URBAN HOUSEHOLDS' SOLID WASTE GENERATION AND DISPOSAL IN SELECTED SLUM AREAS OF LAGOS STATE

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ABSTRACT

Since it has been established in relevant literature that sustainable waste management entails the act of rethinking, reducing, recycle and reuse, this paper examined the inter-relationship between households' solid waste generation and disposal in selected slum areas of Lagos State. Sources of data included primary and secondary sources. A set of questionnaire were administered in three selected slum areas of Lagos State. The sample frame is the total households in the three selected slum areas (Ijeshatedo, Iwaya and Amukoko) of Lagos State based on the Lagos Metropolitan Development and Governance Project (27,476 households). The sample size was determined through the use of sample size formula developed by Yamene (1973). This translated to a sample size of 394. The sampling technique used was multi-stage sampling technique. The methods of data analysis included frequency table, chi-square, cross-tabulation, correlation co-efficient analysis of Variance (ANOVA) through the Statistical Package for Social Science (SPSS). The inter-relationship between solid waste generation and disposal was investigated using variables such as distance of dumpsite, method of solid waste disposal, respondents' monthly income, households' size and Land use. It was deduced that 36.6% of the respondents revealed that houses very far from the dumpsite have high rental value and high households' number and this lead to higher quantity of solid waste generated and disposed by the households. Recommendations such as proper location and management of dumpsite were suggested among others. In conclusion, the study recommended strategies such as proper location and management of dumpsite, effective ways of caring out activities of waste management authority and effective management of Lagos State waste management Authority.

Keywords: Urban, Household, Solid Waste Generation, Solid Waste Disposal, Slums

INTRODUCTION

Sustainable development is 'development that meets the needs of the present without compromising the ability of future generations to meet their needs' (Brundtland Report). A growing population and development in the region will inevitably increase pressures on the environment with growing solid waste generation and disposal rates. Sustainable waste management aims to address these long term pressures through the recovery, recycling, and reuse of resources, and the minimisation of waste streams. This includes the management of resources in an environmentally sound and economically effective manner. It is in this direction that Resource Conservation and Recovery Act (RCRA) (2000) established any solid waste as any solid, semisolid liquid or contained gaseous materials discarded from industrial, commercial, mining or agricultural operations and from community activities. In Nigeria, the most commonly used methods of solid waste disposals include refuse composting incineration and sanitary landfill dumpsites. Refuse composting requires relatively high temperature for mechanical composting while the collected refuse are disposed off to rot or ferment. The end product is called "compost" and used as common manure in farms. Incineration processes involve burning of collected solid wastes from households, offices and markets. Incineration is usually carried out in order to ensure size reduction and conversion of refuse to other uses without grossly affecting the environment.

Lagos environment is not an exception as it manages about 30% of the country's municipal solid waste in its environment (LAWMA, 2010). Thus, with the concentration of national socio- economic activities, especially the presence of over 60% of the country's total industrial and commercial activities, the state is faced with grave urban crisis that is closely associated with municipal solid waste management (Oresanya, 2007). As a result of this, the city expands with a population of about 17 million people and over 6,000 metric tonnes (George, 2010) and 9,000 metric tonnes (LAWMA, 2010) of municipal solid waste are generated daily. More so, the variation of solid waste generation is based from country to country is based on the economic situation, industrial structure, waste management regulations and life style. Solid waste is generated from households, offices, shops, markets, restaurants, public institutions, industrial installations, water works and sewage facilities, construction and demolition sites, and agricultural activities. Waste can be subdivided into Garbage and rubbish. Waste is generally known to be generated from range of human and animal activities, production processes to consumption stage and the management of waste has been a major problem in developing countries with slums such as Nigeria, where generation of waste per unit of output is much higher than that in the developed countries because of inefficiency in manufacturing processes.

According to the United Nation Expert Group (UNEG), a slum is an area that combines to great extent, the following characteristics: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding and insecure residential status. In the Traditional perspective, slums are defined as areas that were once desirable but which thereafter deteriorated after the original dwellers moved on to the new and better parts of the city. The quality of slum settlements varies from the simple shack to permanent structures while access to water, electricity, sanitation and other basic services and infrastructure tends to be limited (Alagbe, 2005) . It has also been defined as a group of individual living under the same roof that lack one or more of access to safe water, access to sanitation, secure tenure and durability of housing. Slums areas are characterized by overcrowding, deterioration, insanitary conditions, or absence of basic facilities such as portable water, drainage system, schools, health facilities, recreational grounds and post office. UN-Habitat (2007) define slum as "a heavily populated urban area that is

characterized by substandard housing and squalor". A slum is also defined as a heavily congested and poorly built temporary human settlement which is prone to antisocial activities, which is characterized by a shortage of safe drinking water, inadequate power supply, lack of proper sanitation and scarce medical and social facilities. However, since study on inter-relationship between sustainable households' solid waste generation and disposal in selected slum areas of Lagos State has not been isolated for investigation, this study intends to do so.

STUDY AREA and METHODOLOGY
Study Area

The study areas are the Iwaya, Ijeshatedo and Amukoko slum areas of Lagos state. Amukoko is located in Ajeromi-Ifelodun local government area of Lagos state and has a geographical coordinates of latitude 7.2166667 and longitude 4.2500000. As a total population of 120,000 (International network on Gender and sustainable energy, 2011). Amukoko as a land area of about 41 hectares and a population of about 48,498 people (LASURA, 2013). Ijeshatedo is located in Surulere local government area of Lagos state. Ijeshatedo is bounded by Asimowu canal and Ijesha road by the north, Jubril Martins road at the east and Cele express at the west. It has a total population of 69,296 people and land area of 63hectares (LASURA, 2013). Iwaya is located in Lagos mainland local government area of Lagos state. It has geographical coordinate of latitude 6°30' 15.0006" and Longitude 3°23'30.9984". Iwaya is largely a fishing village where most of the residents make a living from fishing and trading. The population of Iwaya is about 82,993persons in 2002 and has land area of 60ha (LASURA, 2013).
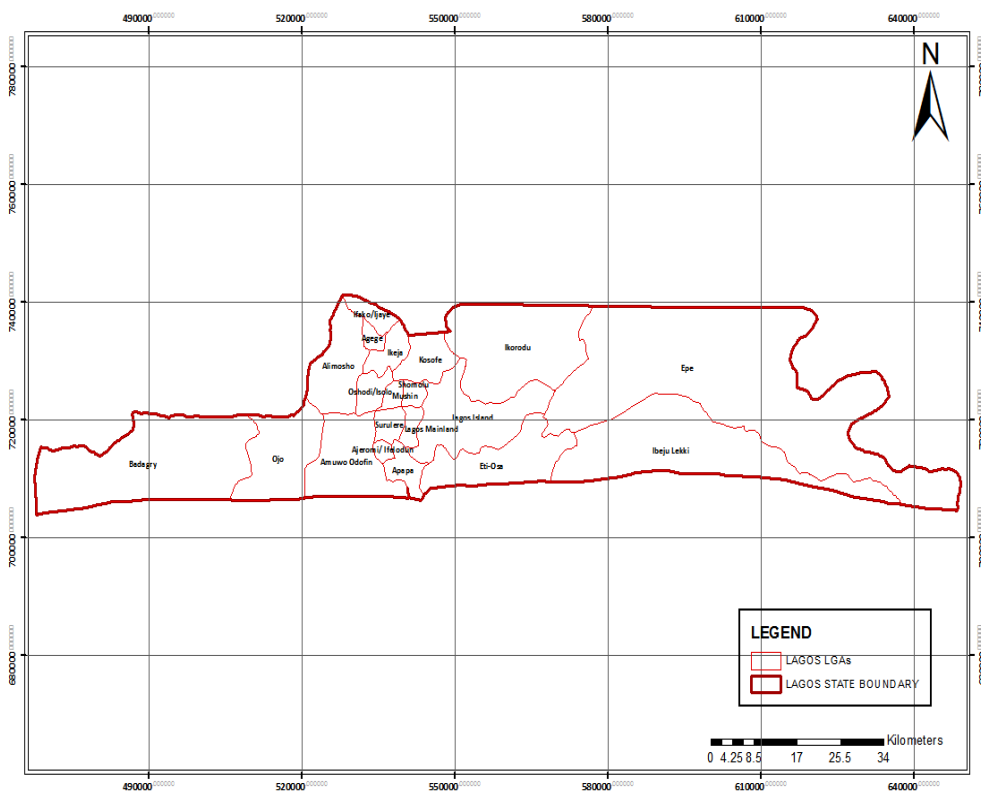

Figure 1: Map depicting Lagos state and the study areas

Source: Adapted from Department of Survey and Geo-informatics, University of Lagos,

Methodology

The two major sources of data utilized were the primary and secondary sources. The sample frame for this research is the total households in the three different selected slum areas (Ijeshatedo, Iwaya and Amukoko); of Lagos state based on the Lagos metropolitan Development and Governance Project (27,476). The total number of households' size was determined by multiplying the total number of buildings with the average household size. The average household sizes of Ijeshatedo, Iwaya and Amukoko are 5, 5 and 7 respectively (World Bank Report on households' survey, 2006). Thus, the total number of households' size for Ijeshatedo, Iwaya and Amukoko are 5,250, 6,455 and 15,771 which translated to the sample frame (27,476). The sample size for this study was obtained through the sample size formula developed by Taro Yamane (1973). It is given as

$$n = \frac{N}{1 + N(e)^2}$$

Where n= the sample size

N= the Population size or sample frame

e= the acceptable sampling error.

Thus, N =27,476, e = 5%=0.05 which is the sampling error/precision level.

$$n = \frac{27,476}{1 + 27,476 \times (0.05)^2}$$

$$n = \frac{27,476}{69.69}$$

n=394

Thus, for the purpose of this research, the total numbers of household size represent the population size (N). After the computation, the sample size of Ijeshatedo, Iwaya and Amukoko translated to 394 which amount to a sample ratio of 1.4%. Thus, this becomes the sample size. In view of this, a total number of 394 numbers of questionnaire were administered at the three study areas. Thus, 75 sets of questionnaire were administered at Ijeshatedo while sets of 93 and 226 questionnaire were administered at Iwaya and Amukoko respectively. Thus the proportion of the questionnaire administered in each of the study area is derived as follows:

Ijeshetedo $= \frac{5,250}{27,476} \times 394$ =75

Iwaya $= \frac{6,455}{27,476} \times 394$ = 93

Amukoko $= \frac{15,771}{27,476} \times 394$ = 226

The sampling technique used is multi-stage sampling technique. Multi-stage sampling involves the division of population into groups and sub- groups. The sampling procedures encompass the identification of the study area and selection of respondents for the conduct of the interview in accordance with the questionnaire. The use of descriptive statistical method was used for analyzing data and it involved the use of frequency table, charts and cross tabulation. The inferential statistical methods include chi-square, correlation and Analysis of Variance (ANOVA) through the use of Statistical Package for Social Science (SPSS).

RESULTS AND DISCUSSION

Inter-Relationship between Households' Solid Waste Generation and Disposal in the Study Area

Distance of Dumpsite

Based on personal interview conducted and questionnaire administered in the three study areas, it was noticed that houses very far from the dumpsite have high rental value and high households' number. Thus, this lead to higher quantity of solid waste been generated and disposed by the household. On the other hand, houses very close to the dumpsite are of low standard and of low rental value. The houses are been occupied by low number of households that generate low quantity of solid waste and thus disposed low quantity of solid waste. At Ijeshatedo, 34.7%, 22.7%, 14.7% and 25.3% of the respondents were recorded. At Iwaya, 36.6%, 22.6%, 12.9%, and 23.7% of respondents were estimated while at Amukoko, 35.4%, 22.6%, 14.6% and 25.2% were estimated. Table 1 give details. By using the one way analysis of variance (ANOVA), it was conclude that there are statistical significant variations in the distance of dumpsite and solid waste generation and disposal in the study area($F= 0.930$, $P< 0.05$).

Table 1: Distance of Dumpsite

Respondent Location	Options	Frequency	Percent (%)
Ijeshatedo	Less than 1km	26	34.7
	Ikm-2km	17	22.7
	2km-3km	11	14.7
	3km above	19	25.3
	missing	2	2.7
	Total	75	100
Iwaya	Less than 1km	34	36.6
	Ikm-2km	21	22.6
	2km-3km	12	12.9
	3km above	22	23.7
	missing	4	4.3
	Total	92	100
Amukoko	Less than 1km	80	35.4
	Ikm-2km	51	22.6
	2km-3km	33	14.6
	3km above	57	25.2
	missing	5	2.2
	Total	226	100
	Average total	394	

Table 2.ANOVA Testing of Distance of Dumpsite

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	-.004	.044	-.087	.930
	Spearman Correlation	-.004	.050	-.087	.931(c)
Interval by Interval	Pearson's R	-.007	.050	-.130	.897(c)
N of Valid Cases		394			

a Not assuming the null hypothesis.

b Using the asymptotic standard error assuming the null hypothesis.

c Based on normal approximation.

Inter-Relationship between Monthly Income and Method of Solid Waste Disposal

According to the information gathered from the households through the questionnaire administration, it was noted that there is a strong relationship between monthly income and the amount of solid waste generated and disposed. It was noted that households' heads that have high monthly income consume more households' products and thus, generate more solid waste and dispose more of it. In this view, they practised effective ways of waste disposal such as making use of the plastic container provided by Lagos State Waste Management Authority (LAWMA). On the other hand, households' head with moderate or low income generate low quantity of solid waste and disposed low quantity of solid waste. The low income earners practiced more of open dump method, burning and the use of nylon as means of solid waste disposal. Table 3 gives details on the percentage of respondents methods of waste disposal based on their income. By using the one way analysis of variance (ANOVA), it was conclude that there are statistical significant variations in the monthly income and method of solid waste disposal in the study area (F=0.760, P < 0.05) (See Table 3).

Table 3: Cross Tabulation of Inter-relationship between Monthly Income and Method of Solid Waste Disposal

Method of solid waste	Monthly income									
	5,000		6,000-10,000		11,000-20,000		21,000-30,000		31,000 and above	
Open dump method	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency
	0	0	0	0	20.9	14	14.5	12	0.0	0
Packed inside sacks for collection	33.3	13	23.9	16	38.8	26	30.1	25	26.1	36
Burning	0.0	0	0	0	22.4	15	15.7	13	21.0	29
Incineration	0	0	17.9	12	0.0	0	0.0	0	0.0	0
Waste Management Authority	66.7	26	58.2	39	17.9	12	39.8	33	52.9	73
Total	100	39	100	67	100	67	100	83	100	138

Table 4: ANOVA Testing of the Correlation Between Monthly Income and Method of Solid Waste Disposal.

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-b	.013	.041	.306	.760
	Spearman Correlation	.016	.050	.324	.746(c)
Interval by Interval	Pearson's R	-.037	.048	-.724	.469(c)
N of Valid Cases		394			

a Not assuming the null hypothesis.

b Using the asymptotic standard error assuming the null hypothesis.

c Based on normal approximation.

Inter-Relationship between Components of Solid Waste on Land Uses

Also, different residential land uses in the area determined the components of waste generated and disposal at the study area of the research work. It was however noted that residential land uses dominated most of the study areas and this gives room for the generation and disposal of solid wastes. In view of this, components of waste generated by residential land use include papers, plastic can empty plastic bottles, remain of recharge cards, cigarette butt and others. Land use

such as mixed land use generates solid waste components such as dead animals, leaves, rags, shoes, food materials and others. These also determine the waste disposed at the end of the day. The percentage of waste components generated and disposed across the study areas are represented in table 5. By using the chi- square, the study inferentially indicated that there are no significant differences in the components of solid waste on land use in the study area. ($x^2 = 0.769, p > 0.05$) Table 5 give details.

Table 5: Cross Tabulation of Inter-relationship between Components of Solid Waste on Land Uses.

	Components of solid waste									
Options	Empty plastic bottle		Plastic cans		papers		dead animals		Remain of recharge cards	
(land uses)	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency	Percent (%)	Frequency
Residential	10.7	41	15.2	47	16.5	100	10.9	54	25.6	63
commercial	2.3	7	2.3	8	2.5	18	3.0	10	3.3	11
Educational	0	2	1.0	2	0.8	4	0.3	2	1.3	2
mixed	0.5	3	1.3	4	2.8	8	1.3	4	2.5	5
Total	13.5	53	19.8	61	22.6	129	15.5	70	32.7	81

CONCLUSION AND RECOMMENDATIONS

In order to achieve sustainable solid waste management and disposal, there is need for proper location of dumpsites with a view to controlling its effects on the environment. This can be achieved if the government and the community should revisit and enact laws regarding the locations of dumpsites. These laws should include the location of dumpsites which are well fenced in and away from human settlements. The law should also make provision for proper follow up and maintenance of the dumpsites to avoid pollution on the environment and health hazards. Also, government should ensure proper and effective ways of caring out monthly environmental sanitation in slum areas of Lagos state in order to make a lot of urban dwellers become more conscious of the purity of their surroundings. This will enable the dwellers to adopt modern waste management technology that could help correct the negative attitude of citizens towards waste disposal and management. Also, there should be enactment of waste management laws with stiffer penalties on offenders to ensure compliance. The state government should make provision of near-by solid waste collection points with segregation facilities to enhance easy collection and disposal of solid wastes from households. Also, establishment of solid waste recycling plants to reduce the quantity of solid wastes generated. More so, effective monitoring of waste contractors to ensure that their performance is up to expectation. Provision of more waste evacuation equipment and maintenance of existing ones, more landfill sites for disposal of biodegradable solid wastes, provision of incinerators for conversion of solid wastes into ash, conduction of town hall meetings to educate members of the public on proper solid management. There is also need for the implementation and monitoring of Nigeria's National Environmental Sanitation

Policy (NNESP) of 2005, which is the most recent policy that specifically addresses excreta and sewage management at both the state and local government. This can be achieved though Public enlightenment campaign on regular basis so that the residents will know the importance of good living conditions to their health and economy of the nation in general. More so, developing appropriate funding schemes for slum improvement and sanitation should be put in place. Education and Enlightenment or sensitization programs should be intensified and brought down to the grass root. Proper education on the hazards of the indiscriminate disposal of refuse should be made available in consonance with an action plan in order to monitor and control waste expected in the study area. There should also be a room for international co-operation towards achieving the action plans. Expanding recycling programmes through the activities of scavengers among others (Waste-to-wealth) with Land fills management and control is also very important. Waste-to-energy programs can be generated through the land fills (Generation of Methane Gas). There is an urgent need for well trained staff, vehicles, trucks, tipper, pay loaders, bulldozer and road sweeper, which must be backed up with well stocked maintenance store provided for spare parts for all equipment. This study also emphasised a need for an organised refuse collection both from households. There must be a disposal site in each street and avenue nearest to the sources of waste, which must be accessible by everyone and the collection should be daily and regularly. The support of private sector and NGO's is also required most especially in the area of organising maintenance workshops and enlightened programme, which should include grassroots participation and input.

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