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Waste management in an academic housing environment: A challenge to urban sustainability in Akure, Nigeria

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Abstract
One of the pressing global issues is the sustainability of our urban areas. For a housing environment to be sustainable, the disposal of waste must be taken as a priority by home owners. This paper examined the typology of waste disposal in an academic housing environment in Akure using the housing neigh bour hood of the Federal University of Technology Akure. Stratified random sampling technique was used to reach occupants of housing units and close ended questionnaire was used to elicit needed information from them. Structured interview of appropriate official of Ondo State Waste Management Board, Akure was also done to examine the role of the state government in ensuring urban sustainability through good management of waste. Findings show that less than 10% patronized the Ondo State Waste Management Board, Akure which revealed that government efforts in ensuring a sustainable urban neighbourhood was inadequate. Recommendations included the need for a more efficient enforcement of sanitation laws, public awareness and surveillance on waste disposal and a more proactive strategy by the government at all levels to combat waste as the urban population grows especially in the academic environment.

Keywords: academic, housing, Nigeria, sustainability, waste disposal

1. Introduction
One of the prices that must be paid for increased rate of urbanization and industrialization is the increasing volume of wastes being generated. This poses a challenge to the cleanliness and sustainability of the housing environment. In developing nations such as Nigeria, the technology to cope with the efficient management of wastes is still grossly inadequate. The management of waste is far from being satisfactory in Nigeria as crude means such as burying, burning, or haphazard disposal in unacceptable ways are employed or wastes even being left unattended to resulting in health hazards and environmental pollution (Nwigwe, 2008) [12]. One of the criteria for assessing sustainability in housing development is effective waste management or disposal (Ayoola, Lawal and Akinluyi, 2012) [5]. The population of a city usually grows with the location of a higher institution of learning such as a university. Staff and students require housing which are usually grossly under provided by the management. Hence a greater percentage of staff and student usually live outside the campus. This is the situation in most Nigerian higher institution of learning (Ajayi, Nwosu and Ajani, 2015) [4]. The greater demand on the residential accommodation in close proximity to higher institutions has been researched into by various scholars especially with respect to the rise in property values (Ajayi and Nwosu, 2011; Adebisi, Ezeokoli, Oletubo and Alade 2015) [2, 1]. This paper however aimed at examining the waste disposal methods by the teeming and rising population in an academic housing environment in housing units around the Federal University of Technology, Akure, Nigeria. It also examined the State Government's efforts towards sustainable urban housing environment through effective waste management.

2. Concept of Sustainability and Waste Management
There are many definitions of sustainability. The most popular definition of sustainability in which sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987) [16]. Another definition by Concern, Inc. (1993) [6] is very relevant to this paper. "A sustainable community uses its resources to meet current needs while ensuring that adequate resources are available for future generations. It seeks improved public health and better quality of life for all its residents by limiting waste, preventing pollution, maximizing conservation and promoting efficiency, and developing local resources to revitalize the local economy."
Sustainable homes in the United Kingdom are expected to meet certain criteria which are used to measure sustainability. The design categories included within the sustainable home code are: energy or CO_2, pollution, water, health and well-being, materials, management, ecology and waste (Department for Communities and Local Government, London, 2006). The waste model is highly essential in the sustainability of the housing environment, which is what this paper is focused on. This is in line with the minimum housing standard according to the (Government of Alberta, 2012) [9] in which it is stated that "every housing premise shall have an adequate number of containers suitable for the storage of garbage and refuse awaiting final disposal".
Waste management entails the process of collecting, keeping, treating and disposing waste such that it is harmless to human and animal life, the ecology and the environment in general. Waste management include activities that deal with waste before and

after it is produced, including its minimization, transfer, storage, separation, recovery, recycling, and final disposal. Solid waste management methods of managing municipal solid waste include incineration, landfills, composting and recycling (Huang, 2009) [10]. The amount of waste produced by human activities is increasing in most parts of the world, accompanied by problems of disposal. In developing countries where waste disposal facilities are minimal; people are left with no other option than to dump their waste in sewers, public dump site, streams etc. Various means of disposal that do not promote sustainability of the environment were being employed by residents in different urban settings. Some home owners dig pits on their property for the purpose of waste disposal while others throw waste away indiscriminately (Manda, 2009) [11]. Ayoola *et al* (2012) [5] and Ajayi and Omole (2012) [3] found that burning and dumping in illegal sites such as uncompleted buildings or abandoned bare sites were common practices in different cities in Nigeria.

3. Ondo State Waste Management Authority (ODSWMA)

The Ondo State Waste Management Authority (ODSWMA) was established in May 1999 and saddled with the responsibility of maintaining a clean environment in the state. The ODSWMA is responsible to the Ondo State Waste Management Board and the functions include among others to:

a. rid the state of refuse through regular collection from individual houses, establishments, institutions and other designated areas for disposal to avoid refuse piling, environmental blight and epidemic development;
b. ensure that every owner or occupier of a premise, household/commercial shops or stalls provide and maintain at least one portable covered refuse bin;
c. establish and maintain approved sanitary landfill sites within the state for the disposal of wastes;
d. keep record of and collect user-charges or rates on the weight of waste disposed off and collection of tipping fees at landfill sites;
e. complement or take part in the organization, monitoring and supervision of environmental sanitation campaigns so as to create adequate awareness of the need for effective storage, collection and disposal of waste in Ondo State;
f. set guidelines for waste scavenging and recycling in order to generate revenue;
g. enter into contractual agreements with approved private concerns where necessary, for the actualization of the functions of the Board; and
h. Collaborate with LGAs and other agencies within and outside the state for actualization of its functions (ODSWMA, 2002).

4. Research Methodology

The urban setting of the study is Akure, the Ondo State capital in southwest Nigeria. It lies between latitude 7^0 13' and $7^0$15' North of the Equator and longitude $5^0$10' and $5^0$12' East of the Greenwich Meridian. The population of Akure according to the National Population Census of 1963 was 71,106 people, while the census of 2006 was 353, 211 (Federal Republic of Nigeria, 2007) [8]. The location of the Federal University of Technology Akure with its ever increasing population is having great influence on the population growth of the city. The institution was founded in 1981 under a drive by the government of Nigeria to create universities that specialised in producing graduates with practical as well as theoretical knowledge of technologies. The staff population as at May 2019 stood at 2,413 (Directorate of Academic Planning, FUTA, 2019) while the student population as at 2018/2019 academic session was 15000 comprising of 13000 undergraduate and 2000 post graduate students. Campus accommodation is provided for less than 20% of the population making a larger percentage to reside in off campus accommodations which are privately owned (Adebisi *et al*, 2015; Ajayi, Nwosu and Ajani, 2015 [1, 4], Ogungbe, Olukolajo and Binuyo, 2018) [13]. There are two major gates to the university namely the North and South gates. The South gate is densely populated and characterized with traffic hold ups due to commercial activities springing up along the main road leading to the university.

Both primary and secondary data were used for the study. Secondary data were got through an interview of Director of Planning, Research and Strategy of the Ondo State Waste Management Authority office. Primary data were got from occupants of hostels and other housing types in close proximity to the south gate of the Federal University of Technology, Akure, (FUTA). The sample frame for the study was adopted from the work of Ajayi and Nwosu (2011) [2] and Ogungbe *et al* (2018) [13]. There were thirty three hostels around the FUTA south gate which were registered with the Students' Affairs Division of the University. The study employed stratified random sampling technique to administer questionnaires to the respondents in selected hostels and houses in streets in close proximity to the FUTA south gate till a sample size of eighty was reached. Eighty respondents made up of a respondent per house were sampled out of which 75 of the questionnaires were found useful for analysis. Data were analysed using descriptive statistics.

5. Results and Discussion

According to the scheduled interview with the Director of Planning, Research and Strategy of the Ondo State Waste Management Authority office, the operations of the ODSWMA could be divided into two namely: cleaning and waste collection. Cleaning activities involved sweeping of the highways and cleaning of illegal waste dumps while waste collection involves the collection of wastes from households in the different enumerated areas. Its activities were mainly in Akure, the state capital, but each Local Government Area had a waste management board.

Akure being the state capital is growing rapidly and is divided into eight (8) zones and twenty three (23) sub-zones for the purpose of efficient waste management. Ten (0) subzones were being managed by the ODSWMA, while thirteen (13) by private sector operators and three by the Akure South LGA. Each subzone under the ODSWMA is delineated, mapped and enumerated to cover a size of one thousand two hundred (1200) to one thousand five hundred (1500) clients or household. The subzones under the management of the AKSLGA have larger client sizes and hence not efficiently managed in terms of waste collection. ODSWMA has twenty trucks, ten of which are used for cleaning services and the other ten for waste collection. The staff involved in the waste collection are both permanent and contract staff of the office.

There were thirteen (13) private operators licensed by ODSWMA to collect waste within Akure. A sum of fifty thousand naira

(N50, 000) was payable as license fee and renewable yearly at half the amount. The private operators were usually given a moratorium of three to six months in order to study the terrain and decide if they will continue with the work. The main requirement to be enlisted as a private waste collector apart from the license fee was to have a waste truck and write a letter of engagement to be a Private Sector Participant (PSP). A token tipping fee was also paid by the operators to maintain the landfill sites. Considering the population size of Akure and the rate of urban growth, it was obvious that these facilities were not enough to cope with waste generation.

Wastes collected were being disposed at a landfill site located along Igbatoro Road towards the outskirt of the city. A little sorting and mini recycling was done on the wastes at the site. There were scavengers who usually visited the site and other parts of the town to pick recyclable waste such as metals which were sold to people who would make use of them. According to the interviewee, there is need for enlightenment and surveillance to prevent illegal dumping of waste in the city.

The fees payable by users for waste collection according to the Enlightenment and Enforcement Department of ODSWMA is as shown in Table 1 below:

Table 1: User Charge

Property Type	Rate in naira (N) (1$ = N360)
1. Residential	
Tenement per room	100
1 Bedroom flat	300
2 Bedroom flat	400
3 & 4 Bedroom flat	500
Duplex	600
2. Shop/Stall	
Small	100
Medium	200
Large	Direct assessment
3. Commercial outlets	
Supermarkets, electronic stores, pharmaceutical stores, hotels and event centres	Direct assessment
4. Hospitals	200 per bed space
5. Maternity/ Laboratories	
Small	1000
Medium	2000
6. Schools	20 per pupil
7. Food canteen	
Small	300
Medium	1000
Large	Direct Assessment
8. Filling stations	500 r pump
9. Banks	10000
10. Worship centres/ Vicarage	
Small	500
Medium	1000
Large	2000
11. Abattoirs	Direct assessment
12. Motor Parks/ Recreational centres	Direct assessment
13. Bulk waste collection	Direct assessment
14. Hawkers /Squatters	Direct assessment

Source: ODSWMA, Enlightenment and Enforcement Department

Primary data were gathered from occupants of the housing units in close proximity to the Federal University, Akure on their occupational status, type of accommodation, provision for waste disposal, method of waste disposal and the frequency of waste disposal.

Table 2: Occupational Status of Respondents

Responses	Frequency	Percentage
Student	37	49.3
Civil Servant	12	16.0
Self- Employed	26	34.7
Total	75	100.0

Table 2 reveals that 49.3 % of respondents were students while workers in civil service and self employment accounted for the remaining percentage. This authenticated the fact that the population growth of the university has contributed to the urban growth and development of the study area.

Table 3: Type of Accommodation

Responses	Frequency	Percentage
Tenement	36	46.7
Self -contained Flat	25	33.3
2 Bedroom Flat	8	10.7
3 Bedroom Flat	6	8.0
Others	0	0.0
Total	75	100.0

Tenement buildings or Brazilian type of houses were predominant (46.7%) in the study area as it is the cheapest type of accommodation affordable to students. Self - contained flats were also increasing in number for student accommodation with a change in taste from tenement and accounted for 33.3% of housing units occupied by respondents.

Table 4: Provision for Waste Disposal

Responses	Frequency	Percentage
Yes	28	37.3
No	47	62.7
Total	75	100.0

Table 4 shows that 62.7% of housing units around FUTA made no provision for disposal of solid waste generated within the premises. Due to the high demand for accommodation in the academic environment, investors are mostly concerned with maximising profit without taking into consideration the issue of sustainability of the housing environment in terms of waste management.

Table 5: Methods of Waste Disposal

Responses	Frequency	Percentage
Collection by Ondo State Waste Management Authority	7	9.3
Incinerator	3	4.0
Dumping in illegal sites	44	58.7
Burning at site	21	28.0
Total	75	100.0

The methods of waste disposal mostly employed by respondents were dumping in illegal sites (uncompleted buildings or bushy areas in the neighbourhood) and burning of refuse in front of or at the back of buildings. These unhealthy methods accounted for 58.7% and 28% respectively. The activity of the Ondo State Waste Management Authority was not yet well pronounced in FUTA area as only 9.3% patronized it. The Ondo State Waste Management Authority usually comes once a week for waste collection. The fact that the cost of waste disposal through the ODSWMA was higher than burning or dumping could be responsible for the low patronage of the government waste disposal method. This finding is similar to that of Ajayi and Omole (2012) [3] where it was reported that the government waste collection was non- existent due to bad roads leading to the selected housing estate in another part of Akure. 31.7% burnt their refuse while the 44.4% use illegal dumping ground and only 23.8% use approved incinerator. This is also similar to the finding of Ayoola (2012) [5] in Osogbo, Osun State, Nigeria. On the method of refuse collection and disposal in the city, the Waste Management Authority was responsible for collection and disposal of waste from 6.2% of all the buildings in the selected area, 27.3% and 43.3% of waste generated in the city were disposed of by dumping them on a dump site and by burning respectively, while a large percentage (27.3%) of the respondents pour their waste in drainages located near them. These methods were not only unhealthy, but destroy and pollute the environment. From the two studies, it could be observed that dumping in illegal sites had the highest frequency. These illegal sites are unapproved places such as uncompleted buildings, bushy bare lands or even gutters, thus blocking the drainage. This may appear cheap and without any cost incurred but the effect of a dirty housing environment or unhealthy waste disposal is a price too high to pay in the long run. The fact that the State Waste Management Authority in Ondo and Osun states accounted for less than 10% of municipal solid waste revealed that a lot of attention still has to be paid to urban sustainability through proper waste management as obtainable in developed countries of the world.

Table 6: Frequency of Waste Disposal

Response	Frequency	Percentage
Twice a week	14	18.7
Weekly	5	6.7
Fortnightly	19	25.3
Monthly	37	49.3
Total	75	100.0

Table 6 shows that 49.3% of respondents disposed their waste once a month. In Ondo State, the last Saturday of every month has been set apart as compulsory environmental sanitation in which vehicular movement was restricted for three hours (7-10am). This was perhaps the day most respondents dedicated to disposing their waste either by burning or otherwise. Plate 1 shows a typical refuse burning in a housing unit near the fence of FUTA while Plate 2 shows overflowing waste bins awaiting collection by the Ondo State Waste Management Authority.

Plate 1: Refuse burning on an "Environmental Sanitation Day" in a house near FUTA

This method of waste disposal by burning the refuse near the outer fence of the university is not only unsightly but it can lead to a weakening of the structural stability of the fence, leading to collapse and insecurity challenge. Also the fumes from the combustion constitute air pollution to the occupants within the academic housing environment.

Plate 2: Overflowing waste bins in front of a hostel awaiting collection by the Waste Management Authority

The unsightly overflowing bins awaiting collection attest to the low frequency of waste collection by the ODSWMA. These waste bins lying for a week before being disposed constitute both a health hazard and an unpleasantness to the aesthetic of the housing environment.

7. Conclusion and Recommendations

The study has shown that approximately ninety percent of the housing units around the Federal University of Technology Akure has no sustainable means of waste disposal hence the

Residents disposed their waste the way they liked. Majority adopted illegal dumping and burning while the few that adopted the waste collection by the state government had to wait for minimum of a week before waste bins were disposed at a fee. Based on these, there is a need for environmental campaign on waste collection and management in the study area. This will educate and enlighten the residents of the area on the need for proper disposal of waste in a more hygienic and sustainable way that will not constitute a nuisance to the academic housing environment.

This paper also recommended that every building should be mandated to keep a standard waste bin to be evacuated by the municipal council- Ondo State Waste Management Authority. Penalties should also be placed on culprits of environmental offenders, particularly on home owners that harbour refuse around their buildings and dispose indiscriminately through burning. In the same vein, the collection of waste by the council should be more regular than once a week.

Lastly, there is a need for collaborative efforts among the residents, the municipal council and organised private waste management firms in getting rid of refuse from the study area and other areas in the city. Public-private participation in waste management will enhance timely collection of waste and prevent overflow of waste bins due to irregular collection. The need for proper waste disposal is great in the quest to ensure a sustainable housing environment. Summarily, there is still a lot to be done in order to make Akure and other Nigerian cities more sustainable in term of waste management:

a. Effective enforcement of sanitation laws and ensuring that every house has a big waste bin that is big enough to accommodate the volume of waste being generated. Operation War Against Indiscipline (WAI) being practiced in the 1980s that made all Nigerians comply with cleanliness and orderliness should be revived.
b. Provision of enabling environment for unemployed youths to join as Private Sector Participants in the collection, recycling and disposal of waste.
c. Public enlightenment on the opportunities to convert waste to wealth by unemployed graduates in order to remove the social stigma associated with waste collection in our culture.
d. Landlords Association in each housing environment should encourage owners of uncompleted buildings and bare lands to clear the bush to prevent them from becoming illegal dumpsites.

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