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PERCEPTIONS OF RESIDENTS ON MENACE OF AIRCRAFT NOISE IN THE MAIDUGURI AIRPORT AREA, BORNO STATE, NIGERIA

Bitrus Ayuba¹, Andesikuteb Yakubu Ali², Donatus Adamu Lucas³ and Isaac Innocent Iko² Bitrus Hope Shakson⁴

¹Department of Estate Management, Bingham University, Karu, Nigeria

²Department of Environmental Management, Bingham University, Karu, Nigeria

³Department of Architecture, Bingham University, Karu, Nigeria

⁴Department of Estate Management, University of Jos, Plateau, Nigeria

Corresponding Author's email and phone: andesikutebali@gmail.com, +2347031348808

ABSTRACT

This study examines the perception of residents of Maiduguri international airport area on menace caused by aircraft noise in the study area. To determine the sample size for this research, Krejcie and Morgan's (1970) table of determining sample size was adopted, 420 sample size was adopted for questionnaire administration purpose. The study used a quantitative research approach and collected data from 363 respondents through questionnaire administration. The research utilized the mean ranking in analysing the data obtained from the field. The research revealed that aircraft noise negatively impacts the behaviour of the residents. The study also found that residents are willing to stay in the neighbourhood due to the presence of security personnel in the area but are disturbed by the menace associated with aircraft noise. These menace as identified by the study include vibration, noise pollution, disturbance to sleep, interference to speech and other forms of communication, lack of comfort, temporary hearing loss, reduced opportunity for privacy, vibration and annoyance. The study therefore recommends among other things that investors and property developers should consider the effects of noise on the health and psyche of the residents before embarking on building and construction of residential property, individuals and government should embark on the upgrading of sound insulation on buildings to reduce the negative impacts of aircraft noise to enhance the quality of urban life of tenants. Government through urban development board should also ensure proper land use planning which is an obvious and almost universally accepted technique for minimizing the negative impact of airport noise in areas adjacent to airports

Keywords: Noise level, pollution, Building insulation, Landuse Planning, Urban development, Vibration,

INTRODUCTION

As populations and airports expand to almost all the States in Nigeria, airport noise has become an increasingly important issue affecting residents and communities around their immediate communities. According to Aliyu, Abdu, Ibrahim, Maryam & Habu (2016), airports generate both undesirable impacts, such as noise, and desirable impacts, such as employment opportunities and transportation services. For individuals who might work at (or near) the airport or who use the airport for travel, the benefits of proximity to the airport can be reflected in residential property values. Because it is possible for an airport to have negative and positive effects on the health and psyche of the residents, the net effect can be negative or positive. The empirical problem is the



extent to which a particular study has separated the effect of noise from that of accessibility, neighborhood infrastructure, proximity and willingness to live in the neighbourhood. Suksmith and Nitivattananon (2015) studied Suvarnabhumi International Airport in Thailand, and note that a decrease in house prices and rentals can be expected in the areas surrounding airports and under the flight paths. The most annoying noise associated with airports is generated when aircrafts land and take off (Kholodilin&Mense, 2012;Olayinka, 2013). According to the World Health Organisation, the standard approved noise level in residential areas shall not exceed 55 decibels during the day and 45 decibels at night, the standard approved noise level in industrial areas shall not exceed 90 decibel during the day, the standard approved noise level for commercial areas shall not exceed 70 decibel during the day.

Many studies had attempted to measure the effects of aircraft noise on health and stability of people around the airports across the world. Such researchers include Emerson (1972) who wrote on noise and single-family housing, Espey& Lopez, 2000; Giles-Corti, et al 2016) who discussed property price and exposure to multiple noise source and reported on airport noise and proximity on residential property value, Goines &Hagler(2007)wrote on particulate pollution from Bangladesh airport. Similarly, Gitanjali and Ananth (2003) centered their work on combined effects of noise and vibration produced by aircraft on rental value of buildings. Many studies have really identified issues relating to health, psychology and physical impacts in other are areas but this has not been carried out around to ascertain the effects of and menace of airport noise in Maiduguri airport.

Recent increases in aircraft fuel prices have led to renewed airline interest in turboprop aircraft (Kingsley-Jones, 2013). Turboprop aircraft use less fuel than jet aircraft with a similar seating capacity, and on short routes the speed advantage of jets over turboprops is minor (Kingsley-Jones, 2013). The benefit of an increased proportion of turboprops is that they are quieter than jets, and this advantage is passed on to the airport's neighbors. However, this benefit is relatively minor since jets are still preferred by airlines and passengers over medium distance to long flights due to their speed advantage so it is unlikely that jets will be replaced by turboprops on noise grounds alone(Wolfe, et al 2016; Xie, Kang, &Tompsett, 2011).

Noise is made by aircraft engine run-ups and taxiing on the ground, during take-off and landing, and en-route between destinations. Take-off and landing operations when aircraft are being operated at high power settings and are close to the ground create the most noise problems. Kasimonje (2008) and Jelfs, Culling &Lavandier(2011) found that nearly 70% of residents who live within flight corridors reported themselves as being bothered by aircraft noise. Not all aircraft are noisy, but older jet aircrafts, particularly those dating back to the 1970s are extremely noisy whilst new jets and turboprop aircrafts are much quieter.

Noise from aircraft is very complex and comprises engine noise and airframe noise. Engine noise is the sum of noise produced by several engine components: fan, compressor, combustor, turbine and jet exhaust (Brennan *et al.*, 2001; Huderek-Glapska, &Trojanek, 2013). Airframe noise originates from the airframe itself as well as the undercarriage and undercarriage doors, wing flaps and slats when these are deployed on take-off and landing. The first jet engines were known as turbojets and were the noisiest engines. These were followed by low bypass ratio, and later high bypass ratio turbofan engines which are the quietest even though they produce much more thrust than early turbojet and low bypass ratio engines. This study therefore, examines the effects of aircraft noise on the health and psyche of residents of Maiduguri international airport area and their perception on menace caused by aircraft noise in the study area. The study has determined the resident's perception on the menace caused by aircraft noise on residents of the airport area in

Maiduguri metropolis ant to identify the health effects of airport noise on residents around Maiduguri airport.

MATERIALS AND METHODS

Description of Study Area

Maiduguri international airport is located 6 kilometers west of the city of Maiduguri on coordinates latitude 11° 52' 54"N, longitude 13° 08' 30"E. The area has an average daily temperature of 35°C. Maiduguri which houses one of the most important edifices serving both socio-economic and humanitarian purpose of the North East, it is indeed an aviation hub which shares boarder with three west African countries, namely Niger republic to the North, Chad republic to the East, and Cameroon Republic to the East. The airport is currently surrounded by four residential areas that is; Ngomari which is located 2,000 meters away from the fence of the airport, seven hundred and seventy seven (777) housing estate which is 1,500 meters away from the fence of the airport, shuwari which is 3,000 meters away from the fence of the airport one thousand (1000) housing estate, all of which are in Dala lawanti ward of Jare local government area of Borno state. With seven hundred and seventy seven (777) housing estate housing situated directly under the takeoff and landing route of the airport. The airport is situated on a 98 hectares of land and an average of 3,000 aircrafts and 55,000 passengers use the airport annually making it one of the busiest airports in the North Eastern region of Nigeria (Mai, 2001). According to international civil aviation organization (2010) the distance between the nearest flight path and houses is 4.35 miles or 7KM which has been complied with in the study area.

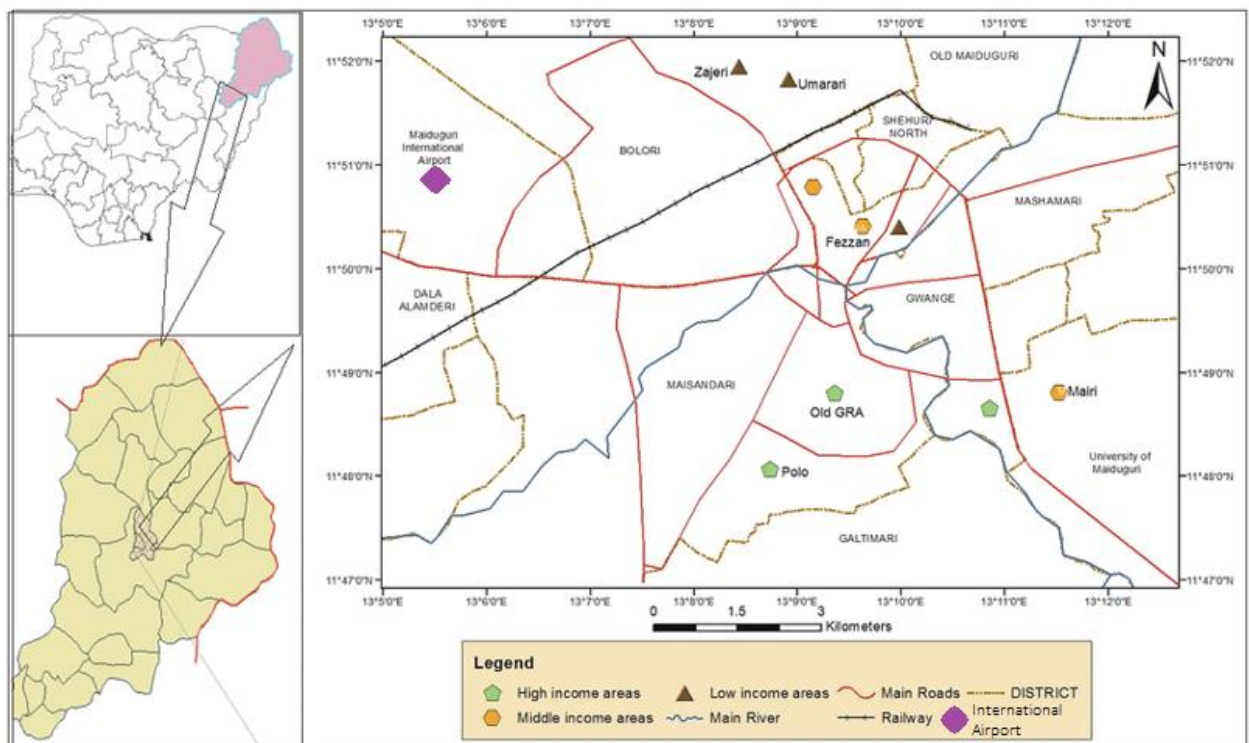


Figure 1: Map of Maiduguri, Borno State The Study Area

Source: Modified from the Administrative map of Borno State



Maiduguri Airport came to be as a result of the royal air force flying into Maiduguri for political reasons. The airport is located about 10 kilometers from the suburbs of Maiduguri metropolis, the then national carrier (Nigerian Airways) was the first to commence civil aviation operations followed by indigenous airlines such as GAS Air, Chanchangi Airlines, Harka Airline and Kabo Air coming into the airport for Hajj operations. The main terminal building of the airport now shares common boundary with the Nigerian Airforce Base.

Data collection and analysis
Sample Size and Sampling Procedure

Study population is the target respondents to study that meet the desired requirements to provide information (data) for the research. The target respondents for this study are residents (in residential properties) located around the airport since they are in the best position to give the right responses and credible information from their experiences. The sample frame is the total number of items of the study population. As Maiduguri international airport is situated at the heart of Dala Lawanti Ward, the airport is surrounded by four residential areas and comprised of one (1) administrative ward (Table 1, the sample frame of this study is the total tenants in the four residential areas that surround Maiduguri international airport (16,512) as stated by Jere Local Government (2016).

Sample Size and Sampling Techniques

Jere Local Government where the airport is located has a total population of 86,978 (NPC, 2006), with fifteen (15) wards. Maiduguri International Airport is located in the heart of the fifteen (15) wards in Jere Local Government Area. A sample was then drawn from the identified residential properties using simple random sampling technique.

Table 1: Sample Frame and Sample Size

S/N	Area	Population (sample frame)	Sample size
1	Ngomari	7,321	165
2	Seven hundred and seventy-seven (777) housing estate	1,723	39
3	One thousand (1000) housing estate	2,123	48
4	Shuwari	5,445	123
	Total	16,512	375

Source: Author (2019)

Therefore, target population for the purpose of this research are residents within the study area. To determine the sample size for this research, Krejcie and Morgan’s (1970) table of determining sample size was adopted. The table indicates that for population size of 16,512, sample size of 375 can be used as the minimum. Since the population size of this study area is 16,512, as shown in Table 1, 375 sample size was adopted for questionnaire administration purpose and this aided the collection of adequate data for the study.



Instrument for Data Collection

Noise Level Measurement

For the purpose of this research, decibel (sound level) meter and questionnaire were adopted as instruments for collecting data from the respondents. The questionnaire was designed to address the research objectives. The ways in which questions are presented in the questionnaire can affect the quality of response. Therefore, it is important that not only the right questions are asked, but also the questions are understood and asked in right way (Case and Shiller 2012). Since questionnaire can lead to error and bias, as well as increasing the tendency of non-response in a survey (Benjamen, 2012), questionnaire for this study was designed in consideration of the nature of the respondents, ease of reading and completion period. The design incorporated the use of only close-ended questions. The close-ended questions, which has more than one response options and five (5) Likert scale with six sections was used for the variable items to ease the means of assessing the response (Kothari, 2004).

The analysis for the pilot study was carried out using Statistical Package for Social Sciences (SPSS) version 25. The reliability of a scale indicates how free it is from random error (Pallant, 2011). The reliability of a scale is measured by its internal consistency. This is the degree to which constructs (items) that make up the scale are all measuring the same underlying attribute. The most commonly used statistical tool for measuring internal consistency is the Cronbach's Alpha coefficient (Pallant, 2011). It provides an indication of the average correlation among all of the items that make up a scale. Values range from 0 to 1, with the higher values indicating greater reliability. According to Devellis (2003), Cronbach's Alpha coefficient of .7 and above is acceptable. Reliability test was conducted on the major constructs of the study which include influence of proximity, rental value, willingness and menace. This was to ascertain their internal consistency.

RESULTS AND DISCUSSION

Resident's Perceptions on Menace caused by Aircraft Noise in the Area

As seen in Table 2, a five-point scale of "Very high, High, Undecided, Low, and Very low" was adopted. The data was collected and analyzed using descriptive statistics and the result of the analysis is presented in Table 2. Table 2 also shows results on the menace caused by aircraft noise in the study area. Table 2, revealed that aircraft noises caused psychological stress and is ranked 1st, noise pollution is ranked 2nd, disturbance to sleep is ranked 3rd, also interference to speech is ranked 4th, lack of comfort is ranked 5th, interference to watching TV is 6th, in the same vein, temporary hearing loss is ranked 7th and ranked 8th is reduced opportunity for privacy while; disturbance to rest, nuisance, interference to relaxation, annoyance, vibration, structural damage, interference with welfare are ranked 9th, 10th, 11th, 12th, 13th, 14th, and 15th, respectively.

Table 2: Health impact caused by Aircraft noise in the study area

S/N	Items	VH	H	U	L	VL	Mean	Std. Dev.	Rank
1	Psychological stress.	192 (52.9)	135 (37.2)	12 (3.3)	12 (3.3)	24 (6.6)	4.36	.834	1 st
2	Noise pollution	192 (52.9)	123 (33.9)	24 (6.6)	24 (6.6)	-	4.33	.867	2 nd
3	Disturbance to sleep	156 (43.0)	169 (46.6)	13 (3.6)	12 (3.3)	13 (3.6)	4.22	.935	3 rd
4	interfere with speech	144 (39.7)	158 (43.5)	24 (6.6)	37 (10.2)	-	4.13	.926	4 th
5	Lack of comfort.	156 (43.0)	134 (36.9)	37 (10.2)	24 (6.6)	12 (3.3)	4.10	1.043	5 th
6	Interference with viewing TV	156 (43.0)	110 (30.3)	61 (16.8)	36 (9.9)	-	4.06	.997	6 th
7	Temporary hearing loss	120 (33.1)	182 (50.1)	25 (6.9)	12 (3.3)	24 (6.6)	4.00	1.063	7 th
8	Reduce opportunity for privacy	96 (26.4)	144 (39.7)	74 (20.4)	49 (13.5)	-	3.79	.983	8 th
9	Disturbance to rest	85 (23.4)	72 (19.8)	144 (39.7)	62 (17.1)	-	3.50	1.031	9 th
10	Nuisance	85 (23.4)	72 (19.8)	144 (39.7)	62 (17.1)	-	3.50	1.031	10 th
11	Interference to relaxation	60 (16.5)	120 (33.1)	86 (23.7)	97 (26.7)	-	3.39	1.052	11 th
12	Annoyance	60 (16.5)	121 (33.3)	62 (17.1)	84 (23.1)	36 (9.9)	3.23	1.254	12 th
13	Vibration	60 (16.5)	84 (23.1)	111 (30.6)	60 (16.5)	48 (13.2)	3.13	1.254	13 th
14	Structural damage	60 (16.5)	73 (20.1)	96 (26.4)	73 (20.1)	61 (16.9)	3.00	1.319	14 th
15	Interference with welfare	12 (3.3)	74 (20.4)	72 (19.8)	85 (23.4)	120 (33.1)	2.56	1.256	15 th

Aviation noise affects the environment and can adversely impact the individuals within a community in different ways. At the Maiduguri International Airport area in Borno State, the noise from the aircrafts is said to affect the residents in the following ways: it causes annoyance (19%) in individuals, it brings about adverse effects and slow down children’s learning process and abilities (25%). This, also based on the survey engenders air pollution (27%), results to Complaints by individuals (18%) and causes Trauma in residents (15%) in the area as seen in Figure 2.

In determining tenants’ perceptions on the menace caused by aircraft noise around Maiduguri international airport. A five-point scale of “Very high, High, Undecided, Low, and Very low” was used. According to the result, psychological stress caused by noise was ranked first, according to Babisch, 2014; Basner *et al.*, 2014 increased stress associated with noise exposure causes physiological stress reactions in an individual, which in turn can lead to increases in established cardiovascular diseases risk factors such as blood pressure, blood glucose concentrations, and blood lipids (blood fats). These risk factors lead to increased risk of high blood pressure

(hypertension) and arteriosclerosis (e.g. narrowing of arteries due to fat deposits) and are related to serious events such as heart attacks and strokes. The second item on the ranking is noise pollution caused by aircraft. During take-off and landing operations when aircraft are being operated at high power settings and are close to the ground create the most noise problems in an environment (Aliyu et al, 2016) also Kasimonji, (2008) found that nearly 70% of residents who live within flight corridors reported themselves as being bothered by aircraft noise pollution. Disturbance to sleep was ranked third; according to Gitanjali and Ananth (2003) Exposure to noise disturbs sleep proportional to the amount of noise experienced in terms of an increased rate of changes in sleep stages and in number of awakenings. There may also be after-effect during the day following disturbed sleep; perceived sleep quality, mood and performance in terms of reaction time all decreased following sleep disturbed by noise (Stansfeld & Matheson, 2003). The WHO estimated sleep disturbance to be the most adverse non-auditory effect of environmental noise exposure (Basner et al., 2014; WHO, 2011), interference to speech and other forms of communication was ranked fourth, lack of enough comfort at home was fifth, interference with viewing television was ranked sixth, temporary hearing loss was ranked seventh, reducing the opportunity for privacy was ranked eighth, disturbance to rest was ranked ninth, according Nelson (2008) In extreme situations, noise can affect residents' conversations, hearing, TV viewings, leisure, and work, in some cases, can generate harmful long-term health effects adversely affecting the productivity and quality of life.

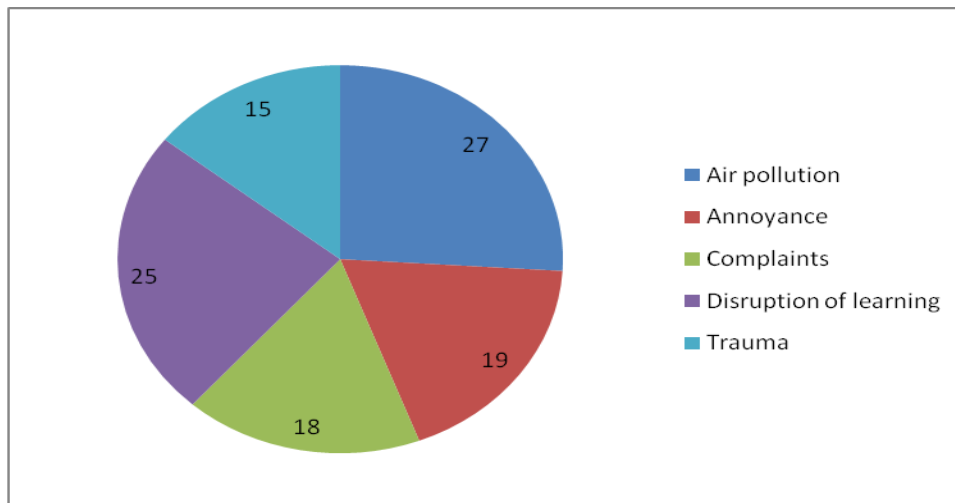


Figure 2: Menace of Aircraft Noise on Residents

Airport and airplanes can generate carbon monoxide and pollutants that are injurious to both the immediate environment and the health of their travelers, handlers and the residents of the area it is sited due to emission of jet fuel. These have resulted to disruption of sleep, increase in the risk of cardiovascular diseases in people living in the vicinity of the airport, speech disruption and psychological health. It also has insignificant effects on birth outcome, low birth weight due to long term effects and psychiatric health as shown by low responses in Figure 3. This Aviation noise according to Jik-Lee & Griffin (2013) and Joshua (2014) has serious negative effects on the on the environment causing community annoyance during takeoff and landing and disruption as the noise becomes louder at that time and this no doubt reduce the values of the assets and estate within the area. Furthermore, nuisance caused by aircraft is ranked tenth this is because noise is one of the major sources of nuisance (Brennan et al. 2001). Disturbance to relaxation is ranked

eleventh also ranked twelfth is the level of annoyance caused by aircraft noise; Olayinka *et al.* (2014) performed a noise survey study in Nigeria. Results from the eight cities surveyed show that noise from any source be it road, rail or aircraft is a source of annoyance and disturbance. Similarly, the result shows that structural damage to the property is ranked thirteenth, vibration to the property ranked fourteenth, also Tzivan *et al.* (2015) has applied path analysis to data collected in a social survey on the community response to traffic noise along a truck road in Tokyo. The data were collected from more than 390 residents by means of a questionnaire. A path model was developed for the relation of the noise annoyance dissatisfaction with the living environment, and the wish of the respondents to move to the antecedent variables, including noise levels, personal factors, and noise effects. The strongest effect on annoyance was for the noise level, followed by interference with daily activities.

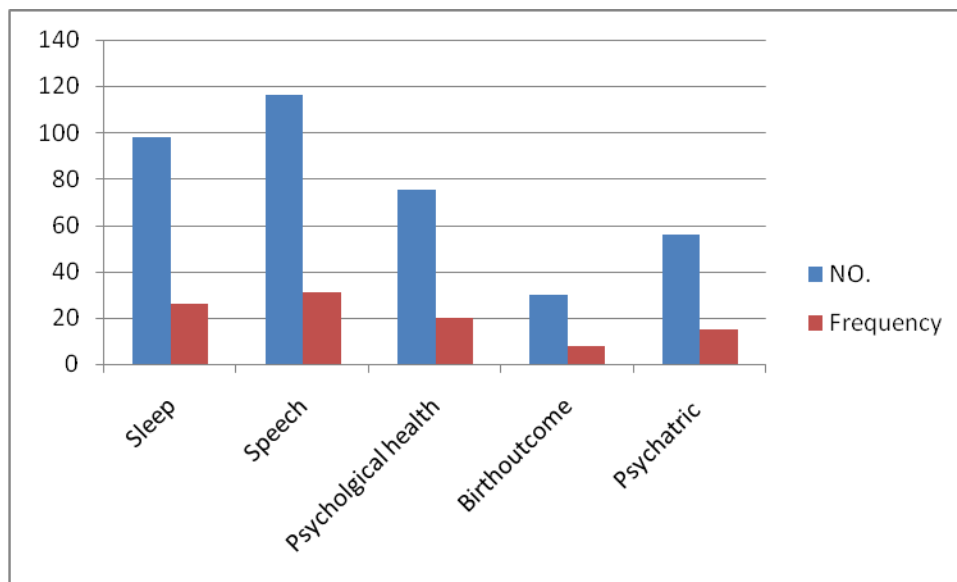


Figure 3: Health Impacts of Aircraft Noise Around the Airport Neighbourhood in Maiduguri

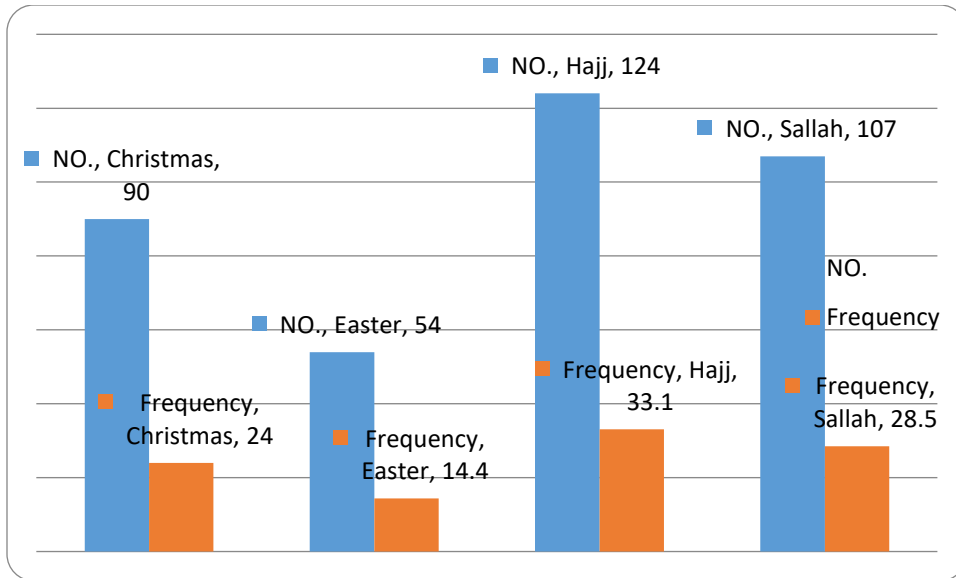


Figure 4: Level of Activities and Peak Periods at the Airport

Source: Field Survey 2020

Figure 4 shows the level of activities and the peak periods of the Maiduguri International Airport. This shows that the operations of the airport during the Hajj periods have the highest value. This means that people travel more using the airport to go to Saudi Arabia for pilgrimage and Hajj activities and this period indicate the peak of traffic in the airport. This is followed by Sallah periods which necessitates the movement of most Muslims to travel by air back home for celebration. The Christmas also follows in that order because people travel home for Christmas celebration and Easter has the lowest of all.

CONCLUSION

This study has revealed that proximity to airport has a strong significant positive influence on the health, psyche and activities of the residents in the study area. Tenants' willingness to pay to some extent depends on the presence of Airforce Base which provides relative security and safety in the area, there is a need to control and manage the incidences of insurgency, particularly Boko Haram, there is a need for a holistic approach which addresses judicial processes, human rights, poverty and corruption. Tenants are willing acquire lands, they are willing to pay for noise reduction, if need be, those with land are willing to develop the land and they are willing to stay in close proximity to the airport despite the noise emanating from the airport due to aircraft takeoff and landing but because of the presence of Nigeria Airforce Base considering the security challenge in the state they are willing to stay in the neighbourhood. The menace caused by aircraft during landing and takeoff as a result of noise emitted include; psychological stress, noise pollution, disturbance to sleep, interference with speech and other forms of communication, lack of comfort at home, interference with viewing television, temporary hearing loss, reduced opportunity for privacy, disturbance to rest, nuisance, annoyance, and vibration to buildings are a serious concern.



RECOMMENDATIONS

Based on the findings of this study, the following recommendations are put forth:

1. The upgrading of the sound insulation of buildings will be a useful technique for reducing the negative impact of aircraft noise. In many countries, sound insulation programs have been carried out to improve the sound insulation of homes, schools, and hospitals near airports.
2. Government through urban development board should ensure proper land use planning which is an obvious and almost universally accepted technique for minimizing the negative effect of airport noise in areas adjacent to airports.
3. Nigerian Civil Aviation Authority (NCAA) and other relevant authorities should regulate and monitor air transport services and ensure compliance with specifications and standards, including aircraft airworthiness in Nigeria.

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