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EFFECTS OF AIRCRAFT NOISE ON RESIDENTIAL PROPERTIES RENTAL VALUE AROUND MAIDUGURI INTERNATIONAL AIRPORT, BORNO STATE, NIGERIA

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ABSTRACT

This study examined the effects of aircraft noise on residential properties rental value around Maiduguri International Airport Area in Borno State. The data was collected through the administration of 363 structured questionnaire to selected household heads residing in the neighbourhoods around the airport. It utilized mean ranking, the simple regression analysis to analyze the data collected. The result of the simple regression analysis revealed that aircraft noise negatively influences residential property value around the airport and that aircraft noise does not really depreciate residential property rental value, the noise level for the day-evening-night time depends on frequency of flights as well as distance from the airport and the time of the day and also showed that rental values of residential properties in the study area fall within the range of 50,000 Naira and below for one room apartment. The study also found that tenants are willing to stay in the neighbourhood due to the presence of Air Force Base (security personnel) in the area. The study therefore recommends among other things, that investors and property developers embarking on property development should take into account the effects of noise on rental value of residential property to avoid wasting of funds in such ventures, also upgrading of the sound insulation of buildings will be a useful technique for reducing the negative impacts of aircraft noise to enhance the quality of urban life of residents. Government through urban development board should ensure the enforcement of land use and physical planning laws to mitigate and minimize the negative impacts of airport noise in the airport areas.

Keywords: Rental Value, Residential property, Sound insulation, Urban life

INTRODUCTION

One of the growing environmental problems today is high levels of noise in residential areas, especially in developing countries. There are several unorganized, informal sector activities that contribute to noise pollution in residential areas, such as leisure, road traffic, home and religious activities, power generator operations, and incompatible use in space. Sources of noise pollution can be roughly categorized according to land use patterns such as, residential / domestic, commercial, industrial, transportation, leisure, public / institution. Noise sources in residential areas can be divided into two main groups: point sources and line sources (Egbenta, Uchegbu, Ubani and Akalemeaku, 2021).

Noise pollution is an unwanted, undesirable, excessive and irritating sound that has a deleterious effect on humans, plants, animals, properties, the built and the natural environment (Wokekoro,2020; Hunderek-Glapska and Trojanek, 2013). Zambrano-Monserrate and Ruano (2019) defined environmental noise as an unwanted sound which could be generated by anthropogenic activities including industrial or commercial

activities, engine vehicles and melodies at high volume. Zambrano-Monserrate and Ruano (2019) also stated that noise that exceeds the ambient sound level by more than 10 decibels (dB) as measured from 15 feet from the source as measured from inside any property or on a public street is prohibited.

In Nigeria, the absence of noise to many urban dwellers is perceived as a strange thing, only typical of the rural areas of the country. This may partly be attributed to the absence of enforced legislation aimed at correcting the negative effects of urbanization, in addition to the unavailability of sufficient theoretical and applied information-driven knowledge about noise pollution in the country. Noise pollution has a tendency of exacerbating already degenerated urban settlements in the country especially noise from aircrafts (Akeh, Shehu, Butu and Modu, 2018).

Maiduguri as a State capital is no exception where urban development, economic growth and the accompanying expansion in transportation are major factors, combined with ongoing road and building construction activities increase and exacerbate the level of noise. Population growth, urbanization and technological development are the main drivers, and future enlargements of highway systems, airports and railway systems will only increase the noise problem (Adegoke and Olaleye and Oloyede, 2013; Alaghbari, Salim and Abdullah, 2012). Maiduguri international airport Ngomari is located in very close proximity to residential properties such as Seven hundred and Seventy-Seven (777) residential housing estate, federal ministry of agriculture staff quarters, and Angwan Old Airport residential area in such a way that during take-off and landing, houses within the listed residential areas tend to vibrate.

The Maiduguri airport is a generic aviation outfit located in Maiduguri Borno State. Ngomari neighbourhood and surrounding areas experienced double-digit population growth in early 2000. Before this large population growth, Maiduguri Airport was largely surrounded by open farmland, especially the flight paths for both airport runways. However, as the area increased in population especially with the development of seven hundred and seventy-seven (777) residential housing estate, the open land near the airport developed with mostly single-family residence.

Additionally, the airport experienced an increase in the number of operations at the airport and being in close proximity to the Nigerian Air force Base in Maiduguri. In terms of the number of airplane operations in North East, Maiduguri Airport ranks first (Dami, Adesina & Garba, 2014; Huderek-Glapska, and Trojanek, 2013; Koramaz and Dokmeci, 2012), with increased operations and new development around the airport, Ngomari residents have recently expressed their concerns of airport noise on the livability of the area on their property values (Palamuleni, 2015; Suleiman and Yusuf, 2013). Several measurement metrics have been used to measure noise exposure in different studies. These include Noise Exposure Forecast (NEF), Noise Number Index (NNI), Australian Noise Exposure Forecast (ANEF), Composite Noise Rating (CNR), Day-Night sound Level (Leq, DNL, or Ldn) and Kosten Unit (KU). All of these measures are not only objective measurement of noise, but also intends to capture the *perceived* grievances of the residents (Oduwole and Eze, 2013; Ajibola, Awodiran and Salu-Kosoko, 2013).

The insurgency in the state has also led to the influx of many Non-Governmental Organizations (NGO`s) who in most cases use aircrafts for their transportation especially helicopters to deliver relief materials and humanitarian services in locations that are not

accessible by road, thus making the airport a beehive of activity which in turn produces much noise as a result of aircraft takeoff and landing. Only a few studies of this type have been conducted in Nigeria and on the communities surrounding the Maiduguri airport, it is against the foregoing that this study on the effect of aircraft noise on surrounding residential property value of Maiduguri airport, Maiduguri Borno State, Nigeria was conducted.

The work of Akeh, Shehu, Butu and Modu (2018) asserts that rental value of residential property around Airport, is not solely based on the proximity to the airport, factors such as; willingness to live in close proximity to the airport, the level of aircraft noise also greatly influence residential property around airport (Walker, 2016; Wokekoro, 2020; Zambrano-Monserrate and Ruano, 2019). This research therefore, explores the extent to which the aircraft noise at the Maiduguri international airport in the Nigeria affects the rental value of residential properties around the neighbourhood. This research has examined the problem of noise and its effects on rental value.

MATERIALS AND METHODS

Study Area

Maiduguri, a town in Northeastern Nigeria, is located between latitudes 11˚04`N and 11˚44'N; and longitudes 13˚04'E and 13˚44'E. It covers a complete land space of 543 km2, which makes it the biggest city in the Northeast Nigeria (Jimme, Bashir and Adebayo, 2016).

Maiduguri metropolis now covers as much as four (4) Local Government Areas namely: Maiduguri Metropolitan, Jere, Konduga and parts of Mafa Local Government Areas. The area is in the huge open landmass that is flat or slightly undulating, evolved on younger sedimentary rocks of the Chad formation. This exceptionally flat terrain is sloping closer to the Lake Chad and has an elevation ranging from three hundred metres and six hundred metres above sea level (Jimme, Bashir and Adebayo, 2016; Emoh, Yusoff, Zahari and Ismail, 2015). Maiduguri lies on, and at the lowest parts of the Bama Ridge which runs in a Northwest/Southeast route from the Nigeria-Niger boundary to the Cameroun Mountains along the Southeast. The topographic panorama to its Northeast and Southwest is really undifferentiated and flat. The place is drained by River Ngadda and its tributary the NgaddaBul (Iyawa, Waziri, Jimme and Sambo, 2020).

Maiduguri is situated within the Sudan Savannah vegetation of Nigeria and is characterized by scanty annual precipitation (650 mm), excessive evaporation and high-water shortage (Dami, Adesina and Garba, 2014). Precipitation is peaked in August with the rains falling mostly in July, August and September. There are four (4) recognized seasons the area and this consist of the Rainy Season, (June to September) Harvest Season (September to November), Harmattan or Cool Season (December to February) and Hot Season (March to May) (Dami, Adesina and Garba, 2014). The rainfall pattern for the thirty years (1981-2010), suggests wonderful dry (beneath averages) and wet (above averages) phases (Iyawa, Waziri, Jimme and Sambo, 2020).

The implied month-to-month temperature is above 20˚C however, daily extremes could reach 47˚C in April. Daily temperature might also exceed 40˚C. The weather of the place is influenced by the North East trade winds and the South West monsoons originating from the Sahara and the Altantic Ocean. The soil of Maiduguri and environs can be categorised into sands of Aeolian origin and the seashore ridge sediments, vertisol or lagoonal clay and fluvisol and clay soil of alluvial deposits.

There also are the brown and reddish brown, regosols, hydromorphic and alluvial soils which can be favorable for agricultural activities of many types (Iyawa, Waziri, Jimme and Sambo, 2020). It has a population of 1.275 million humans according to 2006 census (NPC, 2008) with an annual increase rate of approximately 3.5% and a density of 1145 people consistent with km^2 which makes it the maximum densely populated town in North Eastern Nigeria. The projected population of Maiduguri Metropolis for the 12 months 2021 stood at 2,722,986 (NPC, 2008).

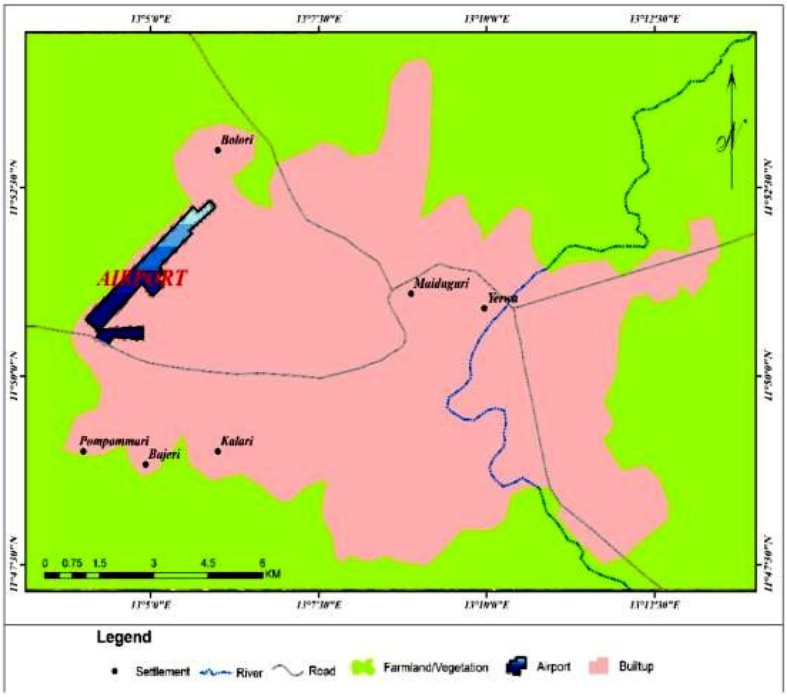

Figure 1: Map of Maiduguri showing the Study Area

Source: National Centre for Remote Sensing, Jos, (2022).

Maiduguri international airport is located 6 kilometers west of the city of Maiduguri with reference coordinates latitude 11° 52′ 54″N, longitude 13° 08′ 30″E and a reference temperature of 35°C. the airport is an important edifice serving both socio-economic and humanitarian purpose of the North East, it is indeed an aviation hub which share boarder with three west African countries, namely Niger republic to the North, Chad republic to the East, and Cameroon republic to the East.

Maiduguri airport came to be as a result of the Royal Airforce flying into Maiduguri for political reason. The airport is located about 10 kilometers from the suburbs of Maiduguri metropolis, the then national carrier (Nigerian Airways) was the first to commence operation followed by indigenous airlines such as GAS air, Harka airline and Chanchangi Air into the airport for Hajj operations. The main terminal building of the airport now boarded the Nigerian Airforce Base (Uyeno, Hamilton & Bigg, 2013).

The airport is currently surrounded by four residential areas namely; Ngomari, seven hundred and seventy-seven (777) housing estate, shuwari one thousand (1000) housing estate, all of which are in Dala Lawanti ward of Jere 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 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 (Borno State Government, 2022; Igbinosa, 2011; Kemiki, Ojetunde and Ayoola, 2014). 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.

Study Population and Sample Frame

Study population is the target respondents surveyed to obtain data for the research. The target audience for this study are tenants in residential properties located and resident around the airport as they are in the best position to respond rightly to the questions posed by the researcher. 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 Borno State Government (2022).

Sample Size and Sampling Techniques

Jere Local Government has a total population of 86,978 (NPC, 2006), with fifteen (15) wards. Maiduguri international airport is located in the heart of one (1) among the fifteen (15) wards in Jere Local Government Area. Therefore, target population for the purpose of this study are tenants within the study area. To determine the sample size for this study Krejcie and Morgan's (1970) Table for determination of sample size was adopted. The Table 1 indicates that for population size of 16,512, sample size of 375 should be used as the minimum. Since the population size of this study area is 16,512, as shown on Table 1, 375 sample size was adopted for questionnaire administration purpose. This is to enable collection of adequate data for the study.

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: Field Survey (2022)

For the purpose of this study, questionnaire was adopted as instrument for collecting data from the respondents living around the airport area. The design incorporated the use of only close-ended questions. Close- ended question has more than one response options and five (5) Likert scale with six sections was used to ease the means of assessing the response (Josh, Kal, Chandel and Pal, 2015; Suksmith and Nitiyattananon, 2015). The analysis for the study was carried out using Statistical Package for Social Sciences (SPSS) version 25 and results are presented in tables and charts.

RESULTS

Effects of Aircraft Noise on Residential Rental Value

One of the persistent environmental issues today is high noise levels in residential areas especially in Airports which have much noise during takeoff and landing of the aircrafts, some respondents were asked questions to whether the aircraft affect them and the responses gotten is represented in Figure 2.

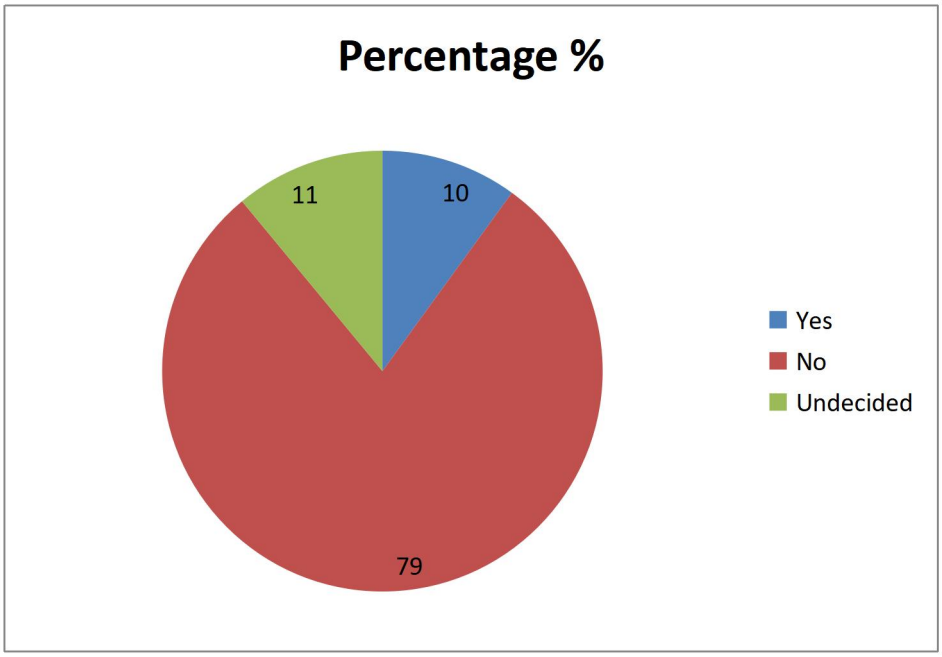

Figure 2: Effects of Aircraft Noise on Residential Rental Value

Source: Field Survey, 2022

Sound is generated by the moving of something either on Air or land and the Airport area is not left out as it generates much noise during flight activities, as such it tends to have effects on property rental value which may be considered as detrimental to human health. The property rental value may either increase or decrease as presented in figure 3.

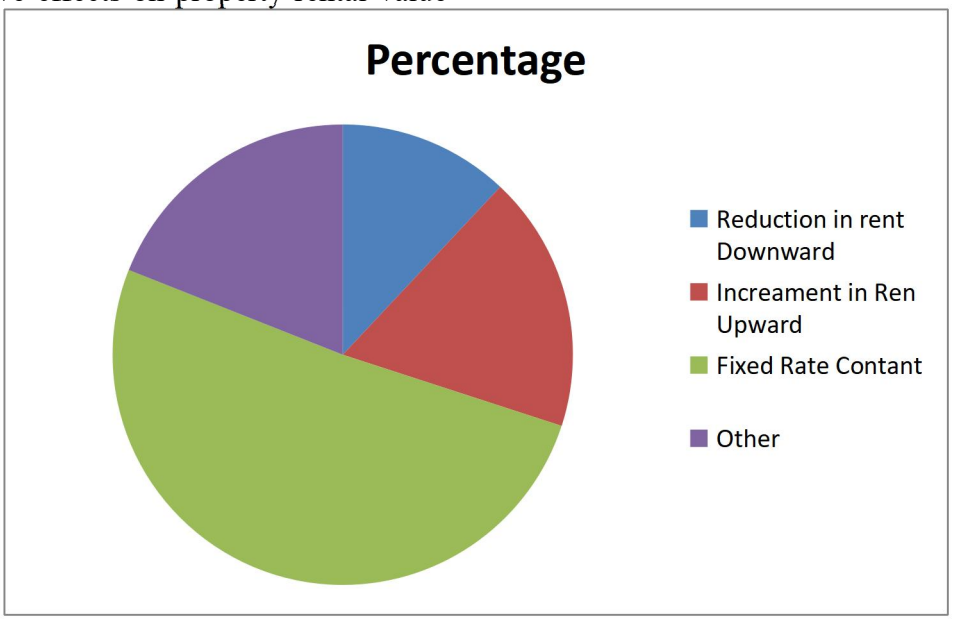

Figure 3: Impacts of aircraft Noise on Property Rent

Source: Field Survey 2022

Effects of Aircraft Noise on Residential Properties Rental Value in the Area

Factors that influence the increase in residential property value

An increase in property value is called appreciation. Appreciation stems from an area due to some factors that influence one another and ultimately lead to increase in the rental value of residential assets. The factors that could cause property values to increase over time are considered in this discussion, like Housing demand and supply, number of bath and bedrooms, plot size, nature and type of facility, tenant's level of income, location and municipal service.

The graph below represents the respondent on how the factors affect them individually.

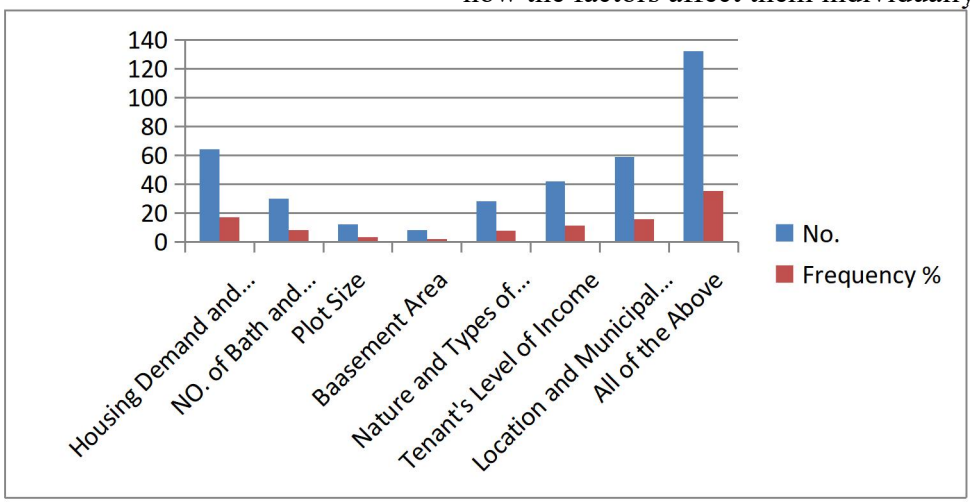

Figure 4: Factors that influence Property Rent increment

Source: Field Survey 2022

Residential Rental Value

The Airport area attract more people around both locally and internationally as many will want to have apartment close to the airport which implies that there will more building around the area, this means that some houses around there may attract high cost of rent or even low rent.

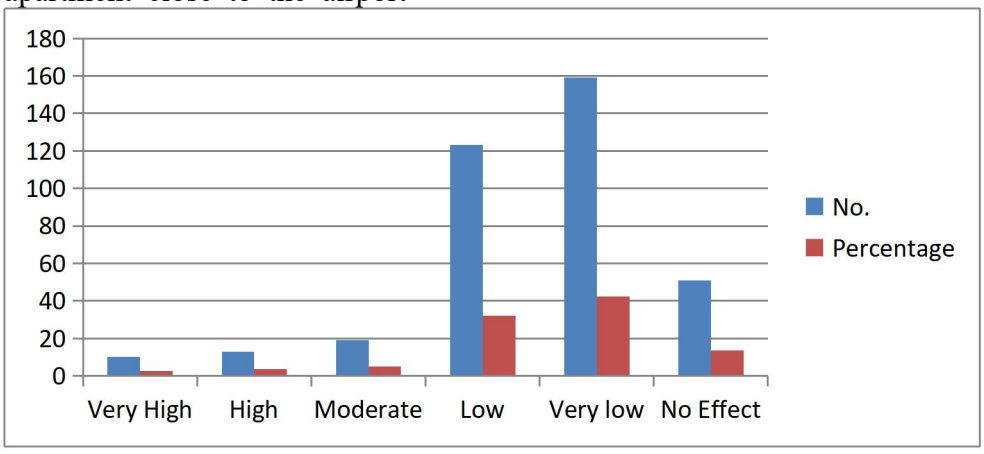

Figure 5: Severity of Impacts of aircraft Noise on Property Rent

Source: Field Survey 2022

Attraction to the Airport Residential Area

The activities that take place in airport residential areas are numerous which brings many offices and it depends on an individual who decide to resides there some will be attracted to some of the following factors which are average daily flight, distance to airport, age of house, rent per annul, proximity to amenities, security closeness to (NAF base) amongst other as presented in Figure 6.

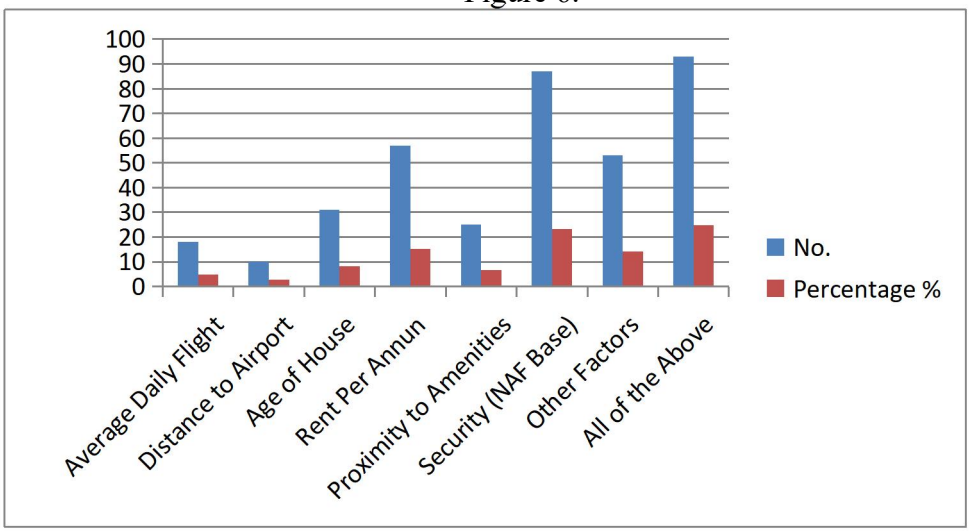

Figure 6: Impacts of Aircraft Noise on Property Rent

Source: Field Survey 2022

Regression Analysis

Table 2: Simple Linear Regression Analysis Summary

Construct	R	R square (R^2)	Adjusted R^2	Unstd. B	Std. β	P value	Decision
RPRV & AN	-.193	.037	0.034	-.148	-.193	.000	Significant

Source: Field Survey, 2019

RPRV =Residential Property Rental Value; AN = Aircraft Noise

Predictors: (Constant): AIRCRAFT NOISE
Dependent variable: RENTAL VALUE

The regression result on Table 2 revealed a weak negative relationship between residential property rental value and aircraft noise. The negative correlation coefficient indicates that the closer the property is to airport, the lower its value with R value of -.193. The R-square value of 0.037 indicates that proximity of residential property to airport accounted for 3.7% decrease in residential property value of the study area. The output also showed the unstandardized β of -.148; standardized β of -.193 and a p-value = 0.000. This implies that one unit increased (that is closeness to the airport) may leads to 0.148 decreases in the residential property value in the study area. It was found out that the menace caused by aircraft noise are psychological stress, noise pollution, disturbance to sleep, Interference to speech and other forms of communication due to the high level of noise, lack of enough comfort at home, interference with viewing television

and performance of complicated task at home also temporary hearing loss, others include reducing the opportunity for privacy, disturbance to rest, and also interference to relaxation. Were the menace perceived by the residents to be caused by aircraft noise in the study area.

The value in the R column represents the correlation between the two variables. R= -.193 revealed a weak negative relationship between residential property rental value and proximity of the property to the airport. The negative correlation coefficient indicates that the closer the property is to airport, the lower its value with R value of -.193. The R-square value of 0.037 indicates that proximity of residential property to airport accounted for 3.7% decrease in residential property value of the study area. The output also showed the unstandardized β of -.148; standardized β of -.193 and a p-value = 0.000. This implies that one unit increased (that is closeness to the airport) may leads to 0.148 decrease in the residential property value in the study area. The results concur with the findings of Palamuleni (2015) who conducted a multi-criteria analysis in Oslo the capital and most populous city of Norway using the expert views of real estate agents and in which the effects of announcements of inclusion of road corridors and rail tracks on the property price and on surrounding communities were examined. As in the case of numerous studies, prices of properties most affected by noise pollution were found to be those located within the first hundred meters from the rail track. Once these households were removed, the significance of the analysis became weak. Analysis by Benjamin, Heffetz, Kimball, and Rees-Jones (2012), it was found that there was a linear relationship with distance to rail track, especially within the first hundred meters. Which is similar to the findings of this study even though the afore mention study deal with the capital value of residential property while this study look at rental value. Similarly in a study on the effect of surface street traffic externalities noise on residential property value conducted in USA by Larsen and Blair (2014) revealed that Single-family homes contiguous to an arterial street were sold at a discount while multi-unit properties contiguous to an arterial street were sold at a premium that is to say Street traffic affects various property types differently.

In a related study conducted by Kemiki, Ojetunde and Ayoola (2014) in Nigeria on Impact of factory noise and dust on rental values of residential settlements, the study found out that adverse externalities of dust and noise diminished rent that is dust and noise have negative effect on residential rental values. The outcome of this study conforms with that of Adegoke, Olaleye and Oloyede, (2013) and Ozdenerol, Huang, Javadnejad, et al (2015) in Nigeria and different parts of the world imply that their effects are not too significant. This justifies why property development keeps springing forth in the study area; as more and more people keep trooping into the airport neighborhood for accommodation despite the noise been produced by aircraft during takeoff and landing of aircrafts.

CONCLUSION

In conclusion, the study revealed that proximity to airport has a weak significant negative influence on rental values of residential properties in the area. The study concludes that noise pollution negatively impacts the neighborhood but has no effect on property values, all things being equal. Based on the findings of this study, the following recommendations are suggested. There is a need on the part of the investors and property developers before embarking on building construction to take into consideration the effect of noise on rental value of residential property in order to avoid wasting of funds in

such ventures. Since tenants' willingness to pay to some extends 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. The upgrading of the sound insulation of buildings will be a useful technique for reducing the negative impact of aircraft noise. Government through urban development board should enforce land use and physical planning laws to minimize and mitigate the negative effects of airport noise in areas adjacent to airports. 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.

High ways should be improved and expanded to reduce the airport use intensity hence, drastic drop in noise at the airport areas.

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