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RESEARCH ARTICLE

Assessment of waste management practice in hostel buildings in Ile-Ife, Osun State, Nigeria

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ABSTRACT

The rise in the construction of hostel buildings to take care of accommodation needs of students in higher institutions of learning has been having effects on waste generation and its management practices. The study was carried out to assess waste generated and adequacy of facilities used in managing streams of waste in privately owned hostel buildings with a view to providing information to enhancing its management practice. This study was carried out in privately owned hostel buildings in Ife Central Local Government Area of Ile-Ife, Osun State, Nigeria. A multi-stage sampling process involving stratification and systematic random sampling technique of the hostels and occupants was used. Preliminary survey was carried out to determine types of hostel facilities, its occupancy pattern and personnel involved in its waste management. Eighteen (18%) out of the 858 occupants of the hostel buildings and eleven (11) waste management personnel were selected during the study. A total of 154 questionnaire was administered on the occupants of the hostel buildings and waste audit exercise was carried out to determine quantities of waste generated by using weighing instrument. The data collected were analyzed with descriptive and inferential methods such as cross tabulation, frequency distribution and mean score analysis. The study found that there was significant variation in the streams of waste generated in the types of hostel buildings sampled. It was found that nylon/polythene bags, covered refuse bin and bucket without cover with mean score value of 3.50, 2.89 and 2.78 respectively were used to collect waste generated. The study also showed variation in the alertness of occupants of the hostels to the severity of environmental conditions of waste generated. It was recommended that waste audit be taken as an integral part of waste management practice with the provision of waste collecting, transporting, disposal facilities and protective equipment in order to prevent environmental hazards associated with waste management.

Keywords: Adequacy, effect, facilities, hostel buildings, waste audit, waste streams

1. INTRODUCTION

Environment is the entity that sustains human life through interaction of the processes that make up the ecosystem. The population of the world is on the increase and it demands the need to construct more buildings and other physical infrastructures where different activities take place through the provision of facilities therein [1, 2, 3]. Urbanization which led to the construction of buildings used for different purposes has been pivotal to solid waste generation in the municipalities based on materials used by its occupants [4, 5]. Throughout history, human advancement has been intrinsically linked to the management of solid waste due to its effect on both public and environmental health. Solid waste management (SWM) has a long and convoluted history [6]. In many regions and countries, national and international targets have been set for municipal solid waste management practices [7]. To develop and implement effective strategies to meet these targets require reliable information on the composition of all parts of waste stream.

UNEP [8] defined wastes as substances or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. Waste also refers to "an item, material or substance an individual considers useless at a given time and place" [9]. Waste is a dynamic concept which can be defined in different ways [10]. In most cases, the definition of waste depends on the type or category of waste under consideration. Some of the

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dominant types of waste include; municipal waste, solid waste, hazardous waste and electronic waste amongst others.

Processes of solid waste management (SWM) have affected human history in many ways, just as they will continue to do so in the future. The modern waste management industry in the developed world has come far, and with recycling and other advances, it will continue to grow and change with the needs of the community [11]. However, countries in the developing world are yet to see many of these changes within the frame of their solid waste management systems (SWMS). Traditionally, municipalities have been in charge of providing SWM services in developing countries [12]. The municipal responsibility in this present world is to organize and manage public sanitation system, including provision of infrastructure for collection, transportation, treatment and disposal of wastes. However, with the ever-increasing population and economic growth, many municipalities in developing countries are struggling to keep SWMS working in a sustainable manner to address waste generated in different types of buildings occupied by people for different purposes. The municipals manage solid waste with the aim of providing good quality sanitation services in order to keep cities clean and to enhance public health and safety. Evaluation of resources for collection, transportation, processing and disposal of waste requires a correct assessment of the quantity of waste generated per capita per day from direct residential areas and the characteristics of waste generated [13].

A number of studies have been carried out on waste generation and management in Nigeria. Kadifa, Latifah, Abdullah and Sulaiman [14] carried out a study on the current status of municipal solid waste management practice in a city, in Nigeria. They were able to identify the challenges and areas requiring improvement, municipal solid waste generation, composition, storage, collection, and disposal systems. Ibrahim, Awomuti and Ajibade [15] examined storage and treatment system of solid waste as a strategy for sustainable environmental development in Ilorin metropolis. They considered the types and sources of waste generated, legislation on its storage and treatment. Afon [16] examined solid waste management practice in selected cities of Oyo State, Nigeria while [17] assessed waste management practices in selected hospital buildings in Ibadan Metropolis, Nigeria. By considering array of studies on waste management in Nigeria, through rapid urbanization, the quest for educational development has had influence on the need to increase construction of hostel facilities to ensure provision of accommodation for students that gain admission into higher institutions of learning. This would have attendant consequences on waste generation by the occupants of the hostel facilities. Most of the past studies did not focus on waste generation and its associated issues in hostel buildings. Hence, the aim of this study is to assess waste generated and adequacy of facilities used in managing streams of waste in privately owned hostel buildings in Ife Central Local Government Area, Nigeria with a view to providing information to enhancing its management practice.

2. RESEARCH METHODOLOGY

The study was carried out in Ife Central Local Government Area of Osun State, Nigeria. The sample frame consisted of the privately owned hostels in Ife Central Local Government Area. A preliminary survey was carried out to establish the types and numbers of hostel facilities that existed in the study area. A multi-stage sampling approach was employed during the course of the study. The first stage involved stratification of the hostels into occupancy form, either for male, female, mixed type and their typology or mode of construction. The second stage involved the use of systematic random sampling technique whereby the first hostel with respondents was randomly selected with further selection of every hostel that existed in the residential zones where the hostels were located. The survey obtained the total occupancy pattern in the selected hostels by selecting 18% of the occupants in the rooms of the hostels (Table 1). This indicated eight hundred and fifty-eight (858) occupants, and 18% of the total number of occupants was selected as sample size. Eleven (11) personnel involved in the management of the waste in the selected hostel buildings were randomly selected to get information on the current waste management practice. Such a limited sample was selected due to the available constraints [18]. A set of questionnaire was administered on the respondents that occupied the hostel buildings in order to depict information on the waste generated and effectiveness of the management practices on the methods of collection, sorting, transportation of waste etc. Waste audit was also carried out for five days to determine quantities of the sorted stream of waste in the hostels with the aid of a weighing scale and the mean weight of each stream determined (Fig 1). Data collected were analyzed with relevant descriptive and statistical methods such as frequency distribution, cross tabulation and mean score analysis based on a Likert scale of 1 to 5 and the results obtained were empirically compared with references in the literature.

Fig 1. Waste generated in the hostel building, sorted and weighed during the waste audit

Table 1. Selected hostels in the study area

Name of Existing Hostels	Number of rooms Per Block	Sample Frame		Total No of Occupants	Sample Size
		Number of Blocks	Number of Occupants		
Poplat	10	3	2	60	11
Rectas	20	4	2	160	29
Fine Touch	40	2	2	160	29
White House	23	2	2	92	16
Green House	13	1	2	26	5
Happy Land	11	2	2	44	8
Bims	28	1	2	56	10
Women Villa	12	2	2	48	9
CTCS	10	5	2	100	17
Mercy of God	16	1	2	32	6
Ebenezer	20	2	2	80	14
Total				858	154

3. RESULTS AND DISCUSSION

As shown in Table 2, based on the administration of questionnaire on the selected 18% (154) occupants out of a total of 858, 112 was returned and found useful for analysis. This indicated a return rate of 72.72% out of the total number of questionnaire administered on the occupants of the hostel buildings. According to [19], a response rate of 40% was adjudged adequate for studies in built environment related researches, and this implies, that the 72.72% return rate ought to be substantial to adequately reinforce findings of the study.

3.1. Profile of the occupants and the selected hostel buildings

This section presents background information on profile of the occupants and characteristics on typology of the selected hostel buildings. The results shows that about 55.36% of respondents sampled in the selected hostel buildings were female while 44.64% were male. This ought to have influence on the type and quantities of waste generated (Table 3). The length of stay is an important factor in determining respondents' knowledge on waste management practice. According to Jackson [20], the length of residency in an area is a function of respondents' experience of the environment. The study shows that a fairly large proportion, 31.25% of the respondents, had occupied the selected hostel buildings for 3 years and would have understanding of management practice of the waste generated. The profile of the study which informed the understanding of the respondents of the adopted waste management practice was also corroborated by the study of [21] that profile of respondents sampled on residential solid waste management in Sango-Ota, Ogun State, Nigeria was also useful in showing the management practice used.

Table 2. Percentage of questionnaire administered and retrieved

Number of Questionnaire Administered	Number of Questionnaire Retrieved	Percentage of Questionnaire Returned
154	112	72.72

It was also shown in the Table that the type of buildings used for hostel facilities in the selected buildings were flat apartment (41.96%) and followed by face-to-face storey building (37.50)%. Amongst the eleven (11) personnel sampled that were involved in the management of waste in the selected hostel buildings, 63.64% of them belonged to the 31-40 age group while 18.18% belonged to 21-30 and above 41 years age group respectively. This indicated that they were adults and would have reasonable knowledge on the job. It was also found that about 81.82% of the waste management personnel were on full-time mode of employment while 18.18% were on part-time mode.

3.2. Components and quantities of waste generated in the selected hostel uuildings

The study determined components and quantities of waste generated and collected in the hostel buildings sampled with the use of weighing instrument. Table 4 shows mean weight of the sorted streams of waste with seemingly variation in the quantities of the components. It was shown that component rubbish stream of waste was significantly most in quantities in male, female or mixed hostel buildings with 5.20, 5.71 and 4.13kg while paper stream had 4.11, 4.23 and 4.45Kg in male, female and mixed hostel types respectively.

Table 3. Profile of the respondents and the selected hostel buildings

Class of Gender of the Respondents in the Selected Buildings		
Gender	**Frequency**	**%**
Female	62	55.36
Male	50	44.64
Total	112	100.00
Length of Stay in the Hostel Buildings		
Period of Stay (Years)	**Frequency**	**%**
1	25	22.32
2	32	28.57
3	35	31.25
4	16	14.29
5	4	3.57
6	0	0.00
7	0	0.00
Total	112	100.00
Occupancy Type of the Hostel Buildings		
Type of Hostel Building (Typology)	**Frequency**	**%**
Face to Face (Bungalow)	15	49.70
Face to Face (Storey Building)	42	15.20
Flat	47	10.60
Duplex	8	8.60
Total	112	15.90

Table 4 also shows that gender characteristic of the hostel occupied by the respondents influenced the quantum of waste generated in female, male or mixed hostel building. This is evident in the variation in the quantities of stream of waste generated in the hostels occupied by the varying gender of the respondents. According to Alli and Eyasu [22], waste generation rate of domestic waste in Addis Ababa City is 0.45kg/capacity/day, while around 100,000 m^3 waste water is also produced per day from domestic activities alone, and waste collectors participate in the waste management at the approved service charges. Hence, the result carried out on the hostel buildings, in Ile-Ife also depicted that approved waste collectors were commissioned to dispose of quantities of waste generated per day by the occupants.

3.3. Perception of the respondents on the components of waste generated

The study assessed perception of respondents on the components of waste generated through the use of a likert scale of 1 to 5 in the mean score analysis method. Table 5 shows that garbage was rated as the most generated type of waste with a mean score of 3.89, rubbish (3.03) and ashes (2.24). The Table also indicated that dead animals had the lowest mean score of 1.75. The result of this Table also consolidates findings of the waste audit which showed that rubbish and garbage had the comparably highest amount of waste generated in the hostel buildings sampled.

3.4. Solid waste management facilities and its adequacy

The study established facilities used in the collection and management of waste generated in the hostel buildings sampled, factors that influenced choice of methods used and adequacy of the facilities used. Table 6 shows that nylon/polythene bags was mostly used by the respondents in collecting waste generated with a mean score of 3.50. Covered refuse bin and bucket without cover were also used with mean score of 2.89 and 2.78 respectively. The study also assessed availability of central waste storage facility used in the management of waste generated in the hostel buildings. Table 7 indicates that 79.50% of the

respondents indicated that there was availability of central waste management facility to collect waste collected in nylons, polythene bags and others in order to enhance effective waste management practice. Past studies of [23] also indicated that growing population in urban centers in Nigeria has led to great waste management problem in Nigeria, and many efforts at getting rid of them informed the provisions of waste collecting and disposal facilities by the Lagos and Abuja Environmental Protection Board respectively.

Table 4. Components and quantities of waste generated in the hostel buildings

Type of Waste	Component of Waste	Male Hostel (kg)	Female Hostel (kg)	Mixed Hostel (kg)
Garbage	Food	3.61	4.30	4.33
	Canning	1.34	0.55	0.73
	Freezing materials	1.71	1.95	0.35
Rubbish	Nylon	5.20	5.71	4.13
	Wood	0.49	0.89	0.68
	Paper	4.11	4.23	4.45
	Rubber/Plastic	1.54	1.58	1.63
	Leather/Fabrics	1.47	2.07	2.01
	Glass	0.70	1.00	2.00
	Metal	0.65	0.17	2.05
	Ceramics	-	0.99	0.54
	Stone/Sand/Soil	0.57	0.13	0.94
Ashes	Residue from combustion of	-	-	-
	Solid product after heating	-	-	-
Large Waste	Demolition waste	2.06	-	-
	Construction waste	-	-	-
	Furniture	1.33	0.58	2.06
	Automobile	-	-	-
	Home appliances	1.62	0.99	2.33
	Trees	-	-	-
	Fire driven waste	-	0.80	0.47
Dead Animals	Household pets	-	-	-
	Rodents	0.59	-	0.78
Sewage Waste	Sludge	-	-	-
	Screening waste	-	0.10	0.17
Industrial Waste	Chemicals	-	-	-
	Paints	-	-	-
	Explosives	-	-	-
Agricultural Waste	Farm animals	-	-	-
	Manure	-	-	-
	Weed	-	-	-
	Crop residues / Food peel	0.82	1.34	1.00

Table 8 indicates relative significance of the factors that influenced the choice of facilities used in the management of facilities used in the hostel buildings sampled. It was shown that infectious and hazardous nature of waste generated and collected, cultural and social basis and number of occupants per room most significantly determined facilities used with mean score of 3.75 respectively. The Table also shows that

logistics, financial capability, type and size of the hostel buildings, administrative process and waste characteristics also influenced choice of the facilities used with a mean score of 3.50. Equally, according to Wahab [17], different operating factors influenced the choice of facilities used in the management of medical waste generated in hospital buildings with financial capability with RII value of 4.05 in public owned hospitals and 3.76 in private owned hospitals respectively. The outlook of the results of this study on the level of facilities used can also be compared with [24] which found in their work that the Dhaka City Corporation is primarily responsible for collecting and managing waste and a significant amount of waste is not collected due to lack of infrastructure, funds and collecting vehicle, but however sought for future integration of waste management strategies in high density residential development areas.

3.5. Severity of environmental hazards associated with waste management facilities and practices used

The study examined respondents' alertness on the environmental conditions/hazards associated with the waste management facilities and practices used in the hostel buildings through the use of mean response analysis. Table 9 shows that respondents were mostly affected by the severity of the presence of cockroaches breeding with a mean score of 3.34, mosquito breeding and attraction to scavenging animals with mean score of 3.32 and 2.81 respectively. Other effects such as odour from collected waste and filthy drain are also determined by the environmental effects of the facilities and practices used in managing waste generated in the hostel buildings.

Table 5. Perception of the respondents on the components of waste generated

Type of Waste	5	4	3	2	1	Mean Score	Rating
Garbage (food, canning and freezing materials)	42	32	28	1	8	3.89	1
Rubbish (nylon, wood, paper, rubber, leather, glass, metal, ceramics, stone/sand/soil)	13	32	29	17	19	3.03	2
Ashes (Residues of combustion, solid products after heating)	8	10	25	22	43	2.24	3
Large wastes (Demolition and construction wastes, automobiles, furniture, and other home appliances, trees, fires etc.)	4	11	20	28	47	2.06	5
Dead animals: (Household pets, rodents)	4	5	15	22	64	1.75	7
Sewage waste (screening wastes, settled solids and sludge)	2	10	26	37	35	2.15	4
Industrial wastes (Chemicals, paints, sand and explosives)	4	8	6	24	68	1.69	8
Agricultural wastes (Farm animal manure, crop residues and others)	0	12	9	32	57	1.78	6

Table 6. Facilities used in the collection of waste generated in the hostel buildings

Facilities Used	Mean Score
Nylon/Polythene bags	3.50
Traditional basket	2.08
Bucket with cover	2.75
Bucket without cover	2.78
Covered refuse bin	2.89
Plastic drums with cover	2.72
Sack	2.53
Worn-out jerry can	1.89
Plastic drums without cover	2.33
Plastic bags	2.49
Card board boxes	2.00
Metal drums with covers	1.87
Metal drums without covers	2.03
Paper cartoon	2.00
Worn-out metal bucket	1.93

Table 7. Availability of central waste storage facility

Response	Frequency	%
Yes	89	79.50
No	23	20.50
Total	112	100.00

Table 8. Factors that influenced choice of facilities used in the management of waste generated in the hostel buildings

Factors	Mean Score
Infectious and Hazardous nature of waste	3.75
Cultural and social basis	3.75
Logistics	3.50
Financial capability	3.50
Type and size of hostel	3.50
Administrative process	3.50
Waste characteristics	3.50
Number of occupants per room	3.75
Organizational framework	3.25
Maintenance repair	3.25
Technical know-how of the manpower	3.13
Waste load time	2.75
Waste reduce time	2.75

Fig 2 shows sections of streams of waste collected in one of the hostel building selected that exposed the occupants sampled to associated environmental hazards/conditions analysed in Table 9. Comparably, past studies in the literature such as [25] showed that rapid urbanization, rural-urban migration, little or no town planning efforts coupled with attitudinal irresponsibility have created environmental challenge in Nigeria and the problems posed by the attendant waste management practice of the growing population has overwhelmed Nigerian government.

Fig 2. Streams of waste collected in one of the hostel buildings sampled

Table 9. Level of severity of environmental conditions of facilities used in managing waste generated

Severity of Environmental Conditions	Mean Score
Odour rom collected waste	2.42
Odour from filthy drain	2.59
Mosquito breeding	3.32
Rat breeding	2.72
Attraction to flies	2.45
Attraction to rats	2.57
Fly breeding	2.63
Cockroach breeding	3.34
Attraction to scavenging animals	2.81

4. CONCLUSIONS

The spate of increase in population has been observed to correspondingly affect intake of students in higher institutions of learning in Ile-Ife, Nigeria, which has paved way for the construction of more private hostel facilities for students' needs. This has had attendant effect on the generation of waste streams which would affect environmental sustainability of the hostel buildings based on the level of waste management practice adopted. In view of this, the study carried out waste audit to determine components cum quantities of waste and perception of respondents on the stream of waste generated in the selected hostel buildings, adequacy of the facilities used in the management of streams of waste generated, factors that influenced choice of the facilities used and the likely environmental conditions associated with the management practice.

The study found preliminarily that larger proportion of the respondents, 55.36% were female while 44.64% were male and a sizeable proportion of them have been occupying the hostel buildings for about 3 years, and this would give them appreciable understanding of the waste management practices adopted in the buildings occupied. The study established that component rubbish stream of waste

was significantly most generated in either male/female or mixed hostel buildings with 5.20, 5.71 and 4.13Kg respectively. Respondents also indicated with a mean score of 3.89 that garbage was most generated while 79.50% of the occupants had access to central waste storage facility to manage stream of waste generated in the hostel buildings and different operating factors influenced the choice of facilities used to collect the waste. In view of the effects and risks that hostel occupants can be exposed to based on the components and quantities of waste generated, waste audit should be taken as an integral part of waste management practice. Similarly, provision of adequate waste collecting, transporting and disposal facilities should be adhered to in order to prevent environmental hazards associated with waste generated in the hostel buildings.

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