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All correspondence should be addressed to
The Editor-in-Chief,
ABSUUJATEES
+2347035090329
Email: absuujatees@gmail.com

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AVERAGE DAILY DEMAND FOR WATER IN SOME RURAL COMMUNITIES IN ISIALA NGWA NORTH LOCAL GOVERNMENT AREA, ABIA STATE NIGERIA.

by

[1]Alozie, M.C, [2]Obasi, S.C.E, and [3]Iwuchukwu, O.

1) Department of Geo & Plan, ABSU,

(2) Department of Architecture, ABSU

3) Department of Architecture, UNIZIK.

Abstract

The work unveiled the Average daily demand (ADD) of water for the inhabitants of the selected communities in Isiala Ngwa North LGA, Abia State for the year 2021 and made further projections of ADD to 2024. This work is an improvement from the previous works of Alozie, Chima and Alozie, (2015). It was discovered that rural communities in Isiala Ngwa are increasing in population as well as Effective Average Daily Demand for water (EADD), driven by improved standard of living, hence exacerbating the need for this research. Investigations were carried out in the Communities that were purposively selected. Three communities were equitably selected from the three pre-existing clans in the area, namely; Ntigha, Ngwaukwu and Nsulu. Baseline population statistics were obtained from NPC (1996) census results and the work of Alozie, (2011). It was however, revealed that Amapu Ntigha inhabitants in 2021 would require 1,058,040 litres and 1,328,428 litres per day, based on either 90 litres per day standard (VITA, 1985) or 113 litres per day standard (WHO) per day. Inhabitants in Eziama Ntigha would also consumes 1,952,820 litres or 2,451,874 litres of water per day. However, the nine Communities selected in 2021 with a combined pop size 267,285 will consume 6,055,650 litres and 7.603,205 litres of water per day. It was recommended that, private borehole operators could be encouraged by the government to increase their Water Generation Capacity (WGC), since the private boreholes are more reliable in water supply both in wet and dry seasons.

Keywords: Average daily demand of water, Effective average demand, Water generation capacities.

INTRODUCTION

In the previous works of Alozie, (2012) and Eze, Alozie and Alozie (2016), implications of average daily demand of water-on-water supply in Isiala Ngwa, Abia State were highlighted. A cursory look would reveal that average daily demand of the respondents that were investigated increased tremendously from 84.64 litres to 172.67 litres representing an increase of 51%, whereas actual water demand within the reported period based on the 90% daily water need especially for desperate areas (VITA, 1985) was higher in 2016. This means that difference in supply and actual demand decreased from 2001 and 2016. Nevertheless, Eze *et al*, (2016) was quick to note that the improvement was due to the increase in private boreholes, which consistently improved their water generation capacity. They further observed that public water supply within the period under review became moribund, leaving water generation capabilities to private borehole operators, and rain water harvesting mechanism. Chima and Alozie, (2006) observed that safe, adequate and accessible supply of water combined with proper sanitation are surely basic needs and

they have recently become essential component of primary health care, and the development of rural areas, especially in sub-Saharan Africa. For significant socio-economic development of a community, an adequate supply of safe water is a pre-requisite (Eze et al, 2016). Factors such as time and energy savings in preventing incidence of disease, through quality water provision can contribute to development of the rural areas provided that the time and energy gained are used meaningfully and economically (Alozie, 2021). In places where water shortages exist, extreme cases of material and human losses also permeate. Given the reasonable increase in the number of functioning private boreholes in the area, it became pertinent to ascertain whether the increase translated to proportionate or marginal increase in water generated and water supplied. For the purposes of the work; water requirement (WR) is the actual water needed to achieve human alimentation, which in this case is, 113 litres per person per day as prescribed by WHO. While Water Demand (WD) is the quantity of water the households/individual are able to collect given their socio-economic capabilities. Water generation (WG) is the quantity of water the private borehole of operators are able to generate with a particular period.

STUDY LOCATION

The research was carried out in nine Communities in Isiala Ngwa North L.G.A this presented in table 1. Isiala Ngwa Local Government Area is located as the Abia Central Senatorial Zone and occupies a land area of about 420 square Kilometers. Population rose exponentially from 142852 in 2006 to 194,231 in 2016 (Eze, et al, 2016). However, it increased further from 2016 to 200,446 in 2017 and 227,361 in 2021, based on National growth rate average of 3.2% presupposing that water demand will increase; perhaps generation will also increase comparably. The study area is geographically located within long 7^0 20'E and 7^0 35' E and Lat 5^0 28'N to $5^0$20'N. It also falls within the wet tropical climate with marked dry season and double maxima rainfall, in June and September (Alozie, 2001). Rain water harvest occurs in the area since the wet season extends from Late March to July and September to October, not less than six months of intense rainfall. Dry season lasts for 5 months, starting from November to early March. Eze, *et al* (2016), further observed that within the period of dry season in the study area, water generation especially some years ago, increased as well as consumption. The increase is attributed to rise in the number of functioning private boreholes in the area. Annual average temperature is around 20^0 to 22^0c with January to march as the hottest months.

METHODOLOGY

The earlier work done by Eze et al, (2016) provided a base line data for the research to achieve judicious comparative analysis

between the 2016 result as obtained by Eze, et al, 2016 and our present day result. Communities listed in 2016 were also selected for questionnaire distribution and investigation. The communities include; Amapu Ntigha, Umuzegu, Agburike, Amaorji, Ihie, Abayi, Avor Ntigha and Umuomaukwu. Data returned from the field were analyzed with comparable statistical technique. We also applied the 4 persons per household bench mark, National population policy as the paradigm for assessing household water demand and consumption. Nine communities were selected, representing purposively the three clans in Isiala Ngwa North L.G.A, namely; Ntigha, Nsulu and Ngwaukwu

RESULTS AND DISCUSSION

Table 1: Population size for the selected Ten communities 2016 to 2021 based in 3.2% population projections

Communities	**2016 (1)**	**2017 (2)**	**2018**	**2020**	**2021**	**2022**
Amapu Ntigha	10,043	10,364	10,696	11,038	11,391	11,756
Eziama Ntigha	18,572	19,129	19,741	20,373	21,025	21,698
Avor Ntigha	4157	4290	4,428	4570	4716	4867
Agburuike Nsulu	4215	4350	4489	4633	4781	4934
Umuomaiukwu Nsulu	3051	3149	3250	3354	3461	3572
Umuzegu Nsulu	2228	2299	2373	2449	2527	2608
Ihie	3056	3154	3255	3359	3466	3577
Abayi	7258	7490	7730	7977	8232	8495
Amaorji	4936	5094	5257	5425	5599	5778
Total	57,516	59,319	61,219	63178	65,198	67,285

Sources: (1) Eze, et al, 2016
(2) Pop size from 2017-2022 population projection based 3.2% growth Rate for National Average.

In table 1, population sizes of the selected communities based on a national projection rate of 3.2% was presented. A cursory analysis would reveal that between 2016 and 2021, population sizes for the communities increased from 57,516 to 67,285 representing an incremental rate of 14.52%

Table 2: Expected Average daily demand for water by individuals in the selected communities on 2021

Communities	**Pop. Size 2021**	**ADD Based on 90 litres per day**	**ADD Based on 113 litres per day**
Amapu Ntigha	11,756	1,058,040	1,328,428
Eziama Ntigha	21,698	1,952,820	2,451,874
Avor Ntigha	4867	438,030	549,971
Agburike Nsulu	4934	444,060	557,542
Umuomaiukwu	3572	321,480	403,636
Umuezegu	2608	234,720	294,704
Ihie	3577	321,930	404,201
Abayi	8495	764,550	959,935
Amaorji	5778	520,020	652,914

Total	67,285	6,055,650	7,603,205

From table 2, ADD based on 90 litres (which is allowed for places in harsh condition (VITA, 1985) and ADD based on 113 litres, WHO, requirement for human alimentation per day were presented. The result indicates that people in Eziama Ntigha would require, 1,952,820 litres or 2,451,874 litres of water per day. This is followed closely by Amapu Ntigha; 1,058,040 litres and 1,328,428 litres respectively. The lowest ADD would be made by Umuzegu Nsuelu; 234,720 litres and 294,704 litres respectively. However, the communities selected (see Table 1) would require 6,055,650 litres and 7,603,205 litres of water for average daily demand of water and this quantity of water would be demanded by 67,285 persons.

Given the nature of infrastructural decay and rising operational costs (Eze, Alozie, and Alozie, 2015), it would be very difficult to assume that water generation capacities will be able to sustain average daily water demand.

Projections of Average Daily Demand for Water and Corresponding Projections from 2022 to 2027

Table 3: Population Projections of the selected communities from 2022-2027 Based on National average rate of 3.2%

Communities	2022	2023	2024	2025	2026	2027
Amapu Ntigha	12,132	12,520	12,921	13,334	13,761	14,201
Eziama Ntigha	22392	23,109	23,848	24,611	25,399	26,212
Avor Ntigha	5.023	5184	5350	5521	5698	5,880
Agburuike Nsulu	5092	5255	5423	5,597	5776	5961
Umuomaiukwu Nsulu	3572	3686	3804	3926	4052	4182
Umuzegu Nsulu	2691	2777	2866	2958	3053	3156
Ihie	3691	3,809	3931	4057	4187	4.321
Abayi	8767	9048	9338	9637	9945	10,263
Amaorji	5963	6082	6264	6464	6671	6,884
Total	09,323	71,470	74,745	76,105	78,542	81,060

From table 3, population size of the communities would likely increase from 69,323 in 2022 to 81,060 in 2027 respectively, an expected exponential rise of 14.48%.

s

Table 4: Projected Average Daily Demand for water by some communities in Isiala Ngwa North LGA for 2022

Communities	**Pop. Size 2022**	**ADD Based on 90 litres per day**	**ADD Based on 113 litres per day**
Amapu Ntigha	12132	1,091,880	1,370,916
Eziama Ntigha	22392	2,015,280	2,530,296
Avor Ntigha	5023	452,070	567,599
Agburike Nsulu	5092	458,280	575,396
Umuomaiukwu	3572	321,480	403,636

Umuezegu	2691	242,190	304,083
Ihie	3691	332,190	417,083
Abayi	8767	789,030	990,671
Amaorji	5963	536,670	673,819
Total	69323	6,239,070	7,833,472

From table 4, Average daily demand for water in the selected communities increased for both acceptable standards of sufficient water for daily human alimentation. For ADD (based in 90 litres per day), demand increased by 2.94%, while ADD (based on 113 litres per day) demand also increased by 2.94%.

Table 5: **Projections of Average daily demand for water by some communities in Isiala Ngwa for 2023**

Communities	**Pop. Size 2023**	**Add based on 90 litres per day**	**Add based on 113 litres per day**
Amapu Ntigha	12,520	1,126,800	1,414760
Eziama Ntigha	23,109	2,079,810	2,611,312
Avor Ntigha	5784	466,560	585,792
Agburike Nsulu	5255	472,950	593,815
Umuomaiukwu	3686	331,740	416,518
Umuezegu Nsulu	2777	249,930	313,801
Ihie	3809	342,810	430,417
Abayi	9048	814,320	1,022,424
Amaorji	6082	547,380	687,266
Total	71,470	6,432,300	8,076,110

From Table 5, Average daily demand for water will increase exponentially as population increase geometrically. However, by 2023 in the selected communities and eventually the local government area, demand for water will exacerbate, especially as standard of living improves

Table 6: Projections of Average daily demand for water in the selected communities for 2024

Communities	**Pop. Size 2024**	**Add based on 90 litres per day**	**Add based on 113 litres per day**
Amapu Ntigha	12,921	1,162,890	1,460,073
Eziama Ntigha	23,848	2,146,320	2,694,824
Avor Ntigha	5350	481,500	604,550
Agburike Nsulu	5423	488,070	612,799
Umuomaiukwu Nsulu	3804	342,360	429,852
Umuezegu Nsulu	2866	257,940	323,858
Ihie	3931	353,790	444,203
Abayi	9338	840,420	1,055,194
Amaorji	6264	563,760	707,832
Total	74,745	6,727,050	8,446,185

In Table 6, as it would seem to apply as standard of living improves, Effective Average daily Demand for the water (EADD) will move towards the WHO standard, which is 113 litres of water per day. The implication of this scenario is that increased water generation capacities would need to improve tremendously so as to march with water demand.

RECOMMENDATIONS AND CONCLUSION

Average daily demand for water in the selected communities will increase exponentially, especially as standard of living improves. It therefore becomes pertinent for

concerted efforts to be made to improve water generation capacities of the individual communities. Very strongly, public water supply systems have collapsed both in the local government and the state, subjecting the inhabitants to look elsewhere for water supply. Alternatives sources of water exist like, surface water, water vendors, and rainwater harvest, Alozie, (2011); Chima and Alozie, (2006); Alozie, (2012) and Eze, *et al* (2015) espoused very sufficiently on the need to consider private borehole and rain water as more veritable sources of water in the area. However, further investigation carried out by Alozie, (2001) would reveal that rainwater harvest, though as old as the existence of human settlement, is not wholesome, giving the dilapidated nature of most rooftops in the rural areas. Giving the extant prejudices associated with rainwater harvest, we therefore recommended that private borehole operations be enhanced to increase and subsequently stabilize water generation capacities of these communities. Government can remove completely, levies/charges on borehole operations. At the same time, subsidizing cost of operations especially, maintenance and drilling of boreholes. The private sector has proved to be good managers and operators of boreholes operations.

In conclusion, this article was intended to expose the growing water needs in the rural areas and create a robust framework for planners engaged in rural project development. To incorporate the necessity of water demand as a key to sustainable rural development.

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SATISFACTION LEVELS OF HOUSING CONSUMERS IN PRIVATE HOUSING IN ENUGU WITH RESPECT TO PHYSICAL CHARACTERISTICS OF BUILDINGS AND THE HOUSING ENVIRONMENT

BY

Irouke V.M.[1] & Ahianba J. E.[2]

Nnamdi Azikiwe University Awka[1], Anambra State; Ambrose Ali University Ekpoma[2]

Abstract

Satisfaction with a dwelling unit is an important element of one's satisfaction in life because a good fraction of one's lifetime is spent in the house where he lives. Different buildings and housing environments lead to different levels of satisfaction among different categories of people. The study assessed the level of satisfaction experienced in the study area by the housing consumers. Being survey research and descriptive in nature, the study used physical observations, interviews, focus group discussions, a questionnaire survey, and a review of related literature to source the data needed. The results were compiled in a database using the Statistical Package for Social Sciences (SPSS) version 23. The research identified that the majority (46.4%) of the housing types developed within the study area were blocks of flats. The analysis of the identifiable pattern in housing types and design was found to be significant. It was also established from the study that there is a significant relationship between the size of rooms, the number of rooms, the location of rooms, and the users' satisfaction. The study suggests that in addition to the building designs, considerations for efficient provision and management of shared spaces and facilities within the compounds should be added.

KEYWORDS: **Consumer Satisfaction, Buildings, Environment.**

INTRODUCTION

Satisfaction with a dwelling is an important factor in the provision of housing for society. As many housing developers face increasing competition, greater attention continues to be placed on satisfied housing consumers. Housing satisfaction enables housing developers to differentiate themselves from their competitors and create a sustainable advantage. Buildings, like any other product, are designed and constructed with lots of expectations from clients, professionals, users, and the community. To clients, buildings require huge capital investment and are expected to bring returns on investment, while to professionals (e.g., architects, builders, and engineers), buildings are products of their creativity and imaginative thinking. On the part of users and the community, one crucial expectation is that buildings will meet their needs and aspirations by supporting their daily activities and ultimately improving the aesthetic quality of the built environment (Hatch et al., 2005).

Nurzafira et al. (2019) described housing as a composite of the total physical and social parts that make up the housing system. The physical and social parts are important to really describe the housing satisfaction of the residents, but the architect has a major role to play in providing the physical characteristics of the building and its environment. Sometimes the provisions of the architect also

affect the social aspect of housing. Every housing provision comprises different housing types meant for different categories of people in the community. The houses include single-family rooms, two-bedroom and three-bedroom bungalows, blocks of flats, apartments, duplexes, and mansionettes, while the occupation of compounds ranges from single-family to multi-family compounds. The way housing consumers perceive the physical building and the provisions made by the architect is important in determining housing satisfaction.

The importance of providing satisfactory housing cannot be overemphasized. Ibem and Aduwo (2013) affirmed that public housing programmes in Nigeria have had the target of providing housing that meets the government's prescribed standards of quality and users' needs, expectations, and aspirations. Unfortunately, in the past few decades, despite the government's laudable efforts, public housing has failed to achieve this goal in Nigeria, as noted by the UN-HABITAT REPORT (2006). With the great demand for housing, private individuals and organizations started their housing projects and developments, now providing houses for the majority of the population. But even with the continuous increase in the housing stock, research has shown that the efforts of the government and those private individuals in housing provision have not yielded the required result. Nwankwo and Okonkwo (2012) noted that the failure of these housing projects was more qualitatively driven and, as such, called for a continuous post-occupancy evaluation of housing projects to find out how the occupants of the completed projects fared.

Satisfaction with housing describes the exact nature of respondents' needs and aspirations concerning housing and the reality of the current residential context. (Hui& Yu, 2009). Conceptually, housing satisfaction according to Djerbani& Al-Abed (2000) refers to the degree of contentment experienced by an individual of family, with regard tothe current housing situation. Satisfaction in housing occurs when housing and neighborhood situation are consistent with the cultural, family, and community housing norms (Akindele et al. 2014). Satisfaction measures the difference between actual and desired households (Galster, 1987). Therefore, housing satisfaction is used to measure the degree of contentment, happiness, acceptance, location/environment, type of structure, comfort, service availability and accessibility, status, as well as habitability or non-habitability (i.e dissatisfaction). Housing satisfaction as a result depends on residents' judgment of their residential and neighbourhood situations. In other words, satisfaction means the absence of complaints and high degree of agreement between actual and desired situations.

With the nascent subscription for continuous housing satisfaction studies by various

authors, some studies have also been carried out on consumer satisfaction in Enugu Urban, but the majority of those studies were done on public housing provision. The public housing consists mainly of prototype buildings, with a lot of them having private compound spaces, which poses a different challenge from multi-family compounds, which are characteristics of housing for a greater population. Not much study has been done to ascertain the satisfaction levels of housing consumers in the private housing sector so as to provide answers and guides for future developmental plans and projects of the housing developers in Enugu. This study attempts to provide answers to the levels of satisfaction experienced by different categories of consumers based on the physical characteristics of the buildings they occupy. The study objectives include the identification of the housing types and residential units present in the study area, as well as the type of compounds housing those buildings. Then there is a survey on the experience of the housing consumers to get their perception of the architectural design of the buildings.

STUDY AREA

Enugu Urban which is the study area is made up of Enugu East, Enugu North, and Enugu South. Enugu Urban is also located within latitude 6.240 N and 6.300 N and longitude 7.270E and 7.320 E. It shares boundary with Igbo Etiti and Isi-Uzo Local Governments in the north, Udi local Governments in the west, Nkanu West Local Government in the south and part of Nkanu East Local Government Area in the east. There are 18 prominent residential areas in the Urban. These are Abakpa, Trans-Ekulu, Nike, GRA, Ogui, Asata, New Heaven, Obiagu, Ogbete, Iva valley, Independence Layout, Achara Layout, Ugwuaji, Maryland, Awkunawnaw, Uwani, Agbani, and Coal Camp. Enugu Urban is the most developed urban area in Enugu state

METHODOLOGY

This study describes the population and a phenomenon of housing consumers' satisfaction; therefore, the research is descriptive in nature. For this research work, data was collected through field investigations and surveys. Therefore, the research design applied in this study is a descriptive survey. A descriptive survey uses surveys to gather data about varying objects. This data aims to determine the extent to which different conditions can be obtained among these subjects. The descriptive survey is preplanned and structured in design so the information collected can be inferred about a population. Therefore, the result obtained from this study can be used to describe the extent to which the design of houses and the provision of functional spaces within a building affect the satisfaction of housing consumers. The study relied on data collected through questionnaire and physical

observations. The questionnaire was designed to collect and analyze quantitative data on the attributes of the respondents as well as their levels of satisfaction with the physical structure of housing as well as the immediate environment. It was used to collect data on the socioeconomic and demographic characteristics of the respondents and their satisfaction with several attributes of the house. Satisfaction with the housing characteristics of the buildings as well as the housing environment were defined in the following ways: very dissatisfied (1), dissatisfied (2), neutral (3), satisfied (4), and very satisfied (5). The respondents selected the options that correspond with their level of satisfaction with the several attributes of the house. Using Weighted Mean, the Mean Satisfaction Scores were generated; that is, instead of each data point contributing equally to the final mean, some data points contribute more "weights" than others do (Theme Horse, 2016). The Mean Satisfaction Scores were used to rank the attributes of satisfaction with housing. The physical observations were done to complement the data collected through the questionnaire and reconnaissance survey, in order to identify and observe the buildings to be studied as well as the characteristics of the neighbourhoods where the buildings are located. This study used a purposive sampling technique based on the housing type. The total number of houses as well as sample size allocation to the house types to be studied was distributed according to the table of Enugu Urban Survey Distribution adapted from 2006 population and housing census of the Federal Republic of Nigeria. For a study of population of 169,422 households, using Krejcie and Morgan Formula for a known population; a sample size of 384 households was generated. When an attrition of 10% was added, a final sample size of 422 households was gotten. Therefore, a total 422 questionnaires were distributed and 348 were returned, giving a percentage returned to 91%. Using the Table for Distribution of Regular Households by Types of Building, adapted from 2006 Population and Housing census of the Federal Republic of Nigeria, as shown in Table 1 below, the ratio of sample size allocation to the different local Government Areas was generated. Afterwards, the total number of different housing types studied in each of the local government areas was further derived from the study.

Table 1 Distribution of Regular Households by Type of Housing Units

LGA	Total	Sample size allocation	Sample Size Allocation to the house types						
			House on a separate standoryard	Traditional structure made of traditional material	Flats in blocks of flats	Semi-detached house	Rooms/le tin house	Informal improvised dwelling	other
Enugu East	64,411	152	28,439	1,677	10,593	2,448	17,832	293	3,129

Enugu North	57,615	144	21,676	320	9,568	2,862	17,569	421	5,199
Enugu South	47,396	126	10,247	308	13,599	2,440	15,819	606	4,377
Total	**169,422**	**422**	60,389	2,305	33,760	7,750	51,220	1,320	12,705

Table adapted from Housing Characteristics and Amenities Tables, 2006 Population and Housing Census of the Federal Republic of Nigeria, Priority tables Vol I

Table 2. Table of Enugu Urban Survey Distributions

s/no	Housing type	Enugu East L.G.A	Enugu North LGA	Enugu South LGA
1	House on a separate stand or Yard	62	54	27
2	Traditional structure made of traditional material	4	1	2
3	Flats in blocks of flats	26	24	35
4	Semi-detached house	6	7	7
5	Rooms/let in house	42	44	40
6	Informal improvised dwelling	1	2	2
7	Other	7	12	13
	Total	152	144	126

Table adapted from Housing Characteristics and Amenities Tables, 2006 Population and Housing Census of the Federal Republic of Nigeria, Priority tables Vol II

RESULTS AND DISCUSSION

Firstly, in the research, the houses and housing types were identified and categorized. The physical housing characteristics were documented as shown in table 3 below

Table 3: The Physical Housing Characteristics

	Frequency	Percent
What house type do you live in?		
Detached masonet (duplex)	71	**18.5**
Semi-detached masonet (twin duplex)	6	**1.6**
Detached bungalow	80	**20.8**
Semi-detached bungalow	49	**12.8**
Block of flats	178	**46.4**
How many bedrooms do you have in your house/apartment?		
1 bedroom	90	**23.4**
2 bedroom	74	**19.3**
3 bedroom	108	**28.1**
4 bedroom	69	**18.0**
5 bedroom and above	43	**11.2**
Is it adequate?		
Yes	264	**68.8**
No	**120**	**31.3**

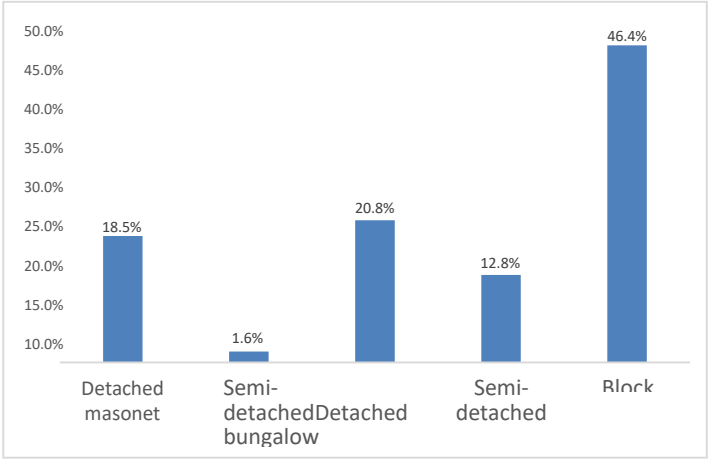

Fig 1 Type of house. Source: Author's fieldwork 2022

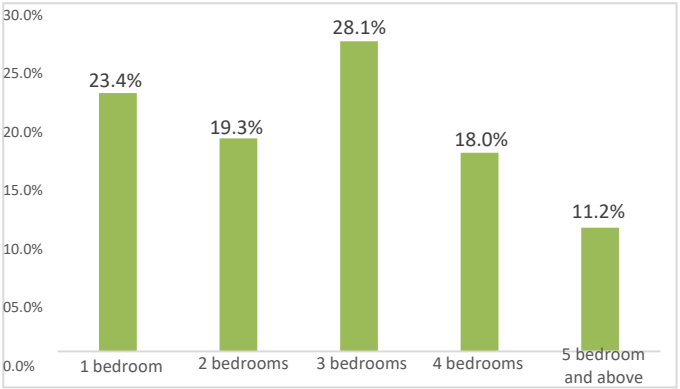

Fig 2: Number of bedrooms in the

house/apartment. Source: Author's fieldwork 2022

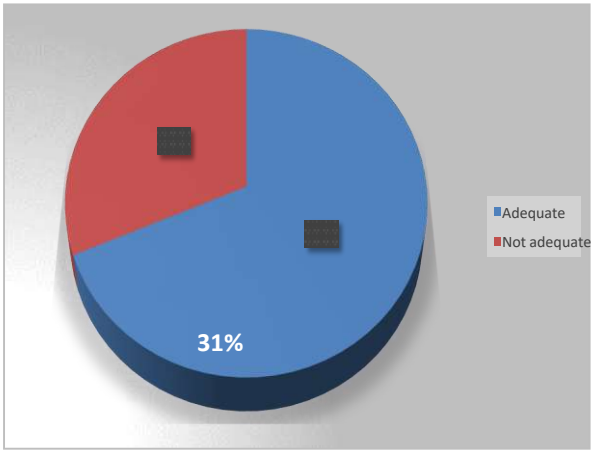

Fig 3: Adequacy of house/apartment.

Table 3 shows that 46.4% of the participants live in block of flats, 20.8% live in Detached bungalow, 18.5% live in Detached masonet (duplex), 12.8% live in Semi-detached bungalow while 1.6% live in semi-detached masonet (twin duplex). Respondents with 1 bedroom apartment are 90 (23.4%), 19.3% live in 2 bedroom, 28.1% live in 3 bedroom, 18% live in 4 bedrooms while11.2% live in 5 bedrooms or more. Of all the housing types, the blocks of flats seem to be dominant with 46.4% of the total buildings in the area. It was also identified that while most of the other residential unit types had one family that occupied a compound, the residential units that have blocks of flats have several occupants who share a compound together, however most of the blocks of flat occupants (68%) agreed to be satisfied with their building.

Table 4. Housing environment characteristics

	Frequency	Percent
How would you describe accessibility by road the location of the layoutyou live in?		
Very accessible	65	16.9
Accessible	163	42.4
Fairy accessible	156	40.6
Inaccessible	0	0.0
Very inaccessible	0	0.0
How would you describe the general topography of the housing layout you live in?		
Very sloppy	1	.3
Sloppy	19	4.9
Fairy sloppy	188	49.0
Relatively flat	159	41.4
Very flat	17	4.4
How would you describe size of the plot your house is built on?		
Quite large	16	4.2
Large	77	20.1
Fairly large	189	49.2
Not large	92	24.0
Not very large	10	2.6
How adequate are distances between individual buildings in the housing layout you live in?		
Very adequate	12	3.1
Adequate	86	22.4
Fairly adequate	205	53.4
Inadequate	80	20.8
Very inadequate	1	0.3
How would you describe overall environmental comfort in thehousing layout you live in?		
Very adequate	8	2.1
Adequate	141	36.7
Fairly adequate	174	45.3
Inadequate	56	14.6
Very inadequate	5	1.3
How would you describe availability of open spaces and playgroundsin the layout you		

live in?		
Very available	4	1.0
Available	55	14.3
Fairy available	156	40.6
Available but not adequate	58	15.1
Not available	111	28.9
How would you describe availability of recreational facilities within your housing layout?		
Very available	3	0.8
Available	38	9.9
Fairy available	137	35.7
Available but not adequate	104	27.1
Not available	102	26.6
What is the main source of water supply to your house/apartment?		
Public water main	101	26.3
Boreholes within the estate	32	8.3
Wells outside/near the building	116	30.2
Water vendors	135	35.2
How is the level of security in the housing layout you live in?		
Very adequate	6	1.6
Adequate	157	40.9
Fairly adequate	177	46.1
Inadequate	43	11.2
Very inadequate	1	0.3
How would you describe noise level in your housing layout?		
Very low	7	1.8
Low	82	21.4
Fairly low	214	55.7
Noisy	80	20.8
Very noisy	1	0.3
How would you describe the level of privacy in your housing layout?		
Very adequate	8	2.1
Adequate	109	28.4
Fairly adequate	215	56.0
Inadequate	52	13.5

Table 4 shows that all the respondents agree that the road to the location of their layout is accessible. They reported that the general topography of the layout is fairly sloppy (49%) or relatively flat (41.4%). The table shows that 49.2% of the respondents described the size of plot oftheir houses as fairly large (49.2%), 20.1% said large while 24% reported not large. More than halfof the respondents (53.4%) agree that that the distances between individual buildings in the layoutis fairly adequate, 22.4% and 20.8% reported adequate and inadequate respectively. The overall environmental comfort was rated fairly adequate by 45.3% of the respondents and adequate by 36.7% of them. Availability of open spaces and playgrounds in the layout were reported as fairly available by 40.6% of the respondents, available by 14.3% and not available by 28.9% of them. Similarly, 35.7% reported that recreational facilities are available, 27.1% said available but not adequate and 26.6% said not available. The main source of water supply is wells outside/near the building (30.2%), water vendors (35.2%), public water main (26.3%) and boreholes within the estate (8.3%). They indicated that security is fairly adequate (46.1%) and adequate (40.9%). More than half of the respondents (55.7%) described the noise level in the layout as fairly low while 56% described the level of privacy as fairly adequate.

It was also established from the study that there was a significant relationship between the size of rooms, the number of rooms, the location of rooms, and user satisfaction. Physical observations carried out during the

study revealed that the users could not make much alterations in the houses where they experienced dissatisfaction as they were only tenants; however, their own way of taking care of the dissatisfaction is to interchange the use of the original designed space or add other activities that take care of their needs to the available space. A building's success depends not only on how effectively it provides the setting for activities of daily living but may also depend on the perception of its housing consumers concerning the space provided.

RECOMMENDATIONS

Having seen the importance attached to the provided spaces by the user, in any given design, the architect should be mindful of the spaces he or she is designing in relation to the user's needs and aspirations. Also, with the studies carried out, the current preferences of users about satisfaction with the architectural design of spaces should provide the basis for design works that make the planning process more participatory and pluralistic, which will prevent the reoccurrence of problems in the process of use. Detailed design and working drawings should be strictly adhered to by contractors during the construction process, and proper supervision, finance, labour and materials should be given priority during the construction process.

CONCLUSION

The research work presented in the paper has focused on the satisfaction levels of housing consumers, with special reference to the physical characteristics of the buildings as well as the housing environment. Based on this research, housing design can be regarded as the most difficult task in the field of architecture because a proper understanding of the nature of human needs is of crucial importance in the formulation of house and space standards. It was also established that designers are not always fully aware of the consequences of their design solutions; only through a post-occupancy survey will the designer usually realize what mistakes or bad decisions have been made during the design process.

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INFLUENCE OF WARD SPATIAL FEATURES ON STAFF ACTIVITIES OF HEALTHCARE DELIVERY IN PUBLIC TERTIARY MENTAL HEALTH FACILITIES IN SOUTHEAST NIGERIA

[1]Onwuzuligbo, C.C, [2]Agbonome P.C., [2]Mbah, P.U., [2]Aniakor U.C.

[1]Department of Architecture, Chukwuemeka Odumegwu Ojukwu University, Uli Campus.

[2]Department of Architecture, Nnamdi Azikiwe University, Awka.

corresponding email: cc.onwuzuligbo@coou.edu.ng

Abstract

Cognitive psychologists have advanced the argument that the configuration of spaces is instrumental in patterning the movement, activities, and modifying the functions of persons using such spaces. The objective of the study was to examine the relationship between type of ward layout (which is a variable of ward spatial features) and staff activities of healthcare delivery in public tertiary mental healthcare facilities that offer inpatient psychiatric services in Southeast Nigeria. Out of the 302 staff who make ward contact with the patients, 190 were sampled for this cross-sectional study. Statistical analysis was carried out using frequency distribution, descriptive summary measures, and Point-Biserial correlation (a = 0.05) using SPSS-20. Data on the following were collected using structured questionnaires: demographic characteristics of the health workers (gender, years of experience in MHC delivery, and designation); specific ward features (social density, type of ward layout, location of nursing station, type of ward supplies service); and the extent to which staff agrees to the influence of each of these ward features on planned patient contact, structured patient observation, and quick response to patient. It was established that type of ward layout does not significantly correlate with overall staff activities, even though the influences of the individual ward features correlated significantly. Inconsistent findings with previous studies may be influenced by the differing socio-cultural context within which the study was carried out and ill-conceived notions among staff, thus, preventing patient-centred model of care in psychiatric hospitals in the study area. Recommendations include the use of private rooms and cubicle wards, decentralized nursing stations, and mental health literacy among care givers on aspects of patient-centred model of care.

Keywords: Direct patient care, Hospital affordance, Staff activities, Ward spatial feature.

INTRODUCTION

Technological advancements have undoubtedly improved the efficiency of staff activities in healthcare settings. However, concerns have been raised about the use of architectural design of the physical environment in these settings to facilitate staff functions, patient safety, and other patient outcomes (Reiling et al., 2008). Cognitive psychologists have advanced the argument that the configuration of spaces is instrumental in patterning the movement, activities, and modifying the functions of persons using such spaces for improved efficiency in executing functions(Reiling et al., 2008).To address the challenge of efficiency in carrying out functions, intrinsic adjustments to organizational climate, healthcare

protocols, and the physical settings of wards are necessary and need to align so that the caregivers and the resources that support them are set up for proper patient care (Tyson *et al., 2002; Ulrich, 2006; Ulrichetal.,2004).*

Several studies have associated design features of wards with positive patient outcomes such as reduced anxiety, higher levels of satisfaction with care, reduced aggression (need for restraint and seclusion), improved social interaction with fellow patients and staff, increased compliance with treatment plans, reduced depression and stereotypy (Stolz et al., 2015; Lockman et al., 2017; Ulrich et al., 2014; Bressington et al., 2019; Grootens-Wiegers et al., 2018; Holohan & Saegert, 1973). However, Tyson et al. (2002) noted that the positive modification in behaviour observed in patients might not entirely be in response to changes in ward features alone. They may be more attributable to changes in staff work activities and behaviours, as well as changes in organizational milieu (indirect influences), than the change in itself (direct influence). It is, therefore, imperative to examine what influence ward spatial features have on staff activities, such that they carry out these activities effectively, thus, enhancing the therapeutic milieu of the ward. Having seen the likely influence of staff work activities on patient outcomes, it is surprising that only a few studies have been done (Lauder et al., 2006; Stuart et al., 2015). The majority of these were focused on regions representative of high-income countries. It is therefore imperative to carry out similar studies in low-and-middle-income countries such as Nigeria, considering that low-and-middle-income countries generally do not have any comprehensive mental healthcare policy, and where they do exist, are ineffectively implemented due to a shortage of resources such as infrastructure, personnel and funding (Gureje &Alem, 2000; Gureje et al., 2005; Thornicroftetal.,2017).

For this reason, the study aims to assess the influence of ward spatial features on staff activities of healthcare delivery in public tertiary mental health facilities in southeast Nigeria, with the view to proffering design modifications to ward design for improved staff functions. The current investigation is part of a wider study aimed at assessing the effects of the physical environment on mental healthcare delivery in public mental healthcare facilities in Southeast Nigeria with the view to proffering design strategies to improve healthcare delivery outcomes for staff and patients. As a specific objective, the current study seeks to examine the relationship between type of ward layout (which is a variable of ward spatial features) and staff activities in healthcare delivery. The null hypothesis postulated for the current investigation is; There is no significant relationship between type of ward layout and staff activities of healthcare delivery in the study area.

METHODOLOGY

The research area is the South-East geopolitical zone of Nigeria comprising five states: Abia, Anambra, Enugu, Imo, and Ebonyi States. Southeast Nigeria is located within latitudes 4°4'35" N and 7°7'44" N of the Equator and longitudes 7°54'26" E and 8°27'10" E of the Greenwich Meridian. According to the 2006 population census conducted in Nigeria, southeast Nigeria has a population of 16,395,555 persons (Federal Republic of Nigeria Official Gazette, 2009).

This cross-sectional study was conducted in the public tertiary health facilities of the region which offer inpatient mental health services. Seven operational facilities were identified given the above-stated criteria, each falling under one of the following categories: state-owned specialist hospital, state-owned hospital department, federal-owned specialist hospital, and federal-owned hospital department. See Table 1.

Table 1: Stratification of Public Inpatient Mental Healthcare Facilities in Southeast Nigeria by Ownership-Specialty

S/No	State Owned Specialist Hospital	State-Owned Hospital Department	Federal-Owned Specialist Hospital	Federal-Owned Hospital Department
1	State Neuro-Psychiatric Hospital, Nawfia	Abia State University Teaching Hospital, Aba	Federal Neuro-Psychiatric Hospital, Enugu	Alex Ekwueme Federal University Teaching Hospital,
2		Enugu State University Teaching Hospital, Parklane		Federal Medical Centre, Umuahia
3				University of Nigeria Teaching Hospital, Ituku Ozalla, Enugu

Following this stratification, random sampling by balloting was applied to each stratum (having more than one facility) to identify the facility to be surveyed. The following were selected:

i. State-owned specialist hospital: State Neuro-Psychiatric Hospital, Nawfia, Anambra state (SNH)
ii. State-owned hospital department: Psychiatric Department of Enugu State University Teaching Hospital, Parklane (ESUTH)
iii. Federal-owned specialist hospital: Federal Neuro-Psychiatric Hospital, New Haven (FNH)
iv. Federal-owned hospital department: Department of Mental Health of Federal Medical Centre, Umuahia, Abia State (FMC)

The number of mental healthcare (MHC) workers for each facility was obtained from the nominal roll of staff for each facility. The respondent sample size was derived using the Taro Yamane formula (Israel, 2012) at 95% confidence level and maximum degree of variability of p =0.05, and adjusted fora non-response rate of 10%

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = Sample size for finite population

N = Population size = 302

e = level of precision = .05

The obtained figure (138 staff) was distributed among the sampled facilities according to the ratio each contributes to N, and the research tool shared accordingly (Table 2)

Table 1: Respondent sample size in sampled facilities

S/N	**FACILITY**	**STAFF**	
		existing	sampled
1	State Neuro-Psychiatric Hospital, Nawfia	38	24
2	Psychiatric Unit, Enugu State University Teaching Hospital, Emene	27	17
3	Federal Neuro-Psychiatric Hospital, New Haven	215	135
4	Department of Mental Health, Federal Medical Centre, Umuahia	22	14
TOTAL		**302**	**190**

The research tool was designed to elicit data on the demographic characteristics of the health workers (gender, years of experience in MHC delivery, and designation); specific ward features (social density, type of ward layout, location of nursing station, type of ward supplies service); and the extent to which they agree to the influence of each of these ward features on planned patient contact (patient handling), structured patient observation, and quick response to patient. These were ranked on a 5-point Likert scale. The research tool was subjected to the scrutiny of experts in the specialties of Architecture, Psychiatry, Psychology, and Statistics to ensure content validity. At the same time, test-retest reliability method was adopted to ensure reliability of the tool.

The study protocol was approved by the Research and Ethics Committees of the individual health facilities, after which the questionnaires were distributed to consenting health workers. Participants also reserved the right to withdraw from the study if and when they wished and were not obligated to return copies of questionnaire upon completion. Data were collected across

the 4 facilities within 6 months (June to November, 2022). Statistical analysis was done with Statistical Package for Social Sciences (SPSS-20) using descriptive summary measures and frequency distribution, Point-Biserial Correlation analysis.

RESULTS

Of the 190 questionnaires distributed, 173 were returned, representing 91.1% response rate. The total number of valid responses per variable of interest was indicated.

Table 3 describes the socio-demographic characteristics of the study population. Data collected on gender of staff show that more female staff (77.1 %) work in the study area, while 22.9% identified as males. A greater percentage of staff had less than 3 years of experience (30.8%), closely followed by staff with 3-5 years of experience (21.5%). Staff with over 9 years of working experience were least represented (11%). More than half (60.1%) were nurses, 14.5% were psychiatrists, 10.4% were social workers, and 5.8% were medical psychologists. 9.2% indicated to be working in other capacities not captured.

Table 3: Socio-demographic characteristics of participants

Characteristic	N	%
Gender	**170[a]**	**100**
Male	39	22.9
female	131	77.1
Years of experience	**172[a]**	**100**
< 3 years	53	30.8
3-5 years	35	21.5
5-7 years	28	16.3
7-9 years	37	20.3
>9 years	19	11.0
Designation	**173**	**100**
Psychiatrist	25	14.5
Nurse	104	60.1
Social worker	18	10.4
Medical psychologist	10	5.8
Other	16	9.2

Table 4shows the distribution of ward features among staff in the study area. With respect to the social density of ward, results show that 94.2% of staff work in high multiple-occupancy wards. More specifically, 34.1% work in wards of at least 21 beds per ward, 21.4% work in 16-20 bed-wards, 20.8% work in wards with between 11 and 15 beds, 17.9% work in wards with 6 to 10 beds, while less than 5.8% work in wards with less than 6 beds.

In terms of type of ward, 83% reported to be working in open wards while 17% reported to be working in cubicle wards. While 72.3% work in wards with centralized nursing stations, 27.7% work from decentralized nursing stations. As far as type of supplies service is concerned, 61.8% reported to be working in wards

with centralized supplies service while 38.2% operate with decentralized ward supplies service.

Table 4: Distribution of spatial features of wards

Spatial feature of	N	%
Social density of ward	**173**	**10**
1-5 beds	10	5.
6-10 beds	31	17.
11 -15 beds	36	20.
16-20 beds	37	21.
21 and above	59	34.
Type of ward layout	**171[a]**	**10**
Open ward	142	83
Cubicle ward	29	17
Location of nursing	**166[a]**	**10**
Centralized	120	72
Decentralized	46	27
Type of ward supplies	**173**	**10**
(TWSS)	107	61.
Centralized	66	38
Decentralized		

Figures do not add up to 173 due to missing data

Table 5 shows how much they agree with the influence of specific ward features as identified in Table4. A greater majority of staff (72.5%) in the study area agree to varying extents that the social density of the ward in which they work positively influences how they handle patients. To this statement still, 18.1% disagreed to different degrees. On the influence of ward layout, 56.7% and 26.3% respectively agree and strongly agree that the layout of wards where they work enhances visibility to patients. On the other hand, 7% and 5.3% respectively disagree and strongly disagree to this.

When queried on response time to patients, 57.1% and 24.7% respectively agree and strongly agree that the location of nursing station from which they operate was instrumental in responding quickly to patients in the event of reactive patient contact. However, a minority of 11.2% disagreed/ strongly disagreed to this assertion. Again, more than half of the staff (73.6%) affirmed, to varying extents, that the type of ward supplies services enhanced response time to patients while 15.4% of staff disagreed to varying extents to this statement.

Table 5: Ratings of influence of spatial features of wards

Affordance	**Strongly Disagree**		**Disagree**		**Neutral**		**Agree**		**Strongly Agree**	
	N	%	N	%	N	%	N	%	N	%
Social density positively influences patient handling (SDPH) N = 171[a]	13	7.6	18	10.5	16	9.4	83	48.5	41	24.0
Ward layout positively influences structured patient observation (WLPO) N = 171[a]	9	5.3	12	7.0	8	4.7	97	56.7	45	26.3

Location of nursing station enhances response time to patients (LNRT) N = 170[a]	8	4.7	11	6.5	12	7.1	97	57.1	42	24.7
Type of ward supplies service enhances response time to patients (TSRT) N = 169[a]	14	8.3	12	7.1	17	10.1	94	55.6	32	18

Figures do not add up to 173 due to missing data

The variable *'type of ward layout'* was used as the dependent variable because it is key in defining the spatial characteristics of a ward. The variables SDPH, WLPO, LNRT, and TSRT were averaged to derive the aggregated variable STAC, which was used as the dependent variable. Because the two variables involved are of nominal and interval scales respectively, Point Biserial Correlation analysis tool was used to test for this association. Results of the analysis gave an output correlation coefficient of -.033 with a significance probability point of 0.668 ($p>0.05$). These values, given the available data, indicate a negative, very weak, and nonsignificant relationship between the two variables, thus, accepting the null hypothesis: *there is no significant relationship between type of ward layout and staff activities of healthcare delivery in the study area. See* Table 6. Table 7 shows the relationships between the influence of identified ward spatial features as reported by the participants. All influences were significantly correlated.

Table 6: Relationship between type of ward layout and staff activities

		Staff Activities of healthcare delivery
Type of ward layout	Pearson Correlation	-.033
	Sig. (2-tailed)	.668
	N	171

Table 7: Relationships between the influence of ward spatial features

		SDPH	WLPO	LNRT	TSRT
SDPH	Pearson Correlation	1	.292**	.267**	.322**
	Sig. (2-tailed)		.000	.000	.000
	N	171[a]	169[a]	169[a]	167[a]
WLPO	Pearson Correlation	.292**	1	.208**	.326**
	Sig. (2-tailed)	.000		.007	.000

	N	169[a]	171[a]	168[a]	168[a]
LNRT	Pearson Correlation	.267**	.208**	1	.387**
	Sig. (2-tailed)	.000	.007		.000
	N	169[a]	168[a]	170[a]	166[a]
TSRT	Pearson Correlation	.322**	.326**	.387**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	167[a]	168[a]	166[a]	169[a]

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

[a] Figures do not add up to 173 due to missing data

DISCUSSION

This cross-sectional study was conducted among staff of public tertiary health facilities in Southeast Nigeria to ascertain the relationship between ward spatial features and staff activities of direct patient care in inpatient mental healthcare settings.

More than three-quarters of the responders in this study were females (77.1%). This imbalance aligns with previous studies on staffing ratios in hospital settings (Alhassan & Poku, 2018; Olabisi et al., 2020; Olashore et al., 2018), and supports the conclusion that females form a greater percentage (over 70%) of healthcare and social workforce in 104 countries, including African countries (Tommasi, n.d.). The group of mental healthcare workers with less than 3 years of experience was the most common (30.8%), whereas personnel with over 9 years of experience made up only 11% of the sample. This finding is consistent with a study conducted in Botswana, where staff with 4 years of experience or less formed the majority of respondents at 50.6% (Olashore et al., 2018). Similarly, in a comparable study, Olabisi et al. (2020) found that the least experienced group of workers was the most prevalent (>6 years, 28.2%). While the difference in value labels of the variable of interest in studies may explain this disparity, commonality can be inferred from these findings. In specialist and teaching hospitals, residents and interns typically havingS years of experience or less are assigned everyday duties of healthcare delivery on the ward under the supervision of consultants and registrars, hence this statistic.

The study found that nurses constituted the highest proportion of respondents (60.1%) compared to other healthcare personnel, a finding that is consistent with several studies across healthcare settings (Haines, 2017; Kwobah et al., 2023; Olashore et al., 2018; Ukpong, 2011). Given their frontline position in providing patient care, nurses are likely to interact most frequently with the physical environment of the ward in the cause of

healthcare delivery. A study by Sajadi et al. (2019) found that nurses were the most frequently encountered staff -members by patients in psychiatric hospital settings. The study also indicated that patients had more positive interactions with nurses than other staff members, suggesting that nurses significantly impact patient experiences in mental healthcare settings.

The question guiding the study is, 'What is the relationship between spatial features of wards and staff activities? The hypothesis posited to answer this question was tested using 'type of ward layout' *TWL* and the aggregated variable 'staff activities' *STAC (SDPH + WLPO + LNRT + TSRT)*. Results at a 95% confidence level gave a negative non-significant result, thus accepting the null hypothesis ($r = -0.033$, $p=0.668$). Thus, even though open ward layouts negatively correlate with overall staff activities within the study area, there is insufficient evidence to support this.

The relationship between affordances of specific physical characteristics that may influence staff activities was examined. These are: 'influence of ward layout on patient observation WLPO' and 'influence of location of nursing station on response time to patients LNRT'. A significant positive correlation was outputted, implying that an increase in WLPO results in an increase in LNRT. Thus, improved patient observation due to type of ward layout enhances how quickly a staff responds to a patient during planned or reactive patient contact. These findings align with those of Yi (2010) and Yi and Seo (2012) who assert that increased visibility of patients in the ward allows for more direct observation, thereby improving response time to patients.

CONCLUSION AND RECOMMENDATIONS

The physical environment in which healthcare delivery is executed undoubtedly plays an important role in staff activities of direct patient care. Other factors such as staff competencies, organizational culture and service process design also influence user and organizational outcomes (Ulrich et al., 2010). As has been observed from this study, and unfortunately so, the principal drive in healthcare facility design (or conversion-of-use of already existing buildings for healthcare purposes), has been the provision of spaces to execute hospital functions rather than the creation of healthcare environments that are psychologically supportive of mental healthcare provision.

The study has substantiated, based on available data from the sampled facilities, the significant relationship, or absence thereof, of specific physical ward features and targeted aspects of staff activities within the study area. While all the relationships between the influences of these ward features were positive and significant, certain ward features did not significantly

correlate with overall staff activities, such as type of ward layout and social density. These findings, which are inconsistent with previous studies, may be influenced by the differing socio-cultural context of the area within which the study was carried out. Thus, even among healthcare providers, there is gross contempt for and lack of empathy towards the mentally ill, even in the cause of taking care of them, hence their responses (Chikaodiri, 2009). This ill-conceived notion thus prevents the staff from fully appreciating the affordance of the physical environment in a patient-centred model of mental healthcare. The study, therefore, recommends using more private rooms and cubicle wards for patients with decentralized nursing stations to enhance staff activities while not downplaying patient privacy. Again, there is an urgent need for healthcare providers to be properly trained on aspects of patient-centred model of care.

COMPETING INTERESTS

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WATER SANITATION AND HYGIENE (WASH) PRACTICES IN SOME SELECTED FOOD MARKETS IN IBADAN, NIGERIA.

MUSTAPHA, T.S. and Oloukoi, G.

Department of Urban and Regional Planning, Lead City University, P.O. Box 30678, Ibadan, Nigeria

Abstract

This study investigated Water Sanitation and Hygiene practices in some selected Food markets in Ibadan, Oyo State, Nigeria. Four markets were selected in four Local Government Areas and were classified into Urban and Rural areas, so as to form a basis for comparison. This study employed Qualitative and quantitative data gathering method, using a structured questionnaire which were coded and entered into a Statistical Package for Social Sciences (SPSS) for analysis. Analysis on the available source of drinking water in the urban markets was borehole, which account for 46% while available source of drinking water in rural markets was unprotected well and this account for 36% and water from vendors account for 18%. The study revealed that market people in the rural area do not have a Service Access to good toilet facilities to enhance WASH and the infrastructures available are pit latrine with slab (36%), pit latrine without slab (23%) and women in markets located in rural areas, 41% engage in open defecation because of lack of toilet facilities. There is lack of knowledge about health risks linked to poor WASH. The study revealed that people are motivated to handwashing, because it would make their hands scent nice and it would prevent them from contracting diseases. The study further revealed that market people could be willing to practice WASH if the infrastructures are readily available and accessible. This study concluded with the fact that the main driving force for poor environmental conditions experienced in the market is attitudinal. What motivates people to WASH is the risk factor associated with poor sanitation. It is therefore recommended that there should be proper sensitization of stakeholders on the need to take care of the environment so as to prevent sicknesses and diseases.

Keywords: Water, Sanitation, Hygiene, Health, Food Market

INTRODUCTION

Immediately after the expiration of the Millennium Development Goals era (2000-2015), the Sustainable Development Goals (SDGs) were adopted by the United Nation in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity (UN, World Water development report, 2022. The 17 Sustainable Development Goals (SDGs) are integrated. They recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability countries have committed to prioritize progress for those who are farther behind. The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. The creativity, knowhow, technology and financial resources from all society is necessary to achieve the Sustainable Development Goals (SDGs) in every context.

Good health is essential to sustainable development and the 2030 Agenda reflects the complexity and interconnectedness of the two. It takes into account widening economic and social inequalities, rapid urbanization, threats to the climate and the environment, the continuing burden of HIV and other

infectious diseases, and emerging challenges such as non-communicable disease universal health coverage will be integral to achieving SDG 3, ending poverty and reducing inequalities. Emerging global health priorities not explicitly included in the Sustainable Development Goals (SDGs), including antimicrobial resistance, also demand action. Water is often considered a plentiful renewable resource, yet the world's supply of clean, fresh water is under increasing threat. The reasons are straight forward. Growing populations and increasing economic activity in many regions are resulting in increasing demand for and pollution of water in both public and private sector (WHO, World Health Statistics: Monitoring Health for the SDGs, 2022). With the United Nations predicting a 40% global shortfall in water supply by 2030 of current consumption and production patterns do not change addressing water risks becomes an imperative, along with transitioning to more water-resilient business models (UN, meetings coverage and press releases, 2016).

Safe drinking-water, sanitation and hygiene are crucial to human health and well-being. Safe WASH is not only a prerequisite to health, but contributes to livelihoods, school attendance and dignity and helps to create resilient communities living in healthy environments[3]. The market place is an important part of a community all over the world. It could be an open square or a place in a commercial location where buying and selling take place. By and large, it occupies an important part of any community as it is a warehouse for goods, food items, household commodities and other materials. However, some markets operate daily and are said to be permanent markets, while others are held once in a week or on less frequent and specified days, such as festival days and are said to be periodic markets. Carrying out an effective sanitation exercise across the markets has become a serious challenge in some major cities in Nigeria. There are reported cases of indiscriminate dumping of refuse on major roads, blocking of drainage systems and often defecation are common practices in some major markets[4]. The importance of hygienic environment cannot be overemphasized. According to some scientists, factors that influence the growth of individuals and the nation at large mostly has to do with hygienic environment. Unfortunately, various elements that make up the environment, such as air, water, land and others are being contaminated daily (The will, Opinion, Enforcing Good Hygiene in Marketplaces, 2022).

In 2018, Nigeria's Water, Sanitation and Hygiene (WASH) sector was declared to be in a state of emergency and approximately 60 million Nigerians were living without access to basic drinking water. About 39% of rural dwellers do not have access to basic water supply, while about 29% practice open defecation. Women and girls bear the major burden of getting water for the family as they would trek miles before they could access water. This has brought negative effects on attendance of girl child in public schools. In recent years, the government of Nigeria has strengthened its commitment towards improving access to WASH services, with the launching of the National Action Plan (NAP), a 13 year strategy for the Revitalization of Nigeria's Water Supply, Sanitation and Hygiene (WASH) sector aimed at ensuring universal access to sustainable and safety managed WASH services by 2030, commensurate with the Sustainable Development Goals and tackling the state of emergency in the sector (WB Report, From Crisis to Green, Resilient and Inclusive Recovery, 2021).

The Federal government with the assistance of the World Bank and other development

partners has developed initiatives designed to fill identified gaps which have limited citizen ability to have access to safe and portable water. One of these initiatives was the National Urban Water Sector Reform Program (NUWSRP). Achievements recorded through the NUWSRP include the construction of over 2,300 additional water points, and 6,546 sanitation compartments and hygiene facilities across the country; the creation of 12,435 direct and 24,870 indirect jobs since 2015, and the certification of a total of 33 Local Government Areas within nine states as Open Defecation Free (ODF) (NDU, WBG, 2021).

Moreover, poor access to improved water and sanitation in Nigeria remains a major contributing factor to high morbidity and mortality rates among children under five. The use of contaminated drinking water and poor sanitary conditions result in increased vulnerability to water-borne diseases, including diarrhea leads to deaths of more than 70,000 children under five annually[7]. Sanitation, in other words, the provision of facilities and services for the safe disposal of human urine and faeces, and the maintenance of hygienic condition through services such as garbage collection and waste-water disposal has occupied a significant attention of the world. Worldwide statistics have accentuated the increasing rate of urbanization in developing countries. An estimated number of 609 million people in Africa live in urban areas as of 2021 and this would not reduce with a critical and unresolved challenge that affects the quality of life (UNFPA Annual Report, 2007)

Food markets in Ibadan, Nigeria is on the increase considering its urbanization, infrastructure and population growth. Virtually, all these food markets lack basic infrastructure that would aid healthy living of both sellers and buyers (Obayelu O, Food Security in Urban Slums, Evidence from Ibadan Metropolis, SW Nigeria, 2018). Many lives are put at risk due to how these food items are handled before they are sold to the public.

The present study, therefore is important to providing understanding on available WASH practices in public spaces with special attention to food market.

AIM AND OBJECTIVE

The aim of the study was to examine Water, Sanitation and Hygiene (WASH) practices in Some food markets in Ibadan and to provide a framework of how such practices can be improved upon and sustained.

The specific objectives of the study are:

i. identify types and usage of available WASH infrastructure in some selected food markets in Ibadan.
ii. profile the socio-economic status/ profile of users of these WASH facilities and infrastructure.
iii. determine Service Access Index (SAI) of WASH across the selected food markets in Ibadan.
iv. assess the level of participation of stakeholders in promoting WASH services usage in the market.
v. investigate motivation and determinant factors for use of WASH facilities in selected food market.

SIGNIFICANCE OF THE STUDY

Despite making real progress in making people have access to clean drinking water, sanitation and hygiene, quite a number, especially in the rural areas still do not have these basic infrastructures. For instance, open defecation has not been totally eradicated, because many still find it convenient for them to answer to nature in the public, which could be attributed to upbringings (UNO Goal 6,

Ensure access to water and sanitation for all, 2021)

Many countries, especially those in the tropics have gone into Environmental Sanitation Management (ESM), because of its sustainability in livelihood and development. The United Nations, therefore, urges all countries to focus on policies and programmes that bring ESM to the centre stage of their development agenda in order to ensure sustainable livelihood transformation[12]. If not well managed, the National environment, including the water bodies such as the sea and the lagoon as natural capital, and their associated livelihood activities such as fishing and salt production is threatened by poor ESM practices. Species are disappearing at a pace of 1,000 times the natural extinction rate. We are facing the sixth great extinction, with up to 1 million species threatened. Therefore, nature must be protected and restored (USAID, Sustainable fisheries and aquaculture, a guide for USAID staff and partners, 2013).

Nigeria, which is a developing country, aims to provide water that meets the standards set out by the World Health Organization. In practice, poor regulatory, legal and institutional frameworks, due to politics that comes to bear prevent this. It is no surprise that potentially toxic concentrations of metals have been reported in Nigeria's drinking water (Odome, Nelson, Andrew Slaughter, Rhodes University of Sasketchewan, 2017). Another major problem that the Country has adopted a "control and command" approach to water resource management. This means that the authority do not really engage the stakeholders. infrastructures in communities tend to collapse when users are not involved in planning and running it. There is also little or no coordination between federal, state and local governments. Poor sanitation and hygiene pose a lot of health risks and can negatively affect patronage to the market, especially by the learned elite in the society. The bane of many societies is ignorance to some basic health practices. This study wants to look at how stakeholders could be encouraged to practice some sanitation tips for the overall well-being of everybody.

It will also present or make visible the possible steps or measures that can help improve sanitation in these selected food markets and other markets in general. It will also contribute to knowledge in the field of sanitation/hygiene, marketing and academia as it will present new dimensions to sanitation research in public health domain. For all these problems to be solved, there should be synergy between government agencies managing water resources and all stakeholders including end-users.

THE STUDY AREA

The study area is Ibadan. Ibadan is a city in Oyo State, South West of Nigeria. The city is made up of eleven local government areas. This include; Ibadan North, Ibadan South West, Ibadan North West, Ibadan North East, Ibadan South East, Ido, Lagelu, Oluyole, Akinyele, Egbeda, Ona-Ara. For the purpose of this study, four local government areas where food markets are highly predominant would be randomly selected. The four local government areas thus selected are Ibadan North, Ibadan South West, Akinyele and Ido. Two in the Urban, which are Ibadan North and Ibadan South West while Sasa and Ido are in the rural with these locations, there will be a basis for comparison.

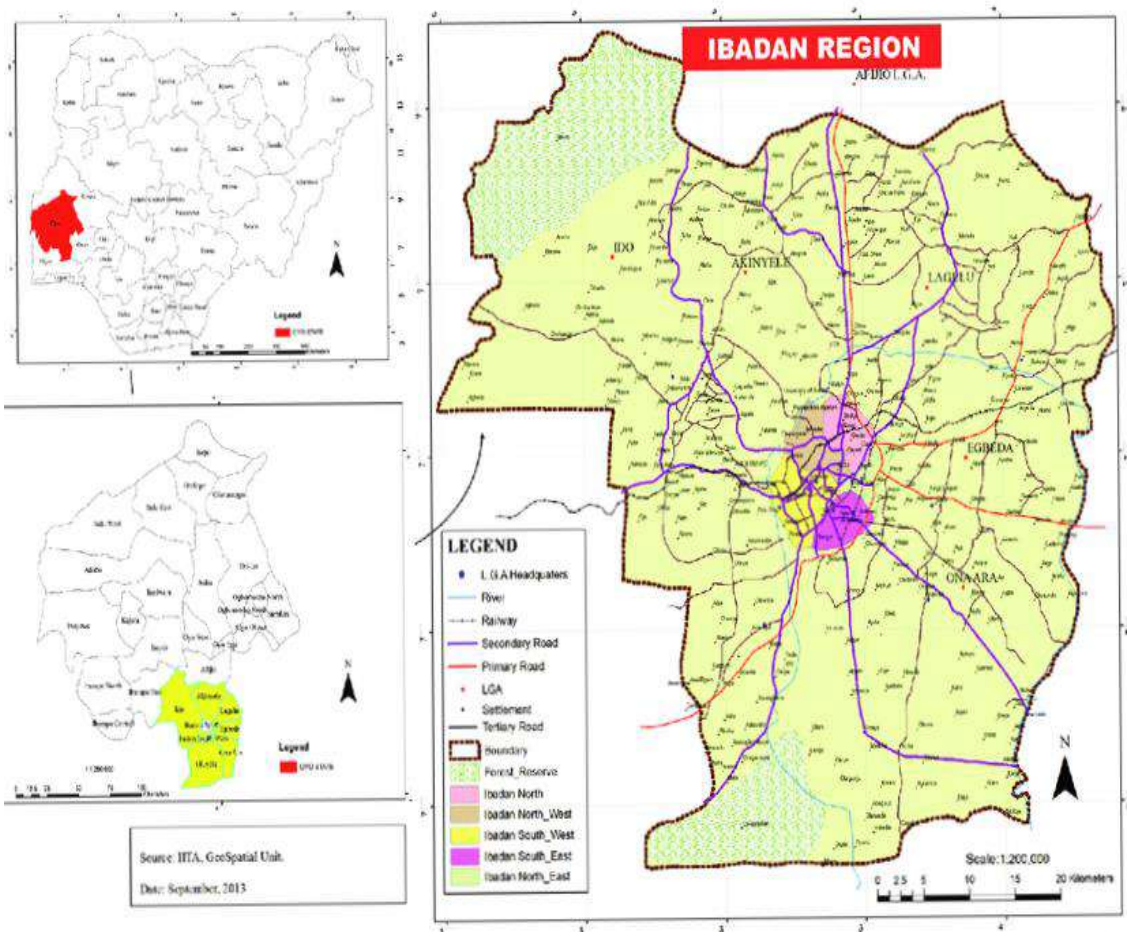

Figure 1: The Study Area

DATA COLLECTION

The primary and secondary data were used for this work. Data is the backbone of any work, which is carried out in the research process. The primary source of data for this research was first-hand information gotten for the research. This was in form of responses gotten from respondents through the use of an interview and questionnaire. Furthermore, secondary source of data is referred to as data already collected and documented in books, progress reports, annual reports, financial records, electronic formats and other relevant medium which are normally stored in libraries and archives. Secondary source of data for the purpose of this study was derived from books, articles, journals, newspaper editorial, YouTube which was related to the topic under consideration.

STUDY POPULATION AND SAMPLING PROCEDURE

The study areas were four food markets: two from the urban center and two from the rural markets. They were critically selected due to their locations and accessibility all year round. The functions each of them performed are very important. For instance, Sasa market is a major market where pepper is sold in Ibadan. Omi-Adio, on the other hand, is a market where fresh produce could be bought. These two are rural and the wastes that are been generated are much. Furthermore, the urban markets with their proximity to government parastatals has given them advantage over the rural markets in terms of provision of WASH infrastructures.

Study Population for this study included officials from the markets leaders and market

participants. The market participants are buyers and sellers. The buyers were tracked by asking them questions or oral interview to know their status. Reconnaissance survey were made to each of the markets prior to the data collection. Through the survey, the market structures were observed and photographs taken. Again the survey provided the researcher with insights into the stakeholder of the markets and their structures. It is the view of the researcher that the market participants, along with the market officials, who have responsibility to maintain sanitation and hygiene, are directly relevant to the subject matter of this study. The sellers in the markets targeted were essentially those who have permanent or semi-permanent structures or sheds, from the observations of the researchers, permanent structures are the stores, stalls, fixed tables and shed from where sellers conducted their businesses. It is the users of those structures that were targeted to constitute the population of the study.

DATA ANALYSIS

Responses from survey's questionnaire were coded and entered into a Statistical Package for Social Sciences (SPSS 16th edition) for analysis. simple descriptive analysis provided the frequencies and percentages of socio-economic variables and indicators for water, sanitation and hygiene access. The study variables were generated based on the benchmark for indicators for access to WASH which were designed to measure progress towards the achievement of the SDGs (UNICEF, strategy for Water, Sanitation and Hygiene 2016-2030, 2016). Initial frequency results of the analysis were transformed into binary format in order to accommodate the benchmarks of "acceptable" and the "unacceptable" value labels of such variables.

The recoding exercise provided the opportunity for inferential statistic in order to determine what factor contributes to access to WASH. This was achieved and analyzed using a regression mode:

$Y= a+ b(x1) + b(x2) + b(x3) + \ldots\ldots\ldots\ldots$

Where x= socio-economic variables

H_{01}- Socio-economic characteristics of users do not have influence on available WASH knowledge facilities that are reliable and users' friendly.

H_1- Socio-economic characteristics of users have influence on their knowledge of available WASH facilities that are reliable and users' friendly.

TEST- Regression

Variables

1. Independent Variables (IDV): Age, Gender, Marital Status, Education
2. Dependent Variables (DV): Having WASH facilities that are desirable and Users' friendly

The Independent Variables were transformed for Regression Analysis by selecting the value label with the highest frequency. For instance, the highest frequency was coded "1" while others were coded "0", viz;

Gender: Female 1, Male 0

Married: Married 1, Others 0

Education: at most Secondary School Certificate 1, Others 0

RESULT

REGRESSION

Variables Entered/Removed[a]			
Model	Variables Entered	Variables Removed	Method
1	Age, Educational Background, Gender[b]	.	Enter
a. Dependent Variable: Having handwashing facilities that are desirable and user friendly			
b. All requested variables entered.			

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.823[a]	.678	.668	.616	.678	66.710	3	95	.000
a. Predictors: (Constant), age, educational background, gender									

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	75.838	3	25.279	66.710	.000[b]
	Residual	36.000	95	.379		
	Total	111.838	98			
a. Dependent Variable: Having handwashing facilities that are desirable and user friendly						
b. Predictors: (Constant), age, educational background, gender						

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.500	.649		6.938	.000
	educational background	2.000	.178	1.550	11.255	.000
	gender	-3.000	.400	-1.173	-7.500	.000
	age	-.500	.082	-.468	-6.086	.000
a. Dependent Variable: Having handwashing facilities that are desirable and user friendly						

DECISION

The ANOVA (F) value of 66.710 at df of 3 is significant at 0.05 alpha level. The t values for age, gender and educational background are also significant. Therefore, the H_{01} is rejected and H_1 is accepted. Meaning Dependent Variables (DV), i.e. having WASH facilities that are desirable and users' friendly are the motivating factors that make users' use the facilities.

Furthermore, Chi- Square Analysis was done to Show differences or similarities between urban and rural markets across the food markets

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
market location * what are the available sources of drinking water	100	99.0%	1	1.0%	101	100.0%
market location * what type of toilet do you make use of	100	99.0%	1	1.0%	101	100.0%
market location * is the toilet closed to the water supply	100	99.0%	1	1.0%	101	100.0%

market location * do you wash your hand	100	99.0%	1	1.0%	101	100.0 %

Market Location * Hand Washing (hygiene)

			do you wash your hand			Total
			yes	No	Not sure	
market location	Sasa	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0 %
		% of Total	10.0%	10.0%	5.0%	25.0%
	Bodija	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0 %
		% of Total	10.0%	10.0%	5.0%	25.0%
	Omi-Adio	Count	11	8	6	25
		% within market location	44.0%	32.0%	24.0%	100.0 %
		% of Total	11.0%	8.0%	6.0%	25.0%
	Oja' Oba	Count	10	8	7	25
		% within market location	40.0%	32.0%	28.0%	100.0 %
		% of Total	10.0%	8.0%	7.0%	25.0%
Total		Count	41	36	23	100
		% within market location	41.0%	36.0%	23.0%	100.0 %
		% of Total	41.0%	36.0%	23.0%	100.0 %

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.996[a]	6	.986
Likelihood Ratio	.987	6	.986

Linear-by-Linear Association	.117	1	.732
N of Valid Cases	100		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.75.			

Market Location * Proximity of toilet facility to water sources

			is the toilet closed to the water supply			Total
			yes	No	Not sure	
market location	Sasa	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%
	Bodija	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%
	Omi-Adio	Count	8	10	7	25
		% within market location	32.0%	40.0%	28.0%	100.0%
		% of Total	8.0%	10.0%	7.0%	25.0%
	Oja' Oba	Count	8	11	6	25
		% within market location	32.0%	44.0%	24.0%	100.0%
		% of Total	8.0%	11.0%	6.0%	25.0%
Total		Count	36	41	23	100
		% within market location	36.0%	41.0%	23.0%	100.0%
		% of Total	36.0%	41.0%	23.0%	100.0%

			what type of toilet do you make use of			Total
			ventilated improved pit latrine	pit latrine with slab	pit latrine without slab	
market location	Sasa	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%
	Bodija	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%
	Omi-Adio	Count	11	8	6	25
		% within market location	44.0%	32.0%	24.0%	100.0%
		% of Total	11.0%	8.0%	6.0%	25.0%
	Oja' Oba	Count	10	8	7	25
		% within market location	40.0%	32.0%	28.0%	100.0%
		% of Total	10.0%	8.0%	7.0%	25.0%
Total		Count	41	36	23	100
		% within market location	41.0%	36.0%	23.0%	100.0%
		% of Total	41.0%	36.0%	23.0%	100.0%

Market Location * Available types of toilet facilities in the market

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.996[a]	6	.986
Likelihood Ratio	.987	6	.986
Linear-by-Linear Association	.611	1	.435
N of Valid Cases	100		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.75.			

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.996[a]	6	.986
Likelihood Ratio	.987	6	.986
Linear-by-Linear Association	.117	1	.732
N of Valid Cases	100		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.75.			

Market Location * Available sources of drinking water in the market

			what are the available sources of drinking water			Total
			borehole	unprotected well	water vendor	
market location	Sasa	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%
	Bodija	Count	10	10	5	25
		% within market location	40.0%	40.0%	20.0%	100.0%
		% of Total	10.0%	10.0%	5.0%	25.0%

	Omi-Adio	Count	13	8	4	25
		% within market location	52.0%	32.0%	16.0%	100.0%
		% of Total	13.0%	8.0%	4.0%	25.0%
	Oja' Oba	Count	13	8	4	25
		% within market location	52.0%	32.0%	16.0%	100.0%
		% of Total	13.0%	8.0%	4.0%	25.0%
Total		Count	46	36	18	100
		% within market location	46.0%	36.0%	18.0%	100.0%
		% of Total	46.0%	36.0%	18.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.449[a]	6	.963
Likelihood Ratio	1.453	6	.963
Linear-by-Linear Association	1.054	1	.305
N of Valid Cases	100		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is 4.50.

Bodija and Oja'ba are located in Urban setting, while Sasa and Omi-Adio are located in the Rural areas of Ibadan. The result, however indicated that there is no difference in the four locations of the food Markets in Ibadan whether Urban or Rural. This could be traced to Socio-ecological issues. This means that users of WASH facilities exhibit similar behavior irrespective of the location of the food Market that they operate.

RESULT AND DISCUSSION

This study investigated water sanitation and hygiene (WASH) practices in some selected food markets in Ibadan Nigeria. Five Research objectives were raised and answered. One hundred copies of questionnaire were administered among market men and women at Bodija, Oja Oba, Omi Adio and Sasa market. The data were analyzed using frequency distribution table and percentage.

On objective number one, which is on identifying types and usage of available WASH infrastructure in some selected food

markets in Ibadan. The findings of the study revealed that the major source of drinking water in the urban market area was borehole; Oja'ba 64% and Bodija 32%, while for the rural market area, the available source of drinking is unprotected well and water vendor; Sasa 28% and Omi-Adio 32%. The method of purification of drinking water in the the rural markets are adding alum and adding bleach, i.e 40% for Sasa and 64% respectively, this shows that the market people know the importance of treatment of their water before drinking. In addition, the findings revealed that they clean the storage for storing their water. Sasa market clean their container after 2 days and this accounted for 28% while in Omi-Adio, they clean their water container after5 days and this accounted for 48% of the respondents. In all the markets, they use both cup with handle and bowl to collect water from the storage facility, except for Omi-Adio market with 48% of the respondents using Calabash to fetch water. It was discovered the water storage facility used by the market people are narrow mouthed container; Sasa 36%, Omi-Adio 64%, Bodija 40% and Oja'ba 24% and wide mouthed container; Sasa 32%, Bodija 36% and Oja'ba 36%. The alternative water storage for Omi-Adio is underground concrete brick, which accounted for 32% of respondents.

This corroborates the findings of SDG 2019 which opined that Up to 171 Million people are off the SDG target for access to safety managed drinking water supply services with only 14% of the population having access to safety managed drinking water supply services. The urban markets have access to basic water supply than the rural markets. Accessibility to boreholes is on the increase than pipe borne water which is recorded at 32% for Bodija and 64% Oja'ba, respectively. Even though the use of Geepee tank as reservoir is in the increase, most of these markets do not have access to it, except at Bodija market, which was provided by politicians as their community development project. According to UNICEF NORM report, access to basic drinking water has increased slightly between 2018 and 2019, by comparing National, Urban and Rural. This effect is felt in urban centers among the rich compared to the poor that are majorly in rural areas.

On objective two which is on the profile the socio-economic status/ profile of users of these WASH facilities and infrastructure. The current study revealed that the market people in the rural area (Sasa and Omi-Adio markets) have access to only unprotected water and they do not treat the water before use while the markets people in the rural area (Bodija and Oja'ba markets) have access to borehole water and they use a cup with handle to fetch water while the rural markets people use a bowl to fetch water. Also the markets people in the rural area store their water in wide mouthed container and underground concrete bricks, while the market people in the urban areas store their waters in narrow mouthed containers. There was increase in hand-washing in 2018 to 2019 due to the Covid-19 pandemic. Despite the high awareness of hand-washing times only a few respondents considered hand-washing after using toilet; 36% respondents at Sasa, 48% at Bodija and 44% at Oja'ba markets, while just 4% respondents wash their hands after using the toilet. 44%, 44%, 60% and 80% at Sasa, Bodija, Omi-Adio and Oja'ba respectively consider hand washing after handling dirty material. Furthermore, a small handful don't wash their hands before eating, which is why sicknesses and diseases are in the community. The available data shows that urban centers have access to basic hygiene than those living in the rural centers, which could be attributed to the wealth and education status of the

people. This corroborates UNICEF NORM report 0f 2019 on equity in access to sanitation and services, which the urban centres at 53% and rural at 39%. Furthermore, gender and disability also play major role in access to hygiene. People living with disabilities are at disadvantage in accessing basic hygiene as well as women and girl child, compared to men., which supports UNICEF NORM report of 2019, which put accessibility of people living with disabilities at market and parks at 17%.

In addition, on objective 3 which is on the Service Access Index (SAI) of WASH across the selected food markets in Ibadan. It was revealed from the study that the markets people in the rural area do not have a service access to good toilets facilities to enhance WASH: the sanitation and hygiene available to Omi-Adio market people are Pit latrine with slab is 36% respondents and pit latrine without slab 40% and the market people in the rural area do not have access to any sanitation and hygiene facility; they only make use of bush defection/no toilet which recorded at 4% for Omi-Adio and 20% for Sasa, despite the modern toilet facilities that have been constructed after the fire incidence. This is attitudinal problem. This corroborates the findings of Timothy Obiezu, 2019 who opined that about 25% or more than 47 million Nigerians lack access to toilet facilities and that majority are in the rural areas where many poor people cannot afford to install toilets in their homes. Although sanitation has really improved across the country, although open defecation is still very high. There is an increase in access to sanitation services in 2019 compared to 2018. There was an increase of 6.6 million person accessing basic sanitation facilities. But about 25% of the population still practice open defecation, with the worst scenario found in rural areas. About 44% of the populations have access to basic sanitation services, with the rural centers recording the highest in the years under review and the urban centers are still engage in open defecation. The urban centers have more access to basic sanitation then the rural, while open defecation is practiced majorly by the rural.

Furthermore on objective four which is on the access of the level of participation of stakeholders in promoting sanitation in the market, the study revealed that access level of promotion is low, this corroborates the findings of UNICEF NORM report, 2019 who opined that about 27% of markets and motor parks have access to basic water supply services, accessibility for persons living with disabilities is low as only 17% of the markets and motor parks have improved water supply facilities within the premises and accessible to PLWDs. Most motor parks and markets did not have toilets for public use. Findings on operations and maintenance services in markets and parks showed that only 38% of markets and parks have dedicated committee to serve as custodians and caretakers of WASH facilities in public places. About 14% of markets and motor parks have basic water and sanitation services, but it is an improvement in 2019 over 2018. As usual markets and motor parks in the rural areas are at disadvantaged.

In conclusion on objective five which is on investigating motivation and determinants of use of WASH facilities in selected food market, the study revealed that knowledge about the risk factor of poor sanitation and hygiene is the major motivation for the market people. This corroborates the findings of Water Aid 2015 on WASH and health that noted that increasing access to WASH can contribute significantly to improving health outcomes, and is particularly important to efforts aimed at reducing the burden of disease and malnutrition, as well as relieving pressure on the health care system as a whole.

Most people in the hospital should not have been there if the basics of WASH had been practiced, because most of these illnesses are preventable. Promoting sanitation and hygiene is highly cost effective, especially when combined with other health interventions.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made for markets and public health practitioners;

- Adequate knowledge should be provided to the market people on the importance of proper sanitation. This is important because in all the market, which included rural and urban, there was indiscriminate dumping of waste along the street. This was well pronounced even in Bodija market, that is in the urban centre.
- Adequate knowledge should be provided to the market stakeholders on the risk factors and health challenges associated with poor sanitation and hygiene. This is more important in the rural market, especially at Omi adio, where they still practice open/ bush defecation. At Omi-Adio, for instance, the major river that passes through the market has been turned to wastes dump and defecation area. The same water serves as source of water for people downstream. And once the water has been polluted upstream, there's every possibility of such people to get infected by sicknesses and diseases.
- Good water supply should be provided to the market places so that the market people can practice proper sanitation. The rural market is mostly affected by this in that their major source of water is unprotected well. And most times, people use bad drawers to fetch water from the well and because it's not protected, other unwanted materials could fall into the well without the knowledge of the people. The result of this is pollution that tend to cause sickness and diseases for users, like diarrhea. It is not out of place if those wells could be protected with the construction of either iron or concrete slab as the case may be.
- A modern toilet should be provided at the strategic places in the markets so as to reduce bush defecating. This is important in the rural market, especially Omi-adio market, where bush defecation is rampant. The major toilet at the market is no more functioning. The government should see to this by construction a modern toilet for the market community just a replica of what they have at Sasa market and machinery should be put in motion to see to the maintenance, as this will encourage users to desist from open defecation.
- The rural areas should not be sidelined when distributing sanitation materials as they are also part of the community. Most of WASH incentives only stop at the urban market. Whenever provisions are made for urban centres, rural markets should not be forgotten, since most of these urban markets are served by rural markets via what are been sold. If the latter is neglected, it will definitely affect the former.
- There should be health and sanitation education. It was observed that the surrounding of the public toilet at Bodija market was bushy. This could be a breed for reptiles and other insects which are dangerous to human well-being. Health workers should be put on their toes to make sure the educate market people on dangers associated with dirty environment, especially in the language they would understand. Most of these market people are ignorant of some of these things and once there are environmental health officers that have been trained to educate or train them, there shall be great improvement in their sanitation practices.

- The weekly environmental sanitation should be well enforced. Many market operators do not see any need to take care of their environment, which has made such places to become breeding places for diseases. Some of these people think, such exercise is for a few people, which is why they neither participate nor join hand with the officers in charge. For instance, the Oyo state government has put it in place that every Saturday between the hours of 7am-9am should be used for this exercise, but some see it as a time of rest, whereby they won't come to their stall until after the exercise. Environmental officers in charge of this exercise should be empowered to prosecute any erring market user.
- The government should provide waste bins in strategic and accessible locations in market areas, where wastes generated by market users could be dumped. And once the wastes are ready for disposal, time are not wasted before they start posing nuisance to the environment.
- Government should fix all drainages that have broken down. For instance, the main drainage that carries liquid wastes at Oja'ba has been destroyed. The wastes are no longer flowing as it should be. This stagnant water has become nuisance in the area and has become breeding place for mosquitoes and other water borne insect causing diseases and sicknesses. See plate 4.18
- Government should endeavor to assign task force health officers at strategic locations, especially in areas that are prone to indiscriminate dump of wastes. If people know that they are been monitored ad would be brought to book as offenders, they would desist from such act.

It has been observed that dump sites are not adequate enough. For instance, there is only one dump site at Apete axis for the whole of Ido LGA, which is not readily available for usage. It should be operated and coordinated in such a way that people could gain access to dispose their wastes. In the same vein, there is only one dump site at Moniya, for the whole of Akinyele LGA. This is why people have resorted into dumping their wastes, indiscriminately.

CONCLUSION

Food markets play a very important role in the socio-economic development of a city in terms of sanitation and hygiene which are part of the deriving factors for the well- being of the populace. It could be observed from this study that the sanitation level of market people is low, and the availability of water and sanitation resources differs in both the urban and rural markets. The study also depicted that the promotion of sanitation by stakeholders is very poor which must be enhanced, therefore markets people need to be given enough motivation to exhibit good sanitation. This study concluded that, sanitation regulations and law enforcement plays crucial role in ensuring good environmental condition. The study revealed that, the main driving force for poor environmental conditions experienced in the market is attitudinal. Whatever efforts made so far failed to bring about significant attitudinal change and awareness creation on environmental sanitation in the market. Even though WASH facilities in these markets are inadequate, most market users prefer to defecate in the open. Until this attitude is changed, and people are told that poor hygiene can cause health breakdown, people would not see the need to keep their environment clean. This cannot come cheaply unless everybody sees this as what should be done collective, we might not get the change we all desire. Hence, we should all see this as a collaborative effort, between men to women, young and old!

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AN INVESTIGATION INTO THE ENERGY USAGE IN NIGERIAN PUBLIC BUILDINGS.

[1]Olasunkanmi Ezekiel, OLAGUNJU, [2]Funmilayo Mokunfayo ADEDIRE, Saudat, Oluwakemi, AJIJOLA

[1 2]Department of Architecture, Lead City University, Ibadan. Nigeria

Abstract

Nigeria is currently facing significant challenges in managing its energy resources, which include heavy reliance on non-renewable energy sources, inefficient energy use in public buildings, and environmental concerns. This research emphasizes the urgent need to address these issues and explores potential solutions. The study identifies the key energy management problems in Nigeria's public facilities, focusing on excessive energy consumption, and lack of efficiency. The main goal of this investigation is to propose strategies and guidelines to reduce energy consumption, improve efficiency, and promote sustainable energy practices in public facilities across Nigeria. Using a comprehensive approach, this research reviews existing studies on energy conservation in Nigerian public buildings and conducts economic and environmental impact assessments to evaluate the feasibility of the proposed measures. The findings reveal significant potential for energy conservation in Nigeria's public facilities and highlight specific actions to reduce energy usage, lower operational costs, and mitigate environmental effects. Additionally, the study underscores the economic and environmental benefits associated with these initiatives. This work not only explores opportunities for energy conservation in the public sector but also in electricity production and distribution, advocating for a more sustainable and efficient energy landscape in Nigeria.

INTRODUCTION

The phrase "public facilities" originated in the United Kingdom, where it refers to amenities provided by the government or other social institutions (Hussaini et al., 2023). These encompass a wide range of services such as urban healthcare, education, cultural and recreational activities, transportation, sports, administration, financial services, and community services. Public facilities are integral to urban life, and their design should prioritize practicality to ensure they function effectively. Furthermore, these facilities serve as a representation of the city's identity, with distinctive architectural designs contributing to aesthetics and cultural character. They play a vital role in supporting government services and functions, promoting community growth, and enhancing residents' quality of life.

In recent years, policymakers at various government levels have become increasingly aware of the imperative to transition to sustainable energy practices, driven by the urgent need to address climate change(Wang & Lo, 2021). This transition necessitates a comprehensive examination of the entire energy flow, encompassing primary energy sources, energy conversion, transmission, distribution processes, and final energy consumption. (Gielen et al., 2019) also stated that it is crucial to recognize that energy transformation, transmission, distribution, and end-use processes all entail losses and inefficiencies. While earlier stages of energy efficiency primarily focused on technological advancements, the fourth and final phase, explored in this study, calls for a combined approach, integrating both technical and non-technical measures to influence consumer behavior and lifestyle.

Energy efficiency has gained paramount importance in all aspects of national development, particularly in public buildings.

This significance arises from the substantial energy consumption in public buildings, which significantly impacts operational costs and the comfort of building occupants. Notably, energy efficiency has become critical in the public building sector in Nigeria, where it is associated with high energy/power consumption rates and challenges related to energy efficiency, as highlighted by (Sambo, A. S. 2010).

Energy holds a central role in virtually every aspect of human activities (Litardo et al., 2021), with daily tasks relying heavily on energy resources. Whether for domestic, agricultural, industrial, commercial, or official purposes, energy is indispensable. The disparities in energy access between developed and developing or underdeveloped nations underscore the importance of energy in national development. Developed nations, with greater energy access, typically utilize more energy than their developing counterparts. Addressing energy poverty is essential for nations seeking to combat poverty and promote sustainable development. Energy efficiency does not advocate for reduced energy usage but emphasizes using energy in ways that minimize the energy required to deliver services effectively.

The majority of energy consumption in buildings can be attributed to electrical lighting and appliances, which substantially contribute to energy bills. Enhancing building energy performance necessitates better utilization of procedures and tools, particularly in the context of electrical appliances. Using energy-efficient appliances can significantly reduce the energy needed for services such as lighting, cooling, heating, manufacturing, cooking, transportation, and entertainment. Energy-efficient products enable consumers to achieve more with less energy (Uddin & Rahman, 2012), resulting in substantial energy savings.

End-use efficiency encompasses devices, methods, or procedures that enhance the effective use of energy at the consumer level. It extends beyond electrical devices to include various aspects of efficiency, such as measures to improve building insulation for better thermal regulation. Utility companies providing electricity can also play a pivotal role in promoting energy efficiency through demand-side management strategies, including load shifting. Two major approaches to energy efficiency are the technological approach, which involves adopting more efficient technologies, and the behavioral approach, which focuses on changing consumer behavior to reduce energy waste.

Energy-efficient considerations should be integrated into every stage of the building design process to create structures with low operating and maintenance costs. Achieving energy efficiency has far-reaching benefits: building developers can construct more affordable and straightforward structures, landlords can justify higher rents due to lower operating costs, tenants benefit from reduced operating expenses, and building occupants enjoy improved indoor environments that come with energy-efficient design.

According to (Igbinosun et al., 2021) the Nigeria's energy sector is characterized by nine government-owned electricity generating facilities, including hydroelectric and thermal stations with a combined installed capacity of 6000MW. However, these facilities operate significantly below their capacity due to various challenges, from gas supply issues to inadequate maintenance. Nigeria presently produces approximately 2000MW of electricity, with some exported to neighboring Niger Republic, where

electricity access remains limited. Despite efforts to commission additional gas-powered stations, the energy supply remains insufficient, underscoring the imperative of adopting an energy-efficient culture.

LITERATURE REVIEW

ENERGY SOURCE IN NIGERIA

Nigeria is the continent's top oil producer and the fourth-largest exporter of liquid natural gas in 2012 (NESP, 2014). However, the majority of this production is currently exported and only a small portion is imported back into Nigeria in refined form. Nigeria produced 159Mtoe of oil and gas in 2011, but only used 20.5Mtoe of it, making up 17.4% of the country's total raw energy consumption. The production of hydroelectricity makes up about 0.5Mtoe (0.4% of the total energy used). There are coal reserves as well, though they haven't been widely used yet. In Nigeria, biofuel and waste account for the majority of the remaining energy consumption (82% in 2011), primarily in the form of firewood burned for cooking and water heating. The use of fossil fuels has remained relatively stable over the past twenty years, as shown in Figure 2, presumably as a result of costs and inadequate infrastructure to deliver oil and gas to domestic users. In many parts of Nigeria, the rate at which firewood is consumed far outpaces the rate at which it is replenished, making the situation unsustainable and contributing to desertification.

ENERGY EFFICIENCY IN NIGERIA

There is a lack of trustworthy information on the energy consumption of buildings, in part because the mains electricity is not accurately metered and in part because the majority of buildings also use gasoline and diesel generators to generate electricity, which makes assessments more difficult. Professor Chinedu Nebo, a former minister of power, estimated that 55% of Nigerians who use electricity are not metered in the late 2014 (Nebo, 2014). This is acknowledged as a significant impediment to energy efficiency, and actions are being taken to ensure the installation of suitable meters. According to (Oyedepo S.O.,2013) energy is Nigeria's main driver of socioeconomic progress and economic expansion. It contributes significantly to the country's foreign policy and serves as a tradeable good that generates national income that is used to fund government development programs (Sambo S.A.). The nation's industry, transportation, agriculture, health, and education sectors, as well as commercial and official activities, also use it to produce goods and services (Community Research Development Centre). The industrial, transportation, commercial, agricultural, and residential buildings (household) sectors can be distinguished by how much energy they use.

Energy efficiency improvements are the least expensive way to improve Nigeria's current and future energy supply as the grid tries to catch up with demand in the face of a persistent lack of electrical generation and transmission capacity. Despite having abundant renewable energy resources like wood, solar, hydropower, and wind as well as sustainable energy resources, Nigeria's energy use is incredibly inefficient (Oyedepo S.O. 2013). In Nigeria, inefficient energy use has some serious repercussions, as major energy supply infrastructure has been invested in at a much higher rate than energy demand, and large energy consumption has exacerbated the environmental issues related to inefficient energy use. Buildings in Nigeria consume more energy than is necessary to meet their needs, resulting in significant energy waste. The use of outdated and ineffective appliances and equipment in buildings is one of the causes. If energy is

effectively managed and used, Nigeria would benefit significantly on the economic, environmental, and security fronts. The energy demand in buildings would be decreased by implementing energy efficiency practices through the implementation of policies.

According to (Emodi N.V. and Boo K.J., 2015) Nigeria currently lacks mandatory energy efficiency standards and policies for both the building and industrial sectors. Therefore, a significant obstacle that particularly prevents the mainstreaming of energy-efficient appliances in buildings in Nigeria is the absence of an effective energy efficiency policy. Energy efficiency policy implementation in Nigeria has been hampered by a number of obstacles, including low awareness and general ignorance, affordability issues, a lack of government support, a lack of financial incentives, and unstable electricity supply. To increase the effectiveness of our homes and conserve the current energy generated in the nation, government policies should encourage investments in energy-efficient technologies and practices (Umar D.A. and Abubakar M.M. 2014).

IMPORTANCE OF ENERGY EFFICIENCY

In numerous global economies, energy efficiency has emerged as the primary driver of sustainable development. Efficient energy usage translates into potential savings in personal income, as households won't need to allocate as much of their budget to energy expenses. This, in turn, can prevent the necessity to construct additional power plants, freeing up resources to be invested in other sectors of the economy. Furthermore, improved energy efficiency allows for broader energy access, as saved energy can be distributed more widely across the country. In Nigeria, energy supply experiences fluctuations due to utility companies' inability to meet the simultaneous demands of all consumers (Jimah et al., 2019). Effective energy management in both the public and private sectors can negate the need for backup electricity supply.

The majority of the energy generated in Nigeria relies on fossil fuels, primarily oil and gas, which also results in the emission of greenhouse gases (GHGs) (Uddin et al., 2011) proportional to the amount of electricity produced. Enhancing energy efficiency can reduce our dependence on petroleum to fuel the economy and mitigate GHG emissions. Smart energy usage can also reduce the adverse environmental impacts associated with energy production.

Intervention programs can play a significant role in promoting energy-efficient behaviors among the population, potentially leading to increased employment opportunities. In response to this demand for energy-efficient practices, companies in the electrical appliance sector may engage in competition to develop the most efficient appliances, aiming to attract consumers seeking eco-friendly options.

ENERGY EFFICIENCY PRACTICES IN NIGERIA

As a critical component of production, energy should be managed in conjunction with land, labor, and capital. It's important to note that the cost of supplying energy can often be significantly higher than the cost of conserving it. Therefore, prioritizing energy-efficient production methods can be seen as a swift and cost-effective means of augmenting our energy resources. Energy efficiency now encompasses both the overall economic efficiency of the energy system and the physical efficiency of technical facilities and

equipment, as highlighted by (Unachukwu, G.O., 2003)

Energy efficiency entails making changes to processes and products to reduce the amount of energy needed to provide services such as lighting, cooling, heating, manufacturing, cooking, transportation, and entertainment, among others. Essentially, energy-efficient products empower users to achieve more with less energy, as mentioned by Schutze, E., and Worthington, R. Another definition, offered by Rosen, M.A., characterizes energy efficiency as the practice of achieving the same level of service with less energy consumption. In this context, energy efficiency can be considered a resource and is often seen as a significant, financially advantageous option for near- to mid-term energy supply. Investments in energy efficiency not only add economic value but also contribute to protecting the resource base and mitigating environmental concerns, particularly when coupled with pollution prevention technologies.

On a global scale, energy efficiency has emerged as a primary driver of sustainable development, as noted by (Etiosa, U., 2009). Improved energy use efficiency can reduce the necessity for constructing additional power plants, allowing resources allocated for power plant construction to be redirected to other sectors of the economy. Furthermore, enhancing energy efficiency can enable the distribution of energy from regions with savings to those with higher demand. In Nigeria, energy supply experiences fluctuations due to utility companies' inability to meet the simultaneous demands of all consumers. Effective energy management across residential, public, and private sectors can eliminate the need for backup electricity supply.

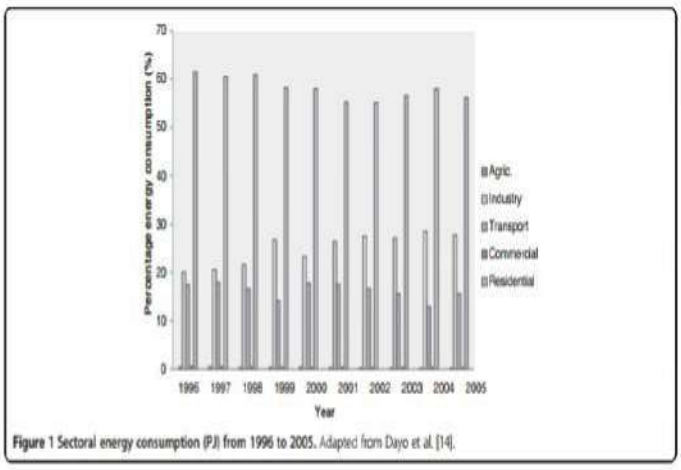

Figure 1: Sectoral Energy Consumption (PJ) from 1996 to 2005. Adapted fromDayoetc Al.

METHODOLOGY

This review article delves into the energy consumption patterns within public buildings in Nigeria. Its primary focus lies in identifying relevant articles that shed light on the challenges associated with energy efficiency and conservation across various sectors within Nigeria's public infrastructure. The research process involved querying the "Google Scholar" database using key terms such as "energy efficiency," "energy consumption," "Nigeria's energy sector," and "public facilities." The inclusion of these keywords in the title, abstract, and full-text of articles served as a criterion for their inclusion in the study. To ensure a comprehensive examination of the subject matter, the initial search was limited to articles published between 1995 and 2023, spanning a period of 28 years. This extended timeframe facilitated a thorough investigation into the persistence and evolution of the energy-related challenges under scrutiny.

FINDINGS AND DISCUSSIONS

Challenges Facing Energy Efficiency in Nigeria

Nigeria is experiencing significant population growth, but the country's expanding energy

needs are not being adequately addressed (Onokala & Olajide, 2020). The current energy policy, which primarily focuses on urban areas, overlooks the critical issue of rural and sub-rural energy demand and supply. This approach is regrettable as it leads to environmental degradation and contributes to global warming due to the widespread use of wood and traditional biomass for energy in rural areas (Okedere & Oyelami, 2021).

The primary objective of supplying energy to urban centers and industrial hubs has resulted in an energy imbalance within the nation's socio-economic and political landscapes. Nigeria struggles to meet the energy demands of its population, especially in rural regions where electricity remains inaccessible.

Two key characteristics define Nigeria's energy crises. Firstly, there is a significant challenge related to the petroleum product market, particularly kerosene and diesel. Despite having five government-owned domestic refineries with a daily processing capacity of 450,000 barrels of oil, Nigeria imports over 75% of its petroleum product requirements. The state-owned refineries have operated at a utilization rate of less than 40% for extended periods in the past two decades. Gasoline is more readily available due to its higher political significance, while kerosene and diesel suffer from ongoing market shortages.

Secondly, Nigeria faces severe electricity-related challenges, despite its abundant energy resources (Jimah et al., 2019). The electricity market, primarily controlled by the government-owned Power Holding Company of Nigeria (PHCN), formerly known as NEPA, has been unable to provide reliable, accessible, and available electricity services in line with international standards. Transmission and distribution losses are significantly higher than global standards, resulting in frequent power outages. Load shedding occurs frequently, even though the peak electricity demand is well below the installed capacity. This situation has a significant impact on the manufacturing sector, with a sharp increase in power outages in recent years.

As a consequence of inadequate service, many customers resort to expensive alternative power sources to mitigate the impact of interruptions on their production activities. Approximately 20% of industrial projects rely on alternative sources of electricity supply.

In summary, Nigeria's energy crisis is characterized by inadequate petroleum product supply, particularly for kerosene and diesel, and severe electricity-related challenges, including high transmission and distribution losses, frequent power outages, and an increasing reliance on costly alternative power sources.

PUBLIC SECTOR ENERGY USE

Government agencies are in charge of a variety of public services, including the provision of infrastructure like harbors, airports, roads, water supply, power generation, street lighting, waste disposal, and sewage systems. Public administration, social services, and health and education services are additional services. A large number of these state- or city-owned public services are significant energy consumers. In contrast to private sector organizations, public sector organizations are typically accountable to the public through a Council or a Parliament. The public generally anticipates the public sector to serve as an example of effective use of public resources to the neighborhood Energy conservation is a crucial component of this. Supply-side efficiency is just as crucial as demand-side efficiency because the public

sector produces electricity frequently. The primary areas of energy use in the public sector are determined by the local environment and its roles within the national system of government, which are typically;

- Lighting- particularly of public areas
- Heating and cooling of buildings
- Public transport
- Construction of roads and buildings
- Sewage treatment and waste disposal

ENERGY CONSERVATION IN VARIOUS SECTORS IN NIGERIA

In Nigeria, there is a growing demand for energy, but the supply is not keeping pace with this demand. Given this situation, it is imperative to prioritize primary energy conservation, rationalization, and efficient utilization. The primary objective of ensuring effective equipment operation is to maximize the conversion of fuel's energy into the working fluid. This not only leads to increased productivity and cost savings but also has an impact on equipment safety, durability, and environmental pollution levels (Habib, 1999). Environmental protection can be achieved by reducing energy consumption or by using energy more efficiently. Actions or recommendations for conserving energy are often referred to more positively as opportunities. Energy conservation opportunities should ideally be both easy to implement and provide a quick return on investment. These opportunities can be categorized into three broad groups based on their ease of implementation and payback periods: maintenance and operational measures, process improvement projects, and significant capital projects (Adeyemo, 2008).

While energy efficiency and conservation are not standalone resources, their adoption in the country can significantly alleviate the supply constraints. Recognizing this, the Federal Government of Nigeria recently approved the establishment of a National Center for Energy Efficiency and Conservation (Sambo, 2008). The Center is tasked with planning and conducting research and development activities related to energy conservation and efficiency. It is responsible for performing the following functions in this regard:

- Create guidelines for the efficient use of energy-saving products and offer guidance on their implementation.
- Establish energy efficiency regulations, standards, and specifications for residential, industrial, and commercial facilities.
- Collect, analyze, and manage data and information related to energy supply and consumption.
- Function as an educational hub for training high-level professionals in energy efficiency and conservation.
- Develop and execute pilot or demonstration projects to showcase energy efficiency principles.
- Disseminate information about energy efficiency and conservation through public awareness initiatives like seminars, workshops, publications, and more.
- Undertake any additional responsibilities directed by the Federal Government concerning energy efficiency and conservation in Nigeria.

ENERGY CONSERVATION MEASURES IN NIGERIA PUBLIC SECTORS

Possible energy conservation measures in office and public buildings include the following:

1. Proper building orientation and symmetry.

The majority of the spaces in the building should be able to receive natural light. By using daylighting to replace electric lighting with natural light, energy consumption is

reduced. In comparison to conventional buildings, daylighting-designed buildings typically use 40% to 60% less electricity for lighting needs.

2. Provision of enough windows for cross ventilation.

Ventilation is crucial in a climate with high temperatures. This will significantly cut down on the use of air conditioners in public areas. Although free and easily accessible, it can be challenging to use sunlight and daylight without creating glare and overheating. By using window sills, louvers, reflective blinds, and other tools to reflect light deep inside the buildings, glare can be reduced. Windows with selective glazing should therefore be preferred as they transmit the most visible light while minimizing solar heat. Through cost-effective building design, there are significant energy savings potentials for office and residential buildings in Nigeria.

3. Lighting

The following are potential energy-saving lighting initiatives in Nigerian offices, shopping malls, and public spaces:

1. Relamping: To save energy, it entails switching out one lamp for another. There are new fixtures that outperform incandescent lamps in terms of energy efficiency, dependability, and longevity. In homes, offices, and commercial and industrial establishments, CFLs are typically thought to be the best replacement for lower-wattage incandescent lamps. The efficacy of these lamps ranges from 55 to 65 lm/W. 10,000 hours is the average rated lamp life, which is ten times longer than the average incandescent. They have a very high luminous efficiency in addition to having excellent color rendering qualities. Moreover, they have the potential to save energy.

2. Installing lighting control systems in bathrooms, stores, and bedrooms. Devices used to dim or turn on lights are known as lighting controls. In bathrooms, shops, bedrooms, and other rarely used spaces, lighting control systems like photocells, timers, occupancy sensors, and dimmers are required. This prevents energy waste in these areas.

3. Street light control

More than half of all electricity used in Nigeria is for street lighting. About 50% or more of this amount of energy is lost due to outdated equipment, poor maintenance, or ineffective use. There is a lot of room for cost and energy savings by increasing light efficiency since street lighting may be the most energy-intensive service that local councils offer. According to a 1999 study by Energy Efficiency Victoria and the Sustainable Energy Development Authority, a combination of the following could significantly improve the quality of street lighting while reducing energy consumption by at least half:

- More efficient lamps e.g., metal halide, compact/tubular fluorescent.
- More efficient luminaries which incorporates reflector design, reduced light loss in the diffuser and more accurate light distribution.
- Efficient ballasts such as ‘low losses or electronic ballasts.
- More accurate control of lighting times e.g., by using an electronic photo-switch.

The amount of electricity required to run traffic lights has steadily increased alongside the growth of urban populations and motorized transportation. The older technology typically uses high-intensity, low-efficiency incandescent lamps with colored lenses that further reduce the lamps' efficiency, and traffic signals are typically on

24 hours a day. The proposed specification for traffic signals by ELI is technology-specific, stating that in order for traffic signal systems to be eligible for inclusion in ELI programs, they must use LED-based products at least for the red signal. Traffic signal LEDs emit colored light, are long-lasting, and save energy. This eliminates the need for colored lenses. It is necessary to either cut back on the amount of electricity the light source uses or the amount of time it is on.

4. Water Supply and Sewerage

The infrastructure for traditional water and sewage systems uses a lot of energy and resources. Embodied energy must be taken into account during the planning process. By using techniques like high-efficiency motors and pumping at the bare minimum pressure necessary, water can be pumped at a lower cost. Managing Energy in Local Government has more advice. Along with the aeration process, pumping is a significant energy consumer in the sewage treatment process. By using dissolved oxygen sensors to control the aeration fan's operation, lowering the pressure drop in air pipes, and using high-efficiency motors, the aeration process can be made to use less energy.

5. Waste management

Most local government bodies are responsible for managing solid waste disposal facilities, and a significant portion of this waste contains valuable materials that can be recycled, utilized for energy generation, or as soil conditioners. Various waste-to-energy initiatives are either currently operational or under consideration. These cogeneration efforts hold the promise of significant cost savings, in addition to delivering positive societal and environmental benefits.

6. Building Design, Insulation and Air Conditioning

Strategic building design or the process of upgrading existing structures can yield substantial energy savings. According to the AGO, constructing buildings with extended lifespans, durability, and adaptability stands out as the most critical approach to mitigating the impact of embodied energy. Many of the principles discussed earlier can be applied to public buildings. Typically, constructing an energy-efficient building from scratch tends to be more cost-effective but also more challenging than retrofitting an existing edifice. It is advisable for all Council-owned buildings to meet stringent insulation standards, especially because many of them are in use for extended periods and are intended to offer a high level of comfort. The energy savings derived from insulation tend to increase with the size of the building.

In office buildings, more than 60% of energy consumption is attributed to heating, cooling, and ventilation (Ifeanyichukwu et al., 2021). For small office spaces, using reverse cycle air conditioners proves to be an energy-efficient heating option, but this may not hold true on a larger scale. Opportunities for savings include regular system maintenance, such as monitoring thermostat settings and sealing air leaks around doors and windows. The use of blinds can also contribute to insulation efforts. During the winter, lowering blinds at night or on cold days can help minimize heat loss.

7. Interior Lighting

Numerous strategies are available for reducing energy from indoor lighting. These include:

Operate lights only when required: Although the majority of Councils adhere to this policy, it is unlikely that "turning off" is always used.

When a room is empty, occupancy sensors that are mounted near doorways and are inexpensive turn off the lights.

Use of an efficient light source: If artificial lighting is controlled, increasing daylight levels can reduce electrical lighting loads by up to 70%. Skylights increase user satisfaction in the workplace and are cost-effective. Although more expensive, compact fluorescent lights can cut lighting costs by up to 80%. A typical 36-watt fluorescent lamp costs about $2 to purchase, but it costs about 10 times as much to run for just one year in a building. In comparison to a compact fluorescent, it also has a shorter lifespan, lower efficiency, poorer light quality, and a faster rate of performance degradation. A traditional recessed fluorescent lamp fitting with a diffuser made of acrylic plastic distributes about 50% of the light the lamps produce.

Lighting systems require regular maintenance: fluorescent lamps have a propensity to be kept until they are no longer useful, by which time they may be producing only one-third of what they did when they were brand-new. The following benefits are made possible by routine maintenance programs, which include window cleaning:

- light quality of the built environment is maintained
- tendency to add more light fittings because of falling light levels will be avoided
- bulk lamp replacement facilitates recycling through a special lamp crusher.
- When lamps are changed one at a time, the mercury they contain ends up in landfills, contaminating the environment.
- Light-colored walls, ceilings, and furniture reflect more light into work areas, requiring less artificial lighting to achieve the desired luminance. For this reason, the walls in many government buildings are painted white.

8. Office Equipment

Even though computers and related equipment only contribute a small amount to energy use, energy efficiency in this sector will result in significant savings. Energy use can be affected by:

- Specifications established for new equipment.
- The extent to which energy saving features are utilized.

Policies for purchases are crucial. An international standard for energy-efficient equipment called "Energy Star" can cut the energy consumption of specific products by more than 50%. This category of printers and fax machines can reduce electricity consumption by over 65%, saving about $20 per unit annually in electrical costs. For savings to be realized, energy features must be installed and used, though. One of these functions is "sleep mode," whereas "screen savers" do not reduce electricity consumption (Energy Smart Schools Computer Related Equipment). When not in use frequently or overnight, all electrical equipment should be turned off. When buying equipment, there are a number of additional factors to take into account. To reduce energy waste from idle times, it is worthwhile to compare the photocopier's rated volume with its actual copying volume before buying. Taking into account various "styles" of technology, such as laptop computers that consume a tenth as much energy as desktop PCs. Energy savings can quickly offset the additional cost of the machines.

CONCLUSION

Energy management should be integrated with the management of land, labor, and

capital, as it plays a pivotal role in production. Given that the cost of energy provision can far exceed the cost of energy conservation, it is crucial to consider energy-efficient production methods as a swift and cost-effective means to augment our energy resources. Energy efficiency now encompasses not only the overall economic efficiency of the energy system but also the physical efficiency of technical facilities and equipment. Consequently, Nigeria's key economic sectors, including housing, industry, and transportation, stand to benefit greatly from the adoption of energy-saving measures. These measures not only mitigate greenhouse gas emissions but also advance sustainable development and reinforce corporate social responsibility. Aggressive campaigns for energy efficiency measures are imperative within the Nigerian economic landscape.

This work presents opportunities for conserving energy in public sectors, electricity production, and distribution. These opportunities encompass energy-saving practices in cooling systems of public buildings, lighting, transportation, office equipment, electrically operated industrial machinery, and heat engines like pumps, motors, fans, boilers, etc. Various areas for potential energy savings have been identified in this study, along with guidelines and measures to implement them rigorously. Adhering to these guidelines and measures promises substantial energy savings.

To ensure the sustainability of the nation's energy supply and, consequently, sustainable economic development, it is imperative for the government to intensify the implementation of renewable energy and energy efficiency programs.

RECOMMENDATIONS

This study's findings highlight the importance of integrating energy efficiency and renewable energy as essential components for achieving sustainable development in Nigeria. To promote sustainability, it is imperative to employ energy-efficient products and adhere to appropriate procedures in conserving the nation's current energy resources. Therefore, the following recommendations are proposed for the nation to consider:

a) Develop energy-efficiency policies and integrate them into existing energy regulations. A comprehensive and cohesive energy policy is essential to guide the population towards the efficient utilization of the country's energy resources.
b) Promote the adoption of energy-efficient products and practices among end users and energy producers.
c) Raise public awareness about energy efficiency and renewable energy sources.
d) Establish an entity dedicated to promoting the use of energy-efficient products and ensuring compliance with appropriate procedures.
e) Innovate and embrace energy-efficient technologies.
f) Conduct a resource survey and assessment to determine the country's overall potential for renewable energy and to identify local conditions and priorities in various ecological zones.
g) Establish a testing and evaluation laboratory for renewable energy technologies.
h) Create effective incentives to encourage the implementation of energy efficiency policies.
i) Encourage the adoption of clean energy facilities across different sectors of the Nigerian economy.
j) Below is a partial list of potential clean energy opportunities in Nigeria:

k) Enhance the utilization of solar technologies in the public building sector, making it more efficient and comprehensive.
l) Implement energy-efficient lighting systems.
m) Utilize solar and wind energy for irrigation water pumping and electricity generation.
n) Convert agricultural residues into electricity.
o) Generate biogas from waste produced by livestock and animal husbandry.

In addition to these, the current institutions for technology development and research and development should be adequately strengthened to support the transition to a greater use of renewable energy sources. The focus of project development, project management, monitoring, and evaluation should be on human resource development, the transfer of critical knowledge, and know-how. It should be a top priority to create standards and codes of conduct, maintenance manuals, life cycle costing, and cost-benefit analysis tools.

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ASSESSMENT OF CIRCULATION CONDITIONS IN A SHOPPING MALL IN IBADAN SOUTH WEST, OYO STATE, NIGERIA

Ogechukwu Emmanuel, Odor[1] and Babajide Sunday, Aseyan[2]

1. Department of Architecture Lead City University Ibadan, Odoremmanuel@yahoo.com
2. Department of Architecture Lead City University Ibadan, aseyan.babajide@lcu.edu.ng

Abstract

Shopping malls are centers or places where citizen of all classes of people regardless of ability or disability, age, race, ethnicity, social-economic level has access to goods and services. Usually, such centers experience high activities culminating into high human (pedestrians) and vehicular movements. Circulation in shopping mall is synonymous to the role it plays; this movement usually generate congestion when they are not properly organized. Most of existing shopping malls in the study area are faced with circulation challenges in both exterior and interior parts of the building. The study areas are selected shopping malls in Ibadan Oyo State. Mitigating this menace, this study had sort to evaluate the existing architectural scenarios in existing shopping malls and thereby proffering architectural measures to ameliorate and enhances them for better performance.

The outcome of the selected case studies, when descriptively analyzed showed major deficits in meeting the universally acceptable design strategies of a shopping malls that meets the needs of shoppers without inhibition. Thus, the study therefore recommends some strategies that should be followed in the designing of shopping malls in Nigeria, which include among others the importance of good circulations both indoor and outdoor spaces of a shopping mall.

Keywords: Circulation (Vertical and Horizontal), Architecture of Public Space, Accessibility, Shopping Mall Classification.

INTRODUCTION

Circulation in architecture can be expressed as circulation within spatial unit, vertical circulation and horizontal circulation which play an important role in our emotion towards the building. Circulation is vital in public buildings. They are designed and strategically positioned for the optimum flow of people through a building and for convenient interaction with the circulation elements such as staircases, corridors, elevators, parking lots, and so on. Accessible route describes a route taken by pedestrians that is accessible. With little exception, the accessible routes connect the available areas of the building to the public right of way, public transportation stops with buildings that have accessible entrances to elements and places that are accessible both on the site and within the structure, including each story and mezzanine (Janis, 2019).

Equipped appropriately designed environment with circulation elements are supposed to enable all users to achieve positive experiences. Although, as generally observed, some public spaces such as shopping malls, most times, do not provide adequate accessibility of people for the comfort of the users of these buildings. The quality of our interactions with the building and

its environment can be better supported if we see public space such as mall as well-being and positive engagement place. However, this positive engagement level is not evident for persons with disabilities (Poldma.et al, 2014). The universal approach adopted in the design of the built environment allows full access to persons into the interior and exterior of these public spaces regardless of age or ability. Every user of the open space must enjoy social participation. Social participation is defined as the capacity to pick and move around uninhibitedly in one's surrounding and to perform any activity, including utilizing lodging, work, transportation, and social scenes (Ward, Mitchell, & Price, 2007). However, more often than usual, building environments may deny access to some, while allowing access to others.

According to International Council of Shopping Centre, (2010), shopping centre is a group of retail and other commercial establishments that is planned, developed, owned and managed as a single property, typically with on-site parking provided. Architect Victor Gruen established shopping mall ideas (Gruen, 1973). He had in mind a combination of different uses of the city, ranging from commercial to social in a whole unique building. Still, over the years, the non-commercial functions have been scrapped by shopping mall owners to make the malls much bigger than the way they used to be (Jorge, Ester, 2017). The aim was to make more profit while ignoring some other vital issues, especially the ones related to circulation.

In the architectural design or pattern of the public buildings such as shopping malls, circulation is very essential with serious concern.

According to Azuine (2005), human circulation within a building if not properly organized tends not only to create a disorderly state but also endanger human lives, especially when there is conflict between human and vehicular circulation. He further opined that human and vehicular circulation is a major concern, because failure to achieve proper resolution of human and vehicular movement will hamper efficient operation of the center. In view of these, one of the primary challenges in a shopping center is achieving effective and organized circulation pattern for both human and vehicular movements and accessibility measures.

Thus, in the study areas, most of the existing shopping centers are faced with circulation challenges. The prevalent circulation pattern lacks orderliness and clarity. This research seeks to study, the circulation system in existing shopping malls in stated region to identify inadequacies in building's circulation

and produce improved movement conditions for designing a shopping mall.

LITERATURE REVIEW

The shopping mall is a global phenomenon that has its roots in ancient outdoor bazaars where people would go to buy goods from local artisans, farmers and craftsmen. The shopping malls that we know today were birthed in the beginning of the 20th century and have since cover the major cities of the world in a few different forms. Not only has the shopping mall become a place to find and purchase goods, it is also known as a cultural hot spot where people of all ages can come to interact.

The first structure which is considered to be a "shopping mall" in the present-day is located in The City of Damascus, the capital city of Syria. It is called Al-Hamidiyah Souq in old Damascus and dates back to the seventh century.

CLASSIFICATIONS OF SHOPPING MALLS

- According to BOZDEMİR (2021), the International Council of Shopping Centers (ICSC) was established in 1957 in order to lead the development of shopping centers, to encourage architectural design research and to ensure correct management good through circulation system. The council evaluated the shopping mall concept, on the basis of size and capacity. Shopping centers are generally evaluated with their structural size, diversity, and use as economic and cultural symbols as well as their spatial characteristics. In addition, ICSC classifies Shopping Centers by their orientations and locations. ICSC has made different classifications for the United States (USA) and European countries with different parameters in order to improve the spatial structure and standards of shopping centers. Classification for European countries is defined as standard [Extra Large, Large, Medium, Small Scale] and featured [Retail (Large, Medium, Small), Factory Sales and Themed Centers] according to construction area, size of leasable area, number of main stores and commercial domain (Terece and Geç, 2019). While, the classification of the shopping malls in the USA is; Open-Air Centres (Neighbourhood, Community, Life, Power, Themed, Outlet Centres) and Indoor Shopping Centres (Regional, Super-Regional Centres) which are defined in two groups according to their designed size, location and concept (Terece and Geç, 2019).

Table 1A: Classification of shopping malls in Europe according to ICSC Standards

	Shopping Centre Type		L.A. (m^2)	Description
Standard	Very large scale		80.000 ≥	At least 3 main stores, area of influence 8-40 km.
	Large scale		40.000-79.999	At least 2 main stores, area of influence 8-24 km.
	Medium scale		20.000-39.999	Supermarket and main store (daily need), area of influence 5-10 km.
	Small scale		5.000-19.999	Supermarket and at least 2 main store, area of influence 5-10 km.
Features	Shopping parks	Large	20.000 ≥	Designed in a traditional street-street layout, it is compatible with traditional art structures
		Medium	10.000-19.999	
		Small	5.000-9.999	
	Factory Outlets		5.000 ≥	It consists of stores where discounted products are sold. It is generally far from the city centre.
	Theme centres		5.000 ≥	A small number of large stores were created by combining architecture and products in one theme.

	Type	Concept	Size (m^2)
Open-Air Centres	Neighbourhood Centres	Daily needs	3.000-15.000
	Community Centre	General goods, daily needs	10.000-35.000
	Life Centre	Luxury shops, food, entertainment	15.000-50.000
	Power Centres	Big store, few tenants	25.000-60.000
	Themed Centres	For leisure, tourist-targeted	8.000-25.000
	Outlet Centres	Factory outlet	5.000-40.000
Indoor Shopping Centres	Regional	General goods, fashion	40.000-80.000
	Super-Regional Centres	Similar to regional but more variety	80.000<

Table1B: Classification of shopping mall in the USA according to ICSC standards

- **Classification According to Function, User and Product Orientation of Shopping Centers.**

Today, shopping centers have different functions with change and development as well as shopping action. A new classification has been defined according to the function, user and product-oriented nature of shopping centers in Turkey, by making use of ICSC standards, as structures on which the user and the product are fundamental. Accordingly, shopping malls are classified into four groups as Shopping-Oriented, Shopping and Entertainment-Oriented, Shopping and Living Centre and Mixed Functionality according to their relationship with the physical environment, and into three groups as Product-Oriented, User-Oriented, and User-and Product-Oriented according to their user-and product-oriented nature.

Table 2: Classification According to Function, User and Product Orientation of Shopping Centre

CLASSIFICATION	FUNCTION	DESCRIBE
ACCORDINGS TO ITS RELATIONSHIP WITH THE PHYSICAL ENVIRONMENT	Shopping-Oriented	They are the traditional shopping malls. Social activity is limited.
	Shopping and Entertainment-Oriented	The main function is shopping and the side function is entertainment.
	Shopping and Living Centre	It has two different functions together.
	Mixed Functionality	It has functions such as housing, business, entertainment, shopping, education, etc.
ACCORDING TO USER AND PRODUCT ORIENTED	Product-Oriented	It serves with variety and brand superiority.
	User-Oriented	According to age, income level and expectation (Outlet, VIP, Child-Amusement Centres).
	User-And-Product-Oriented	They are specialized centres managed from a single centre.

CIRCULATION SYSTEM IN A SHOPPING MALL

In architecture, circulation refers to the movement and interaction of individuals with a building environment. Circulation is vital in public buildings. They are designed and strategically positioned for the optimum flow of people through a building and for convenient interaction with the circulation elements such as staircases, corridors, elevators, parking lots, and so on by Bukola A. and Marvelous O., 2021. According to American Planning Association, 2018 Circulation is a basic need in creating enabling and conducive shopping environment. It is the second principal aspect when designing because it allows the living and organizing of space. Selecting, planning and developing a shopping centre should be an organized and rational process that is based on adequate and accurate information (Review: Gould, 2015). In a shopping centre were lot of customer's troop in to make their shopping, proper circulation should be provided to ensure the efficiency of the centre, Bacham (2013). He further maintains that the inherent problems of pedestrian circulation in buildings are prime generators of Architectural response. Knorr (2009) opines that circulation also means the pathways through a floor plan, these pathways are how we experience architecture, and the design of these pathways has enormous effect on the success or failure of a plan. Stating further that the circulation space ought to be as interesting as any other part of a building.

As an architectural planning process, circulation can be described as communication among differentiated spaces and between the exterior and interior of a building which may be achieved by opening in the simplest plan. However, not all building requires distinct spaces allotted to horizontal and vertical circulation.

The circulation pattern in any architectural development required for human activity is quite crucial because it is through movement that we enjoy architecture as a three-dimensional experience and also feel the space satisfaction. Without movement, architecture is

merely a stage set; entertaining to look at, but with no direct relationship to user (knorr, 2019). To buttress this, simond et al, (2019), pointed out that "most constructions have meaning only to human and only as we experience them.

Talking about circulation in architectural design, it addresses the built components of a functional design, including spatial planning, articulation of form, circulation systems and environmental communication (Hunter, 2010).

Most designers give circulation low priority, seeing it as a hindrance to good design or a problem to be solved with signage (Carpman and Grant, 2022). In public buildings, circulation is of high importance; for example, in buildings such as shopping centres, museums, it is key to have a floor plan that allows continuous movement while minimizing the necessity to retrace one's steps, allowing a visitor to see each work in a sequential order. Structures such as elevators, escalators, and staircases are often referred to as circulation elements, as they are positioned and designed to optimize the flow of people through a building.

Spatial planning, articulation of built elements, and circulation system design are commonly the responsibility of architects, site designers, the engineering team, interior designers, and building owners and administrators Exterior circulation obstacles are common, including poor identification of building entrances and lack of clear access from parking facilities or mass transportation. Common interior circulation obstacles include the failure to make space within a facility look unique, connecting corridors at acute or obtuse angles, and failure to provide sufficient lighting at intersections, entrance to major destinations, and landmarks (Carpman and Grant, 2022).

HORIZONTAL CIRCULATION

Elements like corridors, verandas, and porches are part of horizontal circulation elements. The horizontal circulation elements help achieve uninterrupted circulation in buildings and provide smooth movements in between levels of the building. Horizontal circulation is defined according to Beirne (2003) as regions of walkways on individual floors of a structure that aid access to other spaces include the highlights like hallways, entryways, terraces, patios, entryways, entrance lobbies, and overhangs (Elottol, 2011).

VERTICAL CIRCULATION

Vertical Circulation aids the vertical movement between floors within a building, which expects to make available unobstructed access to everyone equally. Vertical circulation, as defined by Beirne (2003), says, regions of strolling and automated devices introduced in individual floors of a structure that vertically aid movement to other space including flights

of stairs, ramps, lifts and escalators" (Elottol, 2011).

METHODOLOGY

STUDY AREA

Ibadan, the capital of Oyo state is the third largest city by population in Nigeria with a total population of 3,649,000 as at 2021. It lies between longitude $3^0$5 East of the Greenwich Meridian and latitude $7^0$2 North of the Equator and covers a total land area of 3,123.30 km^2 (Onyemesim et al., 2017). Ibadan is made up of eleven (11) local government areas with 5 of them namely Ibadan North, Ibadan South-West, Ibadan North East, Ibadan South-West and Ibadan North West located within the metropolis. Ibadan metropolis has high relative humidity and experience two major seasons namely rain (March October) and dry season (November- February) (Olarewaju, Tilakasiri, & Bello, 2018). Ibadan metropolis has a tropical climate with a relative annual rainfall of 1200mm to 1500mm (Wahab & A., 2018). However, Ibadan South West was selected for this study being one of the local governments within Ibadan metropolis with a good number of newly built and old shopping malls.

MATERIAL AND METHODS

This study adopts the descriptive design approach. Primary and secondary data were collected for this study. The primary source of the data collected was through naturalistic observation that is a direct observation within the study area. Random and purposive sampling methods were employed. Adopting random sampling, Ibadan South west was selected from the five LGA within Ibadan metropolis. Thereafter, two locations namely Ring Road and Oluyole Estate were purposively selected based on the long years of existence of the shopping mall brands in these areas which include, Palms Mall and Ace Mall. The indoor and outdoor circulations within the malls were critically observed while pictures were taken for on the spot assessment. The data collected were descriptively analyzed and presented

FINDINGS AND DISCUSSION

Based on the results of the survey and observation. The result revealed the possible availability of critical circulation parameters, adequacy and physical conditions.

Table 3: Availability of Circulation Parameters

	Case study 1(Ace Mall)		**Case study 2 (palms mall)**	
Circulation parameters	**Available**	**Not-availability**	**Available**	**Not-availability**
Vertical circulation				
Stairs	**X**		**X**	
Ramps		**X**	**X**	
Lifts	**X**		**X**	
Escalators		**X**	**X**	
Horizontal circulation				
Hallways,		**X**	**x**	
Entryways,	**X**		**x**	
Car parks	**X**		**x**	
Entrance lobby	**X**		**x**	
Lobbies	**X**		**x**	
Terraces,	**X**		**x**	

Table 4: Assessment of the adequacy of available Circulation Parameters

	Case study 1(Ace Mall)					Case study 2 (palms mall)				
Circulation parameters	**Very inadequate**	**inadequate**	**undecided**	**adequate**	**Very adequate**	**Very inadequate**	**inadequate**	**undecided**	**adequate**	**Very adequate**
Vertical circulation										
Stairs				**X**					**x**	
Lifts				**X**				**x**		
Horizontal circulation										
Hallways,			**x**							**X**
Entryways,				**X**						**X**
Car parks			**x**							**X**
Entrance lobby			**x**							**X**
Lobbies			**x**							**X**

Table 5: Assessment of the physical conditions of available Circulation Parameters

	Case study 1(Ace Mall)					Case study 2 (palms mall)				
Circulation parameters	**Very poor**	**Poor**	**Fair**	**Good**	**Very good**	**Very poor**	**Poor**	**Fair**	**Good**	**Very good**
Vertical circulation										
Stairs				**x**					**x**	
Lifts				**x**				**x**		
Horizontal circulation										
Hallways,			**X**							**X**
Entryways,				**X**						**X**
Car parks			**X**							**X**
Entrance lobby			**X**							**X**
Lobbies			**X**							**X**

ASSESSMENT OF AVAILABILITY OF CIRCULATION PARAMETER

Table 3, showed information on availability of key vertical and horizontal circulation parameter within the cases under review. It was discovered that, staircases, lift, ramps and escalators were available and properly located at Palms mall ring road, however in the case of Ace mall, though lift and staircases were available, ramps and escalator was not provided. The impulse of this is the fact that vertical circulation was properly considered in the design of the two facilities, however, there provision was at variance to each other. Thus, on vertical circulation availability index, palms mall can be adjudged to be better than Ace mall despite being just newly built. Furthermore, on horizontal circulations, each of the cases was assessed with following horizontal parameters vis the hallways, entryways, terraces, patios, entryways, entrance lobbies, car parks and overhangs. It was discovered that the horizontal circulation indicators were mostly available in both cases, however, palms mall was better as shown in plate 1-8.

Plate 1: Palms Mall lift

Plate 2: Palms Mall escalator and stairs

Plate 3: Palms Mall Ramps and stairs

Plate 4: Palms Mall Outdoor horizontal circulation

Plate 5: Palms Mall Indoor horizontal circulation

Plate 6: Ace Mall staircase

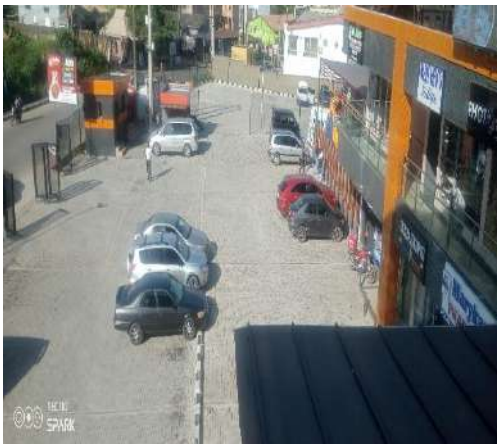

Plate 7: Ace Mall lobbies, outdoor circulation and overhang

Plate 8: Ace Mall lobbies, outdoor circulation, lift shaft and overhangs

ASSESSMENT OF LEVEL OF ADEQUACY OF AVAILABILITY OF CIRCULATION PARAMETER

Table 4, showed information on adequacy of availability of key vertical and horizontal circulation parameter within the cases under review. It was discovered that, staircases, lift, ramps and escalators were adequate at Palms mall ring road and Ace mall oluyole. The impulse of this is that vertical circulation in both cases were carefully provided with the

size and population intended for, hence its adequacy. However, on horizontal circulation, all the parameters were very adequate in the case of Palms mall, and grossly very inadequate at Ace mall as shown in plate 1-8.

ASSESSMENT OF PHYSICAL CONDITION OF CIRCULATION PARAMETER

Table 5, showed information on the physical condition of the available vertical and horizontal circulation systems within the cases under review. It was discovered that, staircases, lift, ramps at Palms mall ring road were in good condition while the escalator was physically good but nonfunctional at the time of this study. It was discovered that the escalator had not been in use for many years running. While the physical condition shows no deterioration, nonetheless lack of maintenance might have orchestrated the non-utilization of the facility and abandonment. Furthermore, the lifts tool at palms show that good physical condition but rarely used too. While the physical condition of the staircase, lift at Ace mall oluyole are good, ramps and escalator are lacking as such there non availability necessitate non assessment of the two parameter. Consequently, on physical conditions of the horizontal circulation, all the parameters showed evidence of good physical conditions in both cases of, as shown in plate 1-8.

Conclusion

Summarily, from the result of the survey it can be concluded that, while circulation principles were enshrined in the design of the two malls, it was observed that the sustainable circulation criteria were not followed by both owners and builders of the malls, hence affecting the overall performance of the circulations provided and the standard expected of circulation in a public building. While Ace mall and palms mall are of different size, circulation irrespective of the scope of the facility performs the same function and thus it is importance to adhere to design principles guiding mall designs in the area of circulation which is cardinal to the overall experience of the mall. I hereby recommended compliance to architectural standards in subsequent architectural designs of malls by professionals. Secondly, the clients should be educated enough in the area of standards, this will disallow them from unnecessary interference of opinion at the design and implementation stage of such facilities. Lastly, planning authorities should up their oversight in ensuring architects and clients in all design submissions complies to regulated standards, this will prevent abuse and enhances quality public space design and provision of public infrastructures.

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UNDERSTANDING CATEGORIES, CREDITS AND PREREQUISITE IN GREEN BUILDING RATING SYSTEM.

Victor Adedeji ADEYEMO[1], Funmilayo M. ADEDIRE[2], Saudat O. AJIJOLA[3], Almustapha, BAWA[4], Marvel Ewaoluwa OYEDEJI[5], Oluwatobi Benjamin ADELEKE[6], Oluwafemi A ADEWUMI[7]

[1 2 3 4 5 6 7] Department of Architecture, Lead City University, Ibadan, Nigeria,

[1]Corresponding author E-mail: ajijola.saudat@lcu.edu.ng **T**;*07080152199*

Abstract

Green building rating systems play a crucial role in promoting sustainable and environmentally friendly practices in the construction industry. These systems provide a framework for assessing and certifying buildings based on their environmental performance, energy efficiency, and overall sustainability. However, navigating the complexities of green building rating systems can be challenging for stakeholders, including architects, designers, developers, and policymakers. This research aims to provide a comprehensive analysis of the categories, credits, and prerequisites within green building rating systems, with a focus on enhancing the understanding and utilization of these systems. The study examines selected green building rating systems, which are LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and Green Star. The research methodology involves a systematic review of literature. By synthesizing and analysing the available information, this study identifies key categories involved in the GBRSs. The analysis also explores the rationale and significance behind these requirements and their alignment with sustainability goals and best practices.

Keywords; Green building Rating systems (GBRs), LEED, BREEAM, and Green Star.

INTRODUCTION

Green building rating systems are a set of standards and criteria for certifying the ecological sustainability of buildings. The goal is to reduce the environmental impacts associated with construction while increasing occupant comfort and productivity outcomes (Ahmed, 2018). Green building rating systems provide a framework for architects, builders, designers, developers, and other stakeholders involved in the design and construction process to measure their performance against established metrics. While green building rating systems were initially created for commercial office buildings, they have now been applied to residential and public sector projects (Lozano et al., 2015).

Green building rating systems are "systems used to assess how sustainably a particular building has been designed" (Kothera, 2017, p.2). Rating systems generally contain several sections related to eco-friendliness, such as energy efficiency, resource use optimization, indoor air quality, materials selection, water usage, and waste management (Gakh & Preziosi, 2014). Green building rating systems also include guidance to encourage certain behaviors that will help achieve stated goals. For example, a green building rating system can include developing incentives or rewards for contractors who opt-in to build low-carbon structures.

Green building rating systems typically classify new construction buildings into one of four categories: Certified, Silver, Gold, and Platinum (Roye et al., 2011). These categories

refer to the level of adherence to benchmarks in each section of the rating system. Buildings that score higher in all categories receive higher ratings — from certified (lowest) to platinum (highest). As an example, LEED certification– a famous international green building rating system—groups projects by different levels of achievement, which range from Certified 40-49 points, Silver 50-59 points, Gold 60-79 points, to Platinum 80+ points (USGBC, 2020).

When considering the significance of green building rating systems, it is imperative to recognize their multiple benefits. Primarily, integrating green building components yields a variety of economic advantages for both owners and tenants: better performance of assets, reduced operating costs, increased profitability, improved guest experience, and more excellent market value (Rivas et al., 2019). Moreover, green building systems enable businesses to help address global climate change through reduced energy consumption, resource conservation, and lower emissions rates. On the health side, green building rating systems improve indoor air quality, thermal comfort conditions, and noise levels, leading to more productive work environments (Spataro & Gonzales, 2016). Finally, environmentally conscious designs enhance financial investments and support cultural values regarding nature preservation, social wellbeing, and sustainability (Kothera, 2017).

Critics argue that green building rating systems require considerable investment and labor from occupants, contractors, and clients, making them inefficient in terms of cost and labor requirements. Furthermore, some scholars claim due to its complexity, these systems fail to produce tangible results in terms of ecologically sensitive building designs (Haas & Kathrotia, 2012). To maximize effectiveness, there needs to be substantial technical training and performance-tracking procedures in place across various stages of the construction process. Recent studies suggest that this problem could be remedied by appointing qualified personnel to manage the implementation and compliance of rating systems in each jurisdiction (Ahmed, 2018).

Green Building Rating Systems (GBRSs) are valuable tools towards achieving sustainability and maintaining balance in the natural environment, however, navigating the complexities of green building rating systems can be challenging for stakeholders, including architects, designers, developers, and policymakers, therefore, the aim of this research paper is to investigate the nature of the categories, credits and prerequisites involved in green building rating systems, so as to enhance the understanding and utilization of these systems and to achieve this aim the following research objectives needs to be taken into considerations

1. To review how green building rating systems have evolved over the years
2. To examine the significance of categories within the selected green building rating systems
3. To explore the credits and prerequisites in the selected green building rating systems

In response to the above research objectives the following research questions needs to be asked;

1. What are the existing green building rating systems?
2. What is the significance of categorizing within green building rating systems?
3. What are the credits and prerequisites in green building rating systems?

Industrialisation has spurred the demand for efficient and rapid communication methods

among individuals worldwide (Maiti et al., 2022). Contemporary communication networks, extensive and advanced, are playing pivotal roles in driving economic transformations and creating opportunities (Tschang & Almirall, 2021). Nevertheless, the escalating demand for communication has led to the rapid emergence of telecommunication companies, facing significant obstacles related to sustainability. Global warming with climate change, along with limited energy availability and increasing costs, are posing serious challenges to the continued viability of these telecommunication facilities (Molla, 2009).
According to (Manzuma et al., 2020), the term telecommunication facilities usually encompass sub functions or facilities such as data centre, switches, customer service centres, call centres, and administrative buildings. (Gungor et al., 2013) has also defined telecommunication facilities to encompass the physical infrastructure, equipment, and technologies utilized to enable communication and the exchange of information over long distances.

The extensive utilization of telecommunications has permeated every aspect of business activities, offering significant advantages and convenience, and causing irreversible transformations in both businesses and societies on a global scale. While its profound impact on societal growth is difficult to measure, it has also played a substantial role in contributing to environmental issues, notably the emission of Greenhouse Gases (GHGs), which contribute to global warming and climate change (Okereke, 2019). These environmental concerns are, in part, attributed to the operations of telecommunication facilities, particularly in developing regions where the reliance on non-renewable energy sources, like burning fossil fuels through generators, is common.

Pursuant to the growing concern about the environmental impact of high level of energy consumption, energy efficiency becomes unarguably crucial as wemove towards a more competitive, secure, and sustainable energy system (Radonjič & Tompa, 2018). Energy efficiency refers to several environmental pollution management issues, notably those related to climate change, which combine the strategies of energy consumption reduction alongside a reduction of GHGs released into the atmosphere (de la Cruz-Lovera et al., 2017).

The current focus on global warming and environmental sustainability has made it imperative, that the telecommunication industry seeks ways to reduce its emissions into the environment. Architecturally, this can be achieved by the use of both active and passive design strategies to reduce energy consumption and in some cases recycling the emissions to benefit theenvironment thereby achieving environmental sustainability (Ahady et al., 2019).

Consequently, the purpose of this article is to assess the design strategies that can be used to achieve environmental sustainability using a case study approach of selected telecommunication office buildings.

LITERATURE REVIEW

Evolution of Green Building Rating Systems
Green building rating systems have been established to measure the environmental, economic, and human health performance of new or renovated buildings. These rating systems are used by architects, engineers, planners, and building owners to compare different designs and identify opportunities for improving their overall sustainability impacts. The development and adoption of green building rating systems have significantly impacted how designers approach projects, allowing them to use

metrics that ensure their designs meet specific standards and goals.

Green building rating systems are gaining popularity as concerns about climate change, resource depletion, and air and water pollution continue to increase. The Leadership in Energy and Environmental Design (LEED) certification system created in 1998 by the United States Green Building Council (USGBC) is spearheading this trend. LEED standards are credited with playing an essential role in helping advance sustainable design worldwide. Since its introduction, LEED has become one of the most widely adopted green building rating systems, certified more than 70,000 projects in 161 countries and all 50 states (U.S. Green Building Council, 2020).

In addition to LEED, several other existing green building rating systems exist. These include BREEAM in Europe, Singapore's Green Mark system, Australia's Green Star ratings, Japan's CASBEE ratings, India's GRIHA rating system, and Brazil's AQUA system. Each rating system evaluates different attributes, such as energy efficiency, water conservation, materials selection and occupant health. Although some of these criteria vary slightly from country to country, they all share common sustainability principles, including reducing waste, conserving energy, using renewable resources, and promoting occupant comfort and well-being (Lam & Wong, 2019).

Over time, green building rating systems have begun to evolve to address technological changes, research advances, and broader societal needs. Technological advances have allowed green building concepts to be incorporated into practical applications in the built environment, leading to improved assessment methods and better decision-making (Shabgard et al., 2014). Additionally, increased public awareness of environmental issues has led to higher stakeholder expectations regarding the choice of materials, occupant safety, and access to natural lighting and fresh air circulation. To meet these rising demands, many rating systems have shifted focus, now offering credit awards based on technical specifications and social considerations like creating healthy indoor environments, enhancing equity/accessibility, and providing educational programming (Kumai et al., 2017).

Other shifts in green building rating systems have also taken place. Modern rating systems have expanded to encompass more significant areas of concern, such as neighborhood revitalization, community resilience, job creation, and natural habitat protection (Fei et al., 2016). They are increasingly engaging beyond traditional domains like energy and environment and recognizing the full scope of what constitutes sustainability. In addition to focusing on the physicality of the built environment, green building ratings today emphasize elements such as promoting biodiversity, resilient infrastructure, secure housing, equitable opportunities, adaptive management, disaster risk reduction, and support for local economies (von Pederson et al., 2015).

Despite being considered an essential factor in encouraging environmentally responsible construction, green building rating systems have faced some criticism. Some believe that these systems do not adequately consider regional variations in terms of climate, geography, culture, and existing regulations, which could potentially alter the final results. Additionally, they can impose a considerable financial burden on developers due to costly fees associated with certifications as well as the added time it takes to navigate the detailed parameters involved. Regarding the latter,

advocates argue that more straightforward procedures should be implemented to make the process realistic and achievable (Nezaminia, Ghoujal & Azadi, 2018).

However, despite the criticisms, green building rating systems remain one of the most effective tools for achieving greater sustainability in the built environment. Not only have they helped redefine and elevate industry standards across the world, but they have also spurred advancements in technology. As government policies reflect global values around sustainable development, these rating systems will continue to be strengthened and updated to help realize the vision of a sustainable future.

CATEGORIES WITHIN THE GREEN BUILDING RATING SYSTEMS

Green building rating systems standards promote sustainable design, construction, and operations over an otherwise non-green building design. While these rating systems have been developed to "encourage" people to consider green methods in planning and implementing projects, much debate exists about what components should be included in each category or subcategory. This review discusses some of these debates by examining key types found in green building rating systems, such as Leadership and Innovation, Energy Efficiency, Water Efficiency, Indoor Environmental Quality, Materials, and Waste Management. Discussion points include leadership in green strategies, energy use responsibility, water conservation initiatives, building communication, product selection, and effective waste management practices.

LEADERSHIP AND INNOVATION

The first critical debate when it comes to green building rating system categories focuses on the inclusion of leadership and innovation categories. It has become nearly universal to expect leading organizations to set an example regarding environmentally responsible practices (Janikula & Chicken, 2020). Many industry professionals believe it is essential for leaders to show a strong commitment to sustainability by demonstrating tangible actions that imply consideration of the environment in every planning or development process. By doing so, they can create policy goals, build teams with shared values, develop education programs, track performance data, plan activities based on strategic priorities, communicate results, and engage through public relations efforts. Further, many experts believe innovation plays a significant role in this process. Considering new technologies, techniques, and materials allow more effective cost savings and pollution reduction opportunities while improving project performance (Garai et al., 2019). For swiftly advancing industries such as green building and renewable energy, innovative strategies are essential for keeping up with the times and competing with existing players. Thus, due to their importance in both creating sustainability models and pushing forward green technologies, the inclusion of core leadership and innovation categories within green building rating systems remains essential.

ENERGY EFFICIENCY

Energy efficiency categories are the second central area contributing to green building rating systems debates. According to the U.S. Green Building Council, energy use represents one of the highest operating costs associated with buildings (U.S. Green Building Council, 2021). Energy efficiency components address areas where considerable reductions in use can be achieved without compromising the quality of life and comfort; topics discussed often include appropriate insulation material, alternative heating

sources, most efficient lighting fixtures, and consideration of using materials from renewable resources (Zhang et al., 2020). However, there is disagreement among those engaged in green building discussions about which elements constitute necessary components of a comprehensive rating system regarding energy efficiency. Proponents of reporting metrics like energy intensity (kWh/square meter), annual peak demand (kW), total energy usage (eV), and emissions per square foot offer evidence for their claims. At the same time, opponents argue other factors more closely related to actual energy efficiency measures (kinds of appliances used, local power generation capabilities, optimization of energy demand, etc.). A compromise may be reached by introducing a mix of general and detailed energy-related criteria, allowing rating systems to capture the diversity of ways buildings must comply with established guidelines.

WATER EFFICIENCY

Thirdly, green building rating systems heavily emphasize water efficiency categories. Also under examination are approaches to reducing potable water use for various housekeeping tasks, washing dishes, or landscaping. Significant considerations commonly include low-flow showerheads, dual flush toilets, waterless urinals, rain catchment systems, greywater recycling systems, etc. (Truyen et al., 2020). As climates change, lack of easy access to sufficient amounts of clean drinking water becomes increasingly prevalent. Therefore, identifying means to reduce overall consumption is paramount in designing energy-efficient buildings. Though awards are given out regularly for exemplary sustainable achievement, this method usually focuses overly upon technological fixations sourced independently of any local context rather than allowing others to lead on improving how communities secure and manage all kinds of water-related services. Hence, recognizing natural local ecosystems and possible indigenous methods must be integrated into utilizing available water resources if society aims to foster resilient communities capable of responding effectively to present-day climate challenges.

INDOOR ENVIRONMENTAL QUALITY

Discussions related to green building rating systems further include indoor environmental quality categories. Optimal IAQ is integral to occupant health and comfort, thus making it inherent in any sustainable building evaluation. Commonly considered features cover air temperature maintenance, humidity control, proper ventilation rates, high filtration levels for incoming outdoor air, lower pollutant concentrations, minimal noise disturbances, avoidance of mold growth, improved sanitization protocols and pest management, etc. (Abdelaal & Elmeligui, 2018). Debates emerge when selecting tests or measurements to assess these components. Ambient CO2 levels, airborne particulate matter, volatile organic compounds (VOCs) presence, microbiological contamination, and dust mite accumulations are just a few of the tests considered; however, their validity becomes contested when measuring effectiveness or accuracy. Moreover, considering specific recommended defeasible acceptance ranges across geographical boundaries creates another layer of complexity that needs addressing before implementation of green building rating systems. Such issues expand beyond rating requirements, yet since the choice is restricted for residential and office occupants and personal preference cannot be the criterion for anything but safety-detrimental abominations, due care, including adequate research into IAQ conditions before

constructing or occupying dwellings, must be taken.

MATERIALS

Another element frequently argued when discussing green building rating systems is materials criteria. Starting at the acquisition phase, chosen materials or products must meet stringent requirements to qualify for credits toward certifications required by locally applicable regulations or those implemented by energy benchmarking positions (Mukesh & Kamble, 2017). Eco-labeling guidelines set up by international publications like LEED mandate either specific certified materials comprising 95 percent of relevant volumes or generally accepted limits for embodied energies and recycled content minimums. Point allocations are additionally affected based on selections made towards 'sound materials management' practice programs meant to minimize extraction from nature, healthier production processes, minimized disposal pathways employed, and reusing nearby harvested parts (Schrimpf et al., 2018). Furthermore, site productivity details extended placements are listed chronologically in revealed consumption lists (Elmarenni et al., 2016). Finally, surveys administering factsheets requesting responses from suppliers throughout supply chains validating origin stories provide real-time user feedback for third-party decision-makers gauging submitted compilation leeway. Addressing these issues requires adept knowledge of global markets and mindful purchasing that ascertains precisely what goes into every manufactured item.

WASTE MANAGEMENT

In conclusion, the dispute surrounds the green building rating system's waste management categories. The sheer volume of garbage produced by human societies necessitates vigilance in safe elimination practices (Karakar et al., 2018). Recycling can account for almost half of this sum since scrapping and processing releases calculated amounts of contaminative fumes unsurmountable by ozone-destroying gasses. Regulations outline desired precinct reactivation tactics like own source separation and permitted secondary dumping routines, all commonplace in developing countries. Nevertheless, reforms targeting facilities tend not to produce polluting residue; instead, they embrace reuse philosophy, driving forward rigorous taxpayer education campaigns assisting companies embracing counterweighing input alternatives. In contrast to passive bailouts reinforcing infrastructure only after the damage occurred, proactive solutions advocating fresh dynamics beloved by specialists promoting patient advocacy intended workflows may assist idea sharing promptly, preserving planetary biodiversity compassionately.

In summary, the inclusion of categories encompassing Leadership and Innovation, Energy Efficiency, Water Efficiency, Indoor Environmental Quality, Materials, and Waste Management within green building rating systems betokens current influential trends in sustainable progress towards minimizing human resource footprints threatening emerging eco-systems globally. Controversies have arisen between supporters arguing positively pertaining to metrics regarding justified behaviors mandated and opponencies preferring ambiguities specifically tailored to ensuring individual's freedoms versus oppressive restrictions transcending jurisdictional spheres equally concerning domestic and industrial circumstances maintaining prudent economic complexities.

METHODOLOGY

This study adopted qualitative research to investigate the available literature as a data source. Secondary data was used which was generated by previous researchers, and content and thematic analysis was applied for data analysis (Bryman, 2015). With this method of research, it is possible to engage in critical debates surrounding the topic under examination. For instance, there may be different views from various authors that can provide stimulating discussions and alternative perspectives on relevant issues such as power dynamics or gender relations (Ihimaera-Smiler, Tredoux & Henderson, 2016). Therefore, qualitatively examining literature sources can add considerable depth to our understanding of complex topics.

FINDINGS AND DISCUSSIONS

This discussion focuses on examining credit and prerequisites in three different building sustainability rating systems: LEED (Leadership in Energy & Environmental Design) certification from the US Green Building Council (USGBC), BREEAM (Building Research Establishment Environmental Assessment Methodology) from BRE Global, and Green Star from the Green Building Council of Australia. This discussion will assess the positive aspects of each system and its strengths in credit and non-credit-based ratings, as well as noteworthy innovations incorporated into each design. Furthermore, it will consider areas where each system may lack comprehensiveness or effectiveness by providing critical debates on credit metrics, resource measurements, environmental impacts, and socio-economic factors that must be factored into sustainable construction practices. The conclusion will then give an overall evaluation of these systems while also making recommendations for improved assessment approaches in the future.

LEED CERTIFICATION

LEED Certification allows buildings to demonstrate their commitment to green construction and recognizes projects according to how environmentally sustainable they are. The program focuses primarily on energy performance, water efficiency, indoor air quality, material selection, and other factors. It has nine distinct ratings that range from Certified to Platinum Level. To reach a specific level, credits must be earned in six categories: Location/Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, and Indoor Quality. Projects are evaluated according to the number of credits achieved and the required total amount for each level. LEED Certification can thus provide a benchmark for comparing different types of construction projects against globally established standards (Liponis et al., 2020).

There have been several criticisms of LEED certification over recent years, many of which revolve around criticism of the focus on individual elements rather than the bigger picture of the project as a whole. Further critiques center on the point systems' ability to incentivize particular choices regardless of true environmental impact (Hough, 2018). For example, there is little emphasis on the embodied energy of materials or robust consideration given to non-energy resources such as land use or long-term site management (Wang & Turpin, 2011). Additionally, some suggest that too much weight is placed on theoretical versus real-world results, leaving any differences between expected and actual outcomes unaccounted for (Hamman & Keeton, 2015). Despite these impediments, LEED

certification remains one of the most accepted and utilized programs for developing high-performing green building projects in the United States (Karunananthan et al., 2019).

BREEAM CERTIFICATION

In the United Kingdom in 1990, BREEAM is a sustainability assessment scheme dedicated to improving operational and design criteria for newly constructed buildings worldwide (Interceramic, 2016). Through compiling guidelines that are tailored to both domestic and international markets, architects and designers can create award-winning and ambitious building projects. Unlike LEED, BREEAM uses life cycle assessments to evaluate projects throughout their various stages and provide valuable insight into a building's quantitative impacts. Concerning assessing buildings, 18 subcategories are considered, including energy and water consumption, waste disposal, occupant health and wellbeing, and legal compliance. Existing structures are judged differently using post-construction evidence gained through regular audits and user feedback about the building itself. Systems that pass BREEAMS requirements result in distinguished awards ranging from Pass, Good, Very Good, Excellent, Outstanding, and Exceptional levels.

However, critics believe BREEAM carries certain limitations due to a narrow scope of factor coverage relative to contemporary trends encompassing holistic, multi-nodal approaches to designing more sustainable built environments (Hough, 2018). Furthermore, BREEAM is prone to selectively counting certain areas while ignoring others - thereby artificially boosting scores to reach higher rankings despite lacking legitimate merits (Hamman & Keeton, 2015). Some argue that allowances are sometimes made for improvements that cannot easily convert into measurable results such as improved access to nature (O'Keefe et al., 2015). Questions such as these have thus raised concerns about BREEAM's ability to clearly differentiate and accurately certify operating performance within a limited framework for assessing buildings (Van Der Lugt et al., 2018).

GREEN STAR RATING SYSTEM

Created in 2003, the Green Building Council of Australia GBCA developed the Green Star rating system as part of a global effort to pursue excellence in sustainable design. Ashely and Landauer (2018) emphasize its "excellence" approach rooted in understanding locally relevant contexts instead of relying strictly upon technical specifications. With four primary rating classes from One to Six Stars, High-Performance points cover 17 key topics, and special emphases are placed on functions associated with biodiversity conservation, healthy indoor environment, urban context, water efficiency, transport emissions, and thermal comfort. The uniqueness lies in its comprehensive nature for addressing residences and industrial applications that extend far beyond teen-adapted designs.

Despite being hailed for its visualization capacities on ecological dynamics related to the elevation process, Green Star has generally attracted mediocre reviews amongst observers, predominately targeted at intangible qualities that underlie its methodology. Baker and Goss (2013) remark on inappropriate thresholds secured onto units of measure, deeming these datasets insufficient to obtain meaningful credentials regarding the ipso facto valuation associated with structural longevity. Intending to overflood a ship with codified data would usually obscure central subject matters had stricter clauses not come to light. On the

outcome side, Proskoska and Crotti linger on the absence of mathematical refinement during the scoring process, resulting in lackluster declarations derived from inadequate inputs. Though bearing no pertinence to varying subjective interpretations, clear-cut parameters were unaccountable for baselines needed to produce tangible intake, slowly eroding trust held by aroused sectors (Xi et al., 2020).

CONCLUSION AND RECOMMENDATIONS

Examining credit and prerequisites in all three rating systems reveals commonalities and distinctions. Although all three systems feature a variety of rigorous certifications that reflect differing levels of building sustainability, they appear to have shortcomings. Problems might arise when certain factors are favored over others, leading to oversimplification or exclusion of necessary components. While none of these systems should be considered inherently superior to the others, striking a balance in their application seems essential to attain the best possible outcomes for sustainable construction. Considering all resources holistically should remain paramount when selecting any of these systems. Future improvements could involve further diversifying metric sets by changing practices, ensuring the accuracy of adding new tools, and applying collaborative learning initiatives to decision-making procedures. Ultimately, best practices should strive to accommodate demographic shifts and encourage ongoing communication channels between all stakeholders for market optimization.

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SAFETY DESIGN CONSIDERATIONS FOR AIRPORT TERMINALS IN NIGERIA

Okorie, Kelachukwu Johnson[1]; Olaniyan Martin[2]; Dauda Olayinka[3]

Abstract:

With the constant influx of millions of travellers through airport terminals on a daily basis, safety remains the foremost concern for airport authorities and designers. To mitigate hazards, minimize accidents, and enhance the overall passenger experience, it is imperative for airport terminal architecture to adhere to stringent safety design standards. This essay delves into the crucial safety aspects that must be considered during the design and construction phases of airport terminals, aiming to provide a secure environment for all airport users. The key factors explored in this context include human factors, emergency preparedness, structural integrity, fire safety, and technological integration. Understanding human factors is paramount in designing airport terminals especially in Nigeria that efficiently cater to diverse passengers. Elements such as wayfinding, clear signage, and an intuitive layout can prevent congestion and confusion. Incorporating ergonomic seating, rest areas, and amenities also contribute to passenger comfort and reduce the likelihood of accidents due to fatigue. Furthermore, ensuring accessibility features for passengers with disabilities fosters inclusivity and safety for all users. Emergency readiness is crucial to ensure swift and orderly responses in critical situations. Terminal designs must incorporate multiple exits, well-defined emergency paths, and clear evacuation signage to facilitate efficient evacuations. Regular emergency drills and staff training are essential to prepare personnel for various scenarios. Implementing modern communication systems and emergency alerts can further enhance real-time updates and overall safety during crises. The structural integrity of airport terminals is of paramount importance, particularly in the face of natural disasters or potential security threats. Terminal buildings should be designed to withstand extreme weather events and seismic activity. Employing fire-resistant materials and careful load-bearing considerations ensure the overall safety and durability of terminal infrastructure. Addressing fire safety is a primary concern in crowded public spaces like airport terminals. Installing advanced fire detection and suppression systems, along with fire-resistant escape routes, are essential components of safety-oriented terminals. Minimizing fire propagation and ensuring sufficient time for evacuation are crucial design considerations. Collaborating with local fire departments during the design phase can lead to effective fire response plans. Moreover, incorporating cutting-edge technology into airport terminal design significantly enhances safety and security. Advanced security screening systems, surveillance cameras, biometric authentication, and contactless technologies reduce potential threats and improve passenger screening processes. Smart building management systems can monitor and respond to potential hazards, optimizing terminal operations while maintaining safety standards. In conclusion, incorporating safety design criteria into airport terminals is of utmost importance to safeguard passengers, staff, and infrastructure. Considering human factors, emergency preparedness, structural integrity, fire safety, and technological integration ensures that airport terminals not only serve as efficient transportation hubs but also stand as symbols of security and hospitality. Continual evaluation and improvement of safety design criteria are essential to adapt to evolving risks and challenges in the aviation industry.

KEYWORDS: safety, design consideration, airport terminal, airport, human factors

INTRODUCTION

Airport terminals serve as vital infrastructures that accommodate millions of passengers daily, making safety a paramount concern for airport authorities and designers. Incorporating safety design criteria into airport terminal architecture is crucial to mitigate risks, reduce accidents, and enhancing the overall passenger experience (Smith et al., 2020). e. This paper explores the key safety aspects that should be considered during the design and construction phases of airport terminals. It delves into the importance of human factors, emergency preparedness, structural integrity, fire safety, and technology integration to ensure a safe and secure environment for all airport users.

An airport terminal is a facility at an airport serving as a hub for ground transportation and facilities for boarding and disembarking from aeroplanes is known as an airport terminal.

Passengers buy tickets within the terminal, move their luggage, and proceed through security. Concourses are the structures that enable access to the aeroplanes (through gates). However, depending on how the airport is set up, the phrases "terminal" and "concourse" can occasionally be used interchangeably.

Smaller airports have one terminal while larger airports have several terminals and/or concourses. At small airports, the single terminal building typically serves all of the functions of a terminal and a concourse. Airport terminals are the primary interfaces between travellers and air transportation.

The design and management of an airport terminal has direct implications for the safety of the public, staff, and aircraft. Therefore, incorporating safety into its design is essential to ensuring a safe and secure environment. The incorporation of safety design criteria can be seen in numerous aspects of the terminal's structure, layout, and operational protocols.

Safety considerations play a significant role when designing or managing an airport terminal (Smith et al., 2020). This includes elements such as security checkpoints, surveillance systems, emergency exits, appropriate signage, as well as fire protection and evacuation plans. In addition, building materials used should be non-flammable and must meet local building codes (Direnzo & Sumner, 2015). Furthermore, the location of the terminals must consider potential hazards such as noise levels, air pollution, traffic congestion, and nearby hazardous sites (Ghasemi et al., 2018). As airports become increasingly busy with passengers and cargo, consideration must also be given to overcrowding and its effects on the overall safety of the terminal (Luo et al., 2019).

Various organizations have published guidelines which set forth specific requirements for airport terminal design and management. International standards are established by the International Civil Aviation Organization (ICAO) as part of Annex 14 – Aerodromes. These require that airport operators develop safety management systems (SMS) with regards to terminal operations (ICAO, 2016). The Federal Aviation Administration (FAA) also offers guidance documents that address various facets of airport terminal design and management (FAA, 2017). Additionally, individual countries may have their own additional legislative requirements for airport safety based on their particular needs (Kolářová & Šíma, 2013).

In addition to regulatory requirements, recent advancements in technology offer new opportunities for enhancing airport safety. For example, intelligent video analytics allow for more effective monitoring of large-scale areas within the terminal (Xu et al., 2019). Automated access control systems can utilize biometric identification while minimizing human interaction (Hussain et al., 2018). Intelligent lighting systems can adjust illumination according to environmental conditions, thus reducing operating costs and increasing visibility of travelers (Zhang et al., 2014). All these technologies help contribute to safer and more efficient operations at the airport terminal.

In Nigeria, the aviation sector is one of the most important and rapidly growing industries. In recent years, there has been a significant increase in aircraft movements as well as passenger and cargo traffic at Nigerian airports due to increased international travel and trade. Despite this growth, however, there have been serious concerns regarding the safety of air operations in Nigeria, especially with respect to airport terminal design and management. The increasing number of passengers and aircraft necessitates improved safety measures at Nigerian airports in order to minimize the risks associated with air travel. This includes the incorporation of safety design criteria into the planning and operational processes for airport terminals. The primary purpose of these safety design criteria is to reduce risk, protect personnel, ensure the safe and efficient operation of the facility, and provide travelers with an enjoyable experience (Oyeniyi et al., 2017).

Previous research works on the subject has largely focused on operational and procedural aspects, such as baggage screening and aircraft maintenance (Nwasonuba & Okeudo, 2021). Little attention has been given to designing buildings that meet ICAO SARPs or evaluating their effectiveness in ensuring passenger safety. Furthermore, much of the literature available is limited to theoretical models rather than practical implementation strategies (Ale et al., 2002). In view of these shortcomings, the current study would pay

attention to examining whether existing safety design at Nigerian Airport terminals meet ICAO SARPs as well as evaluate its effectiveness in ensuring passenger safety.

With millions of travellers passing through airport terminals every day, safety is a top priority for airport officials and designers. To lower hazards, fewer accidents, and improve overall passenger experience, airport terminal architecture must incorporate safety design standards. This essay examines the important safety factors that must to be taken into account while designing and building airport terminals. In order to provide a safe and secure environment for all airport users, it discusses the significance of human factors, emergency readiness, structural integrity, fire safety, and technological integration.

As the number of air passengers continues to rise, ensuring the safety of these terminal facilities becomes even more critical. Safety design criteria encompass a range of factors, including human behaviors, emergency response, structural resilience, fire protection, and technology integration. Integrating these safety criteria into airport terminal design can prevent accidents, injuries, and potential disasters, while also contributing to a smoother and more enjoyable travel experience for passengers. (Statistiques de Trafic 1973

Human Factors and User Behavior:

Understanding human factors is essential for designing an airport terminal that accommodates a diverse range of passengers effectively. Factors like wayfinding, signage clarity, and intuitive layout can prevent congestion and confusion. Implementing ergonomic seating, rest areas, and amenities can enhance passenger comfort and reduce the likelihood of accidents due to fatigue. Additionally, the consideration of accessibility features for passengers with disabilities ensures inclusivity and safety for all users.

EMERGENCY PREPAREDNESS AND EVACUATION

In the event of an emergency, efficient evacuation procedures are vital. Airport terminals must incorporate multiple exits, clear evacuation signage, and well-defined emergency paths to ensure a swift and orderly evacuation. Adequate training for staff and regular emergency drills are crucial in preparing personnel to respond promptly to various scenarios. Moreover, integrating modern communication systems and emergency alerts can facilitate real-time updates and enhance overall safety during crises.

STRUCTURAL INTEGRITY AND MATERIAL SELECTION:

The structural integrity of an airport terminal is paramount for safety, especially during natural disasters or potential terrorist threats.

Terminal buildings must be designed to withstand extreme weather events and seismic activity. Additionally, the selection of fire-resistant materials and careful consideration of load-bearing capacities contribute to the overall safety and longevity of the terminal infrastructure.

FIRE SAFETY MEASURES

Fire safety is a primary concern in crowded public spaces like airport terminals. Installing advanced fire detection and suppression systems, as well as designing fire-resistant escape routes, are critical components of a safety-oriented terminal. The layout should minimize fire propagation and allow sufficient time for evacuation. Collaboration with local fire departments in the design phase can aid in the development of an effective fire response plan.

TECHNOLOGY INTEGRATION

Incorporating cutting-edge technology into airport terminal design can significantly improve safety and security. Advanced security screening systems, surveillance cameras, biometric authentication, and contactless technologies reduce potential threats and enhance passenger screening processes. Furthermore, smart building management systems can monitor and respond to potential hazards, optimizing terminal operations while maintaining safety standards.

CONCLUSION

Safety should be at the core of airport terminal design to protect passengers, staff, and infrastructure. By considering human factors, implementing emergency preparedness measures, ensuring structural integrity, prioritizing fire safety, and integrating advanced technologies, airport authorities and designers can create terminals that are safe, secure, and efficient. Continuous evaluation and improvement of safety design criteria are necessary to adapt to evolving risks and challenges in the aviation industry. With a focus on safety, airport terminals can remain not only convenient transportation hubs but also reliable symbols of security and hospitality.

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ASSESSMENT OF THE ACTIVITIES OF DOMESTIC SOLID WASTE COLLECTION AGENTS IN URBAN AREAS IN CROSS RIVERS STATE

By

[1]Inah S. Abiam, [2]Ejiomofor O,

[1]Dept. of Urban & Regional Planning, Cross River State University
[2]Dept of Architecture, ABSU

Abstract

The research assessed the activities of domestic solid waste collection agents in order to improve waste management in urban areas of Cross River State. Quantitative and qualitative methodological approach employing measurements of waste collected, distance between residence and public community street collection containers (CSCC), pattern of distribution of CSCC, questionnaire survey and field interview of target population for generation of data were used. The quantitative and qualitative data gathered from questionnaire, interviews and field observation were exported into SPSS 10.3 software and Microsoft Excel for analysis. The data were presented using frequencies, percentages. ANOVA test, Nearest Neighbourhood Analysis and Euclidean Distance Measurement. Findings showed that daily waste collection from the study area was 0.41kg which gives I652.14tons daily collection and 555, Il9tons annual collection. Data analysis also showed that there was Community Street Collection Containers (CSCC) in the study area and also the distribution pattern was skewed in favour of the low densities which actually affected coverage of waste collection. The findings further reveal that factors impacting on DSW collection in urban areas of Cross River State include obsolete and insufficient operational equipment and embezzlement of funds meant for waste collection. More so sustainable ways to effectively collect waste from the urban areas were identified to include incorporating and supporting informed sector with incentives, development of a better waste collection infrastructure, reviewing legislation related to DSW collection and designing public education and capacity building to encourage management of household solid waste.

Keywords: Solid Waste Collection, Domestic Solid Waste, Community Street Collection Containers.

INTRODUCTION

In Cross River State, the responsibility of providing a solid waste collection service generally rests on local government governance like any other state in the country (Inah, 2019). However, the fundamental deficiency of local governments in all the states of the country are their failure to ensure that sufficient funds are available to provide an acceptable level of service. Apart of limited funds, poor urban governance have manifested in the absence of inadequate planning and the use of unsuitable vehicles and equipment which had led to serious wastage of effort and expenditure. The general assessment of of the activities of the local governments in collecting and disposing of daily generated waste in these areas has been dismally low. The local governments in Cross River State have consistently not been able to keep pace with domestic generated

solid wastes in the urban areas in Cross Rivers State, making almost impossible to justify the essence of the huge investments in that sector. Incidentally, the abysmal performance of local governments in the area has given reliance to the inclusion of private agencies in the collection of domestic solid waste. This paper highlights the strategic importance and managerial skills of private waste collection institutions, advocates a synergy between local governments and private agencies in the effective collection of domestic solid waste in the urban areas of Cross Rivers State. As Oluyemi, Inah and Odunsi (2017) observed that generation of domestic solid waste will substantially increase due to improvement in household incomes in the area. Hence the need to engage the activities of private collection outfit to reduce obvious lapses and inefficiencies of local governments in the area to adequately collect all the domestic waste generated. Besides, Egbu and Okoroigwe, (2014); Jeric and Tevera (2014), similarly supports the engagement of private waste collectors since there is evidence of abysal failures of local government agencies in collecting domestic solid waste generated in urban areas.

METHODOLOGY

The combined research survey design approach was applied in the selection of sample size, distribution, collection of relevant data and analysis of results from the field. Denzin, (1989) acknowledged that this method ensures the complete capture of all the relevant features of the study. It also helps to crosscheck data gathered from different approaches, thus making the results from the field valid and credible. Contreas, Ishii and Hnnaku, (2006); Ankrah, (2007), Nuhu, (2008) and Inah, (2019) have in similar but separate ways demonstrated that combined survey design has wider acceptability especially in the area of handling topical issues related to waste generation and collection. Specifically, Contreras, et al, (2006) used this method to determine the drivers in current and future municipal solid waste management in Yokonoma, Japan and Boston, USA. While, Ankrah, (2007) and Inah, (2019) favoured some degree of methodological liberalism in synthesizing paradigms where appropriate in environmental research.

Lastly adoption of this technique provides an opportunity to obtain depth information from the different categories of participant including waste disposal service providers, and public institution involved in waste collection services. Selection of sample size was drawn from waste collection providers which include; private and individual waste agencies and informal waste pickers. Operations in the selected areas in Cross River State namely, Calabar Municipal, Ugep and Ogoja.

Table 1: Domestic Solid Waste Collection Agents in Cross River State

State	Number of Agents	No of Distribution
Calabar Municipal	593	46.76
Ugup	350	27.60
Ogojo	325	25.64
Total	**1268**	**100**

From Table 1, more than 46% of the private collectors were domiciled in Calabar Municipal, while Ogoja was least with 25.64% of the private domestic waste collectors. The distribution of the result is appropriate given that Calabar Municipal is higher in both household distribution and generation of domestic solid waste Ugep and Ogoja are smaller urban areas in comprises with Calabar Municipal. It is also important to observe that the private domestic solid waste collectors are in large proportions when compared with urban areas in the state.

RESULTS AND DISCUSSIONS

HOUSEHOLD DOMESTIC SOLID WASTE COLLECTION

From table 2, the questionnaire requested householders sampled in the survey to indicate their waste collection arrangements. The data gathered showed that formal household waste collection arrangement in the three towns include backdoor collection, road side collection, communal street container collection and block collection. In Calabar, three hundred and twenty-nine (329) households representing 55.5% of the sample of 593 indicated that they had communal street collection container while 169 households (28.5%) had roadside collection, 68(11.5%) household had block collection. While the remaining 30 households (4.5%) indicated that they experience backdoor collection.

Table 2: Waste collection services available to the household

Town	How Waste is Collected from Home				Total
	Back door collection	Road side collection	Communal container	Block collection	
Calabar	27	169	329	68	593
Ugep	81	32	-	237	350
Ogoja	15	59	-	251	325
Total	**123**	**260**	**329**	**556**	**1268**
Percentage Distribution (%)	**9.7**	**20.5**	**26.0**	**43.8**	**100**

In the case of Ugep, 237 (67.7%) of the 350 householders in the survey indicated block collection to be their waste collection arrangement while 81 representing 23.1% indicated backdoor collection. The remaining households in the survey, 9.2% (32 households relied on roadside collection as

there were no communal street container collection.

Lastly, in Ogoja, 251 households (77.2%) considered block collection as the most preferred waste collection service available in the town. This is followed in that order by 59 households (18.2%) who were served by roadside collection. The remaining 15 households (representing 4.6%) had backdoor collection and also as there was no communal street container collection in Ogoja Town. The field observation which was done alongside the household survey showed that in all the three towns, communal street container collection services was only found in Calabar and had 26% of the respondents accepting the use of it, while block, roadside and backdoor collection services available in Calabar, Ugep and Ogoja have proportionately 43.8% (556 households), 20.5% (260 households) and 9.7% (123 households) making use of these collection services. Some of the high and medium residential density households were located in newly developing areas in the three cities where waste collections do not extend their operations. In such areas, some residents dumped their waste at depressions, uncompleted buildings, bushes and drains, while others employed the services of informal waste collectors.

Table 3: Domestic solid waste collection agents in Calabar

Agents	Frequency	Percentage (%)
CUDA	260	43.8
private Companies	203	34.2
Informal Agents	58	9.8
Individuals	64	10.8
Others	8	1.4
Total	**593**	**100.0**

Table 3 showed that five principal waste agent were identified. Calabar Waste Management Agency (CWMA), Private Waste Companies, Informal Agents, Individuals and others. The result indicates that about 44% of the total domestic solid waste generated in the city is collected directly by CWMA, a government parastatal that is assigned with this responsibility of waste collection in the urban centres. Their mandate is to collect waste from government and institutional bodies, businesses and households, especially in cases where private waste companies are unable to perform their duties appropriately. The table also shows that 34% of domestic discharge wastes arising from the town are collected by private companies working in partnership with CWMA to collect waste from households.

Other waste collection agencies in the town include informal agents or scavengers whose lection account for 10.0% and most often is on ad-hoc basis because their collection is based on the recoverable materials from the waste they can recycle, individuals like family members, young persons and women directly collect and dispose their waste for no charge and this account for about 11% of the total waste from the town.

Table 4: Domestic solid waste collection agents in Ugep

Agents	Frequency	Percentage (%)
UUDA	239	68.3
Informal Agents	21	5.9
Individuals	86	24.6
Others	4	1.2
Total	**350**	**100.0**

From table 4, there were four waste collection agents who were identified in the survey, namely Ugep Urban Development Authority, informal agents, individuals and others. Approximately, 239 respondents in the survey agreed that 68% of waste generated in Ugep town is collected by Ugep Urban Development Authority. This is followed by 86 respondents who believed that almost 25% of the waste from the town is collected by individuals. While waste collected by informal agents account for about 6% and others whose collection cannot be classified in any of the agents account for 1%.

Table 5: Domestic solid waste collection agents in Ogoja

Agents	Frequency	Percentage (%)
UUDA	191	58.6
Informal Agents	27	8.3
Individuals	100	30.6
Others	7	2.5
Total	**325**	**100.0**

From the table, it can be deduced that out of the 325 responses gathered in the sampled household, 191 respondents accepted that 59% of the waste is generated in Ogoja Urban Development Authority (OUDA). This is followed by 100 respondents who accepted that more than 30% of the waste generated in the town was collected through young individual's efforts who are children. The lie also show that 27 respondents classified waste collected by informal agent to account for 8%, while the rest of the agents that cannot be classified account for almost 3% of the waste collected in the town.

DETERMINATION OF ACTUAL QUANTITY OF DOMESTIC SOLID WASTE COLLECTED

According to Kawai, Huong and Osako (2012), the use of weigh bridges increases the reliability on quantity of domestic solid waste collected, but local government authorities in

most developing countries often cannot afford weigh-bridges because of budget constraints. To overcome this disadvantage, this work adopted the method of Monney, Tiimub and Bagah (2013) to calculate the amount of domestic solid waste generated and collected in the study area based on field measurement and practical data collection.

In the views of the interview granted the executive secretaries of the Cross State Waste Management Agency in Calabar, Ugep Urban Development Authority and Ogoja Urban Development Authority, estimated that the daily waste collection in Calabar to be up to 150 metric tons; that of Ugep and Ogoja daily waste collection estimation was put at 45 tons for Ugep and 15 tons for Ogoja. Given that the quantities of domestic solid waste disposed was supposedly based on projections. This work tries to substantiate reliable figures of quantities of waste collected daily from the towns through a field survey which was established to determine the actual quantities of waste collected and disposed by the various waste management authorities.

From field investigation, we have to establish how to calculate the quantity waste collected and disposed of daily in Calabar, Ugep and Ogoja. In Calabar from field observation, it was found that there are 31 community street collection container (dustbins) distributed in 3 wards sampled with a volume of 10.67m^3 as shown in table 6.

Table 6: Accumulated volume of community street collection containers in Calabar

Ward name	No. of dustbins	Volume of dustbin(m3)	Accumulated volume(m3)
Anantigha	13	13 x 10.67	138.71
Ediba	10	10x10.67	106.7
Ikot Ansa	8	8 x 10.67	85.36

Therefore, by adding the volume of all dustbins in a ward, accumulated volume of the dustbins was determined. The accumulated volume of dustbins in Anantigha, Ediba and Ikot Ansa wards was arrived at as 138.71m3, 106.7m3 and 85.36m3 respectively. The accumulated volume of all community street containers in the sampled area was then multiplied with the waste storage capacity by each collection container to establish the current storage capacity of the collection containers in the sampled area.

In domestic solid waste measurement, bulk density of waste is considered to ascertain the storage capacity per collection container. According to Shublo et al (2013), density is a critical criterion for the estimation of storage, collection, transportation and land filling of waste. For this study, the average bulk density for domestic solid waste is 250kgm^{-3} adopted from Imam, Mohammed, Wilson and

Cheeseman (2008) who did extensive work on domestic waste composition in urban areas of Nigeria. To arrive at the total bulk density of the collection container in the sampled wards in Calabar, the calculated accumulated volume in table 6 was multiplied with the average bulk density (table 7).

Table 7: Total bulk density of community street collection containers in the sampled wards in Calabar.

Wards name	Accumulated volume x average bulk density	Total bulk density (kg)
Anantigha	138.71m^3 x250kgm^{-3}	34677.5
Ediba	106.7m^3 x250kgm^{-3}	26675
Ikot Ansa	85.36m^3 x 250kgm^3	21340
Total		**82692.5**

However, from the CRSWMA report, it is found that in Calabar Metropolis, the waste collection rate is 30% and the city has 735 community street collection containers. In other words, the waste collection frequency is 2.1 days or 2days a week. Therefore, from table 26, the accumulated wastes collected in the 3 wards per day was 82693kg or 82.7 tons which translates to an average waste collection per ward to be 27564kg or 27.6 tons per day. Thus, for two days of the week

waste collection, the quantity of waste collected is shown in table 8.

Table 8: Accumulated waste collected in three wards for two days in Calabar

Wards name	Total waste collected per day(kg)	Accumulated waste collected in 2 days (kg)	Wastes collected per week in (tons)
Anantigha	34677.5	69355	69.4
Ediba	26675	53350	53.4
Ikot Ansa	21340	42680	42.7
Total	66687.5	165385	165.5

Using the data from table 8, the amount of waste collected per week in the 3wards amounts to 165,385kg or 165.5 tons. This shows that the mean weekly waste collection per ward was 55128.3kg or 55.2 tons. To estimate the total quantity of daily waste collected in Calabar metropolis with 22 residential communities. This work used the mean weekly waste collected per community to divide by 7 days that make up a week, which means 7875.5kg or .7.9 tons of waste was collected daily from each ward. The daily waste collection rate was for projection by multiplying the daily waste with the number of communities which amounted to 173,261kg or 173 tons.

Table 9: Variation between household solid waste generated and collected in Calabar.

Location	**Time periods for waste generation and collection**			
Calabar	**Daily (tons)**	**Weekly (tons)**	**Monthly (tons)**	**Yearly (tons)**
Generated	244	1706	6822.4	81864
Collected	173	1211	4844	58128
Difference	71	495	1978.4	23736

The results of the quantity of waste generated and that collected in Calabar was given in table 9. The table shows that differences exist between waste generated by sampled respondents and that collected by the waste collection agency in Calabar. It shows that out of a total of 244 tons of waste daily generated Calabar, 173 tons was collected leaving a surplus of 71 tons of waste collected and this amounts to 30% of uncollected waste. This weekly, monthly and yearly accumulation of uncollected waste amounted to 495 tons, 1978.4 tons and 23736 tons respectively. From the study, the tons of waste that are left uncollected in Calabar was attributed to many factors amongst which are the in the dearth distribution of community street collection containers, shortage of workforce and small number of transporting vehicles.

In Ugep, to estimate the quantity of domestic solid waste collected by the UUDA due to the method employed in waste collection in the area, appropriate steps were employed in the field to get the statistics of quantities of waste collected and disposed of The block method was used by the UUDA for waste collection. In this method, a variation of seven and ten tons tipper was used to collect waste by moving from street-to-street and inviting households to come with their waste through the process of ringing of bell. When the Executive Secretary of UUDA was asked the quantities of waste collected per day, he reported that the quantities of waste collected from the area was determined by multiplying the number of ten-tons tipper used for collection by the number of times waste was collected per day and the frequency of operation in a week.

From the field study, it was found that the sampled wards used one type of Tipper-Truck in Biko-Biko ward and in Ijom ward and each runs once a day and two days in a week. The adoption of this method for estimating waste collection in Ugep and Ogoja was in line with the work of Kawai and Tasaki (2016), who did extensive research on estimates of municipal solid waste collection and their reliability reliable quantity of solid waste collection can be achieved in developing countries who lack the financial capacity and technological sophistication associated with waste collection measurement for models used in developed countries through the adoption a simple model in which field measurements were taken of daily trucks

loaded with disposed waste, their capacity, waste density, volume and number of times evacuation is performed per day were summed up to determine the daily waste collection. It's stated below:

$$W = \sum_{i=1}^{M} \sum \left(C_i \, x V_i x d_i x t_y\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where: W = is annual MSW collection in tons per day

m = is total number of trucks

C_i = is the capacity of trucks i(m^3 per truck)

V_i = is the loading volume ratio of truck i

d_i = density of MSW loaded on truck i (in tons per m^3).

t_y = is the number of trips per truck i on day j (frequency of trips per day)

From equation 1 as stated above, it is obvious that a reliable estimate of quantity of domestic solid waste collected from Ugep and Ogoja can be calculated based on the above model. The field measurement and information collated for Ugep was translated as shown in table 10.

Table 10: Estimates of quantities of domestic solid waste collected per ward in Ugep

Community name	Tipper capacity (tons)	Frequency per day	Daily total (tons)	Collection frequency per week	Weekly total (tons)
Biko-Biko	25	1	25	2	50
Ijom	25	2	50	2	100
Total	**55**		**75**		**150**
Average Tons			**37.5**		**75**

From table 10 in Biko-Biko community, 25 tons of waste was collected while 50 tons of waste was collected in Ijom community daily. The sampled wards had a mean waste collection of 37.5 tons in a day and 50 tons collection per week for Biko-Biko community and 100 tons collection per week for Ijom community. The table also indicated an accumulated weekly collection of 150 tons and a mean tonnage of 75 tons. Using table 10, a general domestic solid waste collection in Ugep was calculated based on a daily average waste collection of 37.5 tons. The accumulated waste collected from the four wards with the average collection of 37.5 tons per ward becomes 150 tons per day. The weekly, monthly and yearly projection of waste collection is shown in table 30

Table 11: Projection of domestic solid waste collected from the four communities in Ugep.

Daily Projection (tons)	Weekly projection (tons)	Monthly projection (tons)	Annual projection (tons)
150	1050	4200	50400

Table 11 indicates that 1050 tons of waste was collected weekly, 4200 tons monthly and 50400 tons was collected yearly in Ugep. The low rate of waste collection by UUDA was attributed to over centralization of waste collection by the management of UUDA who hardly involves the community members as the main stakeholders for waste collection.

Table 12: Variation between solid waste generated and collected in Ugep

Location -	**Time periods**			
Ugep	**Daily (tons)**	**Weekly (tons)**	**Monthly (tons)**	**Yearly (tons)**
Generated	186.5	1305.1	5221	62647
Collected	150	1050	4200	50400
Difference	36.5	255.1	1021	12247

From table 12, it shows that for every 186.5 daily tons of waste generated in Ugep, only 80% (150tons) of the waste was collected leaving behind 20% (36.5 tons) of the waste to litter around the surroundings. The uncollected daily waste accumulates to 255.1 tons a week and 1021 tons in a month. At the end of the year, a substantial accumulation of 12247 tons of waste have been left Uncollected which significantly poses environmental nuisance in-terms of health hazard and pollution. This development in effective waste collection administration hinges on poor urban governance as a hallmark of cities in developing countries where there are dearth in the provision of equipment, facilities and finances to adequately address the challenges of waste collection peculiar in urban areas.

Similarly, in Ogoja the difficulties encountered in Ugep in-terms of getting data on the quantity of domestic solid waste collected by the, Ogoja Urban Development Authority (OUDA) was also pronounced. So the process of determining the quantity of domestic solid waste collected in Ugep was employed as the same block method of waste collection was used by OUDA. Therefore, since the waste management authorities in Ogoja reported that they normally use five and seven tons truck for their daily operation and the collection frequency for a day is once to the open dump site and the operation was conducted once in a week. This information is summarized in the table 13 below.

Table 13: Determination of daily quantities of domestic solid waste collected in Ogoja

Community name	**Truck capacity (tons)**	**Collection frequency per day**	**Daily total (ton)**	**Collection frequency per week**	**Weekly total (tons)**
Igoli	10	1	10	2	20
Okuku	15	1	15	2	30
Total	25	2	25	4	50
Average		1	12.5	2	25

The table showed that in Igoli ward, 10 tons of waste was collected daily while in Okuku, 15 tons of waste was collected. As it was reported by the waste management authority that waste collection was conducted once a day and twice a week. It also showed a mean

daily waste collection of 12.5 tons, a weekly collection of 50 tons and an average weekly collection of 25 tons. Therefore, to out the total amount of waste collected in Ogoja, the average solid waste lection rate of 12.5 tons per ward was considered. The rate is the average of domestic waste collection rate of all the wards in Ogoja and this was multiplied by 8 which is the total number of wards in Ogoja to give a domestic solid waste collection output of 100 tons per day.

Table 14: Estimates of domestic solid waste collected from the eight wards in Ogoja

Daily output (tons)	**Weekly output (tons)**	**Monthly output (tons)**	**Annual output (tons)**
100	700	2800	33600

In table 14, Ogoja made a weekly domestic solid waste collection of 700 tons, monthly waste output of 2800 tons collection and an annual accumulation of waste collection of 33600 tons.

Table 15: Variation between solid waste generated and collected in Ogoja

Location Ogoja	**Daily estimates (tons)**	**Weekly estimate (tons)**	**Monthly estimate (tons)**	**Annual estimates (tons)**
Generated	134.1	938.6	3754.4	45053
Collected	100	700	2800	33600
Differences	34.1	238.6	954.4	11453

There is variation between the quantity of waste generated by the sampled respondents of the household and the quantities collected by the OUDA. From the table, it shows a daily variation of 34.1 tons of waste left uncollected in the street of Ogoja by extension on a weekly basis out of 938.6 tons of accumulated Ste generated 700 tons was evacuated leaving a balance of the 238.6 tons. Thus, at the end of the month, 954.4 tons of waste are left on the streets of Ogoja to litter and pollute the environment.

Table 16: Estimates of domestic solid waste collected by the waste management authorities in the study area

Location	**Daily (tons)**	**Weekly (tons)**	**Monthly (tons)**	**Yearly (tons)**
Calabar	173	1211	4844	58128
Ugep	150	1050	4200	50400
Ogoa	100	700	2800	33600
Total	423	2961	11844	142128
Mean collection	141	987	3948	47376

Table 16 represents cross tabulation of the three towns with estimated daily, weekly, monthly and annual wastes collected by the waste management institutions in the study area. From the table, 173 tons of waste was

collected in day, which translates to a weekly collection of 1211 tons from Calabar. Calabar equally recorded the highest daily, weekly, monthly and yearly waste collected among the sampled three towns. However, Ugep town, with second class urban status reported a waste collection of 1050 tons per week and 4200 tons monthly and 50400 tons annual collections respectively. While Ogoja records weekly, monthly and yearly collection of 700 tons, 2800 tons and 33600 tons. This might imply that variations in quantities of waste collected by the waste management authorities occurred both within and between the towns.

CHARACTERISTICS AND COMPOSITION OF DOMESTIC SOLID WASTE FOUND IN THE STUDY AREA

DOMESTIC SOLID WASTE COLLECTION IN CROSS RIVER STATE.

The study showed that, in Calabar, Ugep and Ogoja, the daily tonnage of solid waste collection was 173 tons daily and 58128 tons annually; 150 tons daily and 50400 tons annually and 100 tons daily and 33600 tons annually tables 30-35). The study also revealed that the mean daily waste collection id annual total quantity of solid waste collection from urban areas of the State stood at 1652.1 tons and 555120.3 tons respectively. Comparing the waste generation and collection of the study, the research established that, of a total of 2377.5 tons of daily solid waste generated, 1652.1 tons representing 69% was collected while 31% (725.4 tons) was left to litter. Similarly, the research further show that annually the State generates 798840 tons of solid waste and evacuates 555120.3 tons, having a leftover of 243719.7 tons of uncollected solid waste. The 69% tonnage collection from the State lies within highest benchmark of optimum performance for most developing Countries in terms of waste collection as this findings was similar to the work of (Kawai and Tasaki, 2016) who did extensive comperatice studies on Municipal waste collection services in developing countries.

In terms of waste collection arrangements, the data gathered showed 'that house-to-house, roadside, truck visits and CSCC. In Calabar, 24% of the sample indicated that they had home collection, while 15% had roadside collection. Households representing 17% indicated that they kept their waste the home until a waste truck visited their neighbourhood or employed the services of informal private collectors. Whenever the waste trucks failed to come for a long time. Of the remaining 8% households in Calabar survey, a further 24% disposed of their waste in CSCC located within their neighbourhood. Those who indicated that they had no waste disposal services were 47 households representing 9.3%. Out of this 32 disposed of their waste on communal dumps,

while the remaining 15 resorted to any convenient means of disposing waste including dumping into drains, burying and burning.

In the case of Ugep and Ogoja 15% and 22% indicated home collection to be their waste disposal arrangement. Findings indicated that in the three urban areas, households without waste collection services were not only found in high residential districts. Some of the low and medium residential districts were located in newly peripheral neighbourhoods in these urban areas where waste collectors do not extend their operations, some residents dumped their waste at any convenient location including depressions, roadside, bushes and rains (plate) while others employed the services of the informal waste collectors. The periodic collection of waste in the study area is carried out twice a week in Calabar and once in a month and sometimes no collection at all in months in Ugep and Ogoja. Equipment used for waste conveyance includes roll-on-roll-off truks, open tippers, side loaders in Calabar and only loaders who rings bell for households to deposit their wastes in open tippers in Ugep and Ogoja.

Table 3 identified five major agents in Calabar CUD A, private waste contractors, informal agents, individuals and others engaged in waste collection in the study area. From this results about 44% of total DSW originating in Calabar was collected directly by CUDA. While tables 4 and 5 outlines four agents who are in charge of solid waste collection in Ugep and Ogoja, UUDA and OUDA, informal agents, individuals and others. The results showed that for Ugep, UUDA was responsible for 68% of the waste collected. In Ogoja, OUDA only collected 59% of the total waste generated from the area. The result showed that all the urban areas sampled government was responsible for collecting the highest volume all the waste emanating from these places. This development does not promote efficiency as the global trend dwells on complete privatization of waste collection services, thereby freeing local government authorities to carry out over sight functions and supervisory roles more effectively.

METHODS USED IN DOMESTIC SOLID WASTE COLLECTION

Findings from the study revealed domestic solid waste collection from most households within the study area was from community street collection I containers (CSCC) in Calabar and block collection in Ugep and Ogoja. At the household level waste is stored in different types of containers both closed and open containers, polythene sack bags, plastic buckets and condemned local weaved baskets. Many high residential density households living in informal settlements of the urban areas use any available container such as open pails, polythene bags to store waste. Although, the methods used by households for waste collection were

enumerated, table 17, durther presented further submission to this effect. The study found that only in Calabar do households in low residential districts stored their waste in large plastic bins which they position in strategic locations of the house for collection by waste contractors. The bins were either purchased by the households or supplied by the CUDA for a fee. In the medium residential districts, where roadside collection is the norm, 62% in Calabar, 52% in Ugep and 58% in Ogoja indicated that they stored their waste in closed containers, the remaining medium residential areas stored their waste in a variety of containers such as sacks, polythene bags, plastic buckets, and empty carton. Similar containers were in use in the high residential district, except that majority of households used open containers, sacks, empty cartons and polythene bags.

Table 17: Household containers used for waste collection

Type of Containers	Calabar		Ugep		Ogoja	
	*NOHR	%	*NOHR	%	*NOHR	%
Closed containers	317	53.4	106	30.2	105	32.5
Open container	120	20.3	196	56.1	185	57
Polythene bag	90	15.2	27	7.7	18	5.2
Polythene sack	57	9.6	14	4.0	13	4.0
Others	9	1.5	7	2.0	4	1.3
Total	593	100	350	100	325	100

* NOHR = Number of Household Respondents

The field investigation found that in Calabar, Ugep and Ogoja, households in the low density residential areas such as Ikot Ansa, Satellite Town and State Housmg Estate in Calabar; Ijom Njelekoko in Ugep and Abakpa and Okuku in Ogoja collect and store their waste in closed plastic bins which they placed in front of the house for collection by waste service agents. The bins were supplied by the local government authorities to the household for a fee of three thousand five hundred (#3500). The survey showed a variation among the three towns in the use of close containers while there were as many as 317(53.4%) out of 593 households in Calabar, the household respondents reduced to as low as 106(30.2%) households in Ugep to 105(32.5%) households in Ogoja who collect their waste in closed containers. Also, in the medium density residential households where roadside collection is the norm, many householders sampled the survey, 58% in Calabar, 73% in Ugep and 79% in Ogoja showed that they collect their waste in a variety of containers such as polythene bags, polythene sacks, baskets, condemned drums and buckets. The means of collecting waste in the high-density residential households was

the same as those found in the medium density area. Nevertheless, unlike in the low and medium density households where waste is collected in closed containers and placed in designated locations or roadside until it is collected by the waste management institutions, households in the high density residential areas do not have save and durable containers to collect their waste in the home for long but take it for disposal in the community street collection containers as soon as it is generated.

ENUMERATION OF DSW COMMUNITY STREET COLLECTION CONTAINERS

In analyzing the spatial site locations of CSCC, findings indicated that the stock of CSCC available for waste collection was 724 distributed in 22 wards across 42 locations in Calabar metropolis. Out of this number, 419 public CSCC were located in 10 wards of Calabar Municipality and 305 public bins located in 12 wards of Calabar South (Table 18).

Table 18: Distribution of illegal waste collection centres in Ugep

Name of area	No. of illegal waste collection centres	% distribution
Bikobiko	20	35.7
Ijiman	4	7.1
Ijom	16	28.6
Ikpakapit	10	17.9
Ketabebe	6	10.7
Total	56	100

The table showed that about 64% (36 out of 56) illegal community collection centres were distributed in Bikobiko and Ijom wards which signifies high residential density areas like Njelekoko and Ntamkpo in Bikobiko and Aneja and Kekomkolo in Ijom. While the medium density distribution of illegal collection centres were located in Ugom, Kiwel and Kelon accounted for 17.9% (10 out of 56) illegal community collection centres. The low densities accounted for 7.1% (4) and 10.7 (6) of the illegal community collection centres and were cated in Ofeletam axis beside Yakurr Local Government Guesthouse in Ugep.

The CSCC distribution were not evenly distributed as the high residential density were allocated 42% of the public bins, medium density 24.3% and the low density 33.7%. The uneven bin distribution in favour of the low residential density results in shortage of public bins distributed rationally to other high and medium residential densities. The inadequacy of public waste bins makes the waste agencies unable to undertake effective waste collection and also meet spatial coverage. This situation contributes to waste accumulation especially

in the high residential districts where collection service are limited. Findings further showed that the government agencies in Calabar neither have enough waste containers for waste collection in all the residential densities nor do they meet the schedule for waste removal and timely replacement of waste bins. This development makes household residents dump their waste on the ground and results in waste accumulation container sites. The shortage of CSCC in Calabar for waste collection prompted the determination of extra CSCC that will add up to the existing stock to meet the required number expected for effective waste collection operation in Calabar. The calculation of the required numbers of CSCC was arrived at by determining each dustbin volume, per capita waste generation, total quantity of daily waste generation, bulk density of waste, total volume of dustbins in each ward and capacity of all the dustbins in a ward. Hence, 352 (Table 19) CSCC was calculated to be distributed in 22 wards of Calabar metropolis; showing an average additional CSCC of 16 per ward.

Table 19: Typology of measured distances of community street collection centres in Ugep

Distance Measurement (m)	Frequency of Occurrence	Percentage Contribution (%)
50	9	16.1
52	2	3.5
55	2	3,5
60	2	3.5
65	9	16.1
67	2	3.5
70	9	16.1
73	1	1.7
85	9	16.1
89	1	1.8
95	1	1.8
105	9	16.1
Total	56	100

From the table, the five distances whose frequency appears 9 times each distributes about 80.5% which signifies that majority of the households by their disposal behavior have alluded to the 75m buffer zone as the preferred …… distance for the location of CSCC

Equally, findings from Ugep and Ogoja towns indicated that the waste collection agencies activities were also constrained by lack of operational CSCC and this makes easy for households to create illegal waste dumps, thus pie government waste agencies provided unsatisfactory waste collection services. Findings from the study indicates that the distances for the unauthorized waste dumps created by households was haphazardly distributed and requires regularization and standardization. In order to determine the number of CSCC that was required in Ugep and Ogoja, the model developed by Nithya et al (2012) was adopted. The model used parameters such as total quantity of waste

generated per day, density of waste, size of public bins, average filling rate of bin and collection frequency. Optimality constraints such as network of roads, inaccessible areas and creation of buffer zones subject to the variances in the distance placement of proposed CSCC was employed which subsequently determined the number of CSCC in Ugep and Ogoja to be 93 and 67, with an average of 13 two-tons roll-off CSCC in each ward in Ugep and an average of 9 two-tons roll-off CSCC in each ward.

Findings established that the spatial distribution of the collection points in Calabar metropolis was more concentrated in the low-medium density populated parts. The high density areas have fewer collection as the collection points easily gets filled up and creates messy environmental conditions around the bins. Findings also showed that spatial analysis in Calabar municipality, indicated reasonable distribution of CSCC even though, at designated locations, for instance at Basin Authority, EPZ and New Ikang, there are few numbers of CSCC. At Calabar South, the settlement pattern has been characterized into two categories based on population density. In the first category which consist of high to medium density settlements, which include Mayne Avenue, Afokang, Jebbs, Goldie, Essien Town, Atamunu and their peripheral areas consists of buildings closely packed together providing no space for placement CSCC for solid waste collection. The second category is the low density which include Calabar Road, Ambo, Palm Street, Diamond Hill, etc., whose settlement had spaces for location of CSCC and thus 167 CSCC are located here. The difference between the two categories of residential densities in this study is that most of the collection points within the high density areas were over used as large quantities of hips of solid waste were observed during field work in these residential settlements.

RECOMMENDATIONS

The recommendations aimed at enhancing and finding lasting solutions to the growing domestic solid waste generation and collection methods problems in urban areas of Cross River State were directed by the key result of data analyses and research findings amongst which are as follows;

1. The present approach to waste collection management where the government's evaluation of the waste collection problem, centered only on finance and facilities and that provision of funds and equipment can solve the enormous solid waste problems should be seriously scaled up while embracing a more robust integrated approach which incorporates holistic participation through the process of promotion of good governance practices were all

stakeholders including the poor and rich in the urban area form part of the waste collection framework plan and in execution.

2. It is important for the state government and its organ, the Ministry of Environment as policy initiators generally on waste management to commit themselves to the issues of waste collection. This could be done by improving the capacities of the finance, waste facilities and equipment provision and personnel as well as providing them with legal support to enforce regulations on waste disposal and other aspect of general waste management.

3. The study identified the informal methods presently as, significantly contributing to waste collection in the sampled urban areas. But their current operation are mostly uncoordinated and so affected by several barriers. To coordinate their effectiveness, there is need to organize their operation and support them in-terms of capacity building and giving incentives in integrated waste collection, sorting, recycling and composting as a business.

4. The CRSWMA UUDA, OUDA and the local government waste management agencies as presently constituted require to be over-hauled and reengineered in-terms of man-power training to perform its functions more effectively, while CRSWMA, UUDA OUDA as departments in charge of waste collection should be strengthened to be able to monitor, regulate and enforce waste related legislation in the state effectively.

5. The current dearth and paucity of data in waste generation and collection management in the towns of study are typical cases of me rest of urban areas of the state. To overcome this situation, this work recommends that the CRSWMA should establish a research unit that will be vested with the responsibility for advancing waste research and the coordination of a central waste management data bank in Cross River State.

6. There is need to develop a detailed waste infrastructure master plan peculiar to the broad objectives of the urban areas in the state especially those towns with master plan which would be required to guide future development in domestic solid waste management.

7. The operational problems associated with domestic solid waste collection

administration in urban areas are linked to the absence of a comprehensive strategic document for sustainable waste collection in urban areas of the state. Hence there is urgent need to draw up a medium and long term waste management strategic plan in line with global best practices. This plan should spell out realistic targets for waste prevention, re-use, recycling and composting.

CONCLUSION

This study showed that the issues of domestic solid waste collection management has become endemic in urban areas of Cross River State with the quantities of solid waste generated being on the increase. The analyzed data showed that solid waste generation and composition is highly dependent on population and socio-economic status of the population; also there were per capita waste generation variation between residential densities. The enormity of the daily waste generation arising from the study area, only 70% of it is disposed while the 30% is left to rot in the streets. Yet with the ensuing increase in waste generation, the government authorities perform below expectation in handling the waste menace. This unimaginable waste scenario as mentioned earlier came largely from the lack of political will to squarely .wrestle with the issue of waste collection. This is shown in the ineptitude of urban governance administration to enhance local government waste management agencies to deal with the rather hydro-headed, issue of waste collection.

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MEASURING THE QUANTITY OF DOMESTIC SOLID WASTE GENERATED IN SOME URBAN CENTRES IN CROSS RIVER STATE, NIGERIA

By

[1]Inah, S. A., [2]Otunta, G.A

[1]Department of Urban & Regional Planning, (CRUTEH)

[2]Department of Urban & Regional Planning, (FED POLY,UWANNA)

Abstract

The research assessed the domestic solid waste generation and collection methods in order to improve waste management in urban areas of Cross River State. The research adopted both quantitative and qualitative methodological approach employing measurements of waste generated and collected, distance between residence and public community street collection containers (CSCC), waste composition analysis of samples, pattern of distribution of CSCC, questionnaire survey and field interview of target population for generation of data. The quantitative and qualitative data gathered from questionnaire, interviews and field observation were exported into SPSS 10.3 software and Microsoft Excel for analysis, the data was presented using frequencies, percentages, Nearest Neighbourhood Analysis and Euclidean Distance Measurement. Findings showed that per capita daily waste generation in the study area was 0.59kg, which translates to a daily waste generation of 2378tons and 798,840 tons annually. It was discovered that 75% of DSW samples from the urban areas was made up of high organics and papers. This implies that the high level of biodegradable materials in the waste is an indication that it, would serve as a guide for bioconversion programme such as biofuel production and compositing. Data analysis also showed that there was community street collection containers (CSCC) in the study area and also the distribution pattern was skewed in favour of the low densities which actually affected coverage of waste collection. It was recommended that the development of a detailed waste infrastructure master plan peculiar to the broad objectives the respective urban areas would be provide abroad based solution to waste management in the area.

Keywords: Domestic Solid Waste, Generation Urban Centres, Infrastructural Master Plan.

INTRODUCTION

Environmental problems in the 21st century indicate that waste in whatever type, form or classification has become a major consequence of modernism and economic development (Inah, 2019).

In the developing world, the rapid uncontrolled urbanization has saddled cities with daunting physical, socioeconomic and environmental problems. These problems vary from poor infrastructures, inadequate housing, alarming role of unemployment, and poverty, social exclusion; rising crime and violence to inadequate provision of service such as water supply, sanitation and waste disposal. African countries are not left out of these environmental problems. A survey of the environmental conditions of some cities in

Africa revealed that the implorable level of solid waste collection is fast assuming a state of major social and environmental challenge. Gyuse, (2011) vehemently affirmed this premise of the deplorable environmental adverse condition perpetuated by the suffocating presence of heaps of uncollected solid wastes in most city content in Africa. Amongst the number of factors which tended to worsen the situation of solid waste collection are; lack of political commitment of urban administrators, insufficient budgetary allocations, inadequate and standardized poor distribution of public solid waste collection containers and a dedicated work force (Inah, 2019). The enormity of this problem reflected in the level of the attention given to it by United Nations Centre for Human Settlement (UN-HABITAT) in response to the glaring need to improve urban solid waste collection systems. This body, enlisted a menu of choices from which service providers and local government authorities can identifying appropriate, cost effective, and affordable options for efficient solid waste collection, handling and disposal system (UN Habitat, 2010). In Nigeria, poor urban governance has manifested in low level of revenue collection with an inordinate strain on the capacity of urban areas to deliver efficient waste collection services, which generally reduces their areas of service coverage and at the same time diminish the quality of services offered (Inah, 2019).

In Cross River State, the responsibility of providing a solid waste collection service generally rests on local government like any other state in the country. However, the fundamental deficiency of local government in the country is key to the mismanagement of solid waste generated in the states. Several reasons have been advanced for such dismal performance, prominent among them is the Lacunas in local government financing in Nigeria. Apart from limited funds, poor urban governance have manifested on the absence of inadequate planning and the use of unsuitable vehicles and equipment for solid waste collection and evaluation in Cross River State. Thus with abysmal performance of the public sector in solid waste collection in the urban areas, it behoves on policy makers, administrators and settlement managers to partner with the private sector, civil society and the public agencies in the management of waste generated in urban areas of Cross Rivers State. Similar works carried out by Han and Ponce Ueto, (2015) and Davis and Kudzai, (2016) failed to clearly establish quantitative spatial variation and compositional difference in domestic solid waste generated and collected in urban centres. Hence this paper will suggest an Index Efficiency Measuring System (IEMS) in domestic solid waste collection in some urban centres in Cross River State.

STUDY LOCATIONS

The study is restricted to domestic solid waste generated within the selected urban areas of Calabar, Ugep and Ogoja. There urban areas are strategically located in the Southern, Central and Northern senatorial district of Cross Rivers State. Cross River State is bounded in the North by Benue State, in the North West, Ebonyi State, in the South by Akwa Ibom and Atlantic Ocean, in the east by the Republic of Cameroun and west by Abia State. The state has an estimated population of 2,892,988 of which, 468,568 live in Calabar, 97,614 live in Ugep and 46, 790 live in Ogoja (NPC, 2006). It has a total land area of about 23,074km^2 which is divided into 18 local government areas.

The government institution responsible for managing solid waste in Calabar, is the Cross River State Waste Management Agency (CRSWMA), in Ugep, is the Ugep Urban Development Authority (UUDA) and in Ogoja is the Ogoja Urban Development Authority (OUDA). The mandate given to their institutions has the following components; city cleaning, street sweeping, liter control and solid waste collection and disposal and beautification control.

In terms of climate; Cross Rivers State enjoys two distinct seasons- the wet and dry seasons. The wet season commences in the month of April to October, while dry season begins from November to March each year. As a coastal area, Cross River State experiences annual rainfall of 3058mm and a relative humidity of more than 76.8%. The rainfall regime encourages farming activities throughout the year, which in turn entrances the level of individual income and improvement in lifestyles and consumption pattern of the people as well as encouraging the generation of domestic solid waste. High temperature is uniformly experience in the area throughout the year. Mean annual temperature is 25^{o}C, well moderated by the influence of sea breezes and copious rainfall (CRSV, 2020).

METHODOLOGY

The research design adopted for this work, were both quantitative and qualitative survey design. Reason begin that issues of service delivery of an environmental good like solid waste management in human settlements possesses a broad outlook overlapping several academic disciplines, from applied to social sciences. Quantitative approach was applied to determine Per Capita Waste Generation (PCWG). Questionnaire survey was utilized to analyze waste samples as well as understand the nature of domestic solid waste generation in urban areas of Cross Rivers State qualitative approach, such as interviews and participant observation was used to generate supporting data mostly from human subjects in order to strengthen quantitative evidence. This approach is similar to the strategy used by Ezeah, (2010) in analyzing

barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Abuja, Nigeria.

The study population consisted of the following targets: household residing in Calabar, Ugep and Ogoja respectively, private managers and Cross Rivers State Environmental Agency.

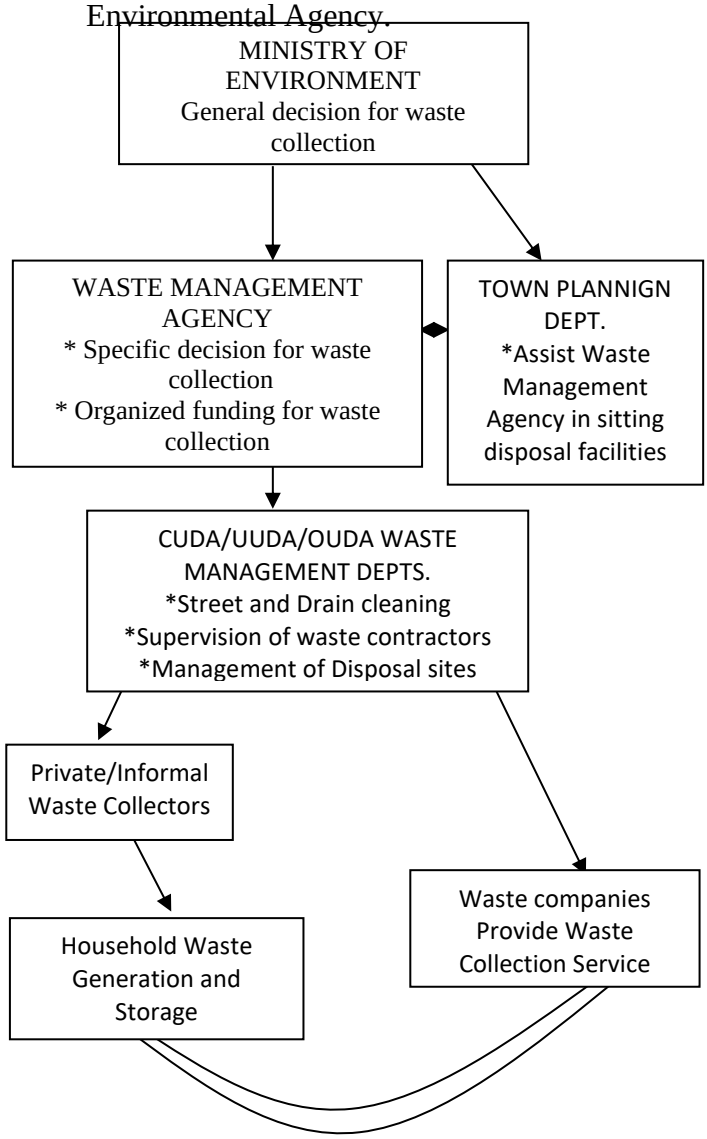

Figure: Conceptual diagram of domestic waste collection stakeholders and their duties

SAMPLE AND SAMPLING TECHNIQUES

SAMPLE SELECTION

The sample selection for this study was influenced by the need to select a sample size first and foremost that is truly representative of the three major urban areas of Cross River State; the need to collate definite data and information as it concerns this study, and the need for precise correct interpretation of data collected and analysed from the study area.

A sample frame is the collection of source materials from which the sample is selected. It is normally a process of electing particular units of the target population that are to be interviewed in the survey. In this study that involves an assessment of domestic solid waste generation and collection systems in urban areas of cross river state, the sampling technique that was employed is the multi-stage sampling process. It involves starting with the sampling frame. The sample frame starts with numbering and listing of the 18 local government areas in alphabetical sequence and picking one of every sixth local government areas in the list and 3 local government councils were picked. This gives a sample ratio of 1:6 and a sample interval of 6. The second stage was to list the urban areas in the selected local councils of which the council headquarters were automatically chosen as the towns. Another stage was to list the population of households in the selected 3

towns. For Calabar, there were 74609 households listed and the selection process was to pick one of every 110 households on the line. This gives a sample ratio of 1:110 with a sample interval of 110; therefore, every one-hundred and tenth household was sampled and a total of 683 households was selected. In Ugep, 24853 households were listed and the picking process to select one of every 61 households, giving a sample ratio of 1:61 with a sample interval of 16; meaning that every sixty-one households was sampled and giving a total of 408 households selected. Similarly, for Ogoja 23943 households was listed and the selection process was to pick one of every 64 respondents. The sample ratio was 1:64 with a sample interval of 64, showing that every sixty-fourth household was sampled and resulted to a total of 374 households selected. In questionnaire administration the use of the sampling frame was to follow the existing stratified residential communities of the three towns under study. In Calabar, the map of the stratified communities as developed by the Department of Town Planning unit of the Ministry of Lands and Urban Development, Calabar was used. Twenty-two communities were listed serially and by random picking, every third community on the list was selected and a total of 7 communities were selected. In Ugep equally 5 communities were listed and by picking every second community on line, a total of 3 communities were selected. While in Ogoja, 8 communities was listed and by selecting every second community on line, 4 communities were picked. In the selected communities in the 3 towns, simple random sampling was employed to select streets for questionnaire administration. In the streets, the process of households selection was based on picking houses. Household selection was done by counting every seventh house in the selected street for streets without numbering, but for streets with numbers, the numbering was used.

SAMPLE SIZE DETERMINATION

Sample size determination according to Singh & Masuku (2014) is the technique of selecting the number of observations to include in a sample. The aim is to make inferences about the population from a sample. In survey research design, Fowler (2009) viewed that sample size determination relates to the analysis plan for a study and as such there is need to determine the subgroups to be analysed in a study, then subsequently calculate the appropriate sample size based on three elements viz: determination of margin of error, determination of confidence level for the margin of error and estimation of percentage sample response rate or degree of variability. Thus, in order to determine a suitable sample size for the study, a base-line sample size was derived by percentage of not less than 10% (Ismail et al, 2015; Amoah and Kosoe (2014) of the study population. The satellite imagery was subsetted from the Cross River State Topographic Map Scale of

1:250,000, to derive 18 urban areas of the state. Thus, three Local Government Areas were systematically selected by random sampling. The method of selection was to alphabetically arrange and list the local governments in pieces of papers, fold them and place them according to how they appear in the existing three political senatorial districts of the State. The list of the folded local governments was then put into three small trays to ensure that each local government have a chance of being picked. A random hack-saw-draw was carried out in each tray to select the three (3) local government areas and the local government headquarters of the picked local governments automatically became the 3 urban towns selected for study. The selection procedure is represented as shown in Table 1. The basis for selecting the three urban areas is that since the study covers the whole Cross River State, it becomes difficult to simultaneously move to all the local governments to collate data for the study hence the need for the sample representation. Also the selection of the three urban areas reflects the existing political stratification of the State government which covers physical and population diversity.

Table 1: Sampled local government areas and selected urban Centres in Cross River

Existing Local Government	**Sampled Local Government**	**Selected Urban Area**
Northern Cross River	Ogoja	Ogoja
Bekwarra		
Obanliku		
Obudu		
Ogoja		
Yala		
Central Cross River	Yakurr	Ugep
Abi		
Boki		
Etung		
Ikom		
Obubra		
Yakurr		
Southern Cross River	Calabar Metropolis	Calabar Metropolis
Akamkpa		
Akpabuyo		
Bakassi		
Biase		
Calabar South		
Calabar Municipality		
Odukpani		

The urban areas selected for this study is regarded as the initial sample size. Another sample size is the determination of sample population for the survey in terms of questionnaires administered. Also, simple percentage and systematic random sampling method was used in the selection of 12 government officials from 120 government officials identified working in the waste management agencies in the study area. Similarly, 80 informal waste pickers and contractors were identified in the study of which 8 respondents were selected through simple percentage and systematic random sampling. Likewise, in order to obtain a sample size for the household survey and solid waste, this study adopted the work of Cochran (1977) who postulated a formula for sampling for continuous variable

measurement and which has been widely applied by other researchers including Gomez, Meneses, Ballinas and Castells (2008); Gallardo, Bovea, Colomer and Prades (2012) and Miezah, Obiri-Danso, Kadar, Fei-Baffoe and Mensah (2015) suggested the le of a simple procedure of straight forward formula to determine sample size as follows;

$$n = Z * Z \left[\frac{P * P}{D * D}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where; n = is sample size; Z = value for selected alpha level of each tail = 1.96 (the alpha level of .05 indicates the level of risk the researcher is willing to take that true margin of error may exceed the acceptance margin of error), P = estimate of standard deviation in the population and D = acceptance margin of error for mean being estimated. The estimated number of waste samples using the equation 1 is presented in table 2 below:

Table2; Sample size and amount of household solid waste collected for analysis

Town	Study locality	Population	Estimated sample size at 5%	No. of samples collected	Total waste analysed (kg)	Total household survey	Total people generating the waste	Sampling duration (weeks)
Calabar	Satellite town Essien town	12435 24869	123 240	16 21	2044.2 4148.3	12 22	72 154	4 5
	New airport road	37305	357	27	5017.5	34	250	7
Ugep	Ntanmkpo	4142	78	12	1868.4	9	70	2
	Aneja 111	8286	146	17	3642.5	14	135	3
	Yenon	12425	216	25	4210.7	19	205	4
Ogoja	Okuku	3990	55	10	1532.1	7	63	2
	Ugaga	7981	114	18	3356.8	12	126	3
	Ukpahe	10972	181	22	3884.3	18	189	4

A look at table 2 above showed that the actual sample of waste collected from household for analysis is far above the sample size. The larger sample size obtained was necessary in getting a more accurate and precise data which is a true reflection of the waste generated and collected in the study sites. Having determined the sample size of waste to be analyzed, the number of households selected in each town was between 30 and 70.

The population of Calabar, Ugep and Ogoja from the 2006 NPC (National Population Commission figures) stood as follows; Calabar had 875,196; Ugep had 196.271 and Ogoja had 171,901 people respectively.

These population figures were projected to 2018 using the exponential model for population forecasting, stated below;

$$P_o = P_t(1 + r)^n \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (2)$$

Where; P_o is the projected population, P_t is the population of the base year, r is the current rate of growth (2.8%) (NPC, 2018) and n is 12years. The choice of this model was because it is suitable for short term projections for rapidly growing urban areas in Cross River State. Thus, using the formula above, the population of Calabar, Ugep and Ogoja is 522,607, 273,384 and 239,439 peoples, then they obtained population figures was divided with the Average Household Size (AHS), which are 7, 11 and 10 respectively to arrive at the Total Household Size (THS) for the three urban areas. For Calabar the THS was 74,607 people, for Ugep it was 24,853people and for Ogoja it was 23,943 people. By substituting in formula (1) gave the sample sizes (n) for Calabar, Ugep and Ogoja as 690, 410, and 378 respondents. This shows that 1478 households, plus 9 government officials, which totals 1487 respondents and represents 1.2% of the sample frame of 123,405 households for the study area were sampled. To administer questionnaire, a multistage sampling technique was employed. The first sampling process involves selecting communities to represent the 3 types of residential densities in each town, the basis of settlement classification in the three towns was based on some criteria. The criteria used to classify the residential densities of household were based on the residents' residential plot sizes, in which Obateru, (2006) specified standard plot sizes to range from 35m by 40m for low density, 30m by 35m for medium density and 25m by 30m for high density and other spatial variables such as housing and environmental quality attributes which include size of room, quality of building materials, waste disposal system, potable water, electricity and toilet facilities among others. The adoption of this standards for residential household classification into high, medium and low densities also corroborated the work of Inah, Yaro, Agbor and Ukene (2014), they used this development indices to classify residential density status of people living in Calabar metropolis for residential housing satisfaction of the urban poor studies in Cross River State, Nigeria. The information on the residential communities was used to select settlements to represent the different residential densities, which was obtained from a list issued by the Local Government service commission population unit. Three residential densities were randomly selected for questionnaire survey. Guided by information from the local government population unit, that the respective ' population of low, medium and high residential densities was 7%, 21% and 78% in the three urban areas, this was used as a guide to arrive at the number of

questionnaires to administer in each residential density. In Calabar seven settlements in the different residential communities based on existing settlement wards were drawn. While in Ugep and Ogqja, four residential communities each were drawn from the settlement wards. From the list obtained in each town, two residential communities were randomly drawn from each residential density (Table 3) in which households were selected for questionnaire survey

Table 3: Residential communities selected for household questionnaire survey

Density of residential communities	Study Area		
	Calabar	**Ugep**	**Ogoja**
Low	Satellite Town, State Housing	Ntanmkpo, Njelekoko	Okuku, Abakpa
Medium	Essien Town Ekpo Abasi	Aneja III Edemkokol	Ugaga Abouchichi
High	Bacoco Ikot Nkebre	Yenon Unebu	Ugboro Ukpahe

Thus, a total of 1485 copies of the questionnaire were administered on respondents in the study area across the low, medium and high density residential communities and contractors and government

officials in the three sampled towns. For the 3 sampled towns and using the population percentage information list for questionnaires appropriation, it shows the following: In Calabar it was 48 for the low density, 143 for medium density, 492 for the high density, 4 for contractors and 6 for government officials and this totals 693 questionnaires. In Ugep it was 28 for the low density, 86 for the medium density, 294 for the high density, 2 for contractors and 3 for government officials and amounted to 413 questionnaires, while in Ogoja, it was 26 for the low density. 79 for the medium density, 269 for the high density, 2 contractors and 3 government officials and equal amounted to 379 questionnaires. The questionnaire distribution for the study is shown in table 4 below.

From a total of 35 residential communities in the study area, 15 residential communities were selected. In Calabar there are 22 residential communities. The 3 cities were stratified into three strata namely high, medium and low densities consisting of 10, 7 and 5 communities. However, 7 communities were randomly selected and sampled. A breakdown of the household questionnaire distribution showed that out of a total o f 693 copies of questionnaires that were distributed, 593 questionnaires representing 85.6% of the total were returned. Also Ugep has 5 residential communities and follow the same

Table 4. Household sample selection based on residential densities distribution

CALABAR						
Density of PWs*	No. of RCs in Calabar	No. of RCs sampled	Population of household	Number distributed	Number properly filled and returned	Percentage
CALABAR						
High	10	4	53718	492	433	88.0
Medium	7	2	15668	143	116	81.1
Low	5	1	5223	48	35	72.9
Contractor				4	4	
Govt. officials				6	5	
Total	**22**	**7**	**74609**	**693**	**593**	**85.6**
UGEP						
High	3	2	12425	294	255	86.7
Medium	1	1	8286	86	71	82.4
Low	1	1	4142	28	19	67.9
Contractors				2	2	
Govt. officials				3	3	
Total	5	4	24853	413	350	84.6
OGOJA						
High	4	2	11972	269	235	87.4
Medium	2	1	7981	79	66	83.2
Low	2	1	3990	26	19	73.0
Contracto				2	2	
Govt. officials				3	3	
Total	8	4	23943	379	325 85.6 j	85.6

*Residential communities

density stratification as that of Calabar, but four communities were sampled, 2 for high, 1 each for low and medium densities. The questionnaires distribution was 2 and 3 respectively for contractors and government officials and for households and out of the 413 questionnaires distributed, 350 which is 84.6% were retrieved. Similarly, Ogoja has 8 communities but four were sampled 2 for high and 1 each for low and medium density. A total of 379 questionnaires were distributed and 325 were retrieved as 2 came from contractors, 3 from government officials representing 85.6%. In each residential community, the questionnaires were randomly distributed along streets and one resident per dwelling was interviewed. This method follows similar studies on domestic solid waste management in cities of developing and developed countries (Kayode and Omole, 2011; Kawai and Tasaki,2016).

MEASUREMENT OF GENERATED SOLID WASTE IN THE STUDY AREA

The approach adopted in the measurement of solid waste generated was to sample ten percent of 1465 households selected for questionnaire administration as part of the households for waste measurement. Thus a total of 147 households were sampled for waste measurement. The distribution of households selected from the three towns based on the percentage was as follows, 68 households for Calabar, 42 households for Ugep and 37 households for Ogoja. This proportion exceeded the minimum acceptable sample size of one percent recommended by Pfimatter and Scherttenleib (1996) and Gomez, Meneses. Ballinas and Castells (2008) for such survey.

Stratified, purposive and direct sampling technique was employed in each town to select the number of households. The randomly selected households from the study locations were visited to educate the occupants on waste management and the reasons for willingness to participate. The selected households were earlier trained over a three-day period on waste sorting and separation using designed flyers and personal contacts. Another step was the sorting procedure of the waste. This was carried out by members of the households and the research team. Two polythene bags were supplied to each household for the sorting and separation of food waste and other wastes such as plastics, metals, papers, glass, textiles etc as they were labeled appropriately. The sorting, separation and weighing process was done two days in a week for a period of 8 months distributed as follows, 4 months in Calabar, 2 months each in Ugep and Ogoja for the dry and wet season. The sorters, supervisors and recorders underwent training for all aspects of sorting, measurement and recordings of waste. A total of 6 sorters and 2 recorders for data entry were employed for the study. All the research assistance was provided with protective equipment to wear for the study.

The weighing of the sorted waste was done with a Salter band spring balance (100-200kg) and a top pan balance (China P090008, Hot pan) of two capacities 1kg and 5kg (Labotrix Group Ltd, China). The sorted and segregated waste were placed on the floor covered with plastic sheets to ease weighing. Waste from each household was weighed each day and the weight divided by the households' size (number of residents in the household) to determine the per capita waste generation rate. The field measurement of the waste was conducted between November, 2016 and June, 2017 and lasted for eight (8) months (242 days) and the per capita waste generation was determined as per the mixed or the total waste collected in a day and also the separated fraction using the formula below:

$$PCWG = \frac{weight\ of\ DSW\ generated\ at\ household}{The\ no.of\ persons\ in\ the\ household\ x\ Total\ no.of\ generation\ days} \quad (4)$$

Where; PCWG = Per capita waste generation

Also, the bulk density of the un-compacted waste was determined by dividing the weight of the waste by its volume for a particular household for each day. For the study period, the average bulk density of the household was calculated from the formula;

$$ABDW = \frac{1}{mn}\sum_{i-1} m \sum_{m}^{n} \frac{W_{ij}}{V_{ij}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where; ABDW = Average bulk density of waste

m = total number of days in the study period (242 days)

n = total number of households involved in the study (1 47)

i = ith day on which waste was weighed

j = jth households

V_{ij} = volume of waste on ith day for jth household (m3)

W_{iy} = weight of waste on the ith day for jth household (kg)

In terms of waste composition, the household waste was obtained by the sort-and-weigh method (Pichtel, 2005). This involves sorting the waste into each of the categories considered under the study and weighing them individually. The components of the domestic solid waste measured from the study are shown in chapter four. The waste proportions of each component was expressed as a percentage of the total weight of waste over the study period. It was determined based on the formula below;

$$PCWF = \frac{weight\ of\ separated\ waste}{The\ total\ of\ mixed\ waste\ sampled}\ x\ 100 \quad (6)$$

Where; PCWF = Percentage composition of waste fraction

RESPONSE INTENSITY AND GENERAL CHARACTERISTICS OF THE RESPONDENTS

From Table 5, 1268 respondents representing 85.4% returned their questionnaire while 217 respondents representing 14.6% did not return theirs. Response rate is high. This is because we adopted a system were assistants were engaged; (Calabar, 10; Ugep. 5 and Ogoja, 5). They were quick to administer the questionnaire orally. This system responsively enabled the respondents to attend to the questions without much stress

Table 5: Questionnaires distribution

Category n	**Number Distributed**	**Number Retrieved**	**Number not Retrieved**	**Total**
Calabar Household	683	584	99	683
Contractors Survey	4	4		4
Govt. Officials Survey	6	5	1	6
Ugep Household	408	345	63	408
Contractors Survey	2	2	-	2
Govt, Officials Survey	3	O	-	3
Ogoja Household	375	320	55	375
Contractors Survey	2	2	-	2
Govt. Officials Survey	3	2	1	3
Total	**1486**	**1268**	**217**	**1486**
Percentage of distribution (%)	**100**	**85.4**	**14.6**	**100**

Table 6: Categories of respondent in the sampled towns

Category	Calabar	Ugep	Ogoja	Total	Percentage of respondents (%)
Household Survey	584	345	320	1249	98.5
Contractors Survey	4	2	2	8	0.63
Govt. Officials Survey	5	3	2	10	0.87
Total	**593**	**350**	**325**	**1268**	**100**
Percentage of	**46.8**	**27.6**	**25.6**	**100**	**-**

From table 6, the return rates of questionnaires by respondents in the £ three selected locations were as follows: Calabar. 593 representing 46.8%. Ugep, 350 representing 27.6% and Ogoja, 325 representing 25.6%. On the other hand, the combined return rates of the three categories of respondents was; Households, 1268 representing 98.5%; Private Contractors Survey. 8 ft. representing 0.63% and Agency Officials Survey, 10 representing 0.87%.

DISCUSSION OF FINDINGS

WASTE GENERATION AND COLLECTION IN THE STUDY AREA

In order to determine how much domestic solid waste is generated in the study area, there was need to examine the household size distribution by (idential wards as shown in Table 9 below:

Table 7: Household size distribution by residential wards

Town	Residential Ward	Household Size Distribution				Total %
Calabar		1-3	4-6	7-9	10 - 12+	
	Anantigha	(29)9	(89)28	(67)21	(134)42	(318)100
	Ediba	(29)15	(87)46	(55)29	(19)10	(190)100
	Ikot Ansa	(33)39	(16)19	(5)6	(31)37	(85) 100
Ugep	Biko - Biko	(13)6	(19)9	(47)22	(134)63	(212)100
	Ijom	(3)2	(14)10	(80)58	(41)30	(138)100
Ogqja	Igoli	(14)11	(22)17	(67)52	(26)20	(128)100
	Okuku	(6)3	(22)11	(61)31	(108)55	(197)100

Figures in parenthesis are household sizes and others in percentages

From the table, Ikot Ansa has the highest proportion of one to three persons household (39%), signifying that it comprises of 33 households size. This might be indicative of greater proportion of low residential densities in this ward. Also, in Ediba and Anantigha in Calabar, four to six and ten to twelve person households were recorded with household sizes of 87, 89 and 134 and showing highest

percentage of 28%, 46% and 42%. In Ugep, Biko - Biko and Ijom wards had the highest proportion of 10 - 12 households and 7-9 households being recorded and showing corresponding household sizes Distribution of 134 and 80 representing 63% and 58% respectively. While in Okuku 55% (108 households) and Igoli 52% (67 households) were recorded in Ogoja. The two wards each in Ugep and Ogoja towns as well as Anantigha and Ediba in Calabar represents places where lowest income households reside. Culturally, such households support larger populations as a result of extended family system which is prevalent in Nigeria (Cox et al, 2007).

DETERMINING THE QUANTITY OF WASTE GENERATED

As a way of evaluating the quantity of domestic solid waste generated from the study area, a field work was conducted from one hundred and forty seven households with a proportional household distribution based on the population of the towns (for Calabar there were 68 households, for Ugep we have 42 households and for Ogoja there were 37 households drawn from the categorized three housing densities, low density, middle density and high density) in the three urban areas of study to weigh their waste output for two hundred and forty two days (eight months) in order to determine their daily per capita waste generation based on the size of each household. To arrive at the per capita daily weight measurement, a black polythene bag was given to the sampled households where the measurement was carried out with the appeal that the waste generated by them should be stored inside the polythene bag to enable the research team visit these houses on specified periods for waste measurement.

Thus two months each of waste measurement in wet and dry season was carried in Calabar (November, December, March and April). While in Ugep and Ogoja, the measurements were two months each (January, May, February and June). The result of the field work for both seasons was shown in (Tables 9 and 10) which depicted a per capita daily waste output of 0.59kg and 0.45kg in Calabar for wet and dry season.

Table 8: Quantity of solid waste generated in Cross River State

Sampled Towns	**Residential Densities**	**HH1 (kg)**	**HH2 (kg)**	**HH3 (kg)**	**HH4 (kg)**	**HH5 (kg)**	**HH6 (kg)**	**HH7 (kg)**	**HH8 (kg)**	**HH9 (kg)**	**HH10 (kg)**	**HH11 (kg)**	**HH12 (kg)**	**HH13 (kg)**	**HH14 (kg)**	**Total (kg)**	**Average**
Calabar	Low density	0.78	0.51	0.83	0.79	0.46	0.66	0.58	0.61	-	-	-	-	-	-	**5.22**	**0.65**
	Medium density	0.80	0.62	0.87	0.47	0.32	0.58	0.50	0.62	0.61	0.63	-	-	-	-	**6.02**	**0.60**
	High density	0.67	0.71	0.50	0.24	0.34	0.49	0.43	0.52	0.44	0.54	0.64	0.60	0.48	0.68	**7.28**	**0.52**
Ugep	Low density	0.48	0.41	0.34	0.31	0.71	0.65	0.75	-	-	-	-	-	-	-	**3.65**	**0.52**
	Medium density	0.50	0.47	0.44	0.54	0.76	0.40	0.55	0.52	0.67	-	-	-	-	-	**4.85**	**0.54**
	High density	0.50	0.60	0.49	0.51	0.73	0.46	0.54	0.52	0.82	0.47	0.89	-	-	-	**6.53**	**0.59**
Ogoja	Low density	0.57	0.49	0.43	0.51	0.77	0.63	-	-	-	-	-	-	-	-	**3.4**	**0.57**
	Medium density	0.57	0.52	0.50	0.55	0.71	0.62	0.51	0.62	0.78	-	-	-	-	-	**5.38**	**0.60**
	High density	0.48	0.58	0.47	0.53	0.67	0.56	0.52	0.56	0.67	0.45	-	-			**5.49**	**0.55**

*HH = Household;

Table 8 shows the measurement of solid waste from different households in the three urban areas which was catered into three residential density strata, the low, medium and high. The table shows there is a variation in waste generation in the three urban areas, in Calabar, the high density households generated a total, waste output of 7.28kg and with an average of 0,2kg. In Ugep, the high density househo.ds generated a waste output of 6,3kg, with an average of 0,9kg. While in Ogoja, the highest waste generated was also from the high density households and has a total, output of 5.49kg and with an average of 0.55kg.

Table 9: Quantities of Domestic Solid Waste generated on Calabar in the dry season

Sampled Towns	Residential Densities	HH1 (kg)	HH2 (kg)	HH3 (kg)	HH4 (kg)	HH5 (kg)	HH6 (kg)	HH7 (kg)	HH8 (kg)	HH9 (kg)	HH10 (kg)	HH11 (kg)	HH12 (kg)	HH13 (kg)	HH14 (kg)	Total (kg)	Average
Calabar	Low density	0.61	0.48	0.24	0.27	0.20	0.55	0.51	0.48	0.44	-	-	-	-	-	**3.78**	**0.42**
	Medium density	0.57	0.57	0.69	0.50	0.37	0.52	0.51	0.52	0.62	0.63	0.34	-	-	-	**5.84**	**0.53**
	High density	0.61	0.71	0.25	0.23	0.16	0.49	0.47	0.46	0.50	0.24	0.56	0.54	0.58	0.41	**6.21**	**0.44**
Ugep	Low density	0.45	0.44	0.38	0.10	0.39	0.55	0.66	0.37	-	-	-	-	-	-	**3.34**	**0.42**
	Medium density	0.50	0.49	0.27	0.27	0.43	0.45	0.58	0.51	0.60	0.49	-	-	-	-	**4.59**	**0.46**
	High density	0.47	0.53	0.24	0.25	0.39	0.43	0.57	0.46	0.63	0.44	0.54	0.63	-	-	**5.58**	**0.47**
Ogoja	Low density	0.41	0.46	0.43	0.57	0.32	0.61	0.51	-	-	-	-	-	-	-	**3.31**	**0.47**
	Medium density	0.49	0.46	0.69	0.23	0.40	0.66	0.63	0.64	0.74	-	-	-	-	-	**4.94**	**0.55**
	High density	0.54	0.59	0.62	0.45	0.21	0.42	0.66	0.68	0.62	0.52	0.21	-	-	-	**5.52**	**0.50**

*HH = Household

Table 9 shows a sharp contrast in the weights measurement of waste obtained in the study area. In Calabar the total daily waste output for the three residential densities was 15.84kg and has an average waste output of 0.47kg. In Ugep, it shows a total daily waste output of 13.51kg for the three housing density levels and having an average daily waste output of 0.45kg. While in Ogoja, the daily waste output was 13.77kg and an average daily of 0.51kg. A closer analysis of tables 10 and 11 shows that there are 147 households with a population of 1266 people. This shows that 68 households in Calabar with a population of 476 people produce a daily total waste generation of 34.36kg and an average daily waste rate of 3.16kg. While in Ugep and Ogoja with 42 and 37 households and a corresponding population of 420 and 370 people respectively generates a daily waste output of 28.54kg and an average daily rate of 3.00kg for Ugep and 28.04kg daily waste output and average daily rate of 3.24kg for Ogoja respectively.

Table 10: Quantities of domestic solid waste generated in Calabar in the wet season

Sampled Towns	**Residential Densities**	**HH1 (kg)**	**HH2 (kg)**	**HH3 (kg)**	**HH4 (kg)**	**HH5 (kg)**	**HH6 (kg)**	**HH7 (kg)**	**HH8 (kg)**	**HH9 (kg)**	**HH10 (kg)**	**HH11 (kg)**	**HH12 (kg)**	**HH13 (kg)**	**HH14 (kg)**	**Total (kg)**	**Average**
Calabar	Low density	0.78	0.51	0.83	0.79	0.46	0.66	0.58	-	-	-	-	-	-	-	**5.22**	**0.65**
	Middle density	0.80	0.62	0.87	0.47	0.32	0.58	0.50	0.62	0.61	0.63	-	-	-	-	**6.02**	**0.60**
	High density	0.67	0.71	0.50	0.24	0.34	0.49	0.43	0.52	0.44	0.54	0.64	0.60	0.48	0.68	**7.28**	**0.52**
Total		2.25	1.84	2.20	1.50	1.12	1.73	1.51	1.14	1.05	1.17	0.64	0.60	0.48	0.68	**18.52**	**5.44**
Average		0.75	0.61	0.73	0.50	0.37	0.58	0.50	0.57	0.53	0.59	0.64	0.60	0.48	0.68	**8.13**	**0.58**

Table 11: Per Capita Waste generated in Calabar

Sampled Towns	**Residential Densities**	**HH1 (kg)**	**HH2 (kg)**	**HH3 (kg)**	**HH4 (kg)**	**HH5 (kg)**	**HH6 (kg)**	**HH7 (kg)**	**HH8 (kg)**	**HH9 (kg)**	**HH10 (kg)**	**HH11 (kg)**	**HH12 (kg)**	**HH13 (kg)**	**HH 14**	**Total (kg)**	**Average**
Calabar	Low density	0.61	0.48	0.24	0.27	0.20	0.55	0.51	0.48	0.44	-	-	-	-	-	**3.78**	**0.42**
	Middle density	0.57	0.57	0.68	0.50	0.37	0.52	0.51	0.52	0.62	0.63	0.34	-	-	-	**5.84**	**0.53**
	High density	0.61	0.71	0.25	0.23	0.16	0.49	0.47	0.46	0.50	0.24	0.56	0.54	0.58	0.41	**6.21**	**0.44**
Total		1.79	1.76	1.17	1.00	0.73	1.56	1.49	1.46	1.56	0.87	0.90	0.54	0.58	0.41	**15.83**	**1.39**
Average		0.60	0.59	0.39	0.33	0.24	0.52	0.50	0.49	0.52	0.29	0.30	0.54	0.58	0,41	**6.30**	**0.46**

Table 10 shows an extract of the field measurement of domestic solid waste generated in Calabar during the wet season. The wet season measurement produces a per capita waste generation of 0.58kg for Calabar and presented that the high density households generates more waste than any other residential density during the period with a daily waste output of 7.28kg and average of 0,52kg, as compared to a daily waste output of 6.02kg and 5.22kg generated by the medium and low residential densities respectively. Also table 11 presents the per capita waste generated in Calabar and measurements taken in

November and December and shows a variation in household size and quantity of waste generation of 0.46kg. The harmonization of the wet and dry season per capita waste obtained was used to establish the per capita waste generation of 0.52kg in Calabar.

According, a combination of the measurements for wet and dry season resulted in the average per capita daily output of 0.52kg generated in Calabar (Table 8 and 9), this domestic solid waste output was used to calculate the city's daily waste output. Based on the city's population census of 2006 provided by the National Population Census (NPC), this figure was used to project the population to 2017, which stood at 468,568 people. Thus, the city's total population was used to multiply with the experimental result of 0.52kg per capita per day, this gives a daily waste output for Calabar metropolis to be 243 655kg or 243.7 tons, weekly to be 1,705,588kg or 1705.6 tons and monthly to be 6,822,350kg or 6822.4 tons. While total annual waste generation for the city was 81,864 tons.

Table 12: Estimates of Quantities of domestic solid waste generated in Ugep for wet season.

Sampled Towns	**Residential Densities**	**HH1 (kg)**	**HH2 (kg)**	**HH3 (kg)**	**HH4 (kg)**	**HH5 (kg)**	**HH6 (kg)**	**HH7 (kg)**	**HH8 (kg)**	**HH9 (kg)**	**HH10 (kg)**	**HH11 (kg)**	**HH12 (kg)**	**HH13 (kg)**	**HH14 (kg)**	**Total (kg)**	**Average**
Ugep	Low density	0.79	0.78	0.73	0.45	0.74	0.90	0.91	0.71	-	-	-	-	-	-	6.08	0.76
	Middle density	0.84	0.83	0.62	0.61	0.77	0.78	0.92	0.85	0.94	0.83	-	-	-	-	7.99	0.80
	High density	0.82	0.88	0.59	0.60	0.73	0.78	0.82	0.80	0.980.	0.78	0.88	0.97	-	-	9.63	0.81
Total		**2.45**	**2.49**	**1.94**	**1.66**	**2.24**	**2.46**	**2.65**	**2.36**	**1.92**	**1.61**	**0.88**	**0.97**	**-**	**-**	**23.70**	**2.37**
Average		**0.82**	**0.83**	**0.65**	**0.55**	**0.75**	**0.82**	**0.88**	**0.79**	**0.92**	**0.81**	**0.88**	**0.97**	**-**	**-**	**9.57**	**0.79**

In table 12, the wet season measurement of daily waste generation in Ugep shows there is variation. The low residential density had a total daily waste output of 6.08kg, with an average of 0.76kg. The medium density generates a total daily waste output of 7.99kg, with an average of 0.80kg. While the high residential density group generates a waste output of 9.63kg, having a daily average of 0.81kg, which is the highest among the three residential densities. The overall total of the daily waste generation for the households in wet season was 23.70kg, having an average of 9.57kg.

Table 13: Estimates of quantities of domestic solid waste generated in Ugep for dry season

Sampled Towns	Residential Densities	HH1 (kg)	HH2 (kg)	HH3 (kg)	HH4 (kg)	HH5 (kg)	HH6 (kg)	HH7 (kg)	HH8 (kg)	HH9 (kg)	HH10 (kg)	HH11 (kg)	HH12 (kg)	HH13 (kg)	HH14 (kg)	Total (kg)	Average
Ugep	Low density	0.46	0.51	0.48	0.57	0.37	0.68	0.57	-	-	-	-	-	-	-	**3.64**	**0.52**
	Middle density	0.57	0.54	0.78	0.31	0.48	0.74	0.71	0.74	0.83	-	-	-	-	-	**5.67**	**0.63**
	High density	0.60	0.65	0.68	0.51	0.26	0.47	0.72	0.74	0.67	0.58	0.26	-	-	-	**5.52**	**0.56**
Total		**1.63**	**1.70**	**1.94**	**1.39**	**1.11**	**1.89**	**2.00**	**1.48**	**1.50**	**0.58**	**0.26**				**15.48**	**1.71**
Average		**0.54**	**0.57**	**0.65**	**0.46**	**0.37**	**0.68**	**0.67**	**0.74**	**0.75**	**0.58**	**0.26**				**6.62**	**0.57**

Table 13 also shows the measurement of daily waste generation of different income households in Ugep in the dry season. The daily overall total waste generation among the three segments of residential status was 15.48kg, with a daily average generation rate of 1.71kg. The weights measurement was compared to that of wet season which measured 23.70kg having an average of 0.79kg. Also from table 14 and 15, the mean daily waste output of 0.682kg was generated in Ugep. The mean weight was arrived at by considering the daily waste output of 0.79kg wet season and 0.58kg for dry season. As the population of Ugep by estimation in 2016 was 273384 people, then the town generates a daily average waste output of 1865 tons. Similarly, weekly, monthly and yearly waste generation for the town was 1305.1 tons, 5221 tons and 62647 tons respectively.

Table 14: Estimates of quantities of domestic solid waste generated in Ogoja for wet season

Sampled Towns	Residential Densities	HH1 (kg)	HH2 (kg)	HH3 (kg)	HH4 (kg)	HH5 (kg)	HH6 (kg)	HH7 (kg)	HH8 (kg)	HH9 (kg)	HH10 (kg)	HH11 (kg)	HH12 (kg)	HH13 (kg)	HH14 (kg)	Total (kg)	Average
Ogoja	Low density	0.57	0.49	0.43	0.51	0.77	0.63	"-	-	-	-	-	-	-	-	**3.40**	**0.57**
	Medium density	0.57	0.52	0.50	0.55	0.71	0.62	0.51	0.62	0.78	-	-	-	-	-	**5.38**	**0.60**
	High density	0.48	0.58	0.47	0.53	0.67	0.56	0.52	0.56	0.67	0.45	-	-	-	-	**5.49**	**0.55**
Total		**1.62**	**1.59**	**1.40**	**1.57**	**2.15**	**1.81**	**1.04**	**1.18**	**1.45**	**0.45**					**14.27**	**1.72**
Average		**0.54**	**0.53**	**0.47**	**0.52**	**0.72**	**0.60**	**0.52**	**0.59**	**0.73**	**0.45**					**5.67**	**0.57**

Table 14 and 15 also exhibits the same daily waste generation variation between wet and dry season in Ogoja which are similar to that of Calabar and Ugep. For instance, the weights measured among the residential densities shows a total daily waste generation output of 14.27kg and an average of 1.72kg in wet season and a total daily average waste generation output of 5.67kg and an average of 0.57kg in wet season.

Table 15 Estimates of quantities of domestic solid waste generated in Ogoja dry season

Sampled Towns	Residential Densities	HH1 (kg)	HH2 (kg)	HH3 (kg)	HH4 (kg)	HH5 (kg)	HH6 (kg)	HH7 (kg)	HH8 (kg)	HH9 (kg)	HH10 (kg)	HH11 (kg)	HH12 (kg)	HH13 (kg)	HH14 (kg)	Total (kg)	Average
Ogoja	Low density	0.41	0.46	0,43	0.57	0.32	0.61	0.51	-	-	-	-	-	-	-	**3.31**	**0.47**
	Medium density	0.49	0.46	0.69	0.23	0.40	0.66	0.63	0.64	0.74	"	-	-	-	-	**4.94**	**0.55**
	High density	0.54	0.59	0.62	0.45	0.71	0.42	0.66	0.63	0.62	0.52	0.51	-	-	-	**6.27**	**0.57**
Total		**1.44**	**1.51**	**1.74**	**1.25**	**1.43**	**1.69**	**1.80**	**1.27**	**1.36**	**0.52**	**0.51**				**14.52**	**1.59**
Average		**0.48**	**0.50**	**0.58**	**0.42**	**0.4S**	**0.56**	**0.60**	**0.64**	**0.68**	**0.52**	**0.51**				**S..97**	**0.54**

The daily waste generated by the sampled households in Ogoja in the wet season was 0.57kg and daily waste generated in dry season was 0.54kg. Then, the average of the two seasons gives a daily per capita waste generation of 0.56kg. Through the use of this per capita daily estimate, the daily waste output generated from the town was deduced. Using the population figure of Ogoja for 2017, which stood at 239439 people and multiplying it with the mean daily waste output, it gives 134085.8kg or 134.1 tons daily waste generation for Ogoja. Hence, the weekly, monthly and annual volume of domestic waste generated by the sampled household in Ogoja is 938600 .9kg or 938.6 tons, 3754403.5kg or 3754.4 tons and 45052842.2kg or 45052.8 tons. The weekly estimate of waste generated is higher by 227 tons and 1522 tons when compared with results from Ugep and Calabar, which presupposes that waste generation is high arising from the variation in population, residential densities and educational status peculiar a particular urban area.

Table 16: Estimates of quantities of domestic solid waste generated by the sampled households in the study area.

Location	Daily Estimate	Weekly Estimate	Monthly Estimate	Yearly Estimate
Calabar	243.7	1705.6	6822.4	81864
Ugep	186.5	1305.1	5221	62647
Ogoja	134.1	938.6	3754.4	45052.8
Total	**564.3**	**3949.3**	**15797.4**	**189563.8**
Average generatio	**188.1**	**1316.4**	**5265.9**	**63187.9**

From table 16, it shows the daily, weekly, monthly and yearly estimates of domestic solid waste generated in the study area which stood at, 564.3 tons, 3949.3 tons, 9196.9 tons and 189563.8 tons. With the increase in population summarized at a national rate of 3.2% and improvement in standard of living, the waste generated will still increase in subsequent years.

Table 17: Generation of household solid waste from residential densities

Town	**Population**	**HRD* (kg/p/day)**	**MRD* (kg/p/day)**	**LRD* (kg/p/day)**	**AGR* (kg/p/day)**	**TWG* /tons**	**P-value**
Calab	522607	0.48	0.57	0.54	0.52	244	0.618
Ugep	273384	0.69	0.72	0.64	0.68	187	0.358
Ogoja	239439	0.56	0.58	0.52	0.55	134	0.531
Total		**1.73**	**1.87**	**1.70**	**1.76**	**565**	
Avera		0.58	0.62	0.57	0.59	188	0.267
Std		0.25	0.75	0.21	0.22	165	
Max		0.76	0.72	0.76	0.635	248	
Min		0.36	0.20	0.20	0.208	26	

***HRD= High residential density, MRD= Medium residential density, LRD= Low residential density, AGR=Average generation rate, TWG=Total waste generation rate**

Table 17 showed that the medium residential density generated the highest quantity of waste in their study areas, 0.62kg/person/day

followed by the high 5idential density, 0.58kg/person/day and the low residential density with 0.57kg/person/day for the three towns. Also the table shows an average waste generation of 188 tons of household waste being generated from the sampled three towns under study. From the table the waste generated by the residential density can be estimated, for instance the total waste generated by the three residential density daily in Calabar was 244 tons.

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URBAN REJUVENATION OF ABA AND UMUAHIA IN ABIA STATE, NIGERIA.

[1]Ogbonnaya I.O, [2]Etim E.C & [1]Alozie G.C

[1]Department of Architecture, Abia State University, Uturu.

[2]Department of Architecture, University of Uyo.

Abstract

This study examines urban rejuvenation and its potential application in revitalizing Aba and Umuahia, two major cities in Abia State, Nigeria. Through extensive literature review, it identifies economic decline, infrastructure deficits, environmental degradation, and socio-economic challenges as key drivers necessitating rejuvenation efforts to improve residents' quality of life. The study underscores community resilience as pivotal, emphasizing that by strengthening social cohesion, economic diversity, governance, resource access, and environmental stewardship, urban rejuvenation can foster adaptable, resilient communities. The research explores urban design strategies like mixed-use development, pedestrian-friendly environments, sustainable transportation, cultural heritage preservation, and green infrastructure integration as means to revitalize Aba and Umuahia. It highlights the complementary roles of architects and urban designers in achieving cohesive, context-specific rejuvenation outcomes through effective collaboration and stakeholder engagement. The study culminates with recommendations tailored to Aba and Umuahia, including economic revitalization, infrastructure upgrades, environmental sustainability measures, inclusive urban design, governance reforms, and multi-stakeholder collaboration. It identifies areas for future research, such as longitudinal studies, comparative analyses, community resilience indicators, financing models, and technology integration in urban rejuvenation. Overall, this holistic, evidence-based research contributes to understanding urban rejuvenation processes and their potential impact on Abia State's urban areas, positioning it as a catalyst for fostering vibrant, resilient, and inclusive communities through an integrated economic, social, environmental, and cultural approach.

Keywords: urban rejuvenation, community resilience, urban design, Aba, Umuahia, Abia State, sustainable development, stakeholder engagement, policy implications.

INTRODUCTION

The need for urban rejuvenation has emerged as a critical global imperative due to the deteriorating conditions of many urban areas worldwide. As cities continue to evolve and face various challenges, numerous urban settlements have struggled with issues such as aging infrastructure, economic decline, social segregation, and environmental degradation. Urban rejuvenation initiatives, also referred to as urban regeneration or renewal, aim to revitalize and transform these deteriorating urban areas, addressing multifaceted social, economic, and environmental challenges (Mehdipanah et al., 2018; Zheng et al., 2021). By fostering sustainable

development, improving the quality of life, and creating more resilient and vibrant communities, urban rejuvenation has become a vital process for enhancing the well-being and sustainability of urban environments.

In the context of Abia State, Nigeria, the urban areas of Aba and Umuahia have experienced significant challenges that necessitate comprehensive rejuvenation efforts. Aba, once a thriving commercial and industrial hub, has witnessed a substantial economic decline in recent decades, characterized by deteriorating infrastructure, including dilapidated roads, inadequate water supply, and deficient sanitation systems (Nzeadibe & Anyadike, 2012; Olanrewaju & Adegun, 2021). Furthermore, urban blight, manifested in dilapidated buildings and insufficient public spaces, has become prevalent in several neighborhoods, hindering business activities and adversely impacting residents' quality of life.

Similarly, Umuahia, the state capital, has grappled with challenges resulting from rapid urbanization and population growth. The city's public services and amenities, such as healthcare facilities, educational institutions, and recreational spaces, have struggled to keep pace with the increasing demand (Agoha et al., 2021; Okafor et al., 2022). Additionally, issues of environmental degradation, including poor waste management and air pollution, have become more pronounced, further intensifying the need for comprehensive rejuvenation efforts.

Both cities have also faced socio-economic challenges, including high unemployment rates, particularly among the youth, and pockets of poverty and social inequality (Agoha et al., 2021; Olanrewaju & Adegun, 2021). These multifaceted challenges have contributed to a sense of disillusionment and lack of community resilience among some residents, underscoring the urgency for interventions that can address these issues and unlock the full potential of Aba and Umuahia as vibrant and sustainable urban centers.

The primary objective of this research is to conduct a comprehensive analysis of the concept of urban rejuvenation and its potential application in the context of Aba and Umuahia, Abia State. Specifically, the study aims to:

Critically examine the drivers and rationale underpinning the need for urban rejuvenation initiatives in these urban areas, considering the economic, social, environmental, and cultural factors.

Assess the current conditions and multifaceted challenges faced by the communities in Aba and Umuahia, drawing

upon empirical data and stakeholder perspectives.

Explore the concept of community resilience and its relevance to urban rejuvenation efforts, identifying key factors that contribute to the development of resilient communities.

Analyze the roles of urban design and architectural principles in fostering resilient and rejuvenated urban environments, focusing on strategies that promote sustainable development, social cohesion, and economic revitalization.

Investigate the collaboration and coordination mechanisms required between architects, urban designers, and other stakeholders to achieve successful and cohesive urban rejuvenation outcomes.

By addressing these objectives, the research aims to contribute to the understanding of urban rejuvenation processes and their potential impact on the well-being and sustainability of Abia State's urban areas. Furthermore, it seeks to inform policymakers, urban planners, and stakeholders about effective strategies, best practices, and policy implications for revitalizing Aba and Umuahia, ultimately benefiting the local communities and supporting the state's overall development.

THEORETICAL FRAMEWORK

Urban Rejuvenation and Community Resilience:

The concept of urban rejuvenation is multifaceted and encompasses a range of initiatives designed to address the social, economic, and environmental challenges faced by deteriorating urban areas (Salgado et al., 2020; Sierra & Suárez-Collado, 2021). It involves a holistic approach to revitalizing and transforming urban environments, with the ultimate goal of improving the quality of life for residents and fostering sustainable development.

Closely intertwined with urban rejuvenation is the notion of community resilience, which refers to the ability of a community to withstand and recover from adverse conditions, such as economic downturns, natural disasters, or social upheavals (Mayer, 2019; Toyoda, 2021). Resilient communities are characterized by strong social networks, diverse economic opportunities, effective governance structures, equitable access to resources, and a commitment to environmental stewardship (Carmen et al., 2022; Ningrum et al., 2022). By addressing these key factors, urban rejuvenation initiatives can contribute to the development of resilient communities capable of adapting to and bouncing back from difficult circumstances.

URBAN DESIGN AND ARCHITECTURAL PRINCIPLES

Urban design plays a pivotal role in shaping the physical and social environments of cities, influencing the overall quality of life and community resilience (Heymans et al., 2019; Faedda et al., 2022; Westenhöfer et al., 2023). Effective urban design principles, such as mixed-use development, pedestrian-friendly environments, public space creation, and sustainable transportation systems, can contribute to the rejuvenation of urban areas by fostering vibrant communities, promoting economic growth, and enhancing environmental sustainability (Lehmann, 2023).

Complementing urban design strategies are the contributions of architects, who play a crucial role in designing individual buildings, public spaces, and infrastructure that align with the overall vision and principles of urban rejuvenation. Their expertise in integrating functional, aesthetic, and sustainable design elements is essential for creating quality built environments that

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Complementing urban design strategies are the contributions of architects, who play a crucial role in designing individual buildings, public spaces, and infrastructure that align with the overall vision and principles of urban rejuvenation. Their expertise in integrating functional, aesthetic, and sustainable design elements is essential for creating quality built environments that support the goals of urban rejuvenation.

Urban design determines the physical scale, space, and ambiance of a place and establishes the built and natural forms within which individual buildings and infrastructure are situated. As such, it affects the balance between natural ecosystems and built environments and their sustainable outcomes. The urban structure is a fundamental element of urban design because it entails arranging land use

in urban areas and primarily comprises land division patterns and the topography of the urban area.

Effective urban design principles can contribute to the rejuvenation of urban areas by fostering vibrant communities, promoting economic growth, and enhancing environmental sustainability. For example, mixed-use development can create active urban environments that foster a sense of community, reduce dependence on private transportation, and support local businesses. Pedestrian-friendly environments, with walkable streets, public plazas, and green spaces, can promote active lifestyles, enhance social interactions, and strengthen community cohesion.

Architects play a crucial role in promoting community engagement and rejuvenating communities through design. They can work with communities to create designs that reflect local needs and values, fostering a sense of ownership and pride. Participatory design approaches, which directly involve users in the design process, can empower communities and promote inclusive decision-making.

Furthermore, architects can contribute to the rejuvenation of communities through adaptive reuse, renovation, and revitalization strategies. Adaptive reuse involves repurposing existing buildings for new uses, preserving their historical and cultural significance while giving them a new purpose. This approach can breathe new life into neglected neighborhoods and create vibrant, purposeful spaces filled with the history and heritage of their past life. Renovation projects can meet carbon reduction goals while strengthening local economies and promoting equity. Revitalization initiatives can create vibrant mixed-use developments that provide accessibility to social and cultural resources, residential and retail activation, and a connected urban experience.

Landscape architecture can also play a role in rejuvenating communities by creating regional playgrounds, recreation parks, and community gardens that promote outdoor recreation, social interaction, and environmental stewardship.

In summary, urban design and architectural principles are crucial components of urban rejuvenation efforts. By incorporating mixed-use development, pedestrian-friendly environments, sustainable transportation systems, preservation of cultural heritage, and green infrastructure, urban design can shape the physical and social environments of cities, fostering vibrant, livable, and sustainable communities. Architects, through their expertise in integrating functional,

aesthetic, and sustainable design elements, as well as their ability to engage communities and promote adaptive reuse and revitalization, can contribute significantly to the successful rejuvenation of urban areas.

HISTORICAL CONTEXT AND EVOLUTION

The concept of urban rejuvenation has evolved over time, reflecting changing philosophies and approaches to addressing the challenges faced by cities. In the early 20th century, urban renewal efforts were often characterized by large-scale demolition and redevelopment projects, aimed at addressing slum conditions and modernizing cities (Cerreta & La Rocca, 2021; Roelofs, 2021). However, these top-down approaches faced criticism for their lack of community involvement and the displacement of residents.

In the latter half of the 20th century, a more holistic and integrated approach to urban rejuvenation emerged, emphasizing the preservation of historic buildings, community participation, and the revitalization of existing neighborhoods (Kostešić et al., 2019; Zheng et al., 2021). This shift was influenced by the recognition of the social and cultural values inherent in urban environments and the importance of community empowerment.

Contemporary urban rejuvenation efforts have embraced principles of sustainable development, focusing on environmental protection, economic revitalization, and social equity (Kwon & Nguyen, 2023; Toor et al., 2023). The concept of "smart growth" has gained traction, promoting compact, mixed-use development, pedestrian-friendly environments, and efficient public transportation systems (Bordoloi & Acharya, 2023).

CHALLENGES AND DRIVERS OF URBAN REJUVENATION

Urban areas often face a myriad of challenges that necessitate rejuvenation initiatives. These challenges can include:

Aging infrastructure and deteriorating physical conditions (Liu et al., 2022).

Economic decline and job loss due to deindustrialization or shifts in economic activities (Posel et al., 2021; Van Egdom et al., 2022).

Social issues such as poverty, crime, and segregation (Anser et al., 2020).

Environmental degradation and sustainability concerns (Ferreira Fernandes et al., 2024).

Demographic changes, such as population growth or decline (Nagarale & Telang, 2022).

The drivers behind urban rejuvenation initiatives can vary but often include:

Desire to attract new investment and economic opportunities (Du et al., 2022).

Need to improve living conditions and quality of life for residents (Muhammed & Abubakar, 2019; Wesz et al., 2023).

Pressure to address environmental issues and promote sustainability (Farrukh et al., 2022).

Efforts to revitalize and preserve historic or cultural assets (Hurley, 2010).

Initiatives to enhance a city's competitiveness and attract talent (Bibri & Krogstie, 2019).

ROLES OF KEY STAKEHOLDERS

Successful urban rejuvenation initiatives require the collaboration and coordination of various stakeholders, each playing a crucial role in the process:

Policymakers and government officials: Responsible for developing and implementing policies, regulations, and funding mechanisms to support urban rejuvenation efforts (Baekgaard et al., 2021).

Urban designers and planners: Develop comprehensive plans and strategies for the physical transformation of urban areas, incorporating principles of sustainable design, mixed-use development, and community engagement (Ataol et al., 2019; Lehmann, 2023).

Architects: Contribute to the design and construction of new buildings, public spaces, and infrastructure, ensuring they align with the overall vision and principles of urban rejuvenation (Osman, 2008; Petrescu & Petcou, 2023).

Community organizations and residents: Play a vital role in voicing their needs, concerns, and aspirations, and participating in the decision-making processes that shape the rejuvenation efforts (Anthony Jr, 2023).

Private sector entities: Invest in urban rejuvenation projects, contribute to economic development, and create job opportunities (Bandauko et al., 2022).

Non-governmental organizations (NGOs) and advocacy groups: Advocate for social and environmental justice, promote community empowerment, and ensure that urban rejuvenation initiatives are inclusive and equitable (Banks, 2021).

Effective collaboration and coordination among these stakeholders are essential for achieving successful urban rejuvenation outcomes that address the multifaceted challenges faced by urban areas (Li et al., 2022; Nop et al., 2023).

CURRENT CONDITIONS AND CHALLENGES IN ABA AND UMUAHIA

The data collected through an extensive literature review provide insights into the current urban conditions and challenges faced by Aba and Umuahia.

ABA'S CHALLENGES

Aba, once a thriving commercial and industrial hub, has experienced significant economic decline in recent decades. The city's infrastructure, including roads, water supply, and sanitation systems, has deteriorated, hindering business activities and impacting residents' quality of life. Additionally, urban blight, characterized by dilapidated buildings and inadequate public spaces, has become prevalent in several neighborhoods (Olanrewaju & Adegun, 2021).

UMUAHIA'S CHALLENGES

Umuahia, the state capital, has faced challenges resulting from rapid urbanization and population growth. The city's public services and amenities, such as healthcare facilities, educational institutions, and recreational spaces, have struggled to keep pace with the increasing demand. Furthermore, issues of environmental degradation, including poor waste management and air pollution, have become more pronounced (Agoha et al., 2021).

SHARED SOCIO-ECONOMIC CHALLENGES

Both cities have been faced with socio-economic challenges, including high unemployment rates, particularly among the youth, and pockets of poverty and social inequality (Agoha et al., 2021; Olanrewaju & Adegun, 2021). These challenges have contributed to a sense of disillusionment and lack of community resilience among some residents, underscoring the urgency for interventions that can address these issues.

DRIVERS AND RATIONALE FOR URBAN REJUVENATION

The findings reveal various drivers and rationale for urban rejuvenation initiatives in Aba and Umuahia, as identified through the literature review:

Economic Revitalization: There is a strong desire to revive the economic vibrancy of Aba, once known as the "Japan of Africa" for its thriving manufacturing sector. Urban rejuvenation efforts are seen as a catalyst for attracting new investments, creating job opportunities, and fostering entrepreneurship (Wizor & Ogbonna, 2020).

Improving Quality of Life: Residents and community leaders have expressed concerns about the deteriorating living conditions and lack of access to basic services. Urban rejuvenation initiatives are viewed as a means to enhance the overall quality of life by addressing infrastructure deficiencies, creating public spaces, and improving access to healthcare, education, and recreational facilities (Jacobs et al., 2012; Bastani et al., 2021; Zheng et al., 2021; Wesz et al., 2023).

Environmental Sustainability: Stakeholders have recognized the need to address environmental issues, such as poor waste management, air pollution, and the lack of green spaces. Urban rejuvenation efforts present opportunities to implement sustainable urban design principles, promote eco-friendly practices, and create a healthier living environment (Zheng et al., 2021).

Preserving Cultural Heritage: Both Aba and Umuahia have rich cultural histories, and there is a desire to preserve and showcase these unique identities through urban rejuvenation initiatives. This includes the protection of historic buildings, monuments, squares etc. and the revitalization of cultural precincts, and the incorporation of traditional design elements (Naheed & Shooshtarian, 2022).

Enhancing Community Resilience: The findings suggest that urban rejuvenation can play a crucial role in fostering community resilience by strengthening social cohesion, promoting economic diversity, and enhancing the capacity of communities to adapt and recover from adverse situations (Carmen et al., 2022; Shamsuddin, 2023).

DEFINING AND ASSESSING COMMUNITY RESILIENCE

Based on the review of relevant literature, the concept of community resilience emerged as a critical theme, with stakeholders and residents emphasizing its importance in the context of urban rejuvenation.

KEY FACTORS CONTRIBUTING TO COMMUNITY RESILIENCE

Social Networks and Cohesion: Strong social ties, community organizations, and a sense of belonging were identified as essential elements contributing to community resilience. However, some participants highlighted the need to address issues of social fragmentation and marginalization.

Economic Diversity: A diverse and adaptable local economy, with opportunities for entrepreneurship and skills development, was seen as crucial for

enhancing community resilience. Revitalizing the manufacturing sector and promoting small businesses were viewed as priorities.

Governance and Leadership: Effective governance structures, transparent decision-making processes, and strong leadership were recognized as essential for fostering community resilience and ensuring the successful implementation of urban rejuvenation initiatives.

Access to Resources: Equitable access to resources, such as healthcare, education, and basic services, was identified as a key factor in building resilient communities. Addressing disparities and ensuring inclusivity were emphasized by participants.

Environmental Stewardship: Literature highlighted the importance of sustainable environmental practices and the preservation of natural resources in enhancing community resilience. This includes initiatives such as urban greening, waste management, and the promotion of eco-friendly lifestyles.

ASSESSMENT OF COMMUNITY RESILIENCE IN ABA AND UMUAHIA

The assessment of community resilience in Aba and Umuahia revealed both strengths and areas for improvement. While social networks and cultural ties were identified as assets, economic challenges, governance issues, and resource disparities were highlighted as potential barriers to building resilient communities.

URBAN DESIGN STRATEGIES AND PRINCIPLES

The study explored various urban design strategies and principles that could be applied in the revitalization efforts of Aba and Umuahia. These strategies were informed by best practices, stakeholder inputs, and the specific local contexts of the two cities.

Mixed-use Development: Promoting mixed-use neighborhoods, with a combination of residential, commercial, and recreational spaces, was seen as a key strategy for creating vibrant and active urban environments. This approach can foster a sense of community, reduce dependence on private transportation, and support local businesses.

Pedestrian-friendly Environments: Prioritizing pedestrian accessibility and safety through the development of walkable streets, public plazas, and green spaces was emphasized by stakeholders. This not only promotes active lifestyles but also enhances social interactions and community cohesion.

Sustainable Transportation Systems: Integrating efficient public transportation systems, such as bus rapid transit or light rail, was identified as a priority. This can help reduce traffic congestion, improve air quality, and promote sustainable mobility within the cities.

Preservation of Cultural Heritage: Incorporating elements of Aba and Umuahia's rich cultural histories into urban design was considered essential. This includes the adaptive reuse of historic buildings, the creation of cultural precincts, and the integration of traditional architectural styles and motifs.

Green Infrastructure and Urban Resilience: Stakeholders highlighted the importance of incorporating green infrastructure, such as parks, urban forests, and sustainable stormwater management systems, to enhance environmental sustainability and community resilience.

Inclusive and Participatory Design: Ensuring that urban design processes are inclusive and involve active community participation was emphasized by participants. This can foster a sense of ownership, address the needs of diverse groups, and promote social equity within the revitalized urban areas.

ROLES AND COLLABORATION IN URBAN REJUVENATION

The findings revealed the complementary roles of architects and urban designers in achieving successful urban rejuvenation outcomes.

ARCHITECTS' ROLE:

Architects were recognized for their contributions in designing individual buildings, public spaces, and infrastructure that align with the overall vision and principles of urban rejuvenation. Their expertise in integrating functional, aesthetic, and sustainable design elements was seen as crucial for creating quality built environments.

URBAN DESIGNERS' ROLE:

Urban designers were acknowledged for their role in developing comprehensive strategies and plans for the physical transformation of urban areas. Their holistic approach, which considers factors such as land use, transportation networks, and community needs, was viewed as essential for guiding the overall rejuvenation process.

IMPORTANCE OF COLLABORATION:

However, the study highlighted the importance of collaboration and

coordination between architects and urban designers, as well as other stakeholders, to ensure coherence and synergy in the urban rejuvenation efforts. Effective collaboration can be facilitated through:

Integrated Design Processes: Involving architects and urban designers from the early stages of project conceptualization and planning to ensure alignment between individual building designs and the overall urban vision.

Interdisciplinary Teams: Forming multidisciplinary teams that bring together architects, urban designers, planners, engineers, and community representatives to foster a holistic and inclusive approach to urban rejuvenation.

Continuous Stakeholder Engagement: Maintaining open communication and engagement with local communities, policymakers, and other stakeholders throughout the design and implementation phases to ensure that the rejuvenation initiatives address their needs and aspirations.

Knowledge Sharing and Capacity Building: Promoting knowledge exchange and capacity-building programs to facilitate the transfer of best practices and innovative approaches in urban rejuvenation among professionals and stakeholders.

By fostering effective collaboration and leveraging the complementary expertise of architects and urban designers, the urban rejuvenation efforts in Aba and Umuahia can be more comprehensive, cohesive, and responsive to the unique local contexts and community needs.

STAKEHOLDER PERSPECTIVES AND COMMUNITY ENGAGEMENT

From the literature conducted, the study revealed diverse perspectives and experiences among stakeholders and community members regarding urban rejuvenation in Aba and Umuahia.

POLICYMAKERS AND GOVERNMENT OFFICIALS:

Policymakers and government officials emphasized the economic and infrastructural benefits of urban rejuvenation, viewing it as a catalyst for attracting investments, creating jobs, and improving the overall quality of life. However, some expressed concerns about the potential for gentrification and displacement of low-income residents.

COMMUNITY LEADERS AND RESIDENTS:

Community leaders and residents highlighted the importance of addressing social issues, such as poverty, inequality, and access to basic services. They stressed

the need for inclusive and participatory approaches that empower local communities and ensure that their voices are heard in the decision-making processes.

ENVIRONMENTAL ADVOCACY GROUPS AND NGOS:

Environmental advocacy groups and NGOs emphasized the need to integrate sustainable practices and green infrastructure into urban rejuvenation efforts, promoting environmental stewardship and community resilience.

PRIVATE SECTOR:

The private sector, including developers and business owners, expressed interest in the economic opportunities presented by urban rejuvenation but also raised concerns about regulatory barriers, funding challenges, and the need for a conducive business environment.

ARCHITECTS AND URBAN DESIGNERS:

Architects and urban designers underscored the importance of holistic and contextual approaches that respect the local cultural heritage while embracing innovative design principles and practices. They highlighted the potential for urban rejuvenation to create vibrant, livable, and sustainable urban environments.

Despite the diverse perspectives, there was a general consensus among stakeholders on the need for effective collaboration, inclusive community engagement, and a shared vision for the rejuvenation of Aba and Umuahia.

RECOMMENDATIONS AND CONCLUSION

Based on the findings and discussions, the following urban rejuvenation strategies and interventions are proposed for Aba and Umuahia:

ECONOMIC REVITALIZATION

Establish dedicated industrial and business zones with modern infrastructure and incentives to attract investments in manufacturing and entrepreneurship.

Develop skills training programs and entrepreneurship incubators to support local economic development and job creation.

Promote public-private partnerships for the revitalization of commercial districts and the preservation of cultural and historic assets for tourism opportunities.

INFRASTRUCTURE AND PUBLIC SERVICES

Undertake comprehensive infrastructure upgrades, including transportation

networks, water and sanitation systems, and public utilities.

Prioritize the development of affordable housing and improve access to quality healthcare and educational facilities.

Create a network of well-designed and inclusive public spaces, such as parks, plazas, and community centers, for social interaction and recreation.

ENVIRONMENTAL SUSTAINABILITY AND RESILIENCE

Implement green infrastructure initiatives, such as urban forests, green roofs, and sustainable stormwater management systems, to enhance environmental quality and reduce the impact of climate change.

Promote sustainable transportation modes, including pedestrian-friendly streets, cycling infrastructure, and efficient public transit systems.

Integrate waste management and recycling programs, and raise awareness about eco-friendly practices among residents and businesses.

INCLUSIVE AND PARTICIPATORY URBAN DESIGN

Adopt a participatory approach to urban design, actively involving community members in the co-creation of public spaces, amenities, and infrastructure.

Ensure that urban design principles prioritize accessibility, safety, and inclusivity for all residents, including marginalized groups and those with special needs.

Incorporate elements of cultural heritage and local identity into the design of buildings, public spaces, and streetscapes.

GOVERNANCE AND COMMUNITY EMPOWERMENT

Strengthen governance structures and promote transparency, accountability, and inclusive decision-making processes in urban rejuvenation initiatives.

Empower community organizations and foster partnerships with local stakeholders to ensure long-term sustainability and ownership of rejuvenation efforts.

Implement capacity-building programs to enhance community resilience, leadership, and participation in urban rejuvenation processes.

COLLABORATION AND COORDINATION

Establish interdisciplinary teams and task forces comprising architects, urban designers, planners, policymakers, and community representatives to ensure coherence and alignment in urban rejuvenation efforts.

Facilitate knowledge sharing and best practice exchange among professionals, stakeholders, and other cities or regions that have undertaken successful urban rejuvenation projects.

Promote public-private partnerships and leverage the expertise and resources of diverse stakeholders to drive urban rejuvenation initiatives.

These strategies and interventions are tailored to the specific contexts and needs of Aba and Umuahia, and implementation should involve community engagement, monitoring, and adaptation as needed.

POLICY IMPLICATIONS AND RECOMMENDATIONS

The findings and proposed strategies have several policy implications for urban rejuvenation efforts in Abia State and Nigeria as a whole:

1. Develop comprehensive urban rejuvenation policies and frameworks that integrate economic, social, environmental, and cultural dimensions, ensuring a holistic and sustainable approach.
2. Review and update existing urban planning and development regulations to align with best practices in urban design, sustainability, and community resilience.
3. Establish dedicated funding mechanisms and incentives to support urban rejuvenation initiatives, such as public-private partnerships, tax incentives, and access to financing for small businesses and entrepreneurship.
4. Strengthen institutional capacity and governance structures at the state and local government levels to effectively plan, implement, and monitor urban rejuvenation projects.
5. Promote inter-agency and cross-sectoral collaboration to ensure coordination among various stakeholders involved in urban rejuvenation efforts.
6. Foster community engagement and empowerment by establishing participatory mechanisms and platforms for residents to contribute to decision-making processes and hold authorities accountable.
7. Invest in research, data collection, and knowledge sharing to inform evidence-based urban rejuvenation strategies and promote the adoption of best practices.
8. Prioritize capacity building and skills development programs to equip professionals, policymakers,

and community members with the necessary expertise to drive successful urban rejuvenation initiatives.

By addressing these policy implications, Abia State and Nigeria can create an enabling environment for effective and sustainable urban rejuvenation, promoting economic growth, social inclusion, environmental sustainability, and community resilience.

SUGGESTIONS FOR FUTURE RESEARCH

While this study has contributed to the understanding of urban rejuvenation in the context of Aba and Umuahia, further research is recommended to address the following areas:

Longitudinal Studies: Conducting longitudinal research to evaluate the long-term impacts and effectiveness of implemented urban rejuvenation strategies on various aspects, such as economic development, social cohesion, and environmental quality.

Comparative Analyses: Conducting comparative studies with other cities or regions within Nigeria or internationally to identify best practices, challenges, and contextual factors that influence urban rejuvenation outcomes.

Specialized Focus Areas: Exploring specific aspects of urban rejuvenation in greater depth, such as affordable housing strategies, sustainable transportation solutions, or the role of cultural heritage in urban regeneration.

Community Resilience Indicators: Developing and validating community resilience indicators specific to the contexts of Aba and Umuahia, to better measure and monitor the impact of urban rejuvenation efforts on community resilience.

Financing and Governance Models: Investigating innovative financing mechanisms and governance models for urban rejuvenation projects, including public-private partnerships, community-based financing, and decentralized decision-making frameworks.

Technology and Smart City Applications: Examining the potential of emerging technologies and smart city solutions in enhancing urban rejuvenation efforts, such as data-driven urban planning, real-time monitoring, and citizen engagement platforms.

By pursuing these future research directions, policymakers, urban planners, and stakeholders can gain deeper insights, refine strategies, and develop more effective and sustainable approaches to

urban rejuvenation in Abia State and beyond.

CONCLUSION

This study has explored the concept of urban rejuvenation and its application in the context of Aba and Umuahia, two major urban centers in Abia State, Nigeria. Through a comprehensive review of existing literature, the research has provided valuable insights into the drivers, challenges, and strategies for revitalizing these communities.

The findings have highlighted the critical need for urban rejuvenation initiatives in Aba and Umuahia, driven by factors such as economic decline, inadequate infrastructure, environmental degradation, and social challenges. Stakeholders and residents recognize the potential of urban rejuvenation to revive economic vibrancy, improve quality of life, promote environmental sustainability, preserve cultural heritage, and enhance community resilience.

The study has emphasized the importance of defining and fostering community resilience as a key objective of urban rejuvenation efforts. By strengthening social networks, promoting economic diversity, ensuring good governance, providing equitable access to resources, and encouraging environmental stewardship, urban rejuvenation can contribute to the development of resilient communities capable of adapting and recovering from adverse situations.

The research has explored various urban design strategies and principles that can be employed in the revitalization of Aba and Umuahia, including mixed-use development, pedestrian-friendly environments, sustainable transportation systems, preservation of cultural heritage, and the integration of green infrastructure. These strategies aim to create vibrant, livable, and sustainable urban environments that meet the diverse needs of residents.

The study has also highlighted the complementary roles of architects and urban designers in achieving successful urban rejuvenation outcomes. While architects contribute expertise in designing individual buildings and public spaces, urban designers provide a holistic vision and comprehensive strategies for the physical transformation of urban areas. Effective collaboration and coordination between these professionals, along with other stakeholders, is crucial for ensuring coherence and alignment in urban rejuvenation efforts.

Stakeholder engagement and community participation have emerged as critical

components of the urban rejuvenation process. The study has explored various strategies for inclusive community engagement, such as public consultations, participatory design workshops, community mapping exercises, and collaborative decision-making processes. By actively involving residents and stakeholders, urban rejuvenation initiatives can better address local needs, foster a sense of ownership, and promote long-term sustainability.

The recommendations and policy implications outlined in this study provide a roadmap for policymakers, urban planners, and stakeholders to develop and implement effective urban rejuvenation strategies for Aba and Umuahia. These include economic revitalization initiatives, infrastructure upgrades, environmental sustainability measures, inclusive urban design practices, governance reforms, and collaborative approaches involving various stakeholders.

Furthermore, the study has identified areas for future research, such as longitudinal studies, comparative analyses, specialized focus areas, community resilience indicators, financing and governance models, and the integration of emerging technologies in urban rejuvenation efforts. Continuous research and knowledge-sharing will be crucial for refining strategies, adapting to evolving challenges, and promoting best practices in urban rejuvenation.

Moving forward, the successful implementation of urban rejuvenation initiatives in Aba and Umuahia will require sustained commitment, strategic planning, and collaborative efforts from all stakeholders involved. Effective governance structures, transparent decision-making processes, and robust monitoring and evaluation mechanisms will be crucial to ensure that the proposed strategies and interventions are properly executed and adjusted as needed.

Policymakers at the state and local government levels must prioritize the development of comprehensive urban rejuvenation policies and regulatory frameworks that align with the principles of sustainable development, community resilience, and inclusive urban design. These policies should provide clear guidelines, incentives, and funding mechanisms to support and facilitate the rejuvenation efforts in Aba and Umuahia.

Moreover, fostering partnerships and collaborations across sectors will be essential. Public-private partnerships can leverage the resources and expertise of private entities, while also promoting accountability and shared responsibility.

Collaboration with non-governmental organizations, community-based organizations, and academic institutions can contribute to capacity-building, research, and knowledge-sharing initiatives.

Importantly, the active involvement and empowerment of local communities must be at the forefront of urban rejuvenation efforts. Participatory processes that enable residents to voice their concerns, aspirations, and local knowledge can enhance the relevance, acceptability, and long-term sustainability of the rejuvenation initiatives. Building a shared vision and fostering a sense of ownership among community members will be critical for successful implementation and ongoing maintenance of the revitalized urban areas.

Furthermore, it is crucial to recognize that urban rejuvenation is a long-term process that requires patience, perseverance, and adaptability. Continuous monitoring and evaluation of the implemented strategies will be necessary to assess their effectiveness, identify areas for improvement, and make data-driven adjustments as needed. Embracing a flexible and iterative approach, while maintaining a clear vision and strategic direction, will enable the rejuvenation efforts to evolve and respond to emerging challenges and opportunities.

Lastly, the dissemination and sharing of knowledge and best practices from the urban rejuvenation experiences in Aba and Umuahia can contribute to the broader discourse and advancement of sustainable urban development practices in Nigeria and beyond. By documenting the successes, challenges, and lessons learned, other cities and regions can draw inspiration and insights, fostering a collaborative and mutually reinforcing ecosystem of urban rejuvenation efforts.

In the face of pressing urban challenges and the imperative of creating resilient, livable, and sustainable cities, the rejuvenation of Aba and Umuahia represents a significant opportunity to drive positive change and serve as a model for urban transformation in Nigeria. With a strong commitment to evidence-based strategies, inclusive processes, and effective implementation, these urban centers can unlock their full potential, fostering vibrant communities, economic prosperity, and a harmonious coexistence between the built and natural environments.

In conclusion, this study has contributed to the understanding of urban rejuvenation processes and their potential impact on the well-being and sustainability of Aba and Umuahia. By adopting a holistic and evidence-based approach that integrates economic, social, environmental, and

cultural dimensions, urban rejuvenation can serve as a catalyst for positive transformation, fostering vibrant, resilient, and inclusive communities in Abia State and beyond.

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INFLUENCE OF SOCIO-CULTURAL CHARACTERISTICS ON SATISFACTION OF HOUSING CONSUMERS IN PRIVATE HOUSING IN ENUGU URBAN

By

Irouke V.M.[1] & Ahianba J. E.[2]

Department of Architecture, Nnamdi Azikiwe University Awka[1], Anambra State;

Department of Architecture, Ambrose Ali University Ekpoma[2] Edo State

ABSTRACT

Socio-cultural elements are integral part of any successful housing project. The way people perceive their environment has been greatly influenced by certain variables, which largely include their experience and socio-cultural background. This study examined the influence of socio-cultural characteristics on the consumer satisfaction of the residents of private housing in Enugu Urban. Previous satisfaction studies concentrated on public housing, even when greater percentage of the population lives in buildings owned by private individuals and organizations and adopted the descriptive survey design. The study was carried out with the aid of questionnaire, structured interviews, and physical observations. A total of 422 copies of questionnaires were distributed within the 3 local government areas that make up Enugu Urban. Stratified sampling was employed to make sure that all identified housing typologies within the population were adequately and proportionally covered, From the research, it was found that there is a significant linear relationship between the socio-cultural characteristics of residents and their satisfaction levels ($p < 0.001$). The regression coefficient B showed negative values, which indicates that the socio-cultural characteristics of the residents have a significant negative effect on the satisfaction level. Recommendations were proffered to guide policymakers, some of which include user participation in design, adequate consideration by architects when designing buildings, and orientation of housing developers on the need for other vital considerations other than financial gain.

INTRODUCTION

Housing is universally recognized as a significant economic asset and the second most important human requirement after food. Studies in housing have made tremendous progress recently, with their focus turning on the end-user. Hitherto, much emphasis had been placed on the 'brick and mortar' content (Palm, 2007). This could have been inflamed by the misconception of housing requirements as only shelter from the elements. However, housing goes beyond basic shelter. It constitutes, among other things, a space within which generations of families express their lifestyles and preserve their histories and identities of lineage. Odum (2015) revealed that, as an integral part of human development, housing fulfills a basic need that impacts the quality of life, health, welfare, and productivity of man. Consequently, the United Nations Centre for Human Settlement (UNCHS) (2001) noted that access to decent housing is a basic right for individuals. The right to decent housing was recognized in 1948 in the Universal

Declaration of Human Rights and affirmed in the Vancouver Declaration on Human Settlement in 1976. To fulfill its purpose, housing must be able to meet the needs and aspirations of the residents, contribute to their physical, mental, and social well-being, and provide a quiet environment, living and outdoor space, privacy, cleanliness, safety, and aesthetic satisfaction (Akinyode, 2017).

The home has historically and globally developed with regard to economic and socio-cultural factors. As a result, each civilization develops its own unique home form that is both subjectively influenced by the structural system of social organization and strongly reflective of the historically prevailing cultural values (Awotona and Ogunshakin 1994). According to Rapoport (1977) and Lawrence (1987), traditional values and house patterns are important factors in determining the quality of housing developments. Similar findings have been made about how people perceive their living conditions, including how experience and socio-cultural background impact this perspective. As a result, the level of satisfaction felt by housing consumers in a given housing unit is a reflection of how much they identify with their socio-cultural background (Makinde 2013).

Satisfaction with a dwelling unit is important, as it guarantees life satisfaction because a good percentage of one's life is spent in it. Whether one is satisfied with a place one lives in, will depend on several factors, including an architectural design that takes into consideration the socio-cultural lifestyle of the occupants. One of the main obstacles to housing satisfaction is the lack of socio-cultural factors, including the ethnicity of end users, family values, family size, and religion, among others, as well as the inadequate application of study findings. As a result, the state and federal governments' public housing programs were unable to fulfill the desire for home ownership held by many Nigerians (Onibokun 1985; Akinmoladun and Oluwoye 2007).

Economic and socio-cultural considerations were frequently required to be taken into account while housing was being developed. People's assessments of their living environments have been impacted by a number of factors, including inhabitants' experiences and socio-cultural backgrounds (Makinde 2015). In light of their various socio-cultural backgrounds, the housing consumers' assessments therefore indicated varying degrees of contentment. The ethnicity, religion, and size of the households of the people are social or cultural components. To assess the demands of housing consumers in private housing in Enugu Urban and raise their quality of life, it is crucial to ascertain how people's socio-cultural origins affect their contentment with their housing provision.

Many studies are unsatisfactory because they frequently neglect housing consumers' social and cultural backgrounds and instead narrowly focus on economic and technological advancements and how these affect occupants' satisfaction. The issue is made worse by the fact that homes may be acceptable from the point of view of the architect but not necessarily from the viewpoint of those living inside. The belief that a home's physical and structural compatibility alone is a good indicator of its suitability for providing satisfying housing to its occupants has frequently prevented housing delivery programs for low-income earners from accomplishing their goals (Jiboye 2004). Each ethnic group in Nigeria has developed its own distinctive manner of dwelling that is responsive to its environment and way of life, despite the seeming uniformity and sameness shown in the varied home types (Olotuah 1997). Because of this, choices made while employing a top-down approach to propose a prototype housing design for the entire people of Nigeria have never truly proven successful. Local communities have rich experiences, a unique grasp of their environment, their local building resources, and the ways On the other hand, the absence of consideration for these social norms in housing designs in some buildings of public housing in Enugu has resulted in a number of unanticipated challenges, such as residents modifying the built houses in order to satisfy their needs; others convert certain spaces for other uses apart from the original intention of the design.

STUDY AREA

Enugu Urban which is the study area is made up of Enugu East, Enugu North, and Enugu South. Enugu Urban is located within latitude 6.240 N and 6.300 N and longitude 7.270E and 7.320 E. It shares boundary with Igbo Etiti and Isi-Uzo Local Governments in the north, Udi local Governments in the west, Nkanu West Local Government in the south and part of Nkanu East Local Government Area in the east. There are 18 prominent residential areas in the Urban. These are Abakpa, Trans-Ekulu, Nike, GRA, Ogui, Asata, New Heaven, Obiagu, Ogbete, Iva valley, Independence Layout, Achara Layout, Ugwuaji, Maryland, Awkunawnaw, Uwani, Agbani, and Coal Camp. Enugu Urban is the most developed urban area in Enugu state

LITERATURE REVIEW

This study has examined the influence of socio-cultural characteristics (family values, religious beliefs, family structure, life style, privacy, safety, and security) on housing consumers' satisfaction among those living in private housing in Enugu City. The analysis includes descriptive, correlational, linear, and multiple regression analyses. The concept of housing satisfaction is linked to the material, architectural, and engineering components of the home, the behavioral, social, cultural, and personal characteristics

of the residents, the components of the environment, and the nature of the institutional arrangements that run the home. Assessing housing satisfaction entails evaluating the level of end-user satisfaction for a housing unit with defined building features, located in a particular neighborhood, and with socio-cultural amenities. Residents' satisfaction with housing is defined as an emotional component that reflects their satisfaction and happiness with the housing place, which also creates these feelings. This study agrees with some scholars who have confirmed that housing adjustment promotes housing satisfaction by facilitating the inclusion of users' cultures and also by explaining the reasons for changing needs and desires. This is because housing adjustment remains inevitable as the needs and desires that are basic to households' existence remain dynamic. Moreover, socio-cultural structure in the city becomes one of the essential components of the quality of life; expectations and satisfaction of the individual come into prominence. This outcome of this study finds that family structure was the most important factor among the socio-cultural values influencing consumers' satisfaction, followed by family life style in Enugu town. It has also been argued by many scholars that residents' satisfaction is greatly influenced by the socio-cultural values of societies. These studies support this study, which considers the socio-cultural aspects of housing satisfaction as a key element in determining residents' satisfaction with housing.

In a residential setting, socio-cultural impacts on housing make up a crucial element that will be necessary to satisfy resident demands, uphold public health, and meet residents' individual and collective needs. Physical, psychological, socio-cultural, and environmental requirements that could affect resident satisfaction and attitude by guiding overall individual and family happiness and welfare are a result of problems with housing and residence environments that are brought on by the neglect of these requirements (Agbola 1998).

Housing satisfaction has emerged as the key indicator that researchers and analysts use to assess the performance of the private and public building sectors, as well as an indicator of residential mobility and an assessment of how well new projects are received by occupants. Housing satisfaction as a criterion is chosen based on a number of factors, one of which emphasizes the point of view of the consumers themselves. This emphasis is justified by the fact that many issues with the built environment arise from disregarding the users' perspective. The purpose of residential building performance is to create and maintain a setting that enhances the efficiency of the occupants while permitting optimal resource management with a minimum lifetime

investment, as indicated by Oliveira and Heineck (1999) in Makinde 2015.

THEORITICAL FRAMEWORK

The study is anchored on two theories: the Housing Deficit Theory by Morris and Winter, propounded in 1978, and the Psychological Construct Theory, propounded by Galter in 1985. Housing Deficit Theory is intended to explain how residential dissatisfaction among housing consumers is experienced due to a gap between the actual housing situation and the socio-cultural and housing norms of the people. The key components of the theory explain that individuals judge their housing conditions according to some norms; incongruity between the actual and familial housing norms results in a housing deficit; and a housing deficit is mitigated through some form of housing adjustment. On the other hand, the Psychological Construct Theory by Galster (1985) introduced the notion of a psychological construct of residential satisfaction and theorized that individuals may be seen as cognitively constructing a reference condition for each particular aspect of their residential situation. The theory explains that if a current situation is perceived to be near or superior to the reference situation, a psychological state of satisfaction is manifest, and if, on the other hand, the current situation falls short of the reference situation by more than a threshold deficiency, two alternatives arise. One may attempt to reconcile the incongruence through adaptation, through redefining needs, reducing aspirations, and/or altering the evaluation of the current situation, thereby producing just a small amount of satisfaction. Alternatively, if one can't adapt to the current residential context, dissatisfaction manifests. Such individuals, over time, would likely attempt to reduce their dissatisfaction by altering the conditions of the present dwelling unit or by moving to another congruent residential situation.

The key components of this theory can be stated as follows: individuals cognitively construct a reference condition of their residential situation; satisfaction prevails when current housing is proximately congruent with the reference situation; and incongruence will lead to either adaptation, dissatisfaction, or modification. The above two theories relate to the current study of consumer satisfaction with houses in private housing in Enugu Urban. Drawing from the first theory by Morris and Winter (1978), this research work supposes that the discrepancy between the actual housing condition and familial housing norms results in a housing deficit, and the work of Morris and Winter (1978) with Galster (1985) also agrees with the view of this work that a housing deficit could either lead to dissatisfaction, which the consumer tries to adapt to, or the consumer begins to modify his dwelling to accommodate his "needs". In some cases, residential mobility occurs as the housing consumer seeks a more congruent residential

situation. This work also supposes that satisfaction occurs when the current housing situation is close to or higher than what the consumer sees as ideal. The consumer has constructed a construct of what he believes is ideal, either through past experience or through other cognitive processes. For example, the former housing condition of a consumer affects his perception of his new environment (Galster, 1985).

Considering that the area of study is mostly dominated by low and medium-income earners who probably do not own the houses they live in but are tenants who are likely to have the alternative of moving to another housing condition, the two theories are appropriate for the study. This is because the study aims to find out the residents' perceptions regarding their satisfaction with the design and architecture of their housing. By identifying the level of dissatisfaction, the researcher will be able to investigate how the occupants have been dealing with the apparent dissatisfaction. It will therefore highlight whether they needed to move out of the housing environment or if they had found other ways of dealing with the dissatisfaction. The study also aims to find out the socio-cultural characteristics of the residents in the area and how they influenced their housing conditions or how their houses influenced or affected their cultural or familial lives. A housing deficit could be experienced as a result of the incongruence of the way of life of the consumers with the available house types and functionalities of the building being provided.

METHODOLOGY

Both quantitative and qualitative research methods were employed in the research. The qualitative research, being exploratory in nature, helped the researcher better understand the motivations, needs, processes, and rationale for the behaviours of the housing occupants, exhibited through satisfaction and dissatisfaction. The quantitative research was approached through surveys and the collation of measurable data relating to the research. As the research inquiry needed a survey, questioners and interviews in the field were carried out to determine people's characteristics, opinions, attitudes, preferences, and perceptions of persons of interest to the researcher. The data used for this study are both primary and secondary. Primary data were collected through field observation, direct interviews, and the administration of a questionnaire. Secondary data were derived from books, theses, journals, and Internet materials. In this research study, a self-administered survey was applied in the three local government areas that made up Enugu Urban. This study used five-point Likert scales.

RESULTS AND DISCUSSION

Table 1 below shows that 74.2% of the respondents are male, while most of them are under 50 years old (83.6%). More than half

of the respondents are married (67.4%), while 75.8% are rent-paying tenants. Out of 55 respondents who are owner-occupants, 38 (69.1%) bought directly from developers. More than half of the respondents (59.4%) have lived in the house for between 1 and 5 years. The study intended to determine the age bracket of the respondents as well as the ratio of males to females. The research intended to give the male (in most cases the head of the household) and the female (in most cases who uses the house and its facilities more than the man, especially the wife) equal opportunity to express their concerns, but in most cases the males opted to attend the questionnaires. It should be noted that gender might have some influence on the perception of housing satisfaction.

Table 1: Demographic characteristics of the respondents

	Frequency	Percent
Sex		
Male	285	74.2
Female	99	25.8
Age group		
20 -30	85	22.1
31 - 40	97	25.3
41 - 50	139	36.2
51 - 60	53	13.8
≥60	10	2.6
Marital status		
Single	106	27.6
Married	259	67.4
Separated	7	1.8
Divorced	6	1.6
Widowed	6	1.6
Status of your residency		
Rent paying	291	75.8
Non-rent paying family house	17	4.4
Official residence	1	0.3
Mortgaged house	20	5.2
Owner occupied house	55	14.3
If owner occupied, how did you acquire the house		
Bought directly from developers	38	69.1
Bought from previous owner	7	12.7
Government allocation	2	3.6
Inherited from family	7	12.7
Mortgage arrangement	1	1.8
How long you have been living in the house		
Less than 1 years	29	7.6
1 to 5	228	59.4
6 to 10	64	16.7
11 to 20	46	12.0
>20	17	4.4

Considering the socio-economic characteristics of the respondents, Table 2 below shows that most of the respondents (80.5%) have acquired tertiary education, 47.4% are civil servants, 30.5% are businessmen or traders, and 76.4% earn more than N240, 000 annually. The table shows that 35.2% of the respondents reported 3–5 occupants in a house, 28.6% reported 6–7 occupants, and 23.4% reported 1–2 occupants. More than half of the respondents (64.6%) reported that the occupants of their houses are immediate family members.

Table 2: Socioeconomic characteristics of the respondents

	Frequency	Percent
Level of Education		
No formal education	3	0.8
Primary school	3	0.8
Secondary school	69	18.0
Tertiary education	309	80.5
Occupation		
Unemployed (students, retired, NYSC, applicant)	38	9.9

Artisan (tailor, hairdresser, bricklayer, carpenter, etc)	39	10.2
Civil Servant (banker, teacher, doctor, e.t.c)	182	47.4
Business/trader	117	30.5
Farmer	8	2.1
Level of Income (Annual)		
BELOW 192,000	31	8.1
192,000 - 239,99	60	15.6
240,000 - 1,199,999	97	25.3
1,200,000 - 2,399,999	89	23.2
> 2,400,000	107	27.9
Number of occupants in the house		
1 - 2 people	90	23.4
3 - 5 people	135	35.2
6 - 7 people	110	28.6
8 - 9 people	42	10.9
10 or more people	7	1.8
Nature of relationship with occupants		
Immediate family members	248	64.6
Extended family members	54	14.1
Distant relations	24	6.3
Friends	51	13.3
Others	7	1.8

With the help of bar chart (Fig 1 and Fig 2), the number of occupants in the house, as well as the nature of relationship the respondents have with the occupants are further expounded.

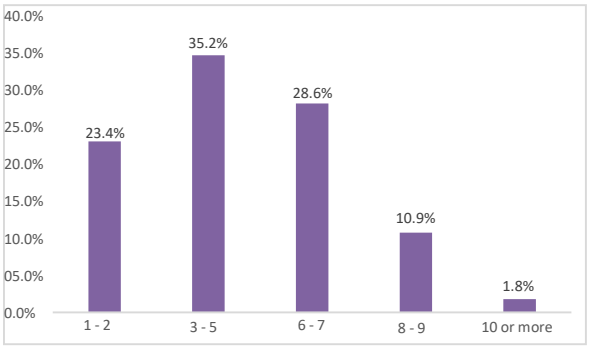

Fig 1 Number of Occupants in the house.

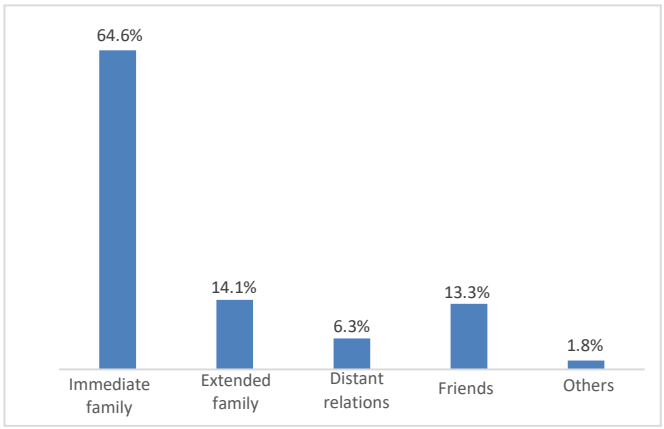

Fig 2: Nature of relationship with occupants.

Further in the research, documentation of the socio-cultural characteristics of the participants was obtained through the questioner. Table 3 shows that the participants rarely engage in social activities such as gatherings in the house, family outdoor activities, family participation in neighborhood community social gatherings, impromptu overnight guests, and engaging in recreational activities within the neighborhood, as indicated by the higher percentage values reported for sometimes, "rarely," or "never.

Table 3: Socio-cultural characteristics of the participants

	Very often n (%)	Often n (%)	Some times n (%)	Rarely n (%)	Never n (%)
How often do you host social gathering in your house?	5 (1.3)	34 (8.9)	166 (43.2)	125 (32.6)	54 (14.1)
How often is your family engaged in outdoor activities?	1 (0.3)	41 (10.7)	171 (44.5)	117 (30.5)	54 (14.1)
How often does your family participate in community social gatherings in your neighbourhood?	4 (1.0)	25 (6.5)	151 (39.3)	149 (38.8)	55 (14.3)
How often do you have impromptu overnight guests?	3 (0.8)	28 (7.3)	169 (44.0)	166 (43.2)	18 (4.7)
How often do you engage in recreational activities within your neighbourhood?	5 (1.3)	33 (8.6)	211 (54.9)	126 (32.8)	9 (2.3)

Table 4 shows a significant linear relationship between socio-cultural characteristics of residents and their satisfaction levels ($p < 0.001$). The socio-

cultural characteristics of the residents have a significant negative effect on their satisfaction levels as indicated by the negative values of the regression coefficient B.

Table 4.: Effect of socio-cultural characteristics of residents on the satisfaction levels of housing consumers.

	R	R^2	B	P value
How often do you host social gathering in your house?	0.313	0.098	-0.231	< 0.001
How often is your family engaged in outdoor activities?	0.304	0.092	-0.228	< 0.001
How often does your family participate in community social gatherings in your neighbourhood?	0.287	0.082	-0.221	< 0.001
How often do you have impromptu overnight guests?	0.211	0.044	-0.188	< 0.001
How often do you engage in recreational activities within your neighbourhood?	0.214	0.046	-0.199	< 0.001

FIELD OBSERVATIONS

The researcher also observed that some of the earlier developed housing layouts, like the artisan quarters, coal camp quarters, and Uwani layout in Enugu North Local Government Area, which were built as small apartments of one bedroom and two-bedroom apartments, have left the present users grossly unsatisfied and have led to some sort of post-design modifications. There have been some additions to the spaces to cater to the increasing needs of the users. Some of these places are gradually characterized by the addition of quick-fix (make-shift) homes, mostly built with recycled wood, zinc, and aluminum products from construction sites. The settlements have homes in total disrepair; the areas are littered with waste and unkempt (even in the middle of formal housing areas). (See plates 1 and 2.) From the interview by the researcher, it was gathered that many people who live in these urban poor settlements do so not just because of the low house rent compared to the cost of getting a more decent accommodation in the newer housing development areas, but because they enjoy some basic facilities like piped water and more constant electricity than so many other places in town. However, some of them admitted that they would prefer to move to a better location if their economy improved. Even for the blocks of flats in Newhaven area, it was observed that some of the users had to convert balconies to storage and other utility spaces as provisions of space made were not sufficient. See plate 3.

Plate 1. Artisan Quarters in Enugu

Plate 2. Coal camp quarters in Enugu. Source

Plate 2. Coal camp quarters in Enugu

DISCUSSIONS

This study looked at how socio-cultural factors, such as family values, religious views, family structure, lifestyle, privacy, safety, and security, affected how satisfied private housing residents in Enugu City were with their homes. The idea of housing satisfaction is connected to the factors that comprise the environment, the institutional frameworks that operate the house, the occupants' behaviour, social, cultural, and personal traits, as well as the material, architectural, and engineering components of the home. In order to evaluate housing satisfaction, one must look at how satisfied end users are with a housing unit that has specific building characteristics, is situated in a specific neighborhood, and has socio-cultural facilities.

Housing satisfaction is described as an emotional factor that reflects the happiness and satisfaction of the housing environment, which also generates those feelings in the individuals who live there. This study confirms the findings of a number of researchers who have shown that housing modification enhances housing satisfaction by making it easier to incorporate user culture and by clarifying the underlying reasons for altering wants and desires. This is due to the fact that housing modification will always be necessary as long as basic human requirements and aspirations are changing. Additionally, the socio-cultural makeup of the city becomes one of the key elements of quality of life, and personal expectations and satisfaction rise to the fore. According to the study's findings, the family unit accounted for the majority of socio-cultural values.

CONCLUSION AND RECOMMENDATION

According to the responses from the housing consumers, it was found that the top three main factors for residents' responses to evaluate their satisfaction with their housing conditions are distance to neighborhood facilities, common housing area and privacy, and sleeping area in dwelling unit features. It concludes that these elements are necessary to include in the residential satisfaction assessment. Also, as shown in the analysis results and field observation, the findings of this study explore that socio-cultural values, which include family lifestyle, are important components forming the housing design.

Accordingly, values influence consumer satisfaction. The study then reveals that socio-cultural values significantly influence consumer satisfaction among occupants of private housing projects in Enugu.

With the above in view, the current preferences of users about satisfaction with the architectural design of spaces should provide the basis for design works that make the planning process more participatory and pluralistic, which will prevent the reoccurrence of problems in the process of use. Also, with the recent technological advancements, residential spaces are changing in size; therefore, in order to accommodate the new electronic gadgets, equipment, furniture, and other services, architects must bear all these in mind when designing.

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