

## Assessment of the Sustainability of Solid Waste Management in Kaduna Metropolis, Kaduna State, Nigeria.

Suleyman Musa Tanko<sup>1</sup>, Henry O.Sawyerr<sup>2</sup>

<sup>1</sup>Department of Environmental Health Science, Kwara State University, Malete, Kwara State

<sup>2</sup>Head, Department of Environmental Health Science, Kwara State University, Malete, Kwara State, Nigeria  
Corresponding Author: Suleyman Musa Tanko

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**Abstract: Background:** Waste is an unwanted useless, rubbish or discarded materials after its primary use is achieved, waste becomes one among the major factors that contribute to high rate of morbidity and mortality in African societies because it serve as a place where a lot of vectors and other pathogenic organisms breed apart from air, water and land pollution. Kaduna state is one among the 36 states of Nigeria and Kaduna metropolis is the state capital of Kaduna state where different types of solid waste is generated by individuals, households, factories, industries, institutions and other various commercial organizations within the metropolis. **Aim:** the major aim of the study is to ascertain as well as evaluate the solid waste management sustainability in Kaduna metropolis. **Objectives of the study:** To find out types of solid waste generated in Kaduna Metropolis, to find out method of waste management in Kaduna Metropolis, to assess the role played by Kaduna State Environmental Protection Agency in solid waste management sustainability, to assess the role of private sectors in solid waste management sustainability in Kaduna Metropolis. **Methodology:** The research is descriptive survey, the population of study include the households within Kaduna metropolis, Government organizations and private solid waste management organizations within Kaduna, fishers formula was used in sampling the required population. Questionnaire and checklist were used as instruments for data collection and descriptive and inferential statistics were used in analyzing the data. **Findings:** The result after the data was analyzed shows that 60% of the household respondents responded that solid waste service providers provided waste bin to house hold for temporary waste collection, also service providers collected solid waste from temporary waste collection centers to the final disposal site, also most of the solid waste generated was house hold domestic solid waste with 58% and finally Kaduna State Environmental Protection Agency (KEPA) liaised with service providers in solid waste collection, separation, treatment, storage transportation and final disposal with 53.34%. **Conclusion:** Kaduna state environmental protection agency liaise with service providers in collection, storage, transportation and disposal of waste in Kaduna metropolis.

**Key. Waste. KEPA. Service Providers. Sustainability. Management**

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### I. Introduction

Waste can be generally described as any item or material that is generated and disposed-off or intended to be disposed off by a person that has custody of it. However, in addition to considerations of legal nature and geographical location of generation, different definitions of waste exist based on conditions under which they occur (Williams, 2005). A process whereby strategic combination of methods are employed to efficiently regulate waste from source of generation up to the final disposal point is referred to as waste management, and the aim is to maintain a perpetually safe and healthy environment at minimal cost (Igbinomwanhia, 2011). Furthermore, waste management has been identified as a challenge in many countries all over the world, much more so in developing countries, and a correlation has been identified between accelerated urbanization, population explosion, industrial development and rate of waste generation in cities found in such countries (Narayana, 2009; UNEP, 2005).

In most cities in Nigeria, waste management issues have become a glaring challenge. In recent years, there has been a phenomenal increase in the volume of wastes generated daily in the country (Olanrewaju & Illembade, 2009). This is due to the huge volume of waste generated in the cities on a daily basis, which calls for proper handling in order to protect the environment and the population. (Hornweg 1999) emphasized that waste is inseparable from life because as long as man is alive, he stores up, uses, and disposes off materials and the complexity of waste which modern civilization produced is directly related to the living standard, socio-economic and cultural attributes of that particular environment.

Over the years, concerted efforts have been made to adequately solve the problems created by the emanation of wastes. Akaninyere and Atser (2001) examined the typology, characteristics and future trends of

solid waste and asserted that the major components of waste are degradable materials (food remnants, paper, and rags) and non-biodegradable plastics, tins, metals, bottles, glass, and bones. The study asserted that in several Nigerian cities, garbage contributes substantially more than other components, this could be explained by the fact that most activities, which affect the environment, stem from the need for food; its production, processing and preparation.

The management of waste constitutes one of the most immediate and serious environmental problems facing most towns in Nigeria. The conventional waste management approach based on collection and disposal has failed to provide efficient and effective results. Onibokan (1989) observed that 23% of Ibadan, 33% of Kaduna, and 44% of Enugu households do not have access to waste collection. A World Health Organization (WHO) Report (2006), has identified waste as one of the biggest challenges to the health of the people residing in Lagos. The report revealed that Lagos has been beset with the difficulties of clearing over 10,000 tons of solid waste generated daily. The lack of effective waste disposal service is becoming a major problem. According to the report, the growth in the population of Lagos from 5.7 million in 1991 to about 9 million in 2005 has made it difficult for the State Government to find a solution to Lagos waste problems. The Lagos Waste Management Authority (LAWMA) corroborated the report and further stated that indiscriminate dumping is an added complication. Emily (2004) asserted that when waste is not collected, unsanitary conditions develop and pose environmental and human health risks. The prevalence of parasites, tetanus, malaria, hookworm, cholera and diarrhea in most cities in Nigeria is attributed to the unsanitary condition in these cities. Oyediran (2004) posits that insanitary disposal of solid waste promotes fecal-oral transmission of diseases through fecal contamination of the hands, food and water. He further states that solid waste dumps provide breeding grounds for mosquitoes, rats and other vermin, generating amongst others; yellow fever, Lassa fever, and trachoma mortality in Nigeria

Sustainability organizations are organized groups of people that aim to advance sustainability and/or those actions of organizing something sustainably. Unlike many business organizations, sustainability organizations are not limited to implementing sustainability strategies which provide them with economic and cultural benefits attained through environmental responsibility. For sustainability organizations, sustainability can also be an end in itself without further justifications.

Recently the natural environment has become a key strategic issue in both the business and academic communities. Through "implementing sustainability strategies, firms can integrate long-run profitability with their efforts to protect the ecosystem, providing them with opportunities to achieve the traditional competitive advantages of & cost leadership and market differentiation via environmental responsibility. Sustainability strategies have been persistently employed in a number of organizations.

Before now waste management was the prerogative of the public sector in Nigeria – via the local government or the ministry of waste management. But the heap of refuse found in most public places, the streets, markets, motor parks and so on became of concern to many business persons who felt that the private sector would do better than the public sectors. Earlier attempts by the private sector were in major cities; Lagos, Ibadan, Kaduna, Asaba, Warri to mention but a few. The free waste disposal by the public was being challenged by the ability to pay waste disposal agents of the private sector. As researchers attempt to look towards the private sector for better environment, this research became interested in assessing solid waste management sustainability in Kaduna Metropolis. .

### **Objectives of the study**

The major aims and objectives of this research work is to ascertain as well as to find out the sustainability of solid waste management in Kaduna Metropolis based on the following specific objectives.

To find out types of solid waste generated in Kaduna Metropolis.

To find out method of waste management in Kaduna Metropolis.

To assess the role played by Kaduna State Environmental Protection Agency in solid waste management sustainability.

To assess the role of private sectors in solid waste management sustainability in Kaduna Metropolis.

### **II. Material and method**

The research design is descriptive survey while the population of the study was two million one hundred and nineteen thousand seven hundred (2,119,700), simple random sampling was used in which five hundred and fifty two (552) household respondents are selected. The instruments used for data collection was questionnaire and observation checklist. Descriptive and inferential statistics were used in the analysis of data.

III. Discussion

Assessment of method of solid waste management in Kaduna Metropolis

Table 1: Multiple proportion test of the agreed respondent on pattern/method of solid waste collection, disposal and treatment in Kaduna metropolis

Item	Number of respondent	Multiple Proportion Test
Private service providers provide Collection bins at homes for solid waste collection	155 (33.5%)	Chi-square = 168.7 df = 10 p-value = 0.0000001*
The facilities provided for the solid waste collection is appropriate and adequate	195 (35.1%)	
The interval/period for the collection of solid waste is suitable	172 (31.2%)	
There is designated point provided for the temporary waste collection	329 (59.6%)	
Private service providers collect solid wastes from households and designated point to final disposal sites as at when due	255 (46.2%)	
Private solid waste service providers are responsible for household solid waste disposal and treatment	223 (40.4%)	
Private solid waste service providers are licensed to operate	250 (45.3%)	
Private service providers provide sorting and segregation materials for proper management of solid waste at source	222 (40.2%)	
Solid waste management does not require technical know-how from providers	233 (42.2%)	
Households treat solid waste through incineration	253 (45.8%)	
Households treat solid waste through composting	262 (47.5%)	

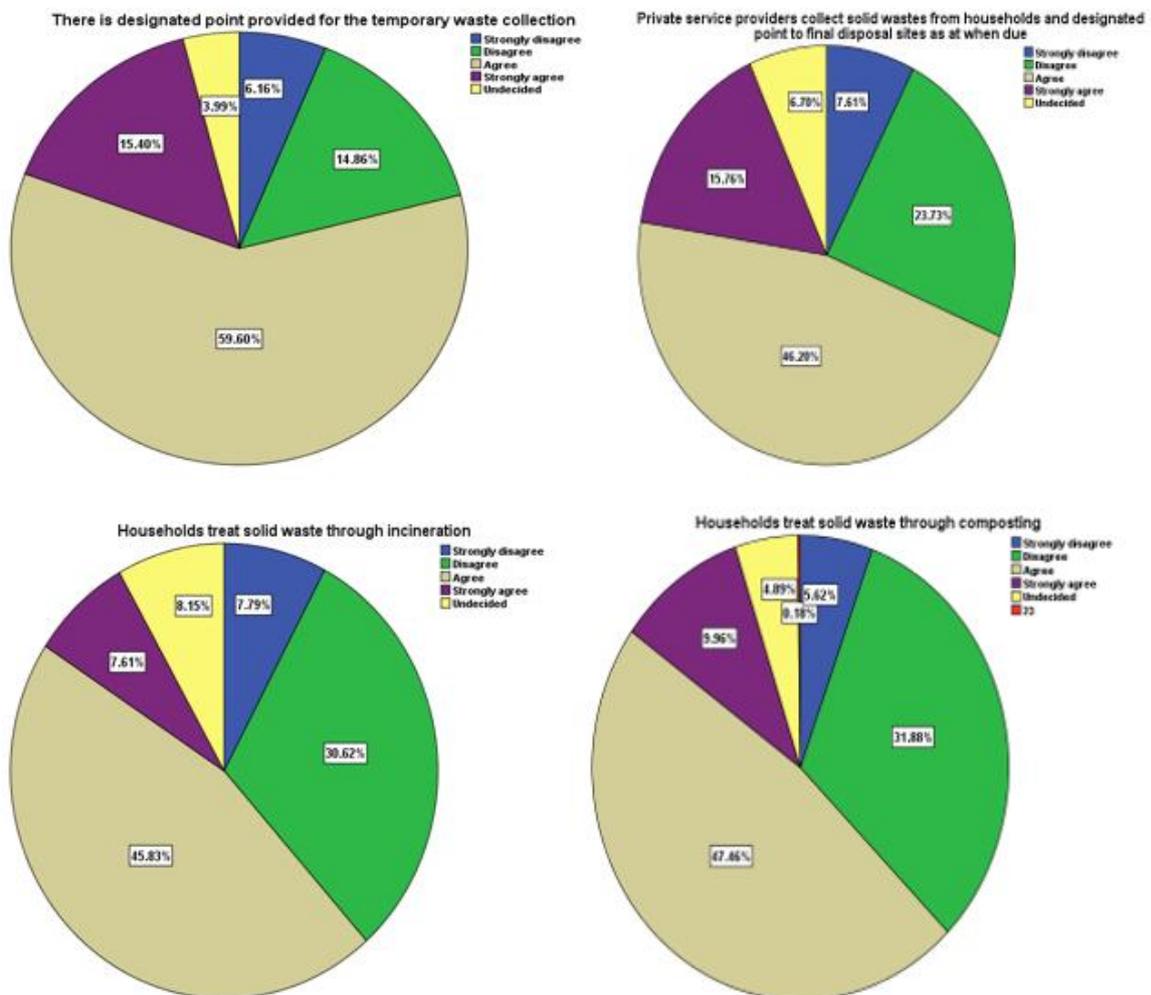


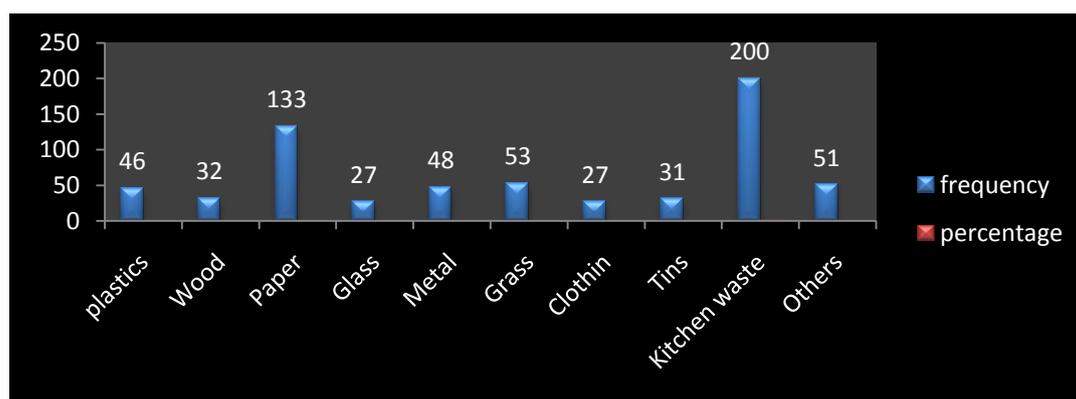
Figure 1: Piechart representation of identifying pattern/method of solid waste collection, separation, storage, transportation, treatment and disposal of solid waste management

Table 1 and figure 1 indicated that the number of private service providers provide collection bins at homes for solid waste collection based on the responses of the respondent of one hundred and fifty five 155 which is equivalent to (33.5%), so also the facilities provided for the solid waste collection is appropriate and adequate based on the responses of the respondent of five hundred and ninety five 195 which is equivalent to (35.1%), moreover the interval/period for the collection of solid waste is suitable is one hundred and seventy two 172 which is equivalent to (31.2%), In addition there is designated point provided for the temporary waste collection based on the responses of the respondent of three hundred and twenty nine 329 which is equivalent to (59.6%), so also private service providers collect solid wastes from households and designated point to final disposal sites as at when due based on the responses of the respondent of two hundred and fifty five 255 which is equivalent (46.2%), at the same time private solid waste service providers are responsible for household solid waste disposal and treatment based on the responses of the respondent of two hundred and twenty three 223 which is equivalent to (40.4%). Private solid waste service providers are licensed to operate based on the responses of the respondent of two hundred and fifty 250 which is equivalent to (45.3%), moreover private service providers provide sorting and segregation materials for proper management of solid waste at source based on the responses of the respondent of two hundred and twenty two 222 which is equivalent (40.2%). Solid waste management does not require technical know-how from providers based on the responses of the respondent of two hundred and thirty three 233 which is equivalent to (42.2%), so also households treat solid waste through incineration based on the responses of the respondent of two hundred and fifty three 253 which is equivalent (45.8%) and households treat solid waste through composting based on the responses of the respondent of two hundred and sixty two 262 (47.5%). The response that is the highest is there is designated point provided for the temporary waste collection with the responses of the respondent of three hundred and twenty nine 329 which is equivalent to (59.6%) responses, which shows that there is a pattern of waste disposal in Kaduna metropolis.

The multiple proportion test of the agreed respondent on pattern/method of solid waste management in Kaduna metropolis revealed that there is designated point provided for the temporary waste collection with 59.6% which show p-value = 0.0000001 less than 0.05 level of significance and therefore reject the null hypotheses which states that there is no efficient pattern/method of solid waste collection, disposal and treatment established for solid waste management in Kaduna metropolis and thus accept the alternate hypotheses which states that there is efficient pattern/method of solid waste collection, disposal and treatment established for solid waste management in Kaduna metropolis. Therefore there is efficient pattern/method of solid waste collection, disposal and treatment established for solid waste management in Kaduna State.

**Table 2: Assessment of types of waste observed at the solid waste collection point in Kaduna Metropolis**

Type of waste	Frequency	Percentage
Plastics	46	8.8%
Wood	32	6.1%
Paper	133	25.33%
Glass	27	5.2%
Metal	48	9.3%
Grass	53	10.1%
Clothin	27	5.52%
Tins	31	5.9%
Kitchen waste	200	38.3%
Others	51	9.4%

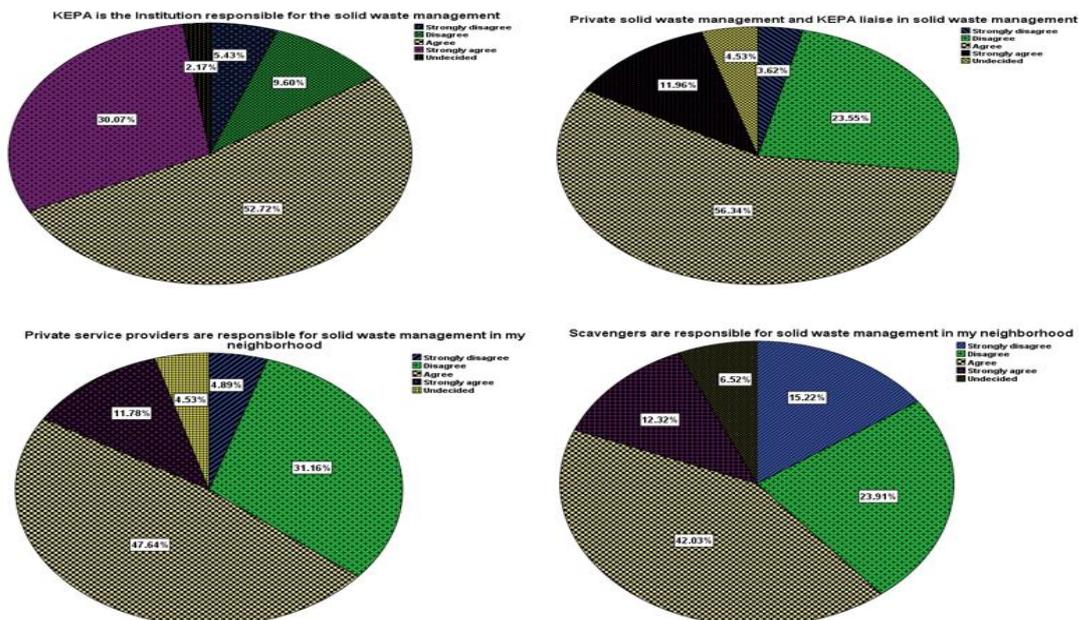


**Figure 2: Graphical presentation of types of waste observed at the solid waste collection point in Kaduna Metropolis**

Based on the checklist of households shown in table 2 and figure 2, 46 among the respondent which is equivalent to 8.76% respond that plastics is the major waste observed in the solid waste disposal point in Kaduna metropolis, while thirty two among the respondent which is equivalent to 6.1% respond that majority of the solid waste observed at the point of disposal is wood in Kaduna metropolis, so also 133 among the respondent which is equivalent to 25.33% respond that majority of the solid waste disposed on the solid waste disposal point is papers in Kaduna metropolis, in addition to that, 27 among the respondent which is equivalent to 5.14% respond that glasses in the solid waste observed at the solid waste disposal point in Kaduna metropolis. Moreover, forty eight (48) among the respondent which is equivalent to 9.14% respond that metals is the major solid waste disposed as the solid waste disposal point in Kaduna metropolis, and fifty three among the respondent which is equivalent to 10.1% respond that grasses is the major solid waste disposed at the solid waste disposal point in Kaduna metropolis, so also twenty nine (29) among the respondent which is equivalent to 5.52% respond that clothing is the major solid waste dispose and the solid waste dumping site in Kaduna metropolis. Apart from that, thirty one (31) among the respondent which is equivalent to 5.9% respond that Tins are the major solid waste disposed on the dumping site in Kaduna metropolis. Two hundred (200) among the respondent which is equivalent to 38.3% respond that kitchen waste is the major solid waste dumped at the solid waste disposal point. And finally only fifty one (51) among the respondent which is equivalent to 9.71 respond for other solid waste disposed at the solid waste dumping site in Kaduna metropolis. Since the greater percentage is 38.3% which respond to Kitchen waste, this shows that majority of the solid waste dumped at the solid waste dumping site in Kaduna metropolis is from kitchen (Domestic) waste. These is an indication that majority of solid waste dumped in Kaduna metropolis at the dumping site is organic in nature, as such it can be able to undergo biodegradable i.e it can decompose and pollute air, water and land. Therefore there is need for the reuse and recycle of such organic waste informs of organic manure into our farm land in Kaduna metropolis.

**Table 3: Assessment of Multiple proportion test of the agreed respondent on identification of institution established for solid waste management in Kaduna metropolis**

Item	Number of respondent	Multiple Proportion Test
KEPA is the Institution responsible for the solid waste management	291 (52.72%)	<i>Chi-square</i> = 25.673 <i>df</i> = 3 <i>p-value</i> = 0.0000116*
Private solid waste management and KEPA liaise in solid waste management	311 (56.34%)	
Private service providers are responsible for solid waste management in my neighborhood	263 (47.64%)	
Scavengers are responsible for solid waste management in my neighborhood	232 (42.3%)	



**Figure 3: Pie chart representation identifying institutionalization for solid waste management in Kaduna metropolis.**

Based on the responses of the respondent shown in table 3 and figure 3 which represent household opinion on institutionalization for solid waste management in Kaduna metropolis

The results were calculated based on multiple proportion test of the respondent that agreed with institutionalization of solid waste management in Kaduna metropolis. This study identified that KEPA is the institution responsible for the solid waste management, since proportion of those that agreed are more than those that disagree and vice versa. Moreover, this study also notices that private sector and KEPA liaise in solid waste management. In Kaduna metropolis.

It was also identified that Scavengers are not much responsible for solid waste management in my neighbourhood 232 (42.3%). Above all, all respondent agreed that institutionalization of solid waste management in Kaduna metropolis is very important and necessary. The multiple proportion test of the agreed respondent on identification of institution established for solid waste management in Kaduna metropolis revealed that the private solid waste providers and KEPA liaise in solid waste management has a significant relationship, since the p-value = 0.0000116 is less than 0.05 level of significance. This revealed that institutional, legal and financial arrangements established for solid waste management in Kaduna metropolis are well establish and implemented.

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