SOLID WASTE DISPOSAL AND WEALTH GENERATION IN PARTS OF KADUNA METROPOLIS, NIGERIA

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Abstract
Solid waste disposal management presents problems in Kaduna metropolis which are linked with economic development, population growth and the inability of Kaduna State Environmental Protection Agency to manage the resulting rise in industrial and domestic waste in the study area. It is on this premise that the researcher was motivated to carry out a study on the topic under review with a view of finding out the situation in Kaduna metropolis, Nigeria. The aim of the research is to evaluate the generation, disposal and wealth generation practices of solid waste in some part of Kaduna metropolis, Kaduna State, Nigeria. The methods of data collection include questionnaire and field survey and methods of data analysis were arithmetic mean, frequency percentage, standard deviation and analysis of variance. The finding shows that Tudun Nufawa ranked the highest in sources of solid waste with 82 (23.6%) of the respondents, Sabon-Tasha ranked second with 79 (22.8%) of the respondents, Panteka ranked third with 70 (20.2%) of the respondents, Narahi ranked forth with 61 (17.6%) of the respondents and Kakuri ranked the least with 55 (15.2%) of the respondents in the study area. The result shows that 166 (47.8%) of the respondents uses indiscriminate open dumping alone as their way of disposing solid waste while 181 (52.2%) of the respondents uses more than one disposal mechanism which include backyard burying, waste burning and indiscriminate open dumping. The finding shows that highly aware of wealth generation from solid waste disposed ranked the highest with 226 (65.1%) of the respondents, aware ranked second with 102 (29.4%) of the respondents and not aware ranked the least with 19 (5.5%) of the respondents. The results shows that Panteka ranked the highest in terms of encouragement of more buying and selling of end of waste resources with 37 (10.7%) of the respondents and Tudun Nufawa ranked the least with 12 (3.5%) of the respondents. With regard to non encouragement of more buying and selling of end of waste resources, Tudun Nufawa ranked the highest with 69 (19.9%) of the respondents and Kakuri ranked the least with 23 (6.6%) of the respondents. It is therefore recommended that Kaduna State Government should come in to harness the abundant manpower of scavengers/ waste pickers by providing safety complaint wears and working instruments to make the working environment safer and encouraging for the participation of youths thereby creating employment.

Keywords: Solid waste; solid waste generation; solid waste disposal; and wealth generation.

Introduction

Waste has been defined by a number of authors as 'any unavoidable material resulting from domestic activity or industrial operation for which there is no economic demand and which must be disposed for' (Tchnobaoglous, 2013; Sridhar, 2013).

But for the purpose of this work we shall conceive waste in the light of Odocha's (2014) definition wherein he considered waste as materials which though may no longer be needed here may become feed stock or raw materials elsewhere in fact, he defined waste as "those materials which are generated as a result of normal operations over which we have control in terms of their production, disposal or discharge" wastes do not therefore, altogether apply to worthless substances. According to Gilpin (2014) waste is seen as materials of solid or semi-solid character that the possessor no longer considers of important value to retain.

Gilpin (2014) stated that waste management in its ramifications, is a planned system of effectively controlling the production, storage, collection, transportation, processing and disposal or utilization of wastes in a sanitary esthetically, acceptable and economical manner. It includes all administrative, financial, legal and planning functions as well as physical aspects of wastes handling. Gilpin (2014) further express waste management as that discipline associated with the generation storage, collection, transfer, transportation, processing and disposal of solid or gaseous wastes in a manner that is in accordance with the best principle of public health, economic, engineering conversion, aesthetics and other environmental considerations that is also responsible to pubic attitude.

The volume of solid waste being generated continues to increase at a faster rate than the ability of the agencies to improve on the financial and technical resources needed to parallel this growth (Ogwueleka, 2015). Solid waste management in Nigeria is characterized by inefficient collection methods, insufficient coverage of the collection system and improper disposal of solid waste. The quantity of solid waste generated in urban areas in industrialized countries is higher than in developing countries; still municipal solid waste management remains inadequate in the latter. Solid waste in developing countries differs from developed countries. Most developing countries, including Nigeria have solid waste management problems different from those found in industrialized countries in areas of composition, density, political, and economic framework, waste amount, access to waste for collection, awareness and attitude. The wastes are heavier, wetter and more corrosive in developing cities than developed cities (Ogwueleka, 2015).

Invariably, due to rapid urbanization in Kaduna metropolis in the past three to four decades, efficient and effective solid waste disposal has become a major problem. Man's unguided development and ineffective solid waste disposal especially in the study area result in a degraded urban environment and out brake of diseases such as cholera and diarrhea. As it stands, effective and efficient solid waste disposal in the study area needs to be addressed to achieve sustainable development. It is against this background that the researcher wishes to evaluate solid waste disposal and wealth generation in parts of Kaduna metropolis, Nigeria.

Statement of the Problem

Ofomata and Eze (2011) stated that "in Nigeria urban solid waste crises has grown in the last thirty years". Urban waste crises in Nigeria is attributed mainly to three factors, namely, rapid increase in urban population, heavy consumption pattern of urban dwellers and inefficiency of the authorities whose statutory responsibilities include efficient refuse management in cities.

Ogwueleka (2015) stated that Kaduna Metropolis generate an average 114,433tons of solid waste per month and 1,373196tons per annum. Waste disposal management presents problems in Kaduna metropolis which are linked with economic development, population growth and the inability of Kaduna State Environmental Protection Agency to manage the resulting rise in industrial and domestic waste in the study area. Haphazard industrial planning, increased urbanization, poverty and inadequate competence of the Kaduna State Environmental Protection Agency are seen as the major reasons for high levels of waste pollution in the study area. Closing the gap in the study area through evaluating the solid waste disposal and wealth generation in parts of Kaduna metropolis can save money for the Kaduna State Government and the inhabitant of the study area by providing alternatives to landfills, dumping and incinerators. This is one way to meet the current demand for urban waste management services in the study area, cutting costs by reducing pollution, environmental degradation and disease, poverty alleviation, and employment and revenue generation,

especially in some part of Kaduna metropolis. Although the direct costs of operating conventional landfills and wastewater facilities are known, the environmental degradation, health problems, and costs of ground water contamination are known only qualitatively. It is on this premise that the researcher was motivated to carry out a study on the topic under review with a view of finding out the situation in Kaduna metropolis, Nigeria.

Aim and Objectives

The aim of the research is to evaluate the generation, disposal and wealth generation practices of solid waste in parts of Kaduna metropolis, Kaduna State, Nigeria. The specific objectives are to;

(i) Identify the sources, types and disposal of solid waste generated in the study area;
(ii) Examine the opportunities explored by the residents on solid waste to wealth generation in the study area;
(iii) Assess the level of awareness on the need to explore more opportunities inherent in solid waste for environmental and economic benefits.

Study Area

Kaduna metropolis is located between longitude 10° 27" N and 10° 38" N and latitude 7° 20" E and 7° 35" E. It lies wholly within the physical and cultural zone of transition described as " the middle belt of Nigeria". The metropolis is made up of four urban Local Government Areas and they include Kaduna North, Kaduna South, Igabi and Chikun. The city is about 10,026km^2 in size, with a population of 1,558,563 according to the 2006 census NPC, (2006).

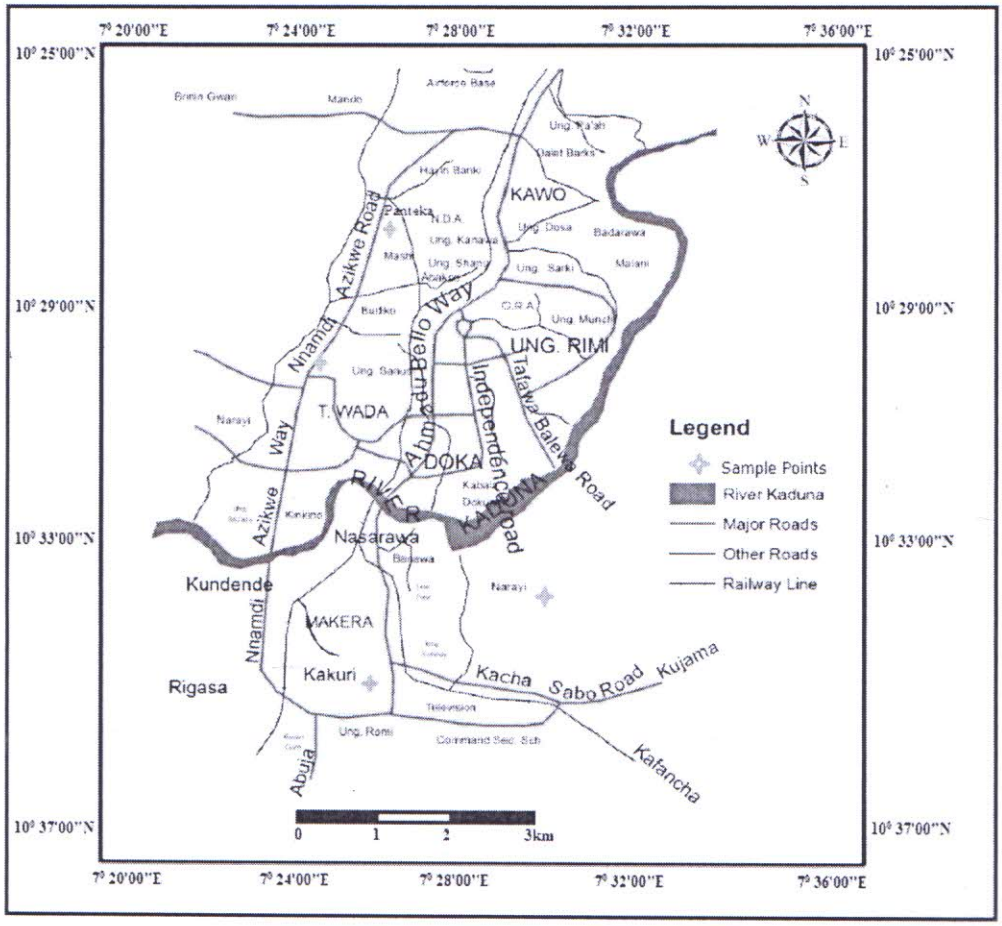

Figure 1: Location of Kaduna Metropolis
Source: Adapted from Kaduna State Administrative Map (2017)

Materials and Methods

The study is a survey research. It utilized structured questionnaire developed from the research questions which illicit the opinions of the respondents on the area of study. Although questionnaire was the major instrument for data collection field observations were also employed. The sample points selected for this study include Narahi, Kakuri, Sabon-Tasha, Tudun Nufawa and Panteka.

The primary data for the study were sourced using structured questionnaire and field survey which were the main instruments for data collection. It was used to elicit responses from the respondents which were mainly the staffs of Kaduna State Environmental Protection Agency and scavengers of solid waste disposed in the study area. Secondary data were generated through the review of some literature related to the topic of this study. Such materials include textbooks, periodicals, newspapers, magazines, workshop/seminar materials and mimeographs (published and unpublished). Such data were mainly used to add value to introduction, literature review, research methodology and research analysis of this study.

Methods of Data Analysis

Standard deviation and descriptive statistics using the mean and tables were used to achieve objective one, two and three of this study. These statistical techniques are easy to present, analyze, and interpret. Statistical Package for the Social Sciences (SPSS 19.0) software was used in analyzing the descriptive statistical technique (frequency-percentage) that was adopted in this study. Sources and types of waste generated were obtained through the field activities while others were through field work and structure questionnaire.

Standard deviation equation was given below.

$$? = ? (x_i - x)^2 = v = \frac{(X-X)^2}{N} \text{ ----------(3.3)}$$

i.e. where x – x represents the deviations of each of the numbers.
N = Number of cases
X = the mean for the data
? = Standard deviation. Thus standard deviation is the root mean square of the deviation of each of the number of x, from the mean x.

Frequency-percentage equation was given below

$$\text{Frequency-percentage} = \frac{\text{Number of observed}}{\text{Total Number}} \text{ X } \frac{100}{1} \text{ -----(ii)}$$

The equation for statistical mean technique used for this study was given below.

$$\bar{x} = \frac{\sum x}{n} - - - - - - - - - - (iii)$$

Where x is the mean of the research question and n = number of respondents.

Results and Discussion

Sources, Types and Disposal of Solid Waste Generated

This sub-section deals with sources, types and disposal mechanism of solid waste in the selected sample points of the study.

Sources of Solid Waste

Sources of solid waste in the study area include household and commercial. The majority of the sources in the sample points were households and the least was commercial as indicated in Table 1.

Table 1: Sources of Solid Waste

Sample points	Sources of solid waste	Frequency		Percentage (%)
Narahi	Household	61		17.6
Kakuri	Household	55		15.8
Sabon-Tasha	Commercial/household	49	30	22.8
Tudun Nufawa	Household	82		23.6
Panteka	Commercial/household	13	57	20.2
Total		347		100

Source: Field Work, 2017

As shown in Table 1, Tudun Nufawa ranked the highest in sources of solid waste with 82 (23.6%) of the respondents, Sabon-Tasha ranked second with 79 (22.8%) of the respondents, Panteka ranked third with 70 (20.2%) of the respondents, Narahi ranked forth with 61 (17.6%) of the respondents and Kakuri ranked the least with 55 (15.2%) of the respondents in the study area. This implies that the sample points selected are generating solid waste close to each as perceived by the respondents.

Types of Solid Waste

The types of solid waste identified in the study area include municipal, industrial and biomedical wastes. As shown in Figure 2, municipal or household waste ranked the highest with 281 respondents, biomedical waste ranked second with 49 respondents and industrial waste ranked the least with 17 respondents. The industrial waste came from pure-water factories and paper printing factories while biomedical waste are those solid waste from hospitals located within the sample points of the study area.

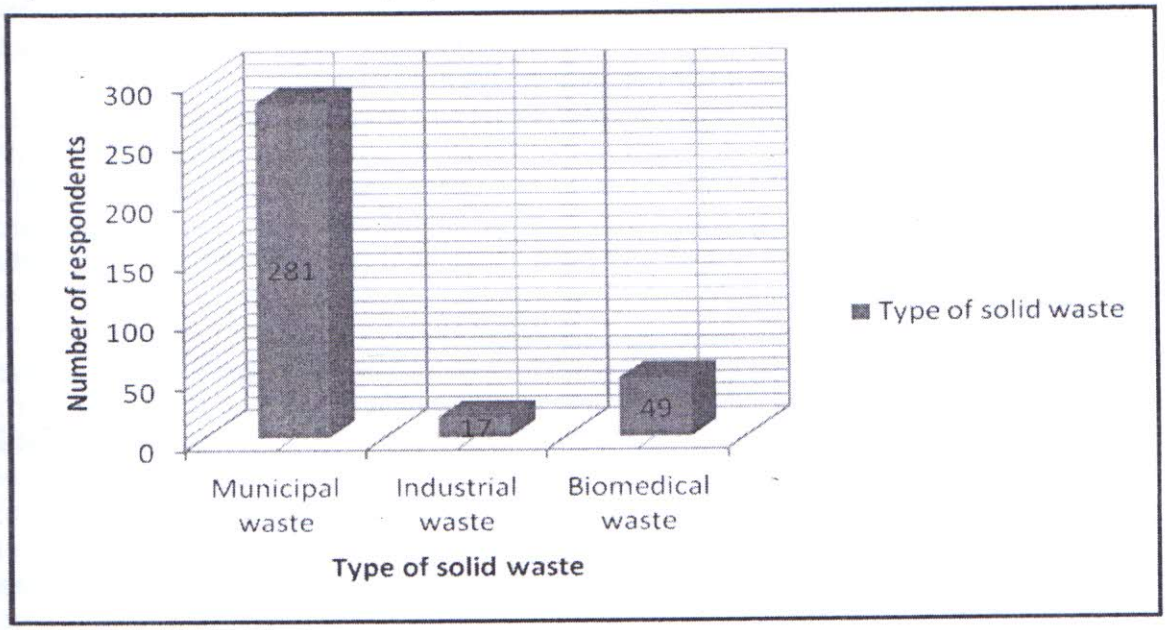

Figure 2: Type of Solid Waste
Source: Field Work (2017)

Disposal Mechanism of Solid Waste

Disposal mechanism of solid waste in the study area includes waste burning, backyard burying and indiscriminate open dumping. Indiscriminate open dumping is the major disposal mechanism of solid waste in the selected sample points which includes Narayi, Kakuri, Sabon-Tasha, Tudun Nufawa and Panteka.

Table 2: Disposal Mechanism of Solid Waste

Sample points	Disposal mechanism of solid waste	Frequency	Percentage (%)
Narahi	Indiscriminate open dumping	43	12.4
Kakuri	Indiscriminate open dumping	59	17.0
Sabon-Tasha	Indiscriminate open dumping/waste burning	101	29.1
Tudun Nufawa	Indiscriminate open dumping	64	18.4
Panteka	Indiscriminate open dumping/ backyard burying	80	23.1
Total		347	100

Source: Field Work (2017)

As indicated in Table 2, 166 (47.8%) of the respondents uses indiscriminate open dumping alone as their way of disposing solid waste while 181 (52.2%) of the respondents uses more than one disposal mechanism which include backyard burying, waste burning and indiscriminate open dumping. This implies that the respondents are disposing there solid wastes in a unsustainable manner which has affected the environment negatively through land, air and water pollution.

Table 3: Standard deviation for sources and disposal mechanisms for solid waste

Item	N	K	S-T	T-N	P	X	S.D
Sources of solid waste	61	55	79	82	70	69.4	10.28
Disposal mechanism of solid waste	43	59	101	64	80	69.4	19.72

Note: N = Narahi, K = Kakuri, S-T = Sabon-Tasha, T-N = Tudun Nufawa, P = Panteka, X = arithmetic mean and S.D = Standard Deviation
Source: Author's data analysis (2017)

The mean for the sources of solid waste was 69.4 and the standard deviation was 10.28 which were low, this implies that the data of the sample points tend to be close to the mean which means that the different sources of solid waste are closely related as indicated in Table 1 of this study.

The mean for the disposal mechanism of solid waste was 69.4 and the standard deviation was 19.72 which were low, this implies that the data of the sample points tend to be close to the mean which means that the disposal mechanisms of solid waste are closely related as indicated in Table 2.

Opportunities Explored by the Residents on Solid Waste to Wealth Generation

As indicated in Table 4, the residents of the study area are aware of wealth generation within solid waste disposed in the study area.

Table 4: Level of Awareness on Wealth Generation from Solid Waste

Level of awareness	Frequency	Percentage (%)
Not aware	19	5.5
Aware	102	29.4
Highly aware	226	65.1
Total	347	100

Source: Field Survey (2017)

Highly aware of wealth generation from solid waste disposed ranked the highest with 226 (65.1%) of the respondents, aware ranked second with 102 (29.4%) of the respondents and not aware ranked the least with 19 (5.5%) of the respondents. This implies that the respondents are fully aware of the wealth generated from the wanted part of solid waste disposed at the sample points of the study area.

Income Generated from Solid Waste

The income generated from solid waste were based on money the scavengers generated on monthly basis which is shown in Table 5.

Table 5: Income Generated by Scavengers

Income Generated by Scavengers	Frequency	Percentage (%)
₦10,000 – ₦50,000	11	55.0
₦50,001 – ₦70,000	7	35.0
₦70,001 and above	2	10.0
Total	20	100

Source: Field Work (2017)

As indicated from Table 5, scavengers that generate between ₦10,000 – ₦50,000 ranked the highest with 11 respondents, ₦50,001 – ₦70,000 ranked second with 7 respondents and ₦70,001 and above ranked the least with 2 respondents. This implies that the scavengers generate money enough to feed their families, equally pay school fees and contributed to cleaning of the environment in the study area.

Level of Awareness on the Need to Explore More Opportunities Inherent in Solid Waste for Environmental and Economic Benefits

The level of awareness on the need to explore more opportunities inherent in solid waste for environmental and economic benefit include more people been involve in recycling of solid waste materials, creation of more fertilizer companies by Kaduna State Government and encouragement of more buying and selling of end-of-waste resources like fabrication of locally made boxes, local save and local pot making. Organizing the scavengers and recyclers into association that the State Government should provide incentive for economic development.

Conclusion

Solid waste sources, types and disposal are challenges to Kaduna State Environmental Protection Agency based on the finding of this study. Though this waste has leads to income generation by scavengers in the study area, the level of awareness on the need to explore more opportunities inherent in solid waste for environmental and economic benefits are not properly taped which has allowed some youth to unproductive to the study area. Today, when solid waste management service is delivered and cost paid for by the generator (providing employment), it means waste has provided wealth too and can be construed as waste-to-

wealth. It is therefore recommended that Kaduna State Government should come in to harness the abundant manpower of scavengers/ waste pickers by providing safety complaint wears and working instruments to make the working environment safer and encouraging for the participation of youths thereby creating employment.

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