International Journal of Advanced Research in Public Policy, Social Development and Enterprise Studies
p-ISSN: 2536-6548 | e-ISSN: 2536-6556

IJARPPSDES

June, 2021
Vol. 4, No. 2

Assessment of Community Participation in Solid Waste Management in Selected Slum Settlements of Jos Town, Plateau State, Nigeria

[1]Mailumo Anthony Sambo, [2]Moris Dabuahat Wetnwan, [3]Peter Musa Wash & [4]Dave Gyang Bott
[1,2,3&4]Department of Urban and Regional Planning, Plateau State Polytechnic, Barkin Ladi

Article DOI:
10.48028/iiprds/ijarppsdes.v4.i2.10

Keywords:
Assessment, Community participation, Solid waste management, Settlements

Corresponding Author:
Mailumo Anthony Sambo

Abstract

A common challenge of all globalizing cities is the rapid generation of waste through households, industrial and commercial activities. Expired materials that have no useful value or materials that have outlived their life spans, unwanted substances, scraps that await disposal or recycling, remain a source of environmental degradation and threat to cities worldwide. This study is aimed at assessing the extent of community participation in solid waste management. To achieve the above stated aim the following objectives will be followed; to ascertain the major sources of solid waste, to examine the present-day solid waste management practices and to appraise the level of awareness and attitude towards community participation in solid waste management. The data used in this study were drawn from primary and secondary sources. A random sampling technique was used to select respondents to be administered questionnaires and also to select the three communities within Jos North L.G.A. to serve as study areas. The findings reveal that the communities still practice old/unacceptable methods of waste management techniques, 76(38%) respondents practice open dumping, 60 (30%) respondents dump waste in the streams/rivers and drainages and 52 (26%) respondents practice open burning. There is no organised collection facility for the residents to disposed their wastes. 90 respondents Emphasis should be targeted to promote sustainable alternative approaches of managing solid waste such as composting and recycling, this will also contribute to enhanced urban agriculture as well as income generation. Community waste management fund should be established for purposes of meeting some of the Solid Waste Management costs such as the provision of basic facilities for collection and storage.

Background of the Study

A common challenge of all globalizing cities is the rapid generation of waste through households, industrial and commercial activities. Expired materials that have no useful value or materials that have outlived their life spans, unwanted substances, scraps that await disposal or recycling, remain a source of environmental degradation and threat to cities worldwide (Ibrahim, Oluwagbemiga, and Adeolu, 2014). In the developing countries of the world, poor waste management have become a menace that threatens livelihoods. The slums and open dump- sites of Sub- Saharan African countries have continually served to illustrate the short- and medium-term effects of ineffective waste management systems. In Nigeria, 25 million metric tonnes of solid wastes are generated yearly. Lagos, the most populous megacity in sub-Saharan Africa, generates between 3.1 million and 4 million tonnes of waste annually (Ogwueleka, 2011). Managing solid waste is one of the costliest urban services, which typically absorbs up to 1% of gross national product (GNP) and 20%–40% of municipal revenues in developing countries.

According to Temidayo (2019), 'Nigeria is increasingly experiencing environmental threats because of the ineffective waste management measures that have been adopted over the years. The fact that there are a different kind of wastes and the existence of specialized waste management techniques that could be tailored towards each kind of waste have made waste management more complex in the developing countries. Solid waste generated in many cities in Nigeria is composed of organic materials, plastics/polythene, cans/metals, bottles/glasses, clothes/shoes, and ceramics. Household waste have been found to also contain hazardous and toxic waste such as expired drugs, dried cells, broken class, syringes which constitute serious environmental and health hazards Kaoje, Sabir, Yusuf, Jimoh, and Raji (2017).

Okoye (2004) identified household size, income level, level of technological advancement and socio-economic status as factors that affect the quantity of solid waste generation, but however, noted that a single factor may not on its own constitutes a difference in the quantity of waste generated by a household. (Adeniyi, 2014), in a study of waste generation in Oyo State, Nigeria, discovered that as education, income and social status increase, per capita waste generation declines. This, he explained is partly influenced by the differences in employment/livelihood pattern in the area. On the main cause of solid waste crises in Nigeria, (Adeniyi, 2014) identify the problems of insufficient available data, funding, poor understanding of solid waste management and residents 'attitude. It is worthy to note that Lagos and Kano are the most populous states in Nigeria by 2006 National population Census. Population growth, increasing urbanization, changes in consumption pattern, and rapid developments in technology have all contributed to an increase in demand for goods and services which lead to introduction of different products to meet up with consumer need and demand(Kaoje et al., 2017).

Statement of Problem

It is widely acknowledged that the management of solid waste is a worldwide problem. This problem is more conspicuous in developing countries such as Nigeria where solid waste management is a main concern. Ebikapade and Jim, 2017observed that solid waste creates a major problem in many developing countries.

In Nigeria, several policies and programmes have been launched to manage municipal waste. However, these policies and programmes have proven very ineffective. Although every state in the federation has an Agency saddled with the responsibility of waste management in its capital city, it would appear that the rate at which solid waste is generated out-matches the rate at which it is cleared and disposed of (Abuja-Citi serve, 2004). The 1999 constitution as amended empowers the Local government councils to collect and dispose wastes in the cities (Nigeria, 1999). In contemporary years, there has been a remarkable increase in the volume of wastes generated every day in Nigeria. This is due to causes which include growth in population, increasing urbanization, industrialization and economic growth. In addition, several urban areas of Nigeria lack operational waste management systems. As a result, most urban homes' resort to the haphazard dumping, burning and/or burying of solid wastes. Ebikapade and Jim(2017) observes that the problem connected with waste management in Nigeria does not seem to be a problem of absence of legislative charter for waste management but other influences have been identified as being responsible for penetrating the crises experienced in the management of waste in Nigeria. He highlighted these other factors as: Lack of adequate funding and excessive population, Insufficient trained professional waste managers, deficiency of effective monitoring and control and uniqueness of the Nigerians' attitude (government - does - everything). Numerous factors are itemized as the challenges fronting solid waste management in diverse cities across Nigeria. Some of these factors are; insufficient environmental policies and legislation, level of environmental awareness and public enlightenment is low, funding is poor, unsuitable technology and insufficient facilities, politics and corruption, haphazard developments and population increase amongst others (Ebikapade and Jim, 2017).

In most settlements across Jos North Local Government Area there is persistent littering of surrounding with household waste and other construction wreckages in a manner best described as “throw it where you like” that now resulted to piles of refuse seen inslum settlements within the city. This problem needs to be addressed and on this background the study was conducted to determine the public opinion and perception on solid waste disposal processes in the selected settlements and to see whether the littering is related to the perception of the people of Jos residents. Angwan Rukuba, Angwan Soya and Jenta Adamu where selected as the case study. This study is aimed at assessing the extent of community participation in solid waste management. To achieve the above stated aim the following objectives will be; to ascertain the major sources of solid waste, to examine the present-day solid waste management practices, to appraise the level of awareness and attitude towards community participation in solid waste management.

Concept of Waste Management

Festus and Omoboye (2015), state that wastes are materials or substances that are either spoiled, rejected or no longer required for their original purpose. This implies that any surplus unwanted material that is worn out, broken or contaminated is waste. However, the Nigerian Environmental Society (Undated) defines waste as "any material that lacks utility or an object or substance that the owner or generator voluntarily or involuntarily relinquishes ownership". The researcher therefore adopts the definition by the Nigerian Environmental Society. (Igbinomwanhia, 2011) defined waste management as 'a process whereby strategic combination of methods is employed to efficiently regulate waste from the source of generation up to the final disposal point with the aim of maintaining a perpetually safe and healthy environment at minimal cost'.

The Wikipedia Web Encyclopedia (2010) defines waste management as the collection, transport, processing, recycling or disposal and monitoring of waste materials. According to Atsegbua (2013), waste management does not just end at collection, transporting processing, recycling or disposal and monitoring of wastes materials but refers to the collection, keeping, treatment and disposal of wastes in such a way as to render then harmless to human and animal life, the ecology and environment generally. In other words, the primary aim of managing wastes is for the safety of human, animal, ecology and environment.

Concept of Community Participation

Community participation is a concept that is pregnant with meanings as a result of its wide applicability. Drawing from several sources in which community participation has been defined, Daramola (2017) defines it as the process by which people living in the same locality are enabled to become actively and genuinely involved in defining issues of concern to them, in making decisions about factors that affect their lives, and in formulating and implementing policies that can bring about positive change in their environment.

This indicates that community participation is the sociological process by which residents organize themselves and become involved at the level of a living area to improve the conditions of daily life. In other words, it is the financial, physical or social involvement of the people in a community in certain projects undertaken to solve their own problems (Musa and Ifatimehin, 2011). It is a process in which community members are involved at different stages of the project cycle with the objective to build the capacity of the community to maintain services created during the project. Its functions range from project design and implementation to evaluation, reflection of community needs and motivation of the community into maintaining and operating project while increasing capabilities at the community level (Moningka, 2000). Community participation means the involvement of people from the earliest stages of the development process as opposed to simply asking their opinion of project proposals that have been developed or for their contribution to the implementation of projects imposed on the community from outside. It emphasizes the implementation of programmes as well as in all the activities that

concern their welfare. The aim, therefore, is to involve all members of a society in a participatory process of assessing their own knowledge, investigating their own environmental situation, visualizing a different future, analyzing constraints on change, planning for change, and implementing change (Daramola, 2017).

Table 1: Sources, Producers and Types of solid waste

Source	Typical producers	Types of material
Residential	Single and multifamily dwellings	Food, paper, cardboard, plastics, textiles, leather, yard waste, wood, glass, metals, ash, household hazardous wastes e.g. gas tanks, waste containing mercury, motor oil, e-waste e.g. computers, phones
Industrial	Light/heavy manufacturing, fabrication, power/chemical plants	Packaging, food wastes, hazardous wastes, ashes
Commercial	Stores, hotels, restaurants, markets, office buildings	Paper, cardboard, plastics, wood, food wastes, glass, metals, hazardous wastes, e-wastes
Institutional	Schools, hospitals (non-medical wastes), prisons, government buildings	Similar to commercial
Construction and Demolition	New construction sites, road repairs, renovation sites, demolition	Wood, steel, concrete, dirt, bricks, tiles
Medical waste	Hospitals, nursing homes, clinics	Infectious wastes (e.g. bandages, gloves, swabs, blood and body fluids) Hazardous wastes (e.g. sharp instruments, chemicals) Radioactive waste from cancer therapies, pharmaceutical waste
Agricultural	Crops, orchards, vineyards, diaries, farms	Spoiled food waste, agricultural waste (e.g. rice husks, cotton stalks, coconut shells, coffee waste) Hazardous wastes (e.g. pesticides)
Other wastes	Street cleaning, landscaping, parks, beaches, wastewater treatment plants	wide range of materials depending on source

Source: (Yakubu, 2017).

The waste hierarchy and the importance of waste prevention

This waste hierarchy is used worldwide as the best option for managing waste based on the principles of sustainability.

Figure 1: Waste management hierarchy Owusu-Sekyere, Twumasi, and Wedoma, (2017).

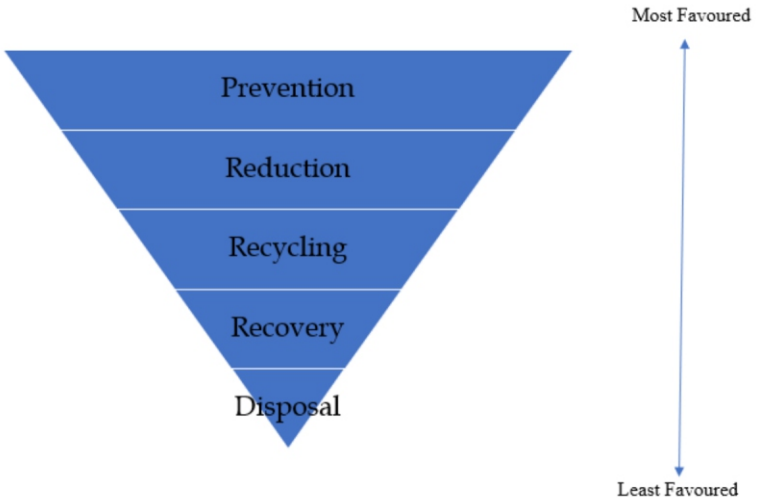


Table 2: How Long Does It Take to Decompose

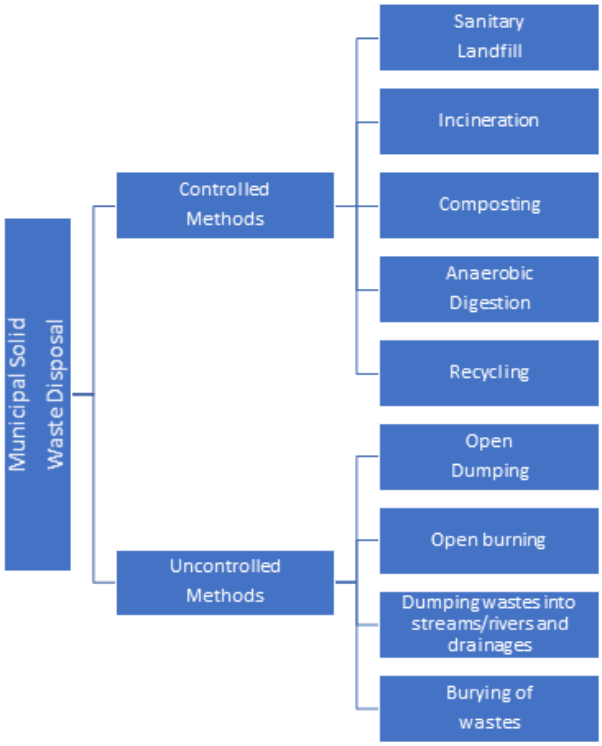
Paper towel 2-4 weeks	Plastic bag 10-20years
Newspaper 6 weeks	Plastic film container 20-30 years
Apple core 2 months	Tin can 50 years
Waxed milk carton 3 months	Rubber boot sole 50-80 years
Plywood 1-3 years	Styrofoam plastic cup 50 years
Wool sock 1-5 years	Aluminum can 80-200 years
Cigarette butt 1-5 years	Disposal diaper 450 years
	Plastic beverage bottle 450 years
	Monofilament fishing line 600 years
	Glass bottle 1 million years

Source: EPA, 2013a

Municipal solid waste management options

There are two ways of managing municipal solid waste, controlled or uncontrolled.

Figure 2: Controlled and uncontrolled management methods (Adopted from Yakubu, 2017)



The Study Area/Method of Data Collection

Jos North Local Government is the capital of Plateau State and located in the north central of Nigeria, regrettably this tier of government is not technically and monetarily placed to implement its constitutional obligation of managing solid waste at the local government area. Where some slight determinations are put in place, it is characterized by the use of unsuitable technology, insufficient collection of solid waste. The data used in this study were drawn from primary and secondary sources. "In selecting the respondents, a combination of simple random sampling and systematic sampling was employed. Random sampling was used to select streets while systematic sampling was used to select households and shops" A random sampling technique was used to select respondents to be administered questionnaires in the study areas also random sampling technique was used to select slum communities within Jos North L.G.A. to serve as study areas. Jos North, the capital of Plateau State was divided into several slum communities that made up the town namely: Angwan Rukuba, Angwan Rogo, Jenta Adamu, Tudun Wada, Gangare, Rikkos, Angwan Suya amongst others. Three communities of Angwan Rukuba, Jenta Adamu and Angwan Soya were randomly selected for this study.

A total of 240 questionnaires were administered on respondents in the three communities (Angwan Rukuba 80, Jenta Adamu 80 and Angwan Soya 80 and 72, 63 and 64 questionnaires were retrieved in that order.

Research assistants were drawn from the settlements selected for the study and adequately trained to ensure adequacy and accuracy of the information to be collected during the questionnaire administration after which they were posted to administer the questionnaires on the respondents. Data collected was entered into and analyzed using Statistical Package for the Social Science (SPSS). The results were presented in tabular forms.

Data Presentation and Analysis

Table 3: Main type of solid waste generated by your household

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
What is the main type of solid waste generated by your household	Leather, vegetable and food remains	26	21	17	64
	textiles, ash, leaves/grass	4	1	2	7
	paper/cartons, plastics & polythene, bottles & glass, tins & metals	5	11	8	24
	1 & 3	11	17	17	45
	2&3	10	6	0	16
	1,2&3	16	7	20	43
Total		72	63	64	199

Source: Field Survey, 2021

The table above depicts the main sources of solid waste generation within the communities as given by 64(32%) respondents with leather, vegetable and food remains being the major source followed by 1 & 3 as given by 45 (23%) respondents.

Table 4: Disposal of wastes after collection/storage

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
How do you dispose wastes after collection/storage	open burning	13	21	18	52
	community collection points	4	4	2	10
	Streams, rivers and drains	29	12	19	60
	open dumpsites	26	26	24	76
	composting	0	0	1	1
Total		72	63	64	199

Source: Field Survey, 2021

The table above depicts that the communities still practices old/unacceptable methods of waste management techniques, 76 (38%) respondents practice open dumping, 60 (30%) respondents dump waste in the streams/rivers and drainages and 52 (26%) respondents practice open burning. This method is considered naive, illegal and dangerous, as it has negative influences on the environment, society and public health

Table 5: What is the distance from your home to the collection point

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
What is the distance from your home to the collection point	less than 100 meters	50	33	44	127
	100-300 meters	11	16	4	31
	301-500 meters	9	9	8	26
	more than 500 meters	2	4	8	14
Total		72	62	64	198

Source: Field Survey, 2021

The table above depicts that 71 (36%) respondents within the communities still travel more than 100 meters to dispose solid waste which is not proper.

Table 6: Solid waste collection facility

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Who provided the collection facility	community	24	22	22	68
	local government	4	1	6	11
	NGO	4	2	1	7
	No body it is an open space	40	38	35	113
Total		72	63	64	199

Source: Field Survey, 2021

The table above depicts that 113 (57%) respondents dumps their waste in open space provided by anybody 68 (34%) respondents dumps their waste in space provided by the community. The government at both the state and local government level is doing very little in the area of waste management in these communities as depicted by the table above. There is no organised collection facility for the residents to disposed their wastes

Table 7: Participation through cash and in kind is necessary because local government has no enough funds to cater for the whole cost of solid waste management

		Community Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Participation through cash and in kind is necessary because local government has no enough funds to cater for the whole cost of solid waste management	strongly disagree	6	4	2	12
	disagree	4	1	7	12
	undecided	3	18	8	29
	agree	32	30	28	90
	strongly agree	25	10	19	54
Total		70	63	64	197

Source: Field Survey, 2021

The table above depicts that 90 (46%) respondents agree to participate in cash and in kind 54 respondents (27%) strongly agree to participate in cash and in kind towards managing solid waste within their communities.

Table 8: Solid waste Management is not of Immediate Priority

		Community Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Solid waste management is not of immediate priority	strongly disagree	23	11	19	53
	disagree	32	13	25	70
	undecided	8	13	6	27
	agree	4	17	8	29
	strongly agree	3	9	5	17
Total		70	63	63	196

Source: Field Survey, 2021

The table above depicts that 123(63%) of the respondents agrees that solid waste management is of immediate priority to the community.

Table 9: Do you separate solid waste into organic and inorganic components before disposal

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Do you separate solid waste into organic and inorganic components before disposal	Yes, I do separate	13	21	10	44
	No, I do not separate	59	39	51	149
	4.00	0	3	3	6
Total		72	63	64	199

Source: Field Survey, 2021

The table above depicts that 44(22%) of the respondents separates their wastes before disposal while 149 (75%) respondents do not separate their wastes before disposal.

Table 10: Community members sometimes do not contribute their views when meetings are conducted as leaders and few influential individuals usually dominates the discussion

		Community			
		Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Community members sometimes do not contribute their views when meetings are conducted as leaders and few influential individuals usually dominates the discussion	strongly disagree	7	5	6	18
	disagree	14	11	8	33
	undecided	7	16	10	33
	agree	28	17	28	73
	strongly agree	14	14	12	40
Total		70	63	64	197

Source: Field Survey, 2021

The table above depicts that 113 (57%) of the respondents do not contribute their quota during meetings because of intimidation.

Table 11: Concept of community participation in solid waste management

		Community Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Do you know the concept of community participation in solid waste management	yes, i know	31	26	35	92
	no, i do not know	39	36	29	104
	4.00	1	0	0	1
	6.00	1	0	0	1
Total		72	62	64	198

Source: Field Survey, 2021

The table above depicts that 104 (53%) of the respondents are not knowledgeable about community participation in solid waste management within the communities.

Table 12: Solid waste management should not be paid for by residents

		Community Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Solid waste management should not be paid for by residents	strongly disagree	6	1	5	12
	agree	6	6	15	27
	undecided	7	18	9	34
	agree	31	26	20	77
	strongly agree	13	10	15	38
Total		63	61	64	188

Source: Field Survey, 2021

The table above depicts that 115(61%) of the respondents in the three communities are in support of residents not paying for the waste they generate to be managed, this contradict table 7

Table 13: Those who dump refuse indiscriminately should be made to pay fine

		Community Angwan Rukuba	Jenta Adamu	Angwan Soya	Total
Those who dump refuse indiscriminately should be made to pay fine	strongly disagree	4	4	0	8
	disagree	1	1	9	11
	undecided	3	4	0	7
	agree	23	18	14	55
	strongly agree	39	36	41	116
Total		70	63	64	197

Source: Field Survey, 2021

The table above depicts that 171 (87%) of the respondents are in support that anyone who dumps waste indiscriminately should be fined.

Discussion of Results

In this research, probability and non-probability sampling techniques were used to collect data. Two hundred and forty questionnaires were systematically shared among residents in the study areas. One hundred and ninety-nine of the questionnaires were retrieved from the respondents in the three communities. These constitute the main data used in this analysis. The main sources of solid waste generation within the communities as given by 64 (32%) respondents with leather, vegetable and food remains being the major source followed by 1 & 3 as given by 45 (23%) respondents. The communities still practice old/unacceptable methods of waste management techniques, 76 (38%) respondents practice open dumping, 60 (30%) respondents dump waste in the streams/rivers and drainages and 52 (26%) respondents practice open burning.71 (36%) respondents within the communities still travel more than 100 meters to dispose solid waste which is not proper.113 (57%) respondents dump their waste in open space provided by nobody 68 (34%) respondents dump their waste in space provided by the community. The government at both the state and local government level are doing very little in the area of waste management in these communities. There is no organised collection facility for the residents to disposed their wastes. 90 (46%) respondents agree to participate in cash and in kind 54 (27%) respondents strongly agree to participate in cash and in kind towards managing solid waste within their communities.123 (63%) of the respondents agrees that solid waste management is of immediate priority to the community.44 of the respondents separates their wastes before disposal while 149 (75%) respondents do not separate their wastes before disposal.113 (57%) of the respondents do not contribute their quota during meetings because of intimidation. 104 (53%) of the respondents are not knowledgeable about community participation in solid waste management within the communities. 115 (61%) of the respondents in the three communities are in support of residents not paying for the waste they generate to be managed, this contradict table 7.171 (87%) of the respondents are in support that anyone who dumps waste indiscriminately should be fined.

It was a taboo to waste anything that cost money in Nigeria. So there was reuse culture that have been planted into Nigerians indigenously. Every item used were structured for reuse.

Recommendations

Based on the study findings the following recommendations are pertinent:

(i) Efforts should be directed towards educating and sensitizing community members about their role in Solid Waste Management activities. This will enhance their participation in Solid Waste Management matters.

(ii) Mediums such as the use of loud speakers, announcement in places of worships (churches and mosques), cultural meetings, house to house visitations by the community leaders, community face book page in addition to the text messages

sent to the household heads should be used to create awareness among community members on community participation in solid waste management.

(iii) Community waste management fund should be established for purposes of meeting some of the Solid Waste Management costs such as the provision of basic facilities for collection and storage.

(iv) A strong link /liaison between the community and local government authorities should be encouraged for purposes of enhancing community participation in Solid Waste Management.

(v) Emphasis should be targeted to promote sustainable alternative approaches of managing solid waste such as composting and recycling through use of site-specific groups. This will also contribute to enhanced urban agriculture as well as income generation.

(vi) The return of "Duba Gari" (Sanitation Inspectors)

(vii) Everybody must be made personally responsible for dealing with the waste they generate, failure to do so should attract penalty.

(viii) A quarterly meeting of the stakeholders in solid waste management would provide an ideal forum to air issues, deal with complaints and seek consensus on problems facing the scheme as a whole.

(ix) Refuse collection points should be provided within service radius of 50 meters and waste tricycles should be made available to collect the waste on a daily basis for onward delivery to the dump sites.

(x) Reward should be introduce for residents who separate their waste before disposal.

References

Abuja-Citi Serve. (2004). *Estimates of waste generation volume and income potential,* Abuja: Nigeria

Adeniyi, T. F. (2014). *Assessment of solid waste management in Samaru Zaria, Nigeria,* Zaria: Ahmadu Bello University.

Atsegbua, L. A. (2013). *Environmental Law in Nigeria, theory and pracice,* Lagos: Ababa.

Daramola, O. (2017). *Community participationin building resilient cities in Nigeria.*

Ebikapade, A. & Jim, B. (2017). Solid waste management trends in Nigeria, *British Journal of Environmental Science*, 25-37.

Environmental Protection Agency. (2013a). *Environmental factoids [Online].* Retrieved from http://www.epa.gov/smm/wastewise/wrr/factoid.htm.

Festus, I. A. & Omoboye, I. A. (2015). Categorization, characterisation, management and future trends of solid wastes in Ado-Ekiti, Nigeria, *Mediterranean Journal of Social Sciences*, 628-638.

Ibrahim, R. A., Oluwagbemiga, E. A., & Adeolu, A. (2014). Municipal household solid waste collection strategies in African Megacity: Analysis of public private partnership performance in Lagos, *Waste Management and Research*, 67-78.

Igbinomwanhia, D. I. (2011). A study of the solid waste chain in Benin metropolis, Nigeria, *Journal of Applied Sciences and Environmental Management*, 589-593.

Kaoje, A. U., Sabir, A. A.,Yusuf, S., Jimoh, A. O. & Raji, M. O. (2017). Residents perception of solid waste disposal practices in Sokoto, Northwest Nigeria, *African Journal of Environmental Scienceand Technology*, 94-102.

Moningka, L. (2000). *Community participationin solid waste management: Factors favouring the sustainability of community participation.* Gouda, The Netherlands.

Musa, S. D. & Ifatimehin, O. O. (2011). *Community participation course guide. A course guide on ESM 206,* Abuja: National Open University of Nigeria.

Nigeria, G. O. (1999). *Nigeria"s constitution,* Abuja: Government of the Federal Republic of Nigeria.

Ogwueleka, T. O. (2011). Municipal solid waste characteristics and management in Nigeria, *Health Science Engineering*, 173-180.

Okoye, P. A. (2004). *Evaluation of domestic solid waste disposal,* Akwa.

Owusu-Sekyere, E., Twumasi A. S. & Wedoma, E. A. (2017). Solid waste generation, planning and projection Wa, Ghana, *UDS International Journal of Development [UDSUD}*, 45-63.

Serve, A. C. (2004). *Estimates of waste generation volume and income potential,* Abuja.

Temidayo, O. (2019). *Potentials for improved inorganic waste managementoptions in Lagos,* Lagos, Nigeria: Norwegian University of Life Sciences.

Yakubu, A. J. (2017). *The waste management system in low income areas of Jos: The challenges and waste reduction opportunities,* Jos: University of Brighton