessity periodically create mock scenarios with a view to perfecting the line of authority, responsibility, cooperative and unifying attitude during a real distress situation.

Table 7.4: Respondents on how to organize for a better distress management in future

	Frequency	Percentage
Availability of more effective facilities	586	94.8
Employment of capable staff	594	96.1
Composition of a well informed safety committee within the airport	478	77.3
Agencies responsible for distress response within and outside the airport should be members of airport safety committee	481	77.8
Staff should be trained and retrained on how to give initial response to distress situations	604	97.7
Mock scenario should always be created	435	70.4

Source: Field Survey, 2007

7.2 ANALYSIS OF AIRPORTS' DISTRESS AND RESPONSE CAPABILITY AMONG THOSE WORKING AROUND THE AIRPORT

As presented in Table 7.5, 20.8% of the respondents said they have never experienced spill over effect of airport incidents/accidents, while the larger proportion (79.2%) of the 462 respondents said they have once or twice experienced a spill over effect of airport incidents/accidents. This table equally indicated a detailed analysis of the type of airport incidents/accidents which the respondents have experienced in the past.

As shown on the table, majority of the respondents indicated that plane crashes and its associated impacts constitute the major externality of airport operations. This represents about 65% of the total responses. Another 17.7% pointed out that fire outbreak constitute one of the major incident/accident experiences. This experience was expressed mostly by respondents at Kano and Lagos airports. Accidents caused by haulage and aviation fuel trucks on the adjoining airport roads constitute some of the other forms of incidents/accidents which some of the respondents have experienced.

Major environmental problems emanating from airport operations were also highlighted on Table 7.5. It was revealed that 36.1% are of the opinion that noise pollution emanating from airport operations especially the movements of aircraft constitutes serious environmental problems. Another 24.7% complained about the usual heavy traffic congestions on major roads leading to and out of the airports. Another 18.4%, however generalised the major environmental problems around the airports as constituting health hazards like eye irritation, ear pains from aircrafts noise etc

Noise pollution constitute the most serious problem within and around the airports and so there is need to cater for this problem perhaps by enforcing airline operators to acquire modern aircraft with lesser noise output.

Table 7.5 further shows that majority of the respondents (75.3%) would want to move out of the locations around the airport where they currently live while only 23.6% indicated that they are not willing to relocate for now. This is because the lives and aspirations of the people in these areas are inextricably interwoven with what they can get from the environment. Thus, in the event of problems, the people would prefer to stick to their source of livelihoods against the odds posed by the apparent risks. It is fundamental that this finding be viewed critically in the management of airport hazards

and disaster risks which global research predicted would increase considerably in the event of increases in the demand for air travel, sophistication in aircraft design and airport operations.

Analysis of the reasons given by those who intend to move out of their houses shows that airport problems as highlighted on Table 7.5 constitute the highest percentage of the reasons given by the respondents (50.0%) while 11.9% intends to move because they had completed their own houses in a different area. The implication of the above is that airport operations constitute a significant negative impact on the living conditions of those living around the airports. This is as presented in Table 7.5.

More than four fifth of the respondents are willing to relocate away from their present location around the airports if given a better alternative (table 7.5). This was further confirmed by the reasons that respondents indicated for their willingness to relocate away from their current place of residence. This is mostly as a result of negative externalities associated with living around the airports.

Table 7.5: Respondents' Third Party Risk Assessment of Airport Operations.

Variables		Frequency	Percentage
Awareness of Spill over effects of airport incident/accidents	Aware	366	79.2
	Not aware	96	20.8
	Total	**462**	**100.0**
Type of airport incident/accident ever experienced before	No response	69	14.9
	Plane crash	299	64.7
	Fire outbreak	82	17.7
	Others	12	2.6
	Total	**462**	**100.0**
Major environmental problems around the airport	Health hazards	85	18.4
	Air pollution	96	20.8
	Noise pollution	167	36.1
	Traffic congestion	114	24.7
	Total	**462**	**100.0**
Willingness to relocate away from the airport environment	Willing	348	75.3
	Not willing	109	23.6
	No response	05	01.1
	Total	**462**	**100.0**
Reasons for willing to relocate	Airport problems	231	50.0
	Better place	45	9.7
	Better employment	17	3.7
	To own house	55	11.9
	No response	114	24.7
	Total	**462**	**100.0**
Willingness to relocate if provided with a better alternative	Willing	394	85.3
	Not willing	68	14.7
	Total	**462**	**100.0**

Source: Field Survey, 2007.

7.3 ANALYSIS OF DISTRESS AND RESPONSE AMONG AIRPORT USERS

Respondents were asked if they have ever witnessed any incidents/accidents at the airports. Table 7.6 shows that, 57.7% have never witnessed any while the remaining 42.3% said they have witnessed some incidents/accidents. Some of the incidents/accidents ever witnessed by the respondents include fire disaster, plane overshoot the runway, Flight Control Into Terrain among others.

The types of accidents that had been experienced by the respondents are further listed on Table 7.6. 81.4% as aircraft overshooting their runways either due to bad weather, flooding or even sometimes wrong information from the control tower. Another prominent incident/accident experienced is forced landing of aircraft (60.9%) which again could be due to bad engine while taking off, wrong signal and other general technical problems. Fire disaster (65.4%) is another major incident that many of the respondents indicated that they have experienced in the past. This is likely to include the fire disasters that occurred at the local wing (now MMA2) of the Ikeja airport, at NAHCO complex, SAHCOL warehouse among others.

When asked about the likely causes of some of these incidents/accidents at the airport, as additionally shown on Table 7.6, a high percentage of the respondents (87.3%) pointed out the fact that the airports lack adequate facilities for accident free and smooth operations within the airport. These facilities include, most importantly, landing and taking off equipment. Also procedural errors were largely identified as part of the causes of some of these incidents/accidents. These errors include non availability of operating procedures, non existence of safety culture and incessant communication breakdown.

The implication of these responses as discussed above is that these incidents/accidents could have been averted if necessary safeguards had been put in place against unprofessional act, inadequate facilities and procedural errors. These were the opinions of the respondents on whether the incidents/accidents could have been averted.

Informal discussions with some of the respondents as regards how incidents/accidents could be better handled revealed that some of these occurrences could have been better handled if, for instance, there are availability of modern equipment to fight fire disaster, evacuate victims at airplane crash sites, if professionals were involved in handling or staff had been better trained to handle such occurrence or even if past experiences had

been properly or adequately recorded and if external related agencies had been called upon and then been responsive to partake in handling of these incidents/accidents.

Table 7.6: Airport users' Assessment of Distress Occurrences in Selected Airports.

Variables		Frequency	Percentage
If respondents ever experienced spill over effects of incidents/accidents.	Experienced	156	42.3
	Never experienced	213	57.7
	Total	**369**	**100.0**
Type of incidents/accidents ever experienced its spill over	Plane over-shoot the runway	127	81.4
	Plane crash	43	27.6
	Forced landing	95	60.9
	Busted landing gear	75	48.1
	Bird strike	86	55.1
	Fire disaster	102	65.4
Causes of the incident/accident as advanced by the respondents	Unprofessional act	260	70.5
	Bad weather	98	26.6
	Lack of adequate facilities	323	87.3
	Procedural error	274	74.3

Source: Field Survey, 2007.

Table 7.7: Further suggestions from the respondents with respect on how Nigerian airports could be made more effective and safer.

Responses	Locations				Total	
	Lagos (%)	Abuja (%)	Kano (%)	Port Harcourt (%)	No	Percentage
No response	12.7	16.5	4.1	14.1	175	47.4
Government should improve on both facilities and employees	2.2	3.3	9.2	2.4	63	17.1
Maintenance of aircraft should be regular	1.6	2.2	2.7	1.1	28	7.6
Proper security	6.0	2.7	1.4	3.0	48	13.0
Good management	8.7	-	6.2	-	55	14.9
Total	**31.2**	**24.7**	**23.6**	**20.6**	**369**	**100**

Source: Field Survey, 2007

CHAPTER EIGHT

SUMMARY AND CONCLUSIONS

8.1 SUMMARY OF FINDINGS

The main aim of this research has been to undertake a geographical analysis of incidents and accidents in four selected Nigerian airports. This is achieved through the use of multi-dimensional indicators, such as, those that deal with airport related variables, infrastructure, aircraft and human indicators. Some of the research objectives include a spatio-temporal analysis of airports development in Nigeria, an analysis of land-use development patterns around the selected airports, with special reference to the age of the airport. Other objectives include an analysis of airport distress occurrences, facilities for safety and distress response within and around the four airports and an identification and analysis of the culture of safety of the various organizations operating within the airports.

The airports selected are the Murtala Muhammed International Airport (MMIA), Ikeja, Lagos, Aminu Kano International Airport, Kano, Nnamdi Azikwe International Airport, Abuja and Port Harcourt International Airport, Port Harcourt. These airports were selected because they are located in contrasting geographical zones of the country. Other factors that were also considered in the choice include the volume of traffic, both passenger and cargo throughput that these airports handled over the years under investigation, among others.

Incidents and accidents within airports tend to result from complex interactions of diverse activities. Improvements in airport safety will require an understanding of how these activities combine to cause incidents and accidents. This therefore calls for a holistic approach to the research. It is in the light of this that relevant theories and models for studying airport safety and distress response system were used in the study. These include the System Theory, Causal Analysis and 'Swiss Cheese' Model.

With respect to the methodology, the data collected for this study were those that deal with basic issues for promoting safety as well as improving responses to distress situations whenever and wherever they occur within and around the airport. These data were used to systematically address the issues arising from the research objectives.

Findings revealed that the basic problems facing the airports in terms of safety and response to distress can be classified under five major headings. These are operational, policy gaps in aviation regulations and reforms, infrastructural, physical environmental and human factors. Though, most of these are interwoven, attempts were made to sieve them into proper perspectives in the analysis.

Operational Problems: These are the major challenges facing the airports as a system in the process of carrying out their basic day to day operations. It was found that the provision of major equipment to operate within the airports is either lacking, obsolete or if available, not properly maintained. This invariably affects safety and, in terms of distress response, it either reduces effectiveness and efficiency or totally impairs response to distress situation. For instance is the loss in transit within the Nigerian airspace of a small aircraft on its way to Obudu Ranch. It took almost five months to find the wreckage of the aircraft. This happened because, not until recently, there was no equipment [Radar] to detect where the aircraft was. The fire inferno which occurred at Sky Power Aviation Handling Company Limited (SAHCOL) in 2002 would not have been so intense with its attendant losses if the Airport Fire Service Department had been well equipped for such a distress situation. The situation was so bad that it took the Airport Fire Service Department over 25 minutes to get to the scene of the fire after much damage had been done. In addition are the ill maintained and insufficient equipment for most of the organizations operating at the airports. The necessary equipment to handle for instance a classified dangerous good (DGR) Cargo is either not effective or not available.

Operational equipment at the airports are inadequate and obsolete as attested to by most of the respondents to the administered questionnaires. This is as presented in tables 6.28; 6.32 and 6.53

The expertise of some of the airport workers is also in doubt. Demuren (2008) agreed with the assertion of some airport senior and junior staff that discussions were held with and indicated that staff turnover at the airport in recent years has been very high. This was partly because of constant changes in the top management staff (which according to Rindams (2008) are mainly political appointees) of the organizations operating within the airports. Each management that comes wanted to dispense off with some of the staff

it met and employ its own 'loyal' staff. Hence, there has been loss of experienced staff to the detriment of safety within the airports because those new staff would have to start learning from the scratch since some of them are from other sectors of the economy other than aviation. More importantly, organizations do not see training and re-training as paramount (Tables 6.4, 6.5, 6.7 and 6.33)

As stated by the Rector of Nigerian College of Aviation (NCAT) Zaria in the Sunday Punch of November 23, 2008, shortage of manpower is rattling the Nigerian Aviation sector (Araba 2008). He posited that the shortage is not in terms of number but rather in the aspect of technical know-how.

Another major issue mitigating against safety and quick response to distress situation within the selected airports is the mode and strategies of information dissemination among and within organizations operating within the airports. Most of the organizations do not believe in having meetings with their staff where management could have a quick feed back and responses to policies and instructions. Rather, they prefer the use of memos which most of the time might not be explicit enough to staff members.

Additionally, there is no cut-out procedure of passing vital information from one organization to the other within the operational arena of the airports. Thus, in a situation whereby a vital information needs to be passed to another organization with a view to averting an incident/accident or even to attending to a distress situation, lack of adequate information dissemination strategy becomes a major problem.

Ensuring of quick turn-round time by airline operators (as this affects their revenue generation) is another major threat to safe airport operations. The airline operators (especially when their aircraft arrive behind scheduled time) will want to leave on scheduled time and thus put pressure on the ground staff to perform their duties hastily, sometimes not paying attention to required safety details. Most of the time, this often leads to damages at the ramp which could be in the form of tractor/catering truck hitting the airplane, or even ground handling equipment colluding with each other. It is threatening to safe airport operations. There is serious ramp congestion especially at both Lagos and Abuja airports. This, it was found out to be the after effect of air transport deregulation policy in Nigeria which did not consider increasing nor improving the available airport facilities to cope with the increases in airline operators which has resulted from such deregulation.

Physical Environmental Problems: There are environmental factors that could pose significant safety problems to airport operations. These can also affect response effectiveness to distress situation. Among these are the poor drainage system which always makes the runaway and apron to be waterlogged each time there is heavy rainfall. Coupled with this is the little knowledge about the airport hydrological features which has not allowed for adequate width and (or) thickness of the constructed or casted apron concrete.

Closely linked with the above is weather which poses a serious threat to operations and distress response at the airports and their environs. The arising/underlining situations under this weather conditions are cloud cover, dust and hamarttan haze which usually affect visibility, lightening and thunderstorm all of which were claimed to have been responsible for the Bellview crash at Lisa village in Ogun State in year 2005. Without a proper and adequate knowledge of the characteristics of these physical phenomena, all the activities within the airports become highly unsafe for both the operators and users.

Topography of the airport environment is another major concern in the physical environment factor. While both Kano and Abuja airports are surrounded by mountains and farm lands, Lagos is surrounded mostly by water bodies while Port Harcourt airport has forests and vegetation around it. All these selected airports do not have contemporary standard Geographical Information Systems (G.I.S.) maps especially the Digital Elevation Models. This poses a serious threat to the airports' operations especially within their vicinities. Safe flying and response to distress situation around the airports is consequently threatened because of this inadequacy.

Presence of wild life in and around the selected airports is another major problem. It was found out that there are a lot of birds, rodents, snakes and even tortoise that habitate within and around the airports. Birds pose threat by flying against moving airplane, rodents could cut wires of runways and apron lightening circuits and at the same time destroy left over baggages and cargoes. Tortoise are found crawling on runways and even snakes moving from the bush to operational areas of the airport. Yet, factors that allow for all these wild life abound within and around the airports. These are, dump sites, anthills, abattoirs, unkept water bodies, over grown bushes and grasses etc.

Another problem is the physical encroachment on supposed airport buffer zones due to urbanization and land-use changes. This was especially observed at both Lagos and Kano

airports, where there are high rise buildings springing up around the airports coupled with erection of communication masts. This became so predominant in Lagos to the extent that the regulatory authority (Nigerian Civil Aviation Authority) through its Managing Director had to cry out in the year 2007 against further erection of masts and high rise buildings on airplane ways. However, the situation is different in Abuja airport where there are farm lands and Port-Harcourt airport where there is grazing.

Infrastructural Problems: The third major category of findings is in the area of infrastructure. These are facilities which include, the out of fashion terminal building, obsolete, unserviceable and ill maintained landing instruments, lightening system, weather forecasting instruments, satellite system, control tower and communication gadgets which are prevalent in all the selected airports. All these infrastructural facilities are germane to safe airport operations and internationally acceptable level of response to distress situations. It is not uncommon for electricity to be off at these selected airports. Investigation revealed that sometimes light could be off for as long as forty five minutes without providing an alternative (Abioye, 2010)

Usim (2008) wrote about the deteriorating facilities at the Muritala Muhammad Airport, which serves as a gateway to outside world, from the malfunctioning toilets, conveyor belts, sluggish and squeaking elevators, leaking roofs, poor air-conditioning system, poor lightening of the broken down runways and aprons. Worse still, rot appears to be the rule rather than the exception.

It is common a situation during the study especially at the Lagos airport to find congestion at the aprons with airplanes waiting for their turn on the right of way on the runway. Also, it is common to have congestion in the sky of almost seven to eight aircraft waiting for several minutes before being allowed to land. This is due to the availability of only one functional runway (19R) that was available at Lagos airport. Port Harcourt airport was even worse when the only runway was closed down for about two years.

Not until October 2010 when the Total Rader Coverage of Nigeria (TRACON) was commissioned, the Lagos Airport Radar which was the only one for the whole country was about thirty years old and malfunctions virtually every time before it finally broke down totally sometimes in October 2008. This is considered critical in view of its (Radar) importance to search and rescue processes and procedures.

There are also challenges brought about by **policy gaps in aviation regulations and reforms.** These challenges are brought about by the neglect of some specific specialized areas of aviation which NCAR (2008) did not address and hence posing some hazards to safe airport operations and response to distress situations.

For instance, the NCAR 2008 was unable to define who has the prerogative authority between NCAA and FAAN to license and certifies the Nigerian airports. This is due to the fact that, the regulation neglected the concept of 'functional separation' as introduced by ICAO in its Annex 14 (AERODROMES). While FAAN who is mandated to be in charge of Nigerian airports' administration and operations is also arrogating the prerogative of licensing and certifying the airports to itself, is claiming that all Nigerian airports are licensed and certified, the NCAA which is the agency recognized by the world body (ICAO), is claiming that no airport in Nigeria is licensed nor certified. Creation of such aviation structures like NCAA and FAAN with some conflicting job functions are at variance with world aviation bodies' requirements. Equally, it is at the same time detrimental to safe airport operations and quick response to distress situations.

Another defect in the NCAR of 2008 can again be viewed from the perspective of the establishment and operations of search and rescue (SAR) whose main responsibility is to save lives and properties during distress situations. The organization of SAR, its management and operations are entrenched in Annex 12 of International Civil Aviation Organization (ICAO). Considering the ICAO recommendations on search and Rescue, its (SAR) activities should be within Nigerian Air space Management Agency (NAMA) and not National Emergency Management Agency (NEMA) as it is the case. Though the researcher noted that, even as NAMA is presently having a department of Search and Rescue (SAR) within it, the agency (NAMA) is not properly funded. This is in addition to the lack of experience and qualified personnel and facilities to operate with. All of these incapacitate the agency in performing its primary function of search and rescue. More so that, after considering the responses of SAR to some accidents within the Nigerian air space, it was revealed that, SAR operations has being highly ineffective and of no significance.

The legislations and regulations that created aviation bodies and agencies did not give them total autonomy but rather still attaches them to the Federal Ministry of Aviation. Most vital decisions that need to be taken by these agencies still have to go through the

ministry for approval; thus subjecting vital aviation safety decisions to stringent bureaucratic procedures and due process.

The negative after effect of deregulation of air transport was another issue that can be considered under defects in aviation regulations. The Federal government deregulated the air transport in the country without necessarily planning for the effects of such deregulation by improving upon and expanding the existing aviation facilities that will cater for the increase in the number of aircraft owners. The existing regulatory bodies could not cope in effectively controlling the surge in the airline ownership, less focus on human capital development and training coupled with non-considering of more effective investments in our airport

Human Activities. The last factor to be considered is Human Activities. These are man made hazards which can lead to accidents or incidents during operation at the airports and as well mitigate against adequate response to distress situations. One of such human creations that were very noticeable during research was series of ramp incidents and accidents that were caused due to serious pressure on ground operators to reduce turn-around time of the aircraft.

To achieve this, various ground operations' staff were seen performing their functions without giving detailed attention to safety operational procedures and recommended practices. This has often led to series of ramp damages to aircraft, equipment facilities and even co-workers' injuries. One of such incidents was when a ground staff used a tractor to hit and damage one of the wings of Allied Air Cargo at the Cargo Ramp area of Muritala Airport Ikeja, Lagos on the 29th of November 2008 (Research observation 2008). Another one happened during period of this research when the top part of a high loader equipment was used to cause damage to the terminal building at M.M.A. Ikeja while series of equipment collision were recorded at Abuja and Kano Airports (Research observation 2008).

Another human factor concerns the supervisors who more often than not do not always perform their functions as expected. Thus the staff are always left on their own without adequate supervision. Consequently, most staff do not adhere to operating procedures and recommended practices which in most cases often lead to incidents and accidents.
The fire inferno at SAHCOL in 2002 would not have occurred if the supervisor on duty was around to instruct the forklift driver on how to handle the explosives (dangerous

good) which was the immediate cause of the inferno. With adequate supervision and appropriate instructions given, perhaps the two aircraft which took off after the ADC crash at the Abuja airport in 2006 would not have been allowed to; as it was hazardous and against airport operations recommended practices. This is because after a crash, the runway where the crashed aircraft took off must be closed down for at least 45 minutes for it to be combed properly for a likely remote cause of crash ICAO Annex 13&14).

Personnel inadequacies are another human factor lapses. Before staffs are deployed to their respective job functions, consideration is not usually given to the mental alertness and psychological state. For instance, the controller on duty during the Hydro Air accident was not in a good health nor good psychological state of mind, if not, he would not have been sleeping on duty while the aircraft was approaching. This was not good enough especially when considering the 100% alertness and safety requirement of airport operations. Also there are times that staff do make wrong judgment and this often leads to one incident or the other.

Another issue within human activities has to do with management malaise. This explains the technique that management adapts to hire and fire staff, compensate/reward as well as punish and communication mode. It also explains management's skills in matching together the company's overall objective with safe operating procedure and industry recommended practices. Since most organizations operating within the airports are still tied to the government ministries, the leadership of such companies are being controlled from the ministries. This has thus created a situation where non professionals, through godfathers, are being appointed to head such organisations. This eventually has led to haphazard control of such organizations outside the operating procedure and industry recommended practices.

The inexperienced heads are always having collision with the established and experienced staff within the organization. Eventually, since the head has the authority to fire and hire, many experienced staff are fired. For example, the Hydro Air accident that occurred in 2001 was due to the inexperienced staff on duty at the control tower who did not know that whenever he resume and especially when in doubt about the condition of available facilities, the necessary unit should be contacted for advice. Rather than contacting apron control about the level and extent of repairs on the runway, which was

under repairs, Hydro Air Cargo was made to land on the runway by this inexperienced officer and hence the accident.

This management malaise has also created unnecessary fear among staff to the extent that,

- Staff do not like expressing their own opinion (as field operators) to management especially when it concerns hazardous situations and occurrences due to fear of management reprisal;
- Incidents and occurrence that need to be reported for future prevention/mitigation are hidden from the management who needs such for purposes of improving on existing standards operating procedures;
- It encourages rumor mongering as staff prefers to relate with themselves rather than with management. This has on many occasions led to some hazardous situations within the aviation industry;
- The above has also led to staff alienation from their work which equally bred job dissatisfaction and apathy all of which are antithetical to safe operations. An unsatisfied staff that is controlling an equipment can be absent minded which eventually can make such staff to either collide with another equipment or a parked aircraft at the ramp. Perhaps that was what happened to the staff of a ground handler that colluded with the aircraft wing of an Allied Air aircraft at the Cargo ramp area of Muritala Muhammad Airport on the 29th of November 2008 (Field Survey, 2008).

Inappropriate procedure of information dissemination is another malaise of management. It was found out that vital information is not usually passed down to staff appropriately. Even in matters concerning safety procedures and recommended practices, management do assume that the moment a section of staff (especially the middle management) are privy to such information, it will automatically dissipate down to other members of staff. But this is not necessarily the case.

Another recorded lapse with human activities was the action and decision of the inexperienced control tower staff and the airport manager at the Nnamdi Azikiwe Airport Abuja allowing some aircrafts to take-off after the ADC crash of 2006 rather than closing the runway for primary accident investigation. This action mis-informed the then inexperienced Aviation Minister who quickly and wrongly addressed a press conference. It was also due to inexperienced staff at NEMA that the whole country was mis-directed

to Kishi in Oyo state rather than Lisa village in Ogun State during the Bellview crash in 2006.

It was observed that, staff do not like to report or record incidents (especially when such incidents can not be easily noticed by superiors) whenever they are on duty because of fear of management reprisal. Invariably, vital and valid detailed information which could be useful in developing operational safeguards will be lost. To this extent, incidents and accidents which could have been prevented with such recorded information will kept on re occurring.

8.2 RECOMMENDATIONS

Operational: Operational activities at the airport concern mostly the equipment and facilities that are used coupled with the expertise and technical know-how of operators. There is need for operational standardization and monitoring if a particular level of airport operational safety and distress response rate is to be achieved.

This requires a concerted effort by the government (through the industry's regulatory and controlling agencies) and the industry practitioners to prevent equipment and facility malfunctioning.

Apart from developing a comprehensive operational standard and procedure, the regulatory and controlling bodies should also ensure that operators comply strictly with these rules. It is therefore recommended that the regulatory body (NCAA) should also develop a safety and distress response performance analysis system. This will make it possible at all times for regulators to assess performance of operators' activities and also identify hazards, activities and trends that could easily reduce safety and distress response level.

The airport authorities should take an audit of various facilities at the airports with a view to developing a relationship between the present capacity of airports and its current needs. This in essence will allow the airport authorities to determine the infrastructural and facility deficiencies of the airports. Invariably, a road map to improving upon the present state of airports' infrastructure and facilities can be charted.

Following from the above, there is need for the airports' master plans to be appropriately reviewed, where schedule of development in terms of infrastructural improvement and

airport expansion will be detailed out. The master plan should also detailed out projected types and progressional volume of activities in the areas of terminal building, airfield, airspace, and ground access.

While it is very important for airport authorities and agencies to improve upon the available aeronautical facilities and equipment, its is equally paramount and expedient to compliment this regular dummy Search and Rescue which will be based on the nation's different geographical terrain and season consisting of swamp, forest, mountain, deep water, rain and dry seasons.

Likewise, the authorities should develop and encourage the operators within the industry to adopt a style of communication that allows for Quick Information Pass-Around (QUIPA). Such communication style should however be included in the industry standards and recommended practices' manual. This is an important part of airport system which enhances safety and distress response, with special enhancement to the activities of search and rescue.

All operators within the aviation industry must be educated to understand safety as everybody's business with the aim of carrying out their activities within the purview of the laid down international and local standards and recommended practices. The civil aviation authority must ensure compliance by aviation operators to the extent that, no operator will be allowed to circumvent the laid down procedure and jeopardize aviation safety.

Operators and their staff should be encouraged to always report any hazard, incidents or accidents that are experienced during operation without the fear of the usual management reprisals. They should be made to recognize that, it is through the development of such data base that safeguards against such hazards, incidents and accidents can be developed. Improvement in distress response can equally be achieved through this developed data base.

At the same time, which ever report is brought forward should not be discarded by the concerned authority no matter how minute the information might be. All reports must be adequately recorded and analyzed against its occurrence. All reported occurrences should not also be used against the reporting operator. If it is not so, operators will desist from

giving such information in future and this will neglect the principle of continuous improvement on safety operation.

Policy Gaps in Aviation Reforms and Regulations: The Nigerian Civil Aviation Regulations of 2009 should be modified to comply with the ICAO Annex 14 which recognizes member nations' Civil Aviation Authorities to be responsible for the licensing and certification of airports.

Nigerian Government should embark on aeronautical facilities improvement program that will cater for the emerging trends in the aviation sector brought about by the deregulation reforms within the industry.

The Nigerian Civil Aviation Authority (NCAA) in conjunction with the Federal Airport Authority of Nigeria (FAAN) should develop an airport operational manual which should be a guiding principle towards safe operations within and around the airport. The manual so developed must take into consideration the contents and provisions of both international and national aviation controlling bodies as regards safety and recommended practices. Such manual should be made available to all the operating organizations within and around the airport.

In view of the sensitivity of airport operations, the NCAA, FAAN and Accident Investigation Bureau (AIB) should develop a line of communication system among and within the operating organizations which will foster a feedback mechanism. Both organizations and staff operating within the airport should be encouraged to always be ready to report any incident, accident, hazard and observations without any fear of being reprimanded. This should be entrenched in plain language in the airport manual.

A legislation should be enacted which will not make specialized aviation agencies like NCAA and AIB owe their existence to the mercy of the government which can decide to scrap them at government's instance. That is, such government actions that scrapped the NCAA in the aviation reforms of 1995 should be legislated against. Such legislation should also be enacted to ensure that specialized aviation agencies are being managed and directed by highly qualified professionals.

The Nigerian Civil Aviation Authority must always ensure that operators/organizations in and around the airports put safety procedures and recommended practices first before their overall companys' objectives.

Physical Environment: The following are some of the recommendations to ameliorate physical environmental issues towards improving airport safety and distress response

The physical encroachment on airport land which was brought about by urbanization needs to be urgently attended to. This is more pronounced at both Muritala Mohammed airport in Lagos and Malam Aminu Kano airport Kano. Such encroachments should also be discouraged and legislated against at Abuja and Port-Harcourt airports. Equally, land-use developments that entail the erection of high rise buildings and masts around the airports should be legislated against and any violation should bear heavy penalty burden.

There should be an updated and internationally acceptable flight chart for each of the airport which will indicate various types of obstacles on airplanes' flying path within and around the airports. Such obstacles should include both natural (like mountains, forest, water bodies etc) and man made (like high rise buildings, masts etc) obstacles.

There is the need to properly understand the hydrological nature coupled with the soil type of the studied airports. This will bring into focus the water level of each airport and eventually become an integral variable in determining the type and form of runways and aprons to be built/constructed for each of the airports. This in the final analysis will ameliorate the challenge of incessant flood being experienced during raining seasons.

Connected to the above is also having adequate knowledge of each airports' topography and the attendant contours. This will assist airport administrators (Federal Airport Authority of Nigeria – FAAN) On how where and how to direct each of the airports' drainage system. This will ultimately put a stop to flooding and water log of both apron, tarmac and runways with its attendant damage being experienced at all times.

Technology advancement has made it almost possible for aircraft avionics to land and take-off in a zero-zero visibility situation. Airports should also provide for such technological advancements to mitigate against such adverse meteorological conditions of zero-zero visibility like harmattan and dust haze, cloud cover, rain storm etc. this becomes of greater importance especially when there is need for distress response.

There is also the need to curtail the activities of wildlife within and around the airports. Of recent the operations manager of Federal Airports Authority of Nigeria decried the menace of bird activities and their strike against flying aircraft in the Nigerian airports. This is in addition to reported cases of reptiles like snakes in airport offices, tortoise on the runways, rodents cutting wires of runways light and destroying goods and consignments at airport stores and cargo ware houses.

All these wild life should be mitigated against through effective and efficient management and control of airport environment. This should be in the form of making airport environment highly unhabitable for wildlife through proper management of grass mowing, control of stretches of water bodies, control of the type of crops that can be cultivated around the airport, disallowing rearing of pigeons around the airports and creation of paths for anti-wildlife combatants around the airports. Additionally, unserviceable/unused aircraft and uncompleted buildings which serve as habitats for wildlife should be discouraged within and around the airports. Farming should be discouraged around the airports. The airport buffer zones' decorative bush landscaping and forests should be carefully selected and managed against wildlife.

The Federal Airport Authority of Nigeria (FAAN) should establish a well funded department of wildlife control within its authority. This department must be made of professionals in wildlife activities. This department should work hand in hand with the air traffic control (in view of their vantage position at the airport) in monitoring and observing wildlife activities in and around the airports. FAAN should always keep adequate record of wildlife activities in and around the airports so as to ensure efficient and effective control of these wildlife impacts on airport operational safety. Record keeping and surveillance will additionally allow airport authorities to know the various types of wildlife that exist at different airports at different seasons and hence, be able to determine different types of technique to be employed in tackling wildlife menace at different airports and at different seasons.

Perimeter fencing of the airports is also recommended. This is to forestall straying of raring and domesticated animals like cows into the airport especially to the runway as well as to prevent encroachment by farmers in addition to others living and working close to the airport.

In view of the heavy traffic that is always being experienced by the airport users, the road network especially around the Muritala Mohammed Airport and Aminu Kano Airport needs to be improved upon urgently. This becomes very imperative in a situation where outside support is needed in response to an airport related incident and accident. Where the traffic is blocked and heavy it becomes a problem to achieve optimum and recommended response time.

Infrastructure

There is no doubt that there exist inadequate infrastructural facilities to effectively cope with the present-day requirements within the selected airport. It is therefore expedient to embark upon infrastructural audit rather than the selected piece-meal infrastructural upgrades that are been carried out within the selected airport. This audit will ultimately allow for a comprehensive understanding of the gap that exists between what infrastructural facilities are available and what is minimally required within the industry to effectively cope with the contemporary needs of safe airport operations. These infrastructures include among others, modern landing instrument, improved lightening system within the airport environment, provision of modern weather forecasting instruments, satellite system, well equipped control tower, modern and functional communication gadgets among others.

Experienced experts on runway construction and maintenance should be consulted to repair and maintain the runways at the selected airports rather than patronizing political associates for their construction and maintenance. That was why the Port-Harcourt airport's runway has not been opened totally for two years now and that of Lagos 18L runway closed for two years due to repairs.

Human Factors

A reduction in human-induced occurrences/mishaps will also have a direct reduction in recorded airport incidents and accidents. Thus efforts should be geared towards ways and methods of reducing human – induced occurrence in airport operations. For these human-induced occurrences, also referred to as manmade hazards to be reduced the following steps should be taken:

The Federal Airports Authority of Nigeria (FAAN) should come up with well articulated Safety Operating Procedures (SOP). This should spell out the functions of various operating organisations within the airport coupled with expectations and limitations of such organizations. This procedure should also include recommended practices for organizations within the airport. All of these should be spelt out clearly and given to these various operating organizations.

Each of the operating organizations within the airports should at the same time prepare their own different Safe Operating Procedures (SOP) and recommended practices in such a way that can easily be understood by their various staff. This should spell out the functions of different categories of staff of the different units within the organization and how to carry out such functions.

Strict adherence to the Safe Operating Procedures and Recommended Practices should be enforced at all levels within the airport operational system.

Supervisors should be made to be equal to their tasks by reducing unprofessional acts during operation.

Background checks like criminals and employee health condition should always be undertaken before employing any staff into work within the airport environment as police report on the theft of DDC machines of INEC at the tarmac of International airport Ikeja Lagos in February 2011 indicted some airport workers.

All staff manning the restricted designated areas of the airport must first be screened and certified physiologically and psychologically sound at all times before allowing entrance into such areas.

Inexperienced, psychologically and physiologically misfit should never be allowed to operate or man any machine or equipment within the airport.

Adequate training and re-training of staff in areas of airport operations should always be one of the main focal points of organizations within the airports system. This should also

extend to skeletal understanding of activities of other complementing units/organization where necessary.

While technical knowledge can be acquired in schools, there is no school where experience can be learnt. To this extent, airport operators should as a matter of policy reduce employee turnover through giving adequate compensation to employees, promotion of job pride and having clear cut career path advancement for staff.

Safety culture and team spirit should be promoted and encouraged among and between organizations operating within the airport. To this extent, there will be mutual respect and understanding among operational staff which will also promote close affinity. Eventually, operational safety will be ensured.

A communication system that encourages and allows for mutual understanding and cross integration of ideas among the various and different levels within the airport operational system should be developed and maintained.

8.3 CONTRIBUTIONS TO KNOWLEDGE

This study has shown the significance of studying airport processes and activities from a holistic rather than from an individualistic perspective. The reviewed literature showed that, researchers on airport safety and distress response had mostly approached it from their individual discipline's orientation without adequately giving attention to the existing linkages in the subject matter with other disciplines. Consequently, this study has considered the airport as a system consisting of different operational components, each with its varying attributes contributing to the overall integrated airport safety system.

This study also emphasizes the immense importance of the environment within which each airport operates. Thus, information and data on the activities of those living and working around the airport should not be neglected in the attempt to understand and improve airport safety and distress response.

This research has also substantiated the relevance and reliability of the three conceptual frame works (the system theory, causal model and Reason's cheese model) in

understanding the degree of contributions of the various components of the airport to the level of airport safety and appropriateness of response to distress situation. This study has demonstrated that these models compliment each other in examining the various components of airport safety and distress response.

Moreover, the study had shown that, accident causation investigation should always go beyond the event itself but rather, investigation should start from the management or government decisions and policies respectively to the event. This, the study revealed will allow for the evaluation of appropriateness of government policies and management decision's to the overall integrated airport safety system.

By using some satellite imageries, the study was able to bring into focus the effect that changes in airport environment can exert on its operational safety. Periodic analysis of satellite imageries of airports are therefore shown to be paramount in improving airport safety. Through these imageries, various emerging environmental hazardous complexities within and around an airport can be exposed early enough before they develop into serious threats and hindrances.

Lastly, the study has also shown the importance of collating and analyzing data on past occurrences to the improvement of airport safety and distress response capabilities. For this reason, operators should always be encouraged to report occurrences at all times by de-emphasizing serious punitive measures when incidents occur.

8.4 CONCLUSIONS

From the outcome of this study, a major conclusion that can be drawn is that there are flaws in the safety procedures in the studied airports. This is found to be responsible for the increasing frequency and severity of incidents and accidents coupled with the low level of response to these occurrences. To ameliorate this situation, these is need for an integrated safety management system which will entail all the operating organizations within the airports to get connected to a common database of causes of past occurrences and co-operatively defining achievable corrective measures. There should also be a common framework among the major stakeholders in the Nigerian aviation sector towards employing the trends in modern airport safety and distress response practices.

8.5 SUGGESTIONS FOR FURTHER RESEARCH

Security at the Nigerian airports should be given adequate attention. To this end, there is need for research into activities to promote the integrated safety systems and common methodologies for risk assessment. These methodologies should take into cognizance the Nigerian context of security abatements and variables.

Distress response at the Nigerian Airports is a major phenomenon that needs to be researched into when considering airport operations. Therefore some studies are needed to consider and evaluate the contents, dictates and provisions of airport emergency plans. Such studies must take into consideration simulation of incidents and accidents in and around the airport to assess level of accessibility to potential accident sites for on time response purposes.

There is need to study the airport physical environment in terms of the existing forests around it with its wildlife habitats. This is of paramount importance in view of the increasing threats of runway incursions by animals and birds flying against moving aircraft.

The contemporary global research on climate change should include the effect of climate change on airport operations.

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APPENDIX I

QUESTIONNAIRE TO AIRPORT SERVICE PROVIDERS FAAN; AIRLINES, AIRCRAFT ENGINEERS, NAHCO, SAHCOL, FUELLERS, GOVERNMENT AGENCIES AT THE SELECTED AIRPORTS

SECTION A: RESPONDENTS DEMOGRAPHIC CHARACTERISTICS

1. Sex: (a) Male [ ] (b) Female [ ]

2. Age: (a) less than 24 yrs [ ] (b) 25-29yrs [ ] (c) 30 – 34 yrs [ ]
(d) 35 - 39 yrs [ ] (e) 40 – 44 yrs [ ] (f) 45 –49yrs [ ] (g) 50-54 yrs [ ]
(h) 55 yrs and above [ ]

3. Marital Status: (a) Single [ ] (b) Marital [ ] (c) Separated [ ]
(d) Divorced [ ] (e) Widow/widower

4. Educational Qualification: (a) No formal education [ ] (b) Primary education [ ]
(c) WASCE/ GCE /SSCE [ ] (d) Trade test [ ] (e) OND/ NCE/ TCII [ ] (f) HND/1st Degree [ ] (g) Master's degree and above [ ]

5. Period of working with the organization: (a) less than 5yrs [ ] (b) 6 –10yrs [ ]
(c) 11-15 [ ] (d) 16-20yrs [ ] (e) above 2oyrs

6. Monthly salary within the organization: (a) N5, 000- N15, 000 [ ]
(b) N16, 000 -N25, 000 [ ] (c) N26, 000 – N35, 000 [ ]
(d) N36, 000- N45, 000 [ ] (e) N46, 000- N55, 000 [ ]
(f) N56, 000- N65, 000 [ ] (g) N66, 000-N75, 000 [ ]
(h) N76, 000 and above [ ]

SECTION B: ORGANIZATIONAL PERSONNEL ATTRIBUTES

1.How are vacancies in your organization indicted?
(a) Internal advert [ ] (b) external Advert [ ]
(c) Personal contact [ ] (d) other specify ----------

2.How is employment interview conducted?
(a) By personnel department [ ] (b) through external consultants [ ]
(c) Management hand pick [ ] (d) all of the above

3. What importance does your organization place on the issue of training and retraining?

(a) Very High [ ] (b) High [ ] (c) Undecided [ ] (d) low [ ] (e) Very low [ ]

4. How many courses/training have you been to in the last five years?

(a) 1-2 [ ] (b) 3-5 [ ] (c) 5-6 [ ] (d) 7 and above [ ]

What is the nature of training attended?

(a) Safety [ ] (b) Computer application [ ] (c) Drug control and Trafficking [ ] (d) Security [ ] (e) Aviation Management [ ] (f) Airfield watch (g) Medical training [ ] (h) Management courses [ ] (i) Disaster Prevention [ ]

5. Is there anything like possession of operational licensing in your organization?

(a) Yes [ ] (b) No [ ]

6. How are information disseminated in your organization? Tick as many options, as applicable

(a) through memos [ ] (b) departmental meetings [ ]

(c) notice board/ postal [ ] (d) general meetings [ ]

(e) No standard [ ]

7. What is the style of promotion in your company?

(a) selective promotion by top management [ ]

(b) personnel departments prerogative [ ]

(c) Through promotion committee [ ]

(d) Recommendation from superiors [ ]

8. When last were you promoted in your organization?

(a) less than 5 yrs [ ] (b)6- 10 yrs [ ] (c) 11- 15 yrs [ ]

(d) Others specify----------

9. How many departments do you have in your organization? ----------

10. In how many department have your worked in your organization in the last 10 years? ----------

11. Since when have you been deployed into your present department?

(a) 1-3 yrs [ ] (b) 4-6 yrs [ ] (c) 7-10 yrs [ ] (d) 10 yrs and above [ ]

12. How do you relate with your superiors/sub – ordinates?

(a) formal [ ] (b)informal [ ] (c) combination [ ]

13. How do you relate with your colleagues?

(a) formal [ ] (b) informal [ ] (c) combination [ ]

SECTION C: ORGANIZATIONAL CULTURAL EXISTENCE

1. Does your company have a vision/ mission statement?

   (a) Yes [ ] (b) No [ ] (c) don't know [ ]

2. Does your company have a documented safe operating procedure?

   (a) Yes [ ] (b)No [ ](c) don't know [ ]

3. If yes, is it made known to staff members?

   (a) Yes [ ] (b)No [ ](c) don't know [ ]

4. If question (3) is yes, How?

   (a) Staff to read it at the management office [ ]

   (b)Keep at each departments office for staff to read [ ]

   (c) Accessible at personnel department for staff [ ]

   (d) Printed out for each staff as manual [ ]

   (e) Staff are informed through organized training/course [ ]

   (f) Others specify ----------

5. Is compliance to procedure enforced? (a) Yes [ ] (b)No [ ]

6. Do you know the job function of your company as regards airport operations?

   (a) Yes [ ] (b)No [ ](c) don't know [ ]

7. How relevant is your job function to airport operations?

   (a)very relevant [ ] (b)relevant [ ] (c) not very relevant [ ]

   (d) not relevant [ ] (e) don't know [ ]

8. Is there any other company whose functions compliment your company's activities as regards airport operations. (a) Yes [ ] (b)No [ ]

9. If yes name the company (ies) ----------

   ----

10. Whose function(s) do you think should come first between your company and this complimentary company(ies) ----------

11. Try to list them in order of priority? ----------

SECTION D: CORE SAFETY ISSUES

The proceeding questions are meant to address some basic safety issues within the airport. You are requested to tick appropriately as regards the provided options. SA= Strongly agree: A = Agree; N= Neutral: SD= Strongly disagree and D= Disagree

S/no		SA	A	N	SD	D
1	Safety is part of my company's core values					
2	Safety is more paramount to my company than target attainment					
3	Safety apparels /wares are often given to all employees in my organization					
4	People of same technical know how are always, being grouped together in the same job functions					
5	Safety statements are always stressed onto employees					
6	My company's operational equipment are always considered before deployment to job functions in my company					
7	Expertise/technical know-how is always, considered before deployment to job functions in my company					
8	Supervisors just group people together into job functions without any consideration.					
9	I don't need to consider any other (complimentary) company in the performance of my duty.					
10	Consideration is not given to health of staff in job allocation.					
11	Even, when given safety apparels, it is not compulsory they are used while performing my duty.					
12	I have stayed too long in this department/ unit and will not mind to have a change to another department					
13	Staff certification is paramount to technical job functions in my company					
14	Operational equipment in my company are bought brand new rather than fairly used.					
15	Compliance to standards are always being stressed to employees in my company;					
16	I think about safety always in the performance of my duty.					

SECTION E: DISTRESS REPONSES

S/no		SA	A	N	SD	D
1	Maintenance department staff are always around during operations.					
2	Equipment /facility spares are stock-piled in my company's maintenance department.					
3	Medical facilites are available at the airport round the clock.					
4	Airport security personnel are very agile, healthy and well equipped.					
5	The equipment used by airport security are modern,					

	serviceable and robust.					
6	Government agencies at airport e.g. police, air force, customers, NDLEA etc are very friendly to airport users.					
7	Government agencies at airport are well equipped for their various task within the around the airport					
8	Airport fire service personnel are very agile, healthy, well informed and can cope with airport operational demands;					
9	Airport fire services are well equipped for their operations;					
10	In case of emergency, the outside medical personnel, fire service, police etc will be ready to compliment airport efforts due to noticeable existing inter-relationship among them.					
11	My company has well trained staff on how to manage emergencies in a distress situation					
12	There exists an emergency response committee within the airport					
13	I am satisfied with the emergency response committee					

MASTER PLAN

1) In your own opinion, do you think activities within the airport are well planned organized? (a) Yes [ ] (b) No [ ]
2) Give your reason(s) for either yes /No to the above. ----------
---
3) Do you think location of various activities within the airport allows for proper/appropriate relationship among these various activities?
(a) Yes [ ] (b) No [ ]
4) Please justify your choice of option. ----------
---
5) Do you think this airport has a master plan? (a) Yes [ ] (b) No [ ]
6) If yes, is this master plan being operated in your own opinion. (a) Yes [ ] (b) No [ ]
7) Are there short comings about this master plan? (a) Yes [ ] (b) No [ ]
8) How is your work /organization been integrated within the master plan? ----------
---

SAFETY INFRASTRUCTURES

1. Does your organization places emphasize on safe operations? (a) Yes [ ] (b) No [ ]

2. Are there safety infrastructures in your organization? (a) Yes [ ] (b) No [ ]
3. If yes, can you list some of the available safety infrastructures within your operational area. ----------
---
4. How are thee infrastructures positioned within the operational areas?
(a) Well positioned [ ] (b) undecided [ ] (c) Not well positioned [ ]
5. Do you know when these infrastructures were installed? (a) Between 1-5 yrs [ ]

(b) 6 – 10 yrs ago [ ] (c) 11-15 yrs ago [ ] (d) 16-20 yrs ago [ ]
6. Are these infrastructures functional? (a) Functional [ ] (b) Not functional [ ]
7. How adequate are these available infrastructures to effectively manage distress situation? (a) Effective [ ] (b) Not effective [ ]
8. How effective are these infrastructures in terms of coping with emerging situation in our airports? (a) No response [ ] (b) Not effective [ ] (c) Fairly effective [ ]
(d) Effective [ ] (e) Highly effective [ ]
9. Can you remember and describe any incident /accident that have occurred within your organization or the airport in the last 1-5 years? (a)Yes [ ] (b) No [ ]
10 If yes, please give a summarized account. ----------
----- ----------
11 Can you evaluate how the distress situation was managed?
(a) Properly managed [ ] (b) Not properly managed [ ]
12. What improvement do you think should be put in place to allow for an improved distress management in future? (a) Availability of more effective facilities [ ] (b) Employment of capable staff [ ] (c) Agencies responsible for distress response within and outside the airport should be members of airport safety committee [ ] (c) Staff should be trained and retrained on how to give initial response to distress situations [ ] (d)Mock scenario should always be created [ ]

QUESTIONNAIRE TO AIRPORT USERS: PASSENGERS, TRAVEL AGENCIES, AIRLINE OPERATORS, IMPORTERS /EXPORTERS CLEARING AGENTS, ETC

SECTION A: RESPONDENTS DEMOGRAPHIC CHARACTERISTICS

1. Sex: (a) Male [ ] (b) Female [ ]
2. Age: (a) less than 24 yrs [ ] (b) 25-29yrs [ ] (c) 30 – 34 yrs [ ]
   (d) 35 - 39 yrs [ ] (e) 40 – 44 yrs [ ] (f) 45 –49yrs [ ] (g) 50-54 yrs [ ]

   (h) 55 yrs and above [ ]
3. Marital Status: (a) Single [ ] (b) Marital [ ] (c) Separated [ ] (d) Divorced [ ]
   (e) Widow/widower [ ]
4. Educational Qualification: (a) No formal education [ ] (b) Primary education [ ]
   (c) WASCE/ GCE /SSCE [ ] (d)Trade test [ ] (e) OND/ NCE/ TCII [ ]
   (f)HND/1st Degree [ ] (g)Master's degree and above [ ]
5. What type of Airport user are you? (a) passenger [ ] (b) traveling agent [ ]
   (c) importer /Exporter [ ] (d) Airline operator [ ] (e) clearing agent [ ]
   (f) Other specify----------
6. Since when have you been using the airport?
   (a) 1-5 yrs [ ] (b) 6-10 yrs [ ] (c) 11-15yrs [ ] (d) 16-20 yrs [ ]
   (e) 21 and above
7. How often do you come to the airport? (a) every day [ ] (b) once a week [ ]
   (c) fortnightly [ ] (d) once a month [ ] (e) quarterly [ ] (f) others specify ----
8. Which of the airport operators do you often deal with?
   (a) FAAN [ ] (b) NAHCO/SAHCOL [ ] (c) Fuellers [ ] (d) clearing agents [ ]
   (e) government agencies [ ](f) Other specify ----------

SECTION B: BASIC ISSUES

1. Do you think your airport service provider has a competitor? (a) Yes [ ] (b) No [ ]
2. If yes would you rather prefer the competitor? (a) yes [ ] (b) No [ ]
3. Either yes or No, please give reasons ----------

   How would you rate the quality of service of your airport service provider?

(A) Very high [ ] (b) High [ ] (c) Low [ ] (d) Very low [ ]

Question 4-11 are to elucidate information about safety as it concern operators within the airport. Please tick as appropriate. SA = Strongly Agree; A= Agree; N= neutral; SD= Strongly disagree D= Disagree

S/no		SA	A	N	SD	D
4	Carrying out my activities at the airport could be very cumbersome					
5	Carrying out my activities at the airport is very hazardous					
6	Airport operators are very carefree in rendering their carrying out their activities					
7	Airport operators do not have a specific/standard in carrying out their activates.					
8	My opinion on question 4 & 5 are due to my customer's non adherence to rules & regulations					
9	Airport operators generally do not have regard for their customs					
10	I can contribute meaningfully to making things better at the airport					
11	Airport operators need my co-operations and contribution to make things work better.					

13. Do you think your customer has adequate and appropriate facilities to carry out your needs at the airport? (a) yes [ ] (b) No [ ]
14. Are you satisfied with your service provider's level of service deliver (a) satisfied (b) not satisfied?
15. Indicate your opinion on the issues below as it relates with your service provider.
    (i) Provision of adequate and effective operational facilities (a) available (b) not available
    (ii) Constant power supply (a) available [ ] (b) not available
    (iii) Constant water supply (a) available [ ] (b) not available
    (iv) Crowd and tout control (a) available [ ] (b) not available
    (v) Adequate security (a) available [ ] (b) not available
    (vi) Clean environment (a) available [ ] (b) not available
    (vii) Friendly government agencies like customs and immigration (a) available [ ] (b) not available [ ]
16. Do you see the environment of the airport (both within and around) as being conducive to carrying out your activities? (a) Conducive [ ] (b) Not conducive [ ]

17. Please state your reasons: ----------
---

18. What improvement do you think can be put in place to make the environment in and around the airport more conducive for your operational activities ? ----------
---

19. Have you ever experienced any type of accident/ incident since you have been doing business at the airport? (a) Yes [ ] (b) No [ ]

20. If yes, please identify which type(s) (a) Plane overshoot the runway [ ] (b) Plane crash [ ]
(c)Forced landing [ ] (d) Burst landing gear [ ] (e) Bird strike [ ] (f) Fire disaster [ ]

21. What do you think were responsible for this? (a) Unprofessional act [ ] (b) Bad weather [ ]
(c)Lack of adequate facilities (d) Procedural errors [ ]

22. Do you think this occurrence could have been averted? (a) Yes [ ] (b) No [ ]

23. If yes how? ----------
---

24. What was your customers' response to the accident? (a) very responsible [ ]
(b) responsible [ ] (c)indifferent [ ] (d) irresponsible [ ] (e) very irresponsible [ ]

25. How well did other airport operators towards responding to the incident/accident.
(a)very cooperative [ ] (b) cooperative [ ] (c) indifferent [ ]
(d) uncooperative [ ] (e)very uncooperative [ ]

26. Do you think response to the accident /incident could have been better?
(a) yes [ ] (b) No [ ]

27. Please state your reasons: ----------
---

28. Is there any airport safety / security committee, to your knowledge within and around the airport? (a) Yes [ ] (b) No [ ]

29. Give further suggestions as to how to make our airport more effective and safer in Nigeria. (a) No response [ ] (b) Government should improve on both facilities and employees [ ] (c) Maintenance of aircraft should be regular [ ] (d) Proper security [ ] (e) Good management.

QUESTIONNAIRE TO THOSE LIVING AND WORKING AROUND THE SELECTED AIRPORTS

SECTION A: RESPONDENTS DEMOGRAPHIC CHARACTERISTICS

1. Sex: (a) Male [ ] (b) Female [ ]
2. Age: (a) less than 24 yrs [ ] (b) 25-29yrs [ ] (c) 30 – 34 yrs [ ] (d) 35 - 39 yrs [ ] (e) 40 – 44 yrs [ ] (f) 45 –49yrs [ ] (g) 50-54 yrs [ ] (h) 55 yrs and above [ ]
3. Marital Status: (a) Single [ ] (b) Marital [ ] (c) Separated [ ] (d) Divorced [ ] (e) Widow/widower
4. Educational Qualification: (a) No formal education [ ] (b) Primary education [ ] (c) WASCE/ GCE /SSCE [ ] (d)Trade test [ ] (e) OND/ NCE/ TCII [ ] (f) HND/1st Degree [ ] (g)Master's degree and above [ ]

SECTION B: BASIC ISSUES

1. Since when have you located here? (a) 1-5 yrs [ ] (b) 6-10 yrs [ ] (c) 11- 15yrs [ ] (d) 16-20 yrs [ ] (e) 20 and above
2. What is your type of activity around the airport? (a) dwelling [ ] (b) Industrial complex [ ] (c) Lock-up shop [ ] (d) Artisan yard [ ] (e) Farming/grazing
3. What type of structure do you have around the airport to carry out your activity? (a) bungalow [ ] (b) two storey building [ ] (c) high rise building [ ] (d) Mast [ ] (e) others (eg. Farmland Graring, Gaming etc)----------
4. Do you think your activity around here can affect operators at the airport? (a) yes [ ] (b) No [ ]
5. Have you been diagnosed of any chest / ear related health problems since you have located here? (a) Yes [ ] (b) [ ]
6. If yes, please state the exact health problem----------
---
7. Do you think your activities constitute any threat to airport operators? (a) yes [ ] (b) No [ ]
8. What threat do you think your activity around here pose to airport operators ? ---------
---
9. Have you ever experienced spill over of airport accident /incident at this your location? (a) yes [ ] (b) No[ ]

10. If yes, what type? (a) No response [ ] (b) Plane crash [ ] (c) Fire outbreak [ ] (d) Others [ ]
11. Please indicate the major environmental problems you face here. (a) Health hazard [ ] (b) Air pollution [ ] (c) Noise pollution [ ] (d) Traffic congestion [ ]
12. What are the challenges at the airport that you think are derived / emanated from your activities here? ----------
13. Do you have any plan to relocate your activity (ies) away from the airport? (a) Yes [ ] (b) No [ ]
14. Please give reason(s): (a) Airport problems [ ] (b) Better place [ ] (c) Better employment [ ] (d) To own house [ ] (e) No response [ ]
15. If your answer to 13 is no, will you still be ready to relocate if provided with a better alternative? (a) Yes [ ] (b) No [ ]
16. How do you think airport environment could be made to allow for a safer airport -----

Appendix II

Table : Passenger Movement To/From the Underlisted Nigerian Airports (Domestic Flights) 2002-2007

	2002		2003		2004		2005		2006		2007	
AIRPORT	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**
ABUJA	578707	574353	709251	706755	789394	803630	820381	832208	802,571	804,850	831,961	845,583
AKURE	1440	1418	1615	1422	1894	2015	1852	1879	1,548	1,488	647	699
BAUCHI	543	646	895	864	1302	1419	1214	1409	527	625	782	759
BENIN	38408	37261	35695	35038	57033	55413	33365	32824	45,532	45,924	82,071	82,094
CALABAR	47090	45776	60577	61362	71234	73211	71889	72145	83,123	83,631	125,836	129,388
ENUGU	83437	78755	99216	104800	120647	113016	110857	108464	97,883	93,558	102,187	99,243
IBADAN	4804	5541	2574	2486	6953	6848	8756	8886	5,646	6,596	3,967	3,466
ILORIN	2318	2950	3022	2866	6819	6526	10682	10255	10,159	9,064	8,952	8,800
IMO	14545	11097	25011	20093	46494	36190	61993	57284	168,568	147,031	248,730	243,850
JOS	19270	17162	23142	20937	28399	26958	29227	26140	16,304	14,454	13,851	11,494
KADUNA	63212	63694	62979	60435	63304	60918	63172	61361	54,749	54,412	49,805	51,407
KANO	68147	69393	84646	82414	102059	84771	98708	79896	80,351	74,306	80,293	76,736
KATSINA	459	494	869	888	537	631	1753	1839	216	189	776	745
MAIDUGURI	34970	32198	35094	34399	36774	36707	29185	28287	14,965	15,717	16,357	15,376
MAKURDI	0	0	0	0	2133	2136	1599	1650	120	122	462	559
MINNA	1715	1682	2329	2492	2654	2687	6425	2689	4,277	3,219	1,579	1,458
MMIA	1074015	1068292	1150013	1158757	1241494	1243217	1351709	1337382	1,415,605	1,434,155	1,438,661	1,439,989
OSUBI	192104	190782	197639	194276	187229	187327	163626	162025	128,456	120,281	140,222	143,992
PHC	349265	351580	451638	400883	399618	396901	454596	460153	278,110	295,697	168,213	176,294
SOKOTO	7280	7418	10234	11550	18739	19467	15642	15387	17,820	28,109	13,002	13,312
YOLA	18482	17764	22602	23313	24510	25227	33053	32214	26,453	27,094	16,642	16,548

Source: NCAA, 2007

Table : Aircraft Movement To/From the Underlisted Nigeria Airports (Domestic Flights) 2002-2007

	2002		2003		2004		2005		2006		2007	
AIRPORTS	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**	**ARR.**	**DEP**
ABUJA	13108	12982	15176	15116	17645	17680	15734	15856	15,854	15,830	15,710	15,708
AKURE	89	89	119	119	277	277	238	237	208	208	136	134
BAUCHI	97	97	120	119	234	231	176	174	94	94	122	122
BENIN	2131	2126	1903	1884	3178	3138	1963	1951	2,752	2,751	3,185	2,870
CALABAR	1242	1228	1370	1367	1802	1802	2096	2065	2,477	2,440	3,304	3,331
ENUGU	2642	2628	2705	2706	2861	2854	2138	2134	2,001	1,994	1,921	1,919
IBADAN	396	395	282	284	714	720	764	760	700	700	489	482
ILORIN	318	317	412	417	784	776	862	870	847	847	875	873
IMO	435	435	587	584	1036	1021	1137	1134	4,566	4,562	4,076	4,076
JOS	477	476	524	525	704	703	580	581	436	436	324	325
KADUNA	2018	2043	1937	1996	1919	1887	1640	1660	1,346	1,348	1,403	1,416
KANO	1434	1419	1920	1915	2038	1944	1880	1733	1,919	1,912	2,128	1,909
KATSINA	51	51	78	77	85	84	97	95	27	27	50	50
MAIDUGURI	582	570	545	547	761	752	669	667	488	498	496	496
MAKURDI	0	0	0	0	160	160	130	130	6	6	56	57
MINNA	200	200	276	277	280	281	297	296	248	248	210	210
MMIA	23786	24026	24261	24464	28187	28332	26285	25912	26,958	27,396	27,827	27,956
OSUBI	12354	12341	13585	13583	11891	11996	9304	9379	6,891	6,885	6,592	6,589
PHC	12597	12401	15880	15670	14899	14670	13904	13748	9,151	8,949	6,005	6,085
SOKOTO	313	338	345	362	513	527	405	422	443	435	410	469
YOLA	553	568	660	663	570	586	688	697	720	717	489	485

Source: NCAA, 2007

Appendix III
Meteorological Data

ABUJA

	MONTHS											
1995	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
DUST HAZE												
FOG								2	2	2		
THUNDERSTOM			4	8	17	7	7	16	13	14	1	
VISIBILITY	1200m	1500m	3000m	3400m	8m	3000m	2500m	600m	400m	600m	3500m	3500m
PRESSURE	1015.3	1014.7	1013.3	1012.5	1014.1	1015.4	1015.1	1015.7	1016.1	1014	1014.5	1014.5
1996												
DUST HAZE												
FOG					1				1	1		
THUNDERSTOM		1		12	16	15	16	10	14	14		
VISIBILITY	2000m	1400m	3000m	2600m	500m	15m	3000m	1500m	500m	500m	3500m	2600m
PRESSURE	1012.9	1012.8	1012.8	1013.1	1014.5	1015.8	1017	1016.4	1015.7	1015	1013.8	1014.1
1997												
DUST HAZE	2	3										
FOG	3				1	1	2		1	3		
THUNDERSTOM			2	11	17	16	10	12	20	24	3	1
VISIBILITY	800m	500m	1200m	10m	1000m	1000m	800m	10m	1200m	600m	3000m	2000m
PRESSURE	1014	1014.9	1013.2	1014.2	1015.2	1015.1	1016.3	1017.1	1015.5	1014.8	1014.2	1015
1998												
DUST HAZE	2	12	1									2
FOG						1	2		4	1		
THUNDERSTOM		3	2	6	16	18	12	8	14	19		
VISIBILITY	600m	1000m	1000m	4400m	10m	500m	800m	7m	200m	900m	3000m	800m
PRESSURE	1014.9	1015.2	1013.6	1013.1	1014.7	1016.4	1016.3	1015.7	1015.8	1015.5	1013.8	1014
1999												
DUST HAZE												5
FOG							1		2			
THUNDERSTOM			5	12	15	16	10	8	15	16	1	
VISIBILITY	2000m	4500m	5000m	1300m	3000m	3000m						
PRESSURE												
2000												

DUST HAZE	1	3										
FOG							1	2	3	1		
THUNDERSTOM			2	9	16	16	13	11	22	10		
VISIBILITY	1000m	800m	1200m	4000m	3500m	3000m	1600m	600m	600m	800m	3500m	200m
PRESSURE	1012.9	1014.7	1012.6	1012.7	1014	1015.1	1015.5	1016.4	1015.1	1015.4	1013.7	1014.9
2001												
DUST HAZE		3										
FOG								1	1			
THUNDERSTOM				7	16	17	17	12	14			
VISIBILITY	1500m	700m	4500m	3000m	15m	12m	1200m	1500m	800m	3000m	2000m	2000m
PRESSURE	1014.8	1014	1013.6	1013.5	1014.5	1015.9	1016.3	1017.3	1016.1	1015.8	1015	1014.4
2002												
DUST HAZE	2		1									
FOG						1		1	1			
THUNDERSTOM			6	10	11	15	21	15	15	17		
VISIBILITY	900m	1200m	1200m	6m	4000m	1500m	5000m	800m	800m	2000m	3000m	4500m
PRESSURE	1015.5	1014.5	1013.7	1012.5	1014.6	1016.2	1017	1016.6	1016.4	1015.6	1015.4	1015.9
2003												
DUST HAZE			1									
FOG							1					
THUNDERSTOM		1	2	12	11	16	9	12	16	21	7	
VISIBILITY	2500m	1500m	800m	10m	10m	2000m	400m	5000m	3300m	6m	3000m	1200m
PRESSURE	1015.7	1014.3	1013.9	1014.1	1014.9	1015.8	1016.6	1016.4	1015.9	1014.8	1014.2	1014.9
2004												
DUST HAZE	2		1									
FOG							1	1	1	1		
THUNDERSTOM		1		13	16	10	18	11	18	15	5	
VISIBILITY	900m	1200m	700m	7m	1500m	3500m	1200m	1500m	1600m	800m	1500m	3000m
PRESSURE	1013.9	1014.5	1013.8	1013.7	1015.1	1017.1	1016.2	1017	1014.5	1015.2	1016.9	1015.4

KANO

	MONTH											
1995	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
DUST HAZE	5		3	4							2	1
FOG												
THUNDERSTOM				2	4	11	9	15	11	1		
VISIBILITY	800m		3800m	100m	10km	12km	6km	7km	800m	5000m	1000m	500m
PRESSURE	1017.2	1016.7	1011.1	1008.5	1010.2	1011.3	1012.3	1012.9	1011.6	1014.3	10152	
1996												
DUST HAZE			1							2	1	1
FOG										2		
THUNDERSTOM					9	11	14	12	14	4		
VISIBILITY	1000m	1000m	300m	2000m	500m	10km	10km	600m	10km	1000m	1000m	1600m
PRESSURE	1013.7	.1012.0	1010.1	10091	10097	1012	1012.9	1013.1	1011.4	1012.8	1014.4	1015
1997												
DUST HAZE	5	16	1									
FOG												
THUNDERSTOM				3	10	13	12	17	8	3	3	2
VISIBILITY	700m	200m	1000m	10km	1500m	10km	10km	10km	800m	300m	500m	20km
PRESSURE	1014.7	1017.8	1011.9	1010.4	1011.8	1011.6	1013.4	1014.1	1013.1	1011.8	1013	1016.1
1998												
DUST HAZE	1	5	9	6		4sandstom			4s/stom	3	1	3
FOG												
THUNDERSTOM				4	5	10	6	16	11	3		
VISIBILITY	600m	700m	200m	1000m	10km	10km	600m	800m	6km	1000m	4000m	200m
PRESSURE	1016.9	1015.9	1014.2	1009.4	1010.6	1013.2	1012.2	1012.7	1012.8	1012.7	1013.1	1015.6
1999												
DUST HAZE	2	8	11	5							6	6
FOG												
THUNDERSTOM					1	8	22	19	12			
VISIBILITY	500m	100m	400m	600m	800m	4000m	10km	600m	10km	3000m	600m	700m
PRESSURE	1014.6	1012.8	1009.1	1010.5	1010.8	1011.5	1013.1	1013.3	1012.6	1012.8	1013.3	1015.5
2000												
DUST HAZE	3	3	6		1							
FOG												
THUNDERSTOM					7	9	11	12	8	4		

VISIBILITY	200m	200m	500m	1200m	1000m	6km	12km	10km	6km	600m	1500m	1500m
PRESSURE	113.8	1017.4	1012.2	1007.9	1009.6	1012	1011.5	1012.8	1012	1012.3	1012.4	1017
2001												
DUST HAZE		7								2		
FOG												
THUNDERSTOM					7	15	17	16	12			
VISIBILITY	1200m	900m	1666m	1200m	4000m	15km	10km	600m	600km	800m	1400m	1400km
PRESSURE	1016.2	1015.2	1011.2	1009	1010.1	1012.5	1012.3	1014	1012.6	1012.9	1014.9	1014.6
2002												
DUST HAZE	8	4	4	2								3
FOG												
THUNDERSTOM				1		13	17	15	13	3		
VISIBILITY	600m	800m	500m	800m	1200m	4000m	10km	500m	8km	1200m	2000m	5000m
PRESSURE	1018.2	1015	1011.3	1007.8	1009.7	1000.7	1013.4	1013.3	1013	1012.6	1014.4	1016.4
2003												
DUST HAZE	3	4	3			1						5
FOG												
THUNDERSTOM					4	5	11	16	23	12	2	
VISIBILITY	600m	800m	400m	800m	800m	2000m	8km	6km	8km	2000m	1200m	300m
PRESSURE	1016.2	1013.5	1012.9	1009.7	1010.4	1012.1	1013.2	1013.4	1013.5	1012	1013	1.15.9
2004												
DUST HAZE	3	9	8								5	1
FOG												
THUNDERSTOM					15	11	17	13	9			
VISIBILITY	600m	800m	800m	1000m	1000m	4000m	7km	7km	4000m	8km	800m	400m
PRESSURE	1014.9	1015.7	1013.2	1009.7	1010.6	1013.3	1013	1013.7	1010.2	1012.3	1013	1014.5

LAGOS

	MONTHS											
1995	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
DUST HAZE												
FOG	3	1					1					2
THUNDERSTOM		10	15	8	16	16	2	14	11	13	3	2
VISIBILITY	200m	4000m	8m	8m	6m	7m	2000m	6m	6m	8m	6m	400m
PRESSURE	1013	1012.4	1008	1009.9	1011.7	1013.1	1013.2	1008.2	1008.8	1012.5	1012	1012.4
1996												
DUST HAZE												
FOG	12	1						1		2	2	13
THUNDERSTOM	3	7	9	16	15	14	9	3		7	2	2
VISIBILITY	800m	800m	7m	8m	8m	6m	6m	500m	6m	100m	400m	200m
PRESSURE	1010.7	1010.2	1009.9	1010.3	1011.9	1013.8	1015.2	1014.8	1013.8	1013.1	1011.7	1012.1
1997												
DUST HAZE												
FOG	4	2						1	1		1	4
THUNDERSTOM	1		6	12	17	17	1	3	8	16	13	4
VISIBILITY	800m	500m	2800m	8m	6m	6m	6m	2000m	3500m	4800m	800m	800m
PRESSURE	1011.9	1012.6	1010.7	1012.1	1013.7	1013.7	1015.6	1015.8	1014.1	1012.8		1012.1
1998												
DUST HAZE	1		1				1					12
FOG	3											6
THUNDERSTOM	1	2	5	4	15	11	2	2	2	14	14	1
VISIBILITY	300m	1200m	2000m	5000m	6m	5000m	6m	3500m	6m	2000m	5000m	250m
PRESSURE	1012.2	1012.6	1010.9	1010.4	1012.5		1014.4	1008.8	1008.5		1011.4	1012
1999												
DUST HAZE												
FOG	4							1	1			9
THUNDERSTOM	3	4	1	9	11	18	9	2	4	14	17	3
VISIBILITY	800m	3000m	5000m	6m	6m	6m	5000m	3000m	800m	5000m	3000m	200m
PRESSURE	1010.8	1010.9	1009.2	1010.5	1012	1012.4	1014.4	1014.7	1013.3	1013.3	1012.1	1011.6
2000												
DUST HAZE	2											
FOG												2
THUNDERSTOM	2	2	7	8	12	15	4	2	12	12	8	1

VISIBILITY	800m	800m	2000m	5000m	2000m	3000m	2500m	5000m	2500m	5000m	2800m	200m
PRESSURE	100.51	1012.1	1010	1010.2	1011.8		1013.9	1015	1013.4	1013.3	1011.3	1012.4
2001												
DUST HAZE												
FOG	7				1				1			2
THUNDERSTOM	2	1	6	10	11	18	10		3	14	4	3
VISIBILITY	200m	3500m	5000m	5000m	600m	3000m	1500m		1500m	5000m	3000m	800m
PRESSURE	1012.5	1011.4	1011.3	1011.5	1012.3	1014.1	1014.8		1014.6	1014.1	1013.4	1012.6
2002												
DUST HAZE	5	3										
FOG	3	1										
THUNDERSTOM	2	3	10	10	13	18	9		6	16	8	1
VISIBILITY	200m	600m	6000m	5000m	3500m	3000m	5000m	6m	8000m	5000m	1500m	300m
PRESSURE	1013.4	1012.1	1011	1010.2	1011.9	1018.1	1015.2	1015	1014.7	1013.4	1012.9	1013.4
2003												
DUST HAZE												
FOG	10						2			1	3	10
THUNDERSTOM	5	5	6	7	10	17	2		6	10	12	
VISIBILITY	100m	1800m	4000m	5000m	3000m	300m	1200m	5000m	3000m	350m	500m	200m
PRESSURE	1013.2	1014.9	1010.9	1011.4	1012.3	1013.5	1015.2	1015	1014.3	1012.3	1011.7	1011.9
2004												
DUST HAZE	2	2	3									5
FOG	5	3						1		1	2	11
THUNDERSTOM	4	4	4	11	13	12	4	2	11	19	9	1
VISIBILITY	100m	800m	600m	3000m	3000m	1500m	3000m	300m	1500m	500m	800m	300m
PRESSURE	1011.3	1011.8	1010.8	1011.5	1013.1	1015.4	1014.8	1015.7	1014.3	1013.5	1012.4	1011.9

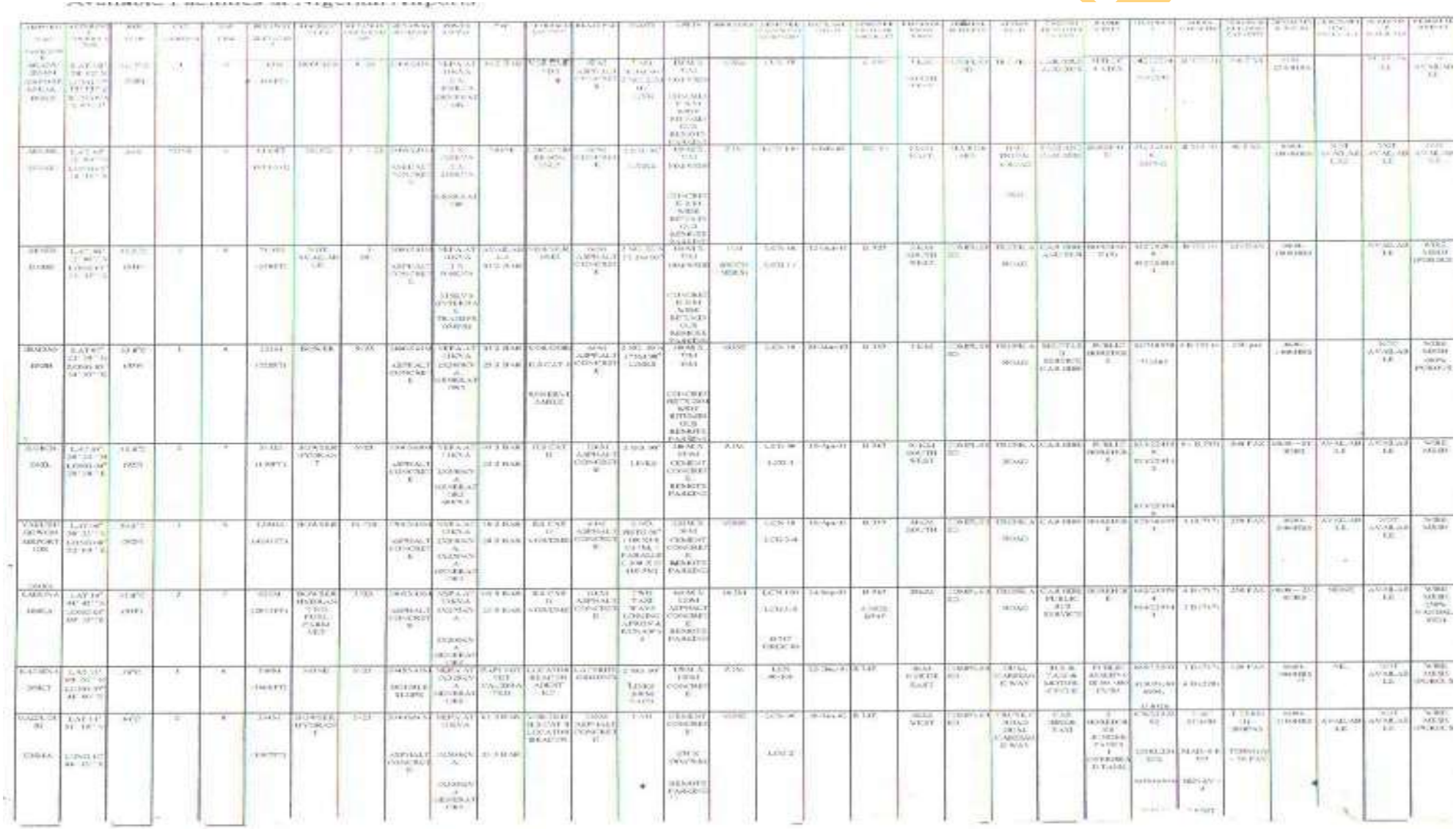
PORT HARCOURT

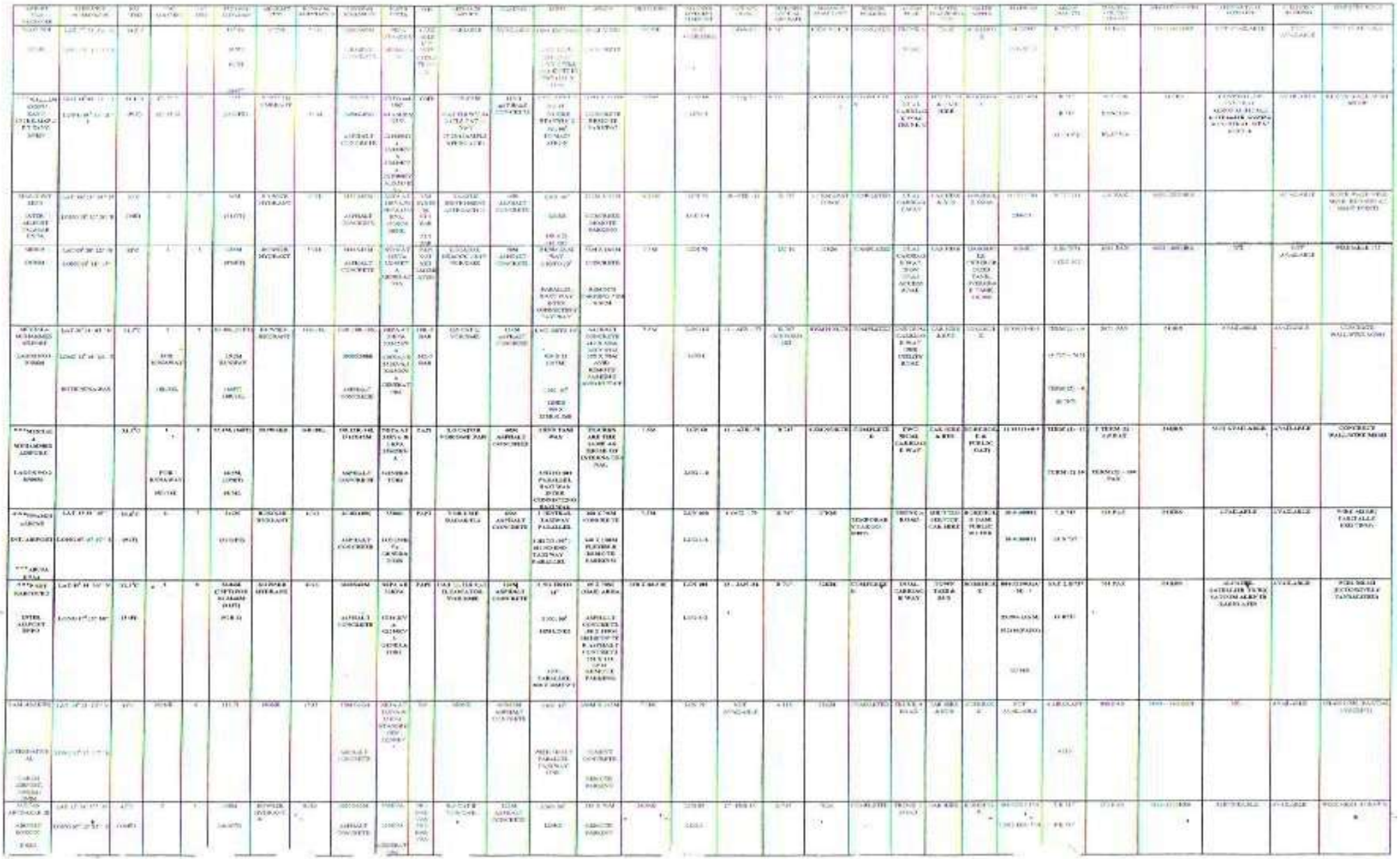
	MONTHS											
1995	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**
DUST HAZE												
FOG	6	5	3	1	1	2	4	2	9	7	12	13
THUNDERSTOM	1	8	14	14	20	13	11	12	15	18	9	3
VISIBILITY	600m	200m	200m	100m	300m	300m	100m	800m	500m	600m	100m	300m
PRESSURE	1012.3	1012.2	1010.7	1009.9	1011.4	1013	1012.9	1013.4	1014	1012.1	1011.7	1011.9
1996												
DUST HAZE			1									
FOG	9	4			2	6	6		3	18	9	7
THUNDERSTOM	7	7	11	19	20	14	13		9	28	6	
VISIBILITY	100m	200m	3000m	3000m	800m	300m	200m		600m	200m	100m	100m
PRESSURE	1010.9	1011.4	1010.8	1010.6	1011.9	1013.7	1014.7		1014	1012.5	1012.2	1008.6
1997												
DUST HAZE	1											
FOG	8	7		3	4		3	1	4	6		9
THUNDERSTOM	1	11	12	13	14	15	13	13	18	14		2
VISIBILITY	200m	300m	3000m	500m	300m	4000m	400m	800m	600m	300m		200m
PRESSURE	1011.5	1011.2	1008.2	1010.6	1011.2	1013.7	1014.4	1014.9	1013.7	1012.6		1011.1
1998												
DUST HAZE												
FOG		6	4	1			3	1	2	1	3	10
THUNDERSTOM	3	5	7	11	16	14	13	3	14	12	12	1
VISIBILITY	100m	900m	600m	3000m	3000m	1500m	100m	600m	800m	800m	100m	100m
PRESSURE	1011.6	1012.5	1010.9	1010.7	1012.6	1014.3	1015	1014	1013.7	1013.6	1011.5	1011.9
1999												
DUST HAZE												
FOG	7	6	3	4	2	1	7	2	2	7	7	13
THUNDERSTOM	5	11	14	13	15	18	5	8	18	18	14	
VISIBILITY	700m	600m	600m	500m	600m	800m	500m	500m	600m	500m	500m	100m
PRESSURE	1010.6	1010.9	1009.7	1011.1	1012.3	1012.7	1014.5	1014.5	1013.3	1013.3	1012.2	1011.6
2000												
DUST HAZE		1										
FOG	10	4	4	2	2	8	1		6	5	13	9
THUNDERSTOM	4	2	6	14	16	17	19	10	21	14	7	4

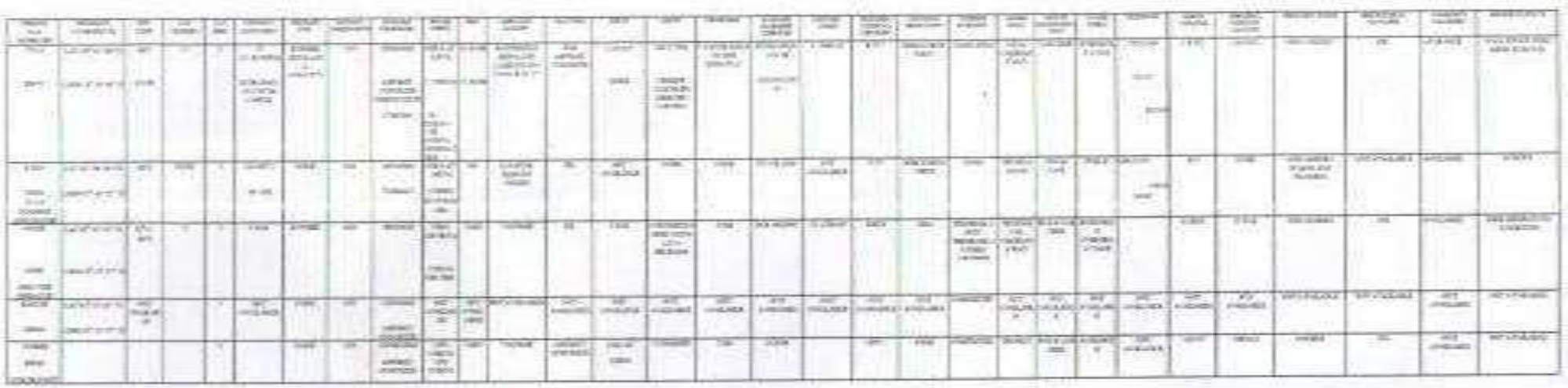
VISIBILITY	200m	200m	600m	200m	500m	200m	800m	5000m	200m	500m	200m	100m
PRESSURE	1010.4	1012.1	1010.4	1010.5	1011.9	1013.5	1013.7	1014.8	1013.4	1012	1011.6	1012.6
2001												
DUST HAZE												
FOG	20	10	1	2	1	4	2	1		3	11	18
THUNDERSTOM	3	2	19	14	18	16	9	2		16	5	2
VISIBILITY	100m	100m	400m	400m	800m	400m	400m	100m		600m	300m	100m
PRESSURE	1012.4	1011.3	1011.2	1011.3	1012.2	1014.2	1011.4	1016	1014	1013.3	1012.6	1011.6
2002												
DUST HAZE												
FOG	13	4	2			11	9	2	2	4	5	9
THUNDERSTOM		6	7	15	17	19	15	7	7			3
VISIBILITY	100m	100m	300m	2500m	2000m	500m	200m	500m	800m	600m	200m	100m
PRESSURE	1012.5	1011.8	1011.2	1010.3	1012	1014.4	1015.1	1014.8	1014.1	1013.2	1013	1013
2003												
DUST HAZE												
FOG	13	6	1	1	2	4	4		4	7	8	11
THUNDERSTOM	4	7	10	12	13	12	14	11	15	19	12	1
VISIBILITY	100m	300m	1000m	700m	100m	200m	600m	3000m	800m	200m	600m	100m
PRESSURE	1012.8	1111.8	1011.2	1011.7	1012.3	1013.7	1015	1014.9	1014.9	1012.8	1011.5	1007.5
2004												
DUST HAZE	1											1
FOG	1	4	4	3	1	5	6	1	6	5	8	4
THUNDERSTOM	9	2	13	15	12	15	15	6	13	4	8	14
VISIBILITY	200m	1800m	1800m	800m	2800m	200m	200m	100m	100m	100m	500m	200m
PRESSURE	1011.1	1011.8	1011	1011.6	1013.1	1015.5	1014.4	1015.7	1013.7	1012.7	1012	1011.2

Appendix IV

Available Facilities at Nigerian Airports







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Source: [illegible]