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An Evaluation of Urban Solid Waste Management in Ajah Area of Lagos Metropolis

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Abstract: Solid waste management has emerged as one of the greatest challenges facing environmentalprotection agencies and the communities in developing countries and the increasing waste generation has become a topic of water pollution and environmental concern in the metropolis.This study seeks to evaluate the management of solid waste in Lagos State and proffers workable solutions to these challenges which will improve environmental sustainability.In this study, solid waste management challenges are characterized by inefficient collection methods, insufficient coverage of the collection system and some level of improper waste disposal. Observation of the environment, and direct interviews with people in the area was also conducted. The data obtained were analyzed and the study indicates that wastes generation, sorting, handling and disposal were mostly implicated, and that dumping and landfill are some of the current methods being adopted in the disposal of wastes within Lagos, composting and incineration are less often adopted just as industry best practice methods like recycling and re-use are less frequently used. It was also seen that the main type of waste disposal system used in Ajah is the PSP, which is meant to make waste management better, but due to challenges in pick up times, it seems to have a drawback. The analysis shows us that the use of PSP is the most prominent waste disposal system practiced but with a challenge of pick up timing. The most generated type of waste within the study area happens to be the food waste. To this effect, recommendations were given to bring solutions as follows;People should be treated as active partners in the process of change, there will be a more likely successful situation of waste management; Relevant information should be presented to the people and even with an increase of awareness to a certain level, additional monitoring and sustained management over a long period of time is necessary; The monthly environmental sanitation practice should be taken more seriously and the waste collection trucks from LAWMA should immediately after the sanitation if not during the sanitation, go round to collect the refuse that will be heaped on roads during the sanitation practice; The state assembly should formulate laws on waste management which will go as far as individual waste practice and ensure that the laws are enforced by government agencies; Monthly awards to neatest areas should be instituted to encourage the people of the areas to keep their environment clean always by properly handling and storing their wastes. Government should not only make laws, but sponsor public health and environmental education programmes regularly and also make environmental education part of the education curriculum at all school levels.

Keywords: Solid waste; Management; Ajah; Waste disposal; Waste generation.

INTRODUCTION

Solid waste management has emerged as one of the greatest challenges facing state and local government environmentalprotectionagencies in Nigeria. The volume of solid waste being generated continues to increase at a faster rate than the ability of agencies to improve on the financial and technical resources needed to parallel this growth. Solid waste management generally in Nigeria, is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of solid waste [1]. Thequantityofsolidwastegeneratedinurban areas inindustrializedcountries ishigher than in developing countries; still municipal solid waste managementremains inadequatein thelatter. Solid waste in developing countries differs from developed countries and most developing countries, Nigeria, inclusive have solid waste management problems different from those found in industrialized countries in areas of composition, density, political and economic

framework, and waste amount, access to waste for collection, awareness and attitude. The wastes are heavier, wetter and more corrosive in developing cities [2]. Solid waste is any garbage, refuse, sludge from a waste water treatment plant, water supply treatment plant or air deed material, including solid, liquid, semi-solid or contained gaseous material resulting from industrial, commercial mining and agricultural operations and from community activities.

Solid waste management (SWM) is an important environmental health service, and is an integral part of basic urban services. From the earliest primitive human society there have been attempts to safely dispose of solid waste. In the early days, disposal did not pose difficulty as habitations were sparse and land was plentiful. Disposal became problematic with the rise of towns and cities where large numbers of people started to congregate in relatively small areas in pursuit of livelihoods. On one hand, the density of population increased in these centers of congregation and therefore wastes generated per unit area also increased. On the other hand, available land for disposal of waste decreased in proportion. SWM thus emerged as an essential, specialized sector for keeping cities healthy and livable [2].

Household waste constitute about 70% of the solid waste generated in Nigeria, the remaining proportion is accounted for by waste from industrial, commercial institutional and miscellaneous sources [3]. These solid wastes are considered to be one of the dangerous causes of environmental pollution; therefore this problem has to be treated in a wise manner to protect our environment [4, 5].

Statement of the Problem

Waste management constitutes a serious and growing sanitation problem in Lagos. There is an urgent need to properly mitigate the continued pollution of water, land, and air by the point and non-point sources. Paradoxically, the staggering burden born of relative affluence, with attendant rising population density, urbanization, industrialization, and socioeconomic development, have created the neglect of the proper management of municipal solid waste (MSW).

The problems are likely to become even more pronounced as the level and as the pace of urbanization continue to grow rapidly. Due to the overwhelming volumes of solid waste, many cities are not able to satisfactorily collect and dispose the generated wastes. Consequently there has been gradual degeneration in the management of household waste in residential areas. Service recipients notably households in some areas within Lagos state have not been given a chance to evaluate and choose providers of their own nor involved in the effective management of solid waste around their residential area simply because they hardly see waste management service providers in their area and they are not literate enough in the area of waste and waste management. The piles of waste which results from improper management often emit putrid smell from decomposition of organic matter consistent and also constitute aesthetic revulsion. The mounds of refuse often block roads and causes traffic obstruction. They also pose fire risk and remain an even- luxuriant source of disease vector.

It is in the light of these problems that this study is geared towards evaluating the waste management practices in Ajah so that steps can be taken for further improvements on the practices of waste management.

AIM AND OBJECTIVES

Aim

The aim of this study was to find out the factors that contribute to the improper management of solid waste in Lagos State using Ajah area as Case Study, and the objectives below were outlined for the study to achieve the aim.

Objectives

The objectives addressed by this study are:

- To determine the type of waste disposal system being practiced in the area.
- To determine the main type of solid waste generated within the study area

LITERATURE REVIEW

Historical Background

Waste, which is a potential source of pollution, is an unavoidable material resulting from domestic activities or industrial operations for which there is no economic demand and which must be disposed of; therefore, man must devise effective means of getting rid of the nuisance; otherwise, the work of his hands would invariable be the precipitating and pre-disposing factor of his ultimate end [6]. Onokerhoraye [7] noted that the overall rate of waste of cities and human activities as well as the location pattern of establishments' vis-à-vis the spatial distribution of human settlements and the ecosystem in general, are sufficient grounds for concern about the state of the environment and waste management.Without any shade of doubt, solid waste is currently one of the biggest environmental problems commonly experienced in Lagos metropolis, as in some other Nigerian Urban cities.

Concept of Waste and Types

Every human activity generates waste but it is the accumulation of wastes that constitute environmental health hazards. Osinowo [8] observes that waste generation occurs through domestic, commercial, industrial, agricultural and other social activities. Domestically, human activities such as

environmental sanitation, food preparation, and consumption of packaged foods, laundry, washing of utensils, discharge of unwanted household items or unserviceable household equipment and old furnishing all lead to huge volume of waste. Activities like retailing and distributive trade, small, medium and large scale industrial operations also bring about the generation of both solid and liquid waste. On-farm operation and in-farm gate activities are usually characterized by waste generation. Typical examples include timber and wood-processing industry which generate large quantities of waste in form of sawdust and shavings Lawal [9].

The Compositions of the various wastes that are generated in Nigeria were given by Ali [10] as follows:

- Household waste – 85%
- Commercial waste - 8%
- Sewage Sludge – 3.5%
- Industrial Waste – 1.6%
- Agricultural waste – 1.1%
- Mini waste – 0.5%
- Hazardous waste – 0.3%
- Radioactive waste – 0.02%

Majority of these wastes are quite hazardous. As a result of their chemical, physical and biological characteristics, they confer both long and short term effects on human beings and the environment; hence, there is a need to think about their proper management Olaniran [11].

Attributable Factors to Bad Waste Management

Different factors have been attributed for the resurgence of wastes on our major roads [12]. Prominent among these are:

- Lack of financial assistance for the private operators by the government
- Insincerity among cart pushers
- People's lack of commitment
- Lack of proper enforcement
- Low level of environmental awareness
- Bad planning
- Population growth
- Attitude to work
- Corruption

In some areas, especially the slums and low income areas, poverty is a major factor.

RESEARCH METHODOLOGY

Introduction

This chapter deals with the procedures used for this research; it highlights the step-by-step methodology employed in data collection, procedures, and methods of analysis of the data as well as their characteristics.

Statement ofthe Relevant Research Questions and Hypotheses

Research Questions

This study was designed to address the following questions:

- Is PSP the main type of waste disposal system being practiced in the area?
- Is food waste the main type of the solid waste generated within the study area?

Statement of Hypotheses

The Hypotheses used for this study are as follows:

- The use of PSP is not the main type of waste disposal system being practiced in Ajah.
- Food waste is not the main type of the solid waste generated within Ajah.

Research Design and Sources of Data

Descriptive research method was used for this study, and according to Isaac and Michael [13], descriptive method is used to describe systematically, a situation or area of interest factually and accurately. The design could be a public opinion survey, fact-finding surveys, or status studies.

In this study, survey design was used and it is a method in which groups of items are studied by collecting, analyzing and interpreting data from a few people considered to be representatives of the study population.

Sources of Data

In other to achieve the aim and objectives of this study, primary and secondary data sources were used.The primary sources of data comprised of reconnaissance survey and the use of well-structured questionnaires.Well-structured questionnaires were administered to the general public within the study area, to the service providers and to the regulators in order to obtain information from respondents in relation to their socio-economic data, the content of waste they generate, their method of waste disposal and their opinion of location/proximity of waste disposal bin. Also, questionnaires were administered among LAWMA officials and finally, an oral interview was conducted with Ministry of Environment officials. Apart from the primary method of data collection used as mentioned, secondary data were also collected from already existing documents that are related to the study.

The secondary data sources that were used in this research work for gathering data were obtained basically from all available existing literature, journals, Internet materials (Wikipedia, world bank online) publication from relevant agencies (LAWMA), textbooks, and maps.

Characteristics of the Population of Study

The population of the study is made up of all the inhabitants of Ajah community in Eti-osa local government area of the Lagos metropolis. This is because everybody in Ajah and people in general generate wastes which are classified as useless and have to be disposed of.Thomas estate within the Ajah community was chosen as the study area because it is an emerging settlement in Lagos state and matters have to be looked into early enough. It's in this area that our study will be conducted, and from this population that we will draw samples and gather the data to be analyzed.

Sampling Design, Procedures and Determination of the Sample Size

Simple random sampling technique was used to select respondents for the study.The technique is unbiased since each person, event, object or thing in the population is given equal opportunity of being selected for the study, so for this survey, the samples were picked randomly without special preference. The sample size was determined based on the population living within Thomas estate and those that were available to be interviewed.

Questionnaire Design, Distribution and Collection of Responses

For this study, the questionnaire was constructed in simple plain English and very clear to the respondents and due to the sample size, a total of 120 questionnaires were administered. 100 were administered among the general public within the study area, 5 questionnaires were administered among the service providers and another 10 questionnaires among the regulators which are the waste management authority and the ministry of environment. These were done by the researcher of which 80 of the administered questionnaires were returned filled.

Procedures for Data Processing

The number of returned and useable questionnaires represents about 66.67% of the total questionnaires distributed and this was found to be adequate for the analysis. The data was generated mostly by the respondents by answering all the required questions in the administered questionnaire. The organization of the generated data is then carried out by the researcher to make more meaning out of the generated data.The statistical method used in the interpretation of the data is the descriptive analysis. In order to have a comprehensive analysis that will meet the objective demand of this research, simple percentage tables for each question in the questionnaire was used to ensure that the results were clear and simple enough for understanding. These percentages were used to take decisions on necessary research question. The research made use of the statistical tables and the collected data were then analyzed using the Chi-square distribution and the hypotheses were tested at 95% level of confidence.

Limitation of the Research Method

Though this is a very common research method, it has certain limitations such as difficulty for the researcher to examine complex issues and opinions. It also makes it difficult for a researcher to gather information that is rich in depth and detail. Also, the researcher can never be certain the person to whom the questionnaire is sent actually fills it in. Where the researcher is not present, it's always difficult to know whether or not a respondent has understood a question properly. Also, the problem of the self-selecting sample is particularly apparent in relation to questionnaires. When a response rate is very low the responses received may only be the opinions of a very highly motivated section of the sample (that is, people with strong opinions who take the time and trouble to complete and return a questionnaire).

RESULTS AND DISCUSSIONS OF FINDINGS

Introduction

In this chapter, the data generated from the questionnaires which were administered on randomly selected respondents from Ajah community is processed and analyzed. The feedbacks from respondents have been presented in a frequency distribution table, analyzed and interpreted. The objective was to investigate the factors which are contributing to the improper management of solid waste.

Demographic Information of the Study Area

The study examined the demography of the respondents of the study area to know their ages, gender, educational levels, number of years lived in the area, and the household size of the respondents. It was intended to obtain information on the type of people that live within the study area.

Demographic Representation of Respondents from Study Area

The feedback obtained, from the respondents indicated that the age of the inhabitants of the study area are mainly youth of less than 40 years; constituting 66% of the total population, which are averagely educated.

Table-1: Demographic Representation of Respondents from Ajah Community

	Options	Frequency of Respondents	Percentage (%)
Age	18-25	13	26
	26-33	14	28
	34-41	6	12
	42 and above	17	34
	Total	**50**	**100**
Sex	Male	23	46
	Female	27	54
	Total	**50**	**100**
Years lived in Ajah	Less than 1 year	11	22
	1-5 years	33	66
	More than 5 years	6	12
	Total	**50**	**100**
Education	None	-	-
	Primary	2	4
	Secondary	14	28
	Tertiary	30	60
	Other	4	8
	Total	**50**	**100**
Household size	1-2	10	20
	3-5	23	46
	Above 5	17	34
	Total	**75**	**100**

Source: Fieldwork, 2014

From the above, it can be seen that the administering of questionnaires concentrated on the youths to the elderly of ages between 18 and above 42 years old.

Types of Solid Waste Generated In the Study Area and Disposal System Adopted

The study investigated the types of solid waste generated within the area, the types of containers used for collection/storage and the waste disposal methods applied; as well as the amount payable for the disposal of wastes.

Types of Solid Waste Generated in Ajah Community

Reported below is an assessment of the solid waste types generated within the study area. The survey revealed food waste as the main solid waste type in the study area; this is in agreement with findings of previous related researches. Other solid waste types generated in same Thomas Estate area of Ajah Community are: Plastic/Nylon, Textile, and electronic waste.

Table-2: Main Solid Waste Types Generated in the Study Area

Waste	Response Frequency	% Percent
Food waste	38	76
Glass	0	0
Plastic/Nylon	3	6
Metal	0	0
Textile	8	16
Electronic	1	2
Total	**50**	**100.0**

Source: Fieldwork, 2014

Test of Hypothesis

In this section of the study two hypotheses were used based on the objectives of the study. These hypotheses were tested using the chi-square statistical tool by cross tabulating the necessary fields from the questionnaire response to get the observed values. The observed and the expected values were then used to get the calculated value for the chi-square which was compared to the tabulated value for the sake of decision making.

The Hypotheses used for this study are as follows:

$H_{0:}$ The use of PSP is not the main type of waste disposal system being practiced in Ajah

$H_{0:}$ Food waste is not the main type of the solid waste generated within Ajah

Waste Disposal System Practiced In Ajah

Hypothesis One

H_0: The use of PSP is not the main waste disposal system practiced in Ajah

H_1: The use of PSP is the main waste disposal system practiced in Ajah

In order to carry out the analysis of this hypothesis, the main variables under consideration were collated. The cross tabulation of the variables was carried out and the result of the analysis is presented in the table below.

Observed Table from Cross Tabulation for Hypothesis One

		Waste disposal method				
Waste collectors	Open dumping	Burying	Dumping in canal	Burning	PSP/ cart pusher	Total
LAWMA	1	0	0	4	15	20
PSP	0	0	0	2	16	18
Unregistered	1	0	0	2	4	7
None	4	0	1	0	0	5
Total	6	0	1	8	35	50

Expected Table for Hypothesis One

	Open dumping	Burying	Dumping in canal	Burning	PSP/ cart pusher
LAWMA	2.4	0	0.4	3.2	14
PSP	2.26	0	0.36	2.88	12.6
Unregistered	0.84	0	0.14	1.12	4.9
None	0.6	0	0.1	0.8	3.5

Using the observed and expected tables, we can calculate the chi-square value using the formula;

$$\frac{(fo - fe)^2}{Fe}$$

df = (4 – 1) x (5 - 1) = 3 x 4 = 12

The above table shows that the calculated chi-square value (χ^2_{cal}) is 37.93 while at 0.05 level of significance and 12 as the degree of freedom, the tabulated chi-square value is χ^2_{tab}= 21.026and according to the statistics, we reject the null hypothesis if the calculated chi-square is greater than the tabulated chi-square and accept the null hypothesis if the calculated chi-square is less than the tabulated chi-square.

Chi-square calculation for hypothesis One

Fo (Observed frequency)	Fe (Expected frequency)	$\frac{(fo - fe)^2}{fe}$
1	2.4	0.82
0	0	0
0	0.4	0.4
4	3.2	0.2
15	14	0.07
0	2.16	2.16
0	0	0
0	0.36	0.36
2	2.88	0.27
16	12.6	0.92
1	0.84	0.03
0	0	0
0	0.14	0.14
2	1.12	0.69
4	4.9	0.17
4	0.6	19.3
0	0	0
1	0.1	8.1
0	0.8	0.8
0	3.5	3.5
		X^2cal = 37.93

Degree of freedom = (row - 1) x (column - 1)

In the above analysis, since $\chi 2cal > \chi^2_{tab,}$ we reject the null hypothesis and accept the alternative that the use of PSP is the main waste disposal system practiced in Ajah. This shows that a proper waste disposal system is practiced more in Ajah and shows that the waste management authority are trying hard to curb most issues of waste and prevent improper waste disposal within the Ajah area.

Hypothesis Two

H_0: Food waste is not the most generated waste within Ajah.

H_1: Food waste is the most generated waste within Ajah.

In order to carry out the analysis of this hypothesis, the main variables under consideration were collated. The cross tabulation of the variables was carried out and the result of the analysis is presented in the table below.

Observed table from cross tabulation for hypothesis Two

Separation of waste from source	Food waste	Glass	Plastic	Nylon/Textile	Electronic	Total
Yes	17	0	3	0	1	21
No	21	0	0	8	0	29
Total	38	0	3	8	1	50

Expected table for hypothesis Two

Separation of waste from source	Food waste	Glass	Plastic	Nylon/Textile	Electronic
Yes	15.96	0	1.26	3.36	0.42
No	22.04	0	1.74	4.64	0.58

Using the observed and expected tables, we can calculate the chi-square value using the formula;

$$\frac{(fo - fe)^2}{fe}$$

df = (2 – 1) x (5 - 1) = 1 x 4 = 4

The above table shows that the calculated chi-square value (χ^2_{cal}) is 10.4 while at 0.05 level of significance and 5 as the degree of freedom, the tabulated chi-square value is χ^2_{tab}= 9.488and according to the statistics, we reject the null hypothesis if the calculated chi-square is greater than the tabulated chi-square and accept the null hypothesis if the calculated chi-square is less than the tabulated chi-square.

Chi-square calculation for hypothesis Two

Fo (Observed frequency)	Fe (Expected frequency)	$\frac{(fo - fe)^2}{fe}$
17	15.96	0.07
0	0	0
3	1.26	2.40
0	3.36	3.36
1	0.42	0.80
21	22.04	0.05
0	0	0
0	1.74	1.74
7	4.64	1.2
0	0.58	0.58
		$X^2cal = 10.4$

Degree of freedom = (row - 1) x (column - 1)

In the above analysis, since $\chi^2_{cal} > \chi^2_{tab,}$ we reject the null hypothesis and accept the alternative that food waste is the most generated solid waste within Ajah. This shows and confirms that the perishables are the most typical composition of wastes generated within Ajah.

CONCLUSION

The study was initiated to find out the factors contributing to the improper management of solid waste in Ajah, Lagos State. A survey method of research was used to gather information about the issues of solid waste, its generation, storage, collection, transfer and disposal. A total number of 120 questionnaires were developed and distributed but 80 out of these questionnaires were recovered and used for the analysis.

Frequencies, percentages, mean and standard deviation were the statistical tools used for the analysis of the data. These tools provided the bases for decision making.

Based on the results derived from the statistical analysis, it was seen from the analysis that food waste is the most generated waste type in the area and due to the failure in the pickup systems of the municipal authorities; these wastes are dumped in any available space.

It was also seen that the main type of waste disposal system used in Ajah is the PSP which is meant to make waste management better but due to challenges in pick up times, it seems to have a drawback. In general, the waste management system in Ajah is good but there still have to be some improvements in the area of waste storage by the people and waste collection by the service providers as they are not consistent in their pickup days and time.

All these need to be addressed immediately to prevent a further break down of the waste management system being run presently in Ajah.

Recommendations

Based on the findings of the study, the following recommendations were made for the improvement of waste management system in Ajah.

- People should be treated as active partners in the process of change, there will be a more likely successful situation of waste management.
- Relevant information should be presented to the people and even with an increase of awareness to a certain level, additional monitoring and sustained management over a long period of time is necessary.
- The monthly environmental sanitation practice should be taken more seriously and the waste collection trucks from LAWMA should immediately after the sanitation if not during the sanitation, go round to collect the refuse that will be heaped on roads during the sanitation practice.
- The state assembly should formulate laws on waste management which will go as far as individual waste practice and ensure that the laws are enforced by government agencies.
- Monthly awards to neatest areas should be instituted to encourage the people of the areas to keep their environment clean always by properly handling and storing their wastes.
- Government should not only put up laws, but sponsor public health and environmental education programmes regularly and also make environmental education part of the education curriculum at all school levels.
- Bill boards with enlightenment features on the need to keep the environment clean and the implications of indiscriminate refuse dump should be mounted in strategic places within the state
- Community leaders, elders and landlords should encourage better sanitation practices by formulating community by-laws that kicks against indiscriminate waste dumping.
- They should be involved actively in promoting awareness of waste management in areas that surround them by organizing conferences, workshops, seminars and so on about environmental education.

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