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Urban Noise Pollution in Nigerian Cities: Imperatives for Abatement

Abotutu Ahi Abel[1*]

[1]*Department of Geography and Regional Planning, Delta State University, P.M.B. 1, Abraka, Nigeria.*

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Noise, it is said, is any sound that is unpleasant to the ear. Medically, when it persists, it can damage the ear. Considering the ear organ, it has been said that human ears were designed to process naturally-occurring sounds, and they are beautifully adapted to handle that task. They are able to detect sounds of intensities that vary across many orders of magnitude, and to meaningfully transmit these signals to our brains. But they are not well equipped to deal with the high noise levels that are common in Nigeria's urban centres today, because such loud sounds occur only rarely in nature. Although the eardrum may sometimes be ruptured by severe noise (acoustic trauma) or pressure changes, the part that is most vulnerable to damage by noise lies more deeply in the inner ear, where the final processing takes place before the sound is converted into nerve impulses that are transmitted to the brain. The extent of damage noise pollution could inflict on man provided the impetus for this study which aims to verify the persistent incidence and magnitude of noise pollution in urban Nigeria. Findings revealed that urban dwellers in Nigeria are exposed to high noise levels (above 70 decibels), with the attendant health implications. The study recommends technical, planning, behavioural and public enlightenment strategies to abate noise pollution in urban Nigeria.

Keywords: Urban; noise; pollution; Nigeria; abatement.

**Corresponding author: E-mail: dr.abotutuabel@yahoo.co.uk, dr.abotutuabel@gmail.com;*

1. INTRODUCTION

About five decades ago, Peter Enahoro in his book *How to be a Nigerian* made a satirical reference to "Nigeria noise" [1]. In 1979, the Bendel State Government enacted a noise control edict. In 1984, the Ondo State Government followed suit and in August 1985, some State Governments, including Rivers, Lagos and Oyo, joined this club of noise abators. Other State Governments might have enacted or may have been in the process of enacting noise laws; and it is not unlikely that some Local Governments have got noise regulations tucked somewhere in their offices. All these underline the fact that the problem of noise, especially in our urban centres of the country has reached such a dimension that it demands some necessary action.

Nevertheless, these strands of evidence purporting that the Nigeria populace is becoming increasingly aware of the noise problem do not necessarily imply getting a sharp focus of the problem. Apart from a few newspaper articles which call attention to the magnitude of the problem as generally observed, there have not been any systematic studies aimed at characterizing its nature and highlighting its effects; nor has there evolved a national policy on the issue [2]. Yet, the country is currently undergoing an environmental revolution which when completed is expected to make the Nigerian environment a cleaner and safer place to live in. Talking about this revolution, issues that have received their fair share of attention include solid and liquid wastes disposal, flood prevention and, to some extent, fire hazards. In relative terms, noise as a public concern has not been clearly distinguished.

The variables through which pollutions reach us include not only the air we breathe, the water we drink, the food we eat, but also the sounds we hear. This emphasizes the point that noise pollution constitutes an element of the general environmental pollution problem. Just as foul air constitute stench to the nose, so also excessive noise to the ear. In fact, noise is no longer regarded as a mere nuisance, it has now been found to be a hazard, posing serious threat to the quality of life enjoyed especially in the urban environment.

It is against this background that attempt is made in this paper to raise some basic issues relating to urban noise pollution in Nigeria; this is with a view to establishing a basis for understanding the problem, and then indicate possible directions for policy-making.

The paper is divided into five sections. Following this brief introduction is section two which discusses the basic characteristics and effects of noise pollution. Section three directs attention to Nigeria and gives a generally qualitative insight into the problems of urban environmental noise pollution in the country. Section four looks into possible strategies for noise abatement, while the last section draws the conclusion.

2. CHARACTERISTICS, MEASUREMENT AND EFFECT OF NOISE POLLUTION

Noise is most often defined as 'unwanted' sound. From this seemingly simple definition, two salient points can be isolated: one, that all noise is sound; and two, that all noise is subjective. The first point implies that some sort of noise is inevitable since there cannot be a noise-free environment. The second point implies that an assessment of where a given level of sound become 'noise' is a function of an individual's perception. At one extreme in human perception are "those few who are relatively insensitive and actually report that they are unaware of even "loud noise", while at the other extreme are another "few perhaps 1-2 percent who are hypersensitive to almost all noises" [3,4]. The bulk of any given population lies between these two extremes. They are neither insensitive nor hypersensitive to noise. Their perception of 'acceptable noise level' can therefore be considered as being on the average. People are prone to react by showing annoyance or irritability whenever they find themselves in an environment where such 'acceptable' limits are exceeded. The properties of noise which may induce people's reaction include its pitch, loudness, quality of tone, duration and frequency [5,6]. Negative reactions are actually induced by noises which are the highest pitched, loudest, poorest in tone and longest lasting.

One of the characteristics of sound which cannot be overlooked in any discussion of noise problem is its wide range in intensity. The sound intensity to which the human ear is exposed ranges from 1 billionth (0.000000001) watt/m^2 to 10 million watts/m^2. However, sound measurement is usually done in *decibels* (dB) rather than the watts since the latter can be clumsy to work with. In the decibel system, logarithms of the ratios of loudness are used to compare sound intensities.

Silence, an arbitrary threshold level of sound is represented by zero decibel. The 0 dB is linked to the hearing threshold at 1000 Hz, but young people usually can hear sound pressure levels of less than 0 dB [7]. The faintest sound audible to the human ear can be represented by an intensity of 1dB. A ten-fold increase in the intensity adds 10 units on the decibel scale and a hundred-fold increase adds 20, and so on. This is expressed in the following formulation:

$$I(\text{dB}) = 10 \log_{10}\left(\frac{I}{I_0}\right) \text{ Intensity in decibels}$$

Table 1 shows what particular decibel levels are like by presenting the decibel values of some representative everyday sounds (see Table 1). It shows that noise may be disturbing when it reaches 60 dB, intolerable when its level exceeds 90, uncomfortable when at 100 and painful when it exceeds 120.

Table 1. Noise levels of representative sounds

Representative sound	Decibels	Characteristics
Threshold of hearing	0	Audible
Normal breathing	10	Audible
Leaves rustling in breeze	20	Very quiet
Whispering	30	Very quiet
Library	40	Quiet
Quiet restaurant	50	Quiet
Conversation	60	Moderately loud
Vacuum cleaner	70	Moderately loud
Food blender	80	Very loud
Heavy traffic	90	Very loud
Train	100	Uncomfortably loud
Machine gun at close range	120	Uncomfortably loud
Jet plane engine at take off	150	Painful

Source: [10]

Another characteristics of noise according to the assessment of acousticians, planners and others with professional interest in noise is that it is basically a city problem. This is to say that rural areas are relatively quiet compared to the city. This can be explained by the fact of the close relationship between population density and ambient noise, in general, the higher the population density, the louder the city.

One other characteristics of noise is how its level has continued to increase over time. A sound expert has estimated that ambient city noise in many areas of the USA has doubled in 20 years [8]. Another investigation estimates that ambient city noise in Canada increases a half–decibel a year [7]. It can be inferred from these findings that increase in the level of soundscape over time has to do with the rate of technological progress. Rosen and Olin's study of a "primitive" tribe in Egypt several years ago appears to have lent support to this explanation. They found that the hearing acuity of the Maabams (a "primitive Egyptian tribe") was superior to that of Americans of all age groups. A seventy-years-old Maabam, they claimed, could hear as well as a young American boy. Rosen and Olin attributed this to "the relatively quiet Maabam environment compared with the technological hubbub that characterizes urban America" [9-14].

Excessive noise, like excessive heat or cold, has many degenerating effects on human life. Studies in environmental noise show that these effects range from interference with speech communication and sleep to psycho-social stress and loss of hearing. Indeed, urban noise pollution has been found to have contributed to reduced efficiency and bizarre behaviour by workers [12,7].

A common effect of noise which is often noticed is interference with speech. When speaking, background noise of 45-60 dB is moderately disturbing; while at 65 one has to shout to be heard. Interference may affect person–to–person or group conversations. It may affect television or radio listening pleasure. It may, in fact, disrupt formal class room teacher–student mutual flow of communication. Interruptions of this nature have the overall effects of prolonging the process of communication, making the process more laborious and generally causing annoyance as well as frustration.

Interference with sleep is one other common effect produced by high ambient city noise. A noise intensity of 35 – 40 dB is slightly interfering while 50 makes falling asleep a lengthy process [15-17]. Noise does not only prevent one from sleeping, it also causes sudden awakening from sleep. This happens when there is an abrupt increase in the intensity of noise level as may be

occasioned by a 'bang', a gun-shot or an explosion. In addition, noise can affect the quality of sleep. It means that a person's sleep may be disturbed without the person being necessarily awake. Sleep is a continuum ranging widely from a state of fully awake to a state of deep sleep and noise can cause a shifting from one stage to another [18,19]. The ultimate effects of sleep interference are headache, fatigue and palpitations [15,20,21].

The disturbing effect of noise is not limited to communication and sleep; it extends to other human activities. In particular, noise interferes with work tasks. Although there are certain work tasks that in themselves generate noise (heavy manufacturing, for example), there are a host of others, that cannot be efficiently accomplished in a high intensity noise environment. Work tasks that require deep concentration will adversely be affected by noise. Studies have shown that noise affects a worker's mind and output. It changes a worker's emotions and behaviour in a number of ways. It stimulates him to a peak and so tends to make him commit more errors [5,22].

More strikingly, noise affects bodily health by causing loss of hearing. It has been found that continued exposure to noise causes gradual hearing loss which may develop into more serious hearing impairment and eventual total deafness [18,23,24]. In the technologically advanced societies, loss of hearing due to urban noise pollution is now considered a serious problem. It is in fact estimated that more than 100 million people in the North American continent may experience gradual partial deafness due to everyday noise.

It has been shown further that noise causes physiological harm to the body. For example, it is medically proven that "loud sounds cause blood vessels to constrict, the skin to pale, muscles to tense and adrenal hormones to be injected in the blood stream" [25]. Other studies have tentatively implicated high noise levels with such ailments as pupil dilation, stomach ulcers, intestinal spasms, and neurosis [17,12].

In summary, urban noise pollution has the effect of impairing mental and physical health and thereby reducing the quality of life.

3. NOISE PROBLEMS IN URBAN NIGERIA

Noise as an urban environmental nuisance in Nigeria is just beginning to attract public attention in a serious way. This perhaps explains the existing lack of documentary sources on the problem. However, there appears to be no doubt that Nigerian urban areas are characterized by high ambient noise pressure and that millions of urbanites might have long been exposed to the harmful psychological and physiological effects of noise. This claim – although yet unsubstantiated – can be supported by direct experience of city living as well as frequency of newspaper articles and media programmes giving some descriptive insight into the problem. Writing in his book, a concerned citizen had this to say:

> Residents of our big cities are increasingly going through the gradual process of partial deafness. Their sensitive eardrums are daily being bombarded by a continuous barrage of environmental noise overflowing from ear-shattering, drum-size speakers of mosques and churches, from hammering neighbours' musical systems, from the shrill horns of motorists; from piercing sirens of escorts; from strident eruptions of drug peddlers; from thunderous week-end open parties; and worse now, from harsh explosions of numerous record and cassette selling kiosks [26].

The above is certainly a graphic description of the soundscape of most Nigerian cities today. The situation has prompted Nigerian ear experts to throw their professional weight into the discussion of the problem. For example, the head of the Ear, Nose and Throat (ENT) unit of the Lagos University Teaching Hospital gave a warning some time in 1984 that more Nigerians might lose their hearing in the next few decades as a result of continuous exposure to urban noise. He based this warning on the increasing number of his patients who complain of hearing loss in recent years.

This phenomenon of increasing urban noise pollution in Nigeria is traceable to a number of perceived factors. Broadly, these can be categorized into three:

i. Socio-economic and cultural factors;
ii. Attitudinal or behavioural factors; and
iii. The structure of Nigerian cities.

4. SOCIO-ECONOMIC AND CULTURAL FACTORS

Under these set of factors are the increasing rate of urbanization, accelerated socio-economic

progress and the deepening religious culture. Nigeria, like many other developing countries of Africa, South Asia and Latin America is undergoing a high rate of urbanization. The Nigeria situation is even more spectacular in the sense that this area of Africa has had a substantial degree of urbanization even before its colonization. The early missionaries who visited the country met the indigenous population living in cities of considerable sizes [27,28]. The sizes have since been magnified over time. More people have moved into the cities, thereby increasing not only the city sizes but also their densities which, by implication, means higher urban noise levels.

Couple with urbanization is the accelerated socio-economic progress the country has witnessed. Nigeria has, over the years, progressed in industrial growth and the development of infrastructural and social facilities. The citizens have thus enjoyed improvement in their living standards. This manifests itself in the increasing rate of car ownership and the possession of electronic and other household gadgets, all of which are sources of urban noise.

Then, there is the religious factor which appears to have a strong influence on the people. Every dominant religion - Christianity, Islam and the Traditional - has elements in its mode of worship which are noise generating. It is a common sight in the Nigerian settlements, especially the urban category, to see gigantic loudspeakers fixed to mosques and churches; it is indeed a common occurrence to hear religious calls, chantings and songs at incredible intensities from those sources day and night. Paradoxically, the same churches and mosques which generate such noise without regard to right of residential quiet usually display "No Noise" and "No Drumming" signposts, apparently to prevent their services from being disturbed by passing street dancers.

5. ATTITUDINAL OR BEHAVIOURAL FACTORS

These are everyday Nigerian habits which constitute incessant sources of noise. It can be observed that most urban noise is the result of some sort of human activity. This implies that some people directly or indirectly benefit either from the sources of noise or from the real noise. A problem arises when other people are one way or the other disturbed by the noise; and here lies the crux of Nigerian urban noise problem which is traceable to attitudinal factors. Peter Enahoro, seemed to have got a firm grip of the Nigerian's behaviour in regard to noise making when he wrote:

> In the beginning, God created the universe, then he created the moon, the stars and the wild beasts of the forests. On the sixth day He created the Nigerian and there was peace. But on the seventh day while God rested the Nigerian invented noise [1].

A visitor coming into the country for the first time is likely to be taken aback by the average Nigerian driver's indiscriminate use of the vehicle-horn. The same behavioural trait can be observed from the record seller who blasts his new records at the highest pitch attainable and up till midnight and even beyond in order to attract customers.

Similarly, it is difficult to maintain tolerable levels of noise inside residential building when every tenant tunes his radio or record player or television to the highest sound level. Another such habit which is detrimental to neighbourhood quiet include street hawking which is not an unfamiliar feature in all Nigerian cities.

6. THE STRUCTURE OF NIGERIAN CITIES

The third factor which explains the phenomenon of urban noise pollution in Nigeria is the structure of its cities. With the single exception of the new capital city-Abuja- all other towns and cities are well known for their mixed land uses. Most of the settlements were not originally subjected to modern town planning principles and practice. Every urban street is a commercial street. Every incidental open space is either an open market or children's playing ground, while incompatible uses (for example, hospital and motor vehicle garage) are located side by side. As a result, those noise sensitive land uses such as residential areas, hospitals and educational institutions are unable to enjoy the relative quiet they actually desire.

A case study: Having described the magnitude of urban noise as it relates to Nigeria and having outlined those factors which might have been responsible, it is considered necessary to have an idea of how the general public feel about urban noise pollution. Are people actually aware that there is a problem? Do they see the problem with the same focal lens as those noise experts, planners and bureaucrats who presently call

attention to the problem? These and some other questions prompted a pilot study based in Warri metropolis. The survey lasted for six months (January – June, 2014). The study intended to test the perception of the city dwellers about urban environmental problems including solid wastes, flood, fire hazard, liquid waste and noise. A total of 1,210 people were interviewed from 21 neighborhoods in the city. The respondents were of both sexes with varying levels of educational background and mixed age and occupational groupings. The interview commenced with questions that border on the living conditions of respondents especially their perception of environmental pollution and government response.

With particular reference to the problem of noise, which is the concern of this paper, an attempt was made to know how people perceived of the noise in and around their homes. It can be seen as summarized in Table 2 that the highest percentage of the respondents (41 percent) reported that the noise around them was "repulsive" which indicated a high degree of dissatisfaction. Another 34 percent reported the situation as tolerable. Only a proportion of 25 percent appear to be indifferent to the noise situation of their city life. The sample size of respondents on airport noise was small due to scarcity of respondent in this category.

With the apparent high level of awareness of the noise problem, what did the respondents see as the most pronounced source of "nuisance noise" in and around their homes? Table 3 reveals that deafening sound from record-players top the list as the most obnoxious source of noise. This is followed by other sources such as the use of grinding machines, intra-city traffic, power generating plants, and religious worship in that order. Others are the noises generated by activities in open markets and motor-packs. The less significant sources as reported are generated by the factories and airport.

What did the respondents consider the major source of "nuisance noise" in and around their workplaces? The data presented in Table 3 show further that as large as 15.4 percent considered vehicular traffic noise as the most pronounced in their workplaces. This is followed by the noise vibrated by record-cassette playing. Others are power generating plants, market places, grinding machines, motor parks, factories, religious worship and the airport in that order. One notable difference between the patterns depicted in columns (2) and (4) of Table 3 is the proportion of people indicating absence of noise problems. This is graphically depicted in Table 3. In workplaces, the proportion is as high as 42.6 percent, whereas in homes, the proportion is only 21.2 percent. Going by the figure it can be inferred that residential noise problems are higher in magnitude than noise problems at workplaces. However, supplementary discussion with respondents show that noise problem at workplaces is not necessarily less in magnitude, rather, respondents seem to have a more liberal attitude to, or higher degree of tolerance for noise at work. In other words, some respondents will take noise at work as given or inevitable, but would prefer a quiet home for rest after work.

Table 2. Perception of noise around homes

	No. of respondents	Percentage (%)
Repulsive	499	41
Tolerable	406	34
Indifferent	305	25
Total	1,210	100

Source: field survey, 2014

In general, the data from Warri metropolis contrary to expectation, portray the population as having a high degree of awareness of the country's noise pollution problem. They do not only have a broad consciousness of the problem; they are also familiar with its various sources. This finding, albeit tentative, calls attention to a fertile source of ingredient for policy making. A citizenry with a keen awareness of a problem will be more ready and willing to participate in finding solutions to the problem.

7. NOISE ABATEMENT MEASURES

The problem of urban noise pollution as a public concern can be tackled by adopting a variety of measures each of which may compliment the others. These measures are in this section discussed under three broad headings:

i. Legislation;
ii. Physical planning; and
iii. Education.

Legislation: Enactment of noise laws and regulations is one of the most familiar ways of controlling unwanted noise. The industrially developed countries of Europe and America have responded to the need for making laws against noise. The UK, for example, passed the Noise Abatement Act of 1960. The US also

passed the Noise Control Act of 1972. These are intended to give legal direction towards the abatement of noise on a nationwide basis. With particular reference to Nigeria, a number of State Governments have evolved noise control laws. Some Local Governments also have bye-laws which have to do with noise. However, there appear not to be a visible Federal Government effort in this direction. Yet, it is expected that directive and guidance from the Federal level should serve as pointers as to area of action by the States and the Local Governments. It is expedient that the Federal Government should come up with a noise abatement law which will specify the roles of State and Local Governments.

At the same time, it should be recognized that the enactment of laws do not make cities quieter if the laws are not enforced, and there are certain problems usually associated with enforcement of noise laws. In the first place, noise by its very nature is an intangible – an environmental intangible; besides, its assessment as earlier pointed out is subjective. So, the enforcement of laws relating to noise is bound to be fraught with operational difficulties. It is also open to abuse unless the provisions are simple, practical and realistic. In particular, it should be recognized that the purpose of any noise legislation is to minimize noise as much as possible, for noise, especially where human beings live, interact and perform activities cannot be eliminated.

In the second place, the problem of noise law enforcement in Nigeria can be made more difficult by shortage of personnel. It is conceivable that the law enforcement agents will always be faced with the problem of allocating manpower resources between some more acute issues, like armed robbery, than the seemingly less pressing noise control. A recognition of this is important so that consideration of manpower is made part of the national noise abatement programme.

Physical planning: One of the basic principles of land use planning is spatial separation of incompatible land uses. Some land uses are noise-sensitive; that is to say, they do not desire noise in and around them. These include hospitals, educational institutions and residential areas. Other land uses are insensitive to noise and they include transportation, manufacturing, and commerce. The principle of 'zoning' provides that in the areas of intense noise, no dwellings, schools or hospitals should be built. Therefore, an effective use of planning control in the Nigerian cities will go a long way in ameliorating the adverse effect of noise. However, as already pointed out, the structure of Nigerian cities with their mixed land uses is not conducive to noise abatement. It is necessary therefore to embark on a gradual but forceful process of rationalization of land use in the cities.

Another planning instrument that should be employed in attenuating noise is the use of vegetational sound barriers. This consist of spatial separation of noise–sensitive land uses from sources of noise by barriers such as trees, hedges and grass. Acoustic green barriers are effective when its thickness is up to 25meters and above and could reduce noise pollution with 10 – 15 decibels [12]. In the on-going struggle to plant more trees in the country, conscious attempts need be made to channel effort to specific objectives such as using vegetation to serve as noise barriers.

Table 3. Sources of "nuisance noise"

Sources	In & around homes		In & around workplace	
	No of respondents	%	No of respondents	%
Marketplace	46	3.8	73	6.0
Motor-park	17	1.4	30	2.5
Airport	3	0.2	7	0.6
Factories	16	1.3	20	1.7
Traffic	99	8.2	186	15.4
Power generating-plant	87	7.2	87	7.2
Grinding- machines	135	11.2	70	5.8
Record players	313	25.9	113	9.3
Religious- worship	79	6.5	16	1.3
Others	159	13.1	92	7.6
None	256	21.2	516	42.6
Total	1,210	100	1,210	100

Source: Field survey, 2014.

One other ways of incorporating noise control in physical planning is the Environmental Impact Statement (EIS). Broadly, EIS ensure proper assessment of the environmental impact of new project or changes in land uses on human activities and their welfare. The noise portion of any EIS will describe the existing noise environment, what a change will be brought about in this environment by a new project, and what anti-noise measures will be employed if the project were to be noise-generating. Applicant is not granted permission to go on with the proposed project until satisfactory noise impact statement is submitted.

Education: It should be borne in mind that none of the measures outlined above (legislation and city planning) will on its own work effectively without the citizen's cooperation; but there can be no cooperation unless the citizen cares, and he does not care unless he is aware. There is a need, therefore, to mount an educational programme that will be mainly directed to the general public. This will be geared towards creating awareness, and leading people to understand the effects of noise pollution on their welfare, to know why anti-noise laws are made, what the provisions of the laws are, and what roles are expected of them in putting into effect the various abatement measures.

8. CONCLUSION

Citizens' well-being under the present urbanizing process and its attendant deteriorating urban environment in Nigeria is a matter for public concern. In an attempt to make the urban environments cleaner and safer places to live in, emphasis has recently been placed on the removal of such pollutants as liquid and solid wastes. Noise as a public health nuisance has relatively been ignored, whereas the noise level to which the urban population is exposed has been increasing during the past five decades. Presently, urban residents in Nigerian cities are expose to high noise levels (70 decibels and above) with the attendant health implications. Consequently, a sizeable proportion of the urban population (75%) are dissatisfied with urban life due to noise pollution problem. Although some disparate State laws have been written which seem to signify awareness of noise pollution, the country is yet to focus on the problem and to accord it the attention it requires. The need has therefore arisen to recognize noise as a pollutant, and accordingly evolve a national environmental noise pollution policy with an appropriate programme.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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