

RE - EVALUATION OF WASTE MANAGEMENT STRATEGIES IN MINNA FOR SUSTAINABLE CITY DEVELOPMENT IN THE NEW MILLENIUM

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ABSTRACT

One common feature of most urban centres in Nigeria is the gradual conversion of any available open space into refuse dump sites. Solid wastes generation create great havoc to Nigerian cities in terms of aesthetic beauty and functionality. It is a source of perpetual odour in our cities and in many cases it blocks access roads and thereby causes traffic obstructions on our highways. The specific objectives of this study are to examine the various components of solid wastes generation; identify the distribution of wastes dump sites within the area, examine the agencies in charge of solid wastes management in the area and their problems, and to make proposals for a more functional and sustainable public oriented wastes management method for the study area. Based on the observed problems associated with the existing waste management strategies in the study area, appropriate waste management recommendations are advanced to handle the situation.

Keywords: Solid Wastes, Waste Management, Sustainable Development, City Development

INTRODUCTION

One of the most serious problems militating against urban environmental sanitation in Nigeria is the gradual and un - hygienic accumulation of solid wastes on any available open spaces. As observed by (Adedibu, 1983, Okpala, 1986, Ojemudia *et al* 2006, and Kawu *et al*, 2007) visits to any urban area in Nigeria will show a prevalence of uncontrolled refuse heaps in open spaces, streams, channels, roadsides and market places. Several local or municipal governments recognize and accept the responsibility of solid waste management but they are ineffective in carrying out their responsibilities, because of inadequate funding, shortage of technical facilities and expertise are offered at times.

Solid wastes is the most popular and most difficult of all wastes to manage locally (Ogunbiyi, 2001). By its nature, it does not flow, evaporate, diffuse, dissolve, or absorb into the surrounding media. It remains in its place of generation, causes all forms of environmental problems to the area, to the extent that those found on drains remain there, obstructs the free flow of water, and thereby causes flood (Victor, *et al* 2006). Solid waste generation causes great havoc to Nigerian cities in terms of functionality, aesthetics beauty, odour, blockage of drainage channels just to mention a few. One characteristic features common with most major urban centres in Nigeria is highlands of solid wastes blocking access roads within and around the markets, thereby causing traffic obstructions and it is a source of perpetual odour in such places and unpleasant sight to the populace (Victor, *et al* 2006).

Many states have employed refuse disposal boards with varying degree of success. Okpala (1986) has observed that solid waste management involves the systematic administration of activities that provides for the storage, collection, transportation, processing, and disposal of

wastes. The community participation in the context of solid waste management, therefore, would involve the action of a social group occupying a defined geographical area based on their own initiative to improve their lot. It has been observed at different forums that household refuse collection is inefficiently organized and till at present times in most Nigerian towns (NNDP 1975 – 1980, FEPA, 1998). The generation of waste cannot be prevented, as wastes are generated from unavoidable sources, such as domestic or residential, commercial, industrial, agricultural, educational and administrative. In terms of the volume of generation, hazard and management industrial and residential wastes are the most troublesome, due largely to the nature of waste compositions of biodegradable and semi – biodegradable materials (Ibrahim, 2002).

OBJECTIVES OF THE STUDY

The specific objectives of this study are to

- i. Examine the various components of solid waste generation in Minna and its environs.
- ii. Examine the distribution of waste disposal sites and their characteristics in the study area
- iii. Examine solid waste management agencies roles and their problems in the area
- iv. To make proposals for a more functional and public oriented waste management method in Minna.

STATEMENT OF THE PROBLEM

One common feature of most urban centres in Nigeria nowadays is the gradual conversion of any available open area into refuse dump sites. These sites not only obstruct human activities but have become convenient grounds for flies, mosquitoes and other pests that constitute harmful health hazards to human beings (Ojemudia *et al*, 2006). As a result of poor waste management system in many urban areas, some households simply tip their waste into storm water during rains, the after effect of which is the littering of roads, blocking of drains and pollution of streams and rivers (Olatubara, 2008).

Many parts of Minna have remained unplanned, uncontrolled and therefore access to some parts is virtually cumbersome and at times impossible. This makes the collection and the disposal in these areas very impossible assignment to be undertaken. The unsightly heaps of waste affects the sanitary standard of the town causing environmental problems such as pollution of the atmosphere, contamination of ground water and diminishing of aesthetic and economic value of the land. These constitute nuisance to the unfortunate inhabitants in these environments (Mustapha, 2004). There are problems of inadequate waste disposal systems in Minna. Because of ever increase in population, waste faster rate than what the authorities can properly manage or dispose off given the capacities they have.

The Niger State Environmental Protection Agency (NISEPA) takes the responsibility for refuse waste management in Minna and the neighboring environment but with gross reported cases of inefficiency and inability to cope with that responsibility. There are volumes of wastes deposits by individuals and not properly and efficiently managed and disposed off by the authority in charge of the responsibility. As noted by Mustapha (2004) because of the Environmental Sanitation unit and the newly established task force on environment management, at both local and state levels, some improvements have been achieved but the authority still finds it hard to completely rid the streets of refuse waste maybe as a result of operational difficulties like inadequate personnel, equipment, proper research and data

collection and lack of adequate information on the location of refuse bins in relation to sources of waste.

As noted by Okpala (1986), it is practically impossible for the government alone to supply all goods and services for the community or individuals because maintenance of facilities is not free. When people see a problem as theirs, they indicate more interest to work together to resolve the problem. They are not likely to destroy, attack and reject what they have participated in creating, especially at the community level (Okpala, 1986).

The main concern of public participation in solid wastes management for sustainable city development is to plan with the people and not for the people. That is how to involve the public in the collection, transportation and disposal of wastes, what they themselves have generated in their daily activities. The necessity for proper solid wastes collection and disposal stems from the concern that improperly stored or treated wastes can breed and harbour diseases bearing pests such as rats, flies, mosquitoes and thereby endanger public health. Flies from solid wastes can transmit typhoid fever, cholera, dysentery and other illnesses that can endanger human lives.

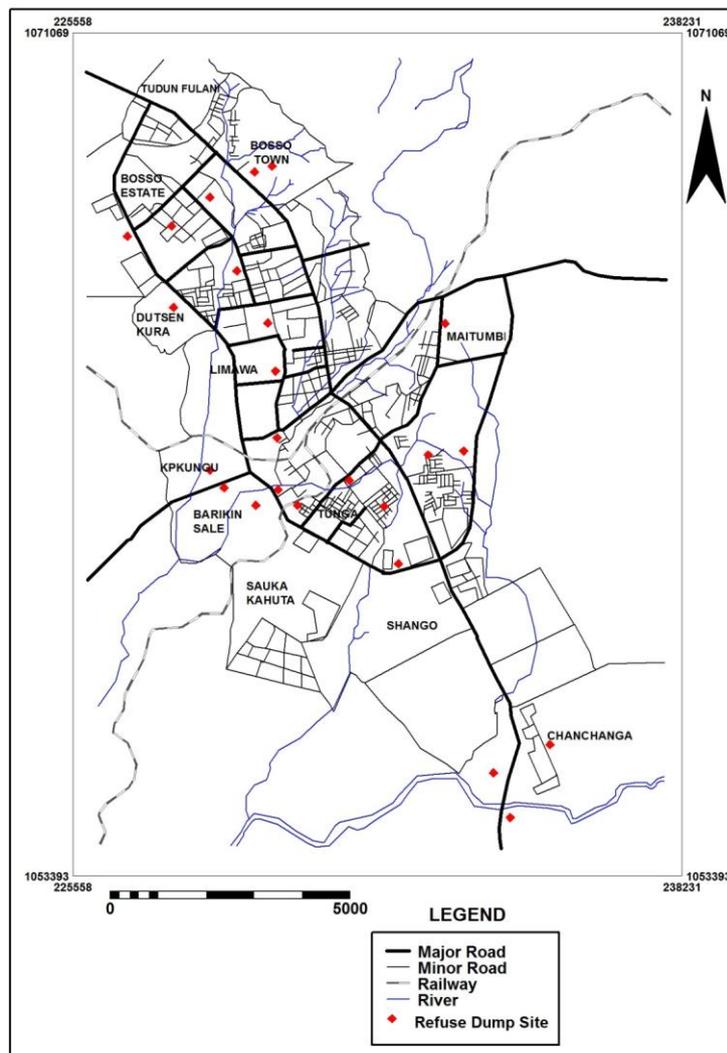


Figure 1: Refuse Dump Sites in Minna and Its Environment

MATERIAL SOURCES AND METHODS

The materials utilized for this study were obtained through primary and secondary sources. The primary data were obtained directly from the field. It entailed all information in the form of photographs and charts collected directly from the field on solid wastes. The secondary data were obtained from indirect sources, in the form of textbooks, maps, newspapers, bulletins, mimeographs, past students' projects, written documents from state ministries and the internet that dwelt on solid wastes management.

Sample Size and Procedure

Minna town is the administrative headquarters of Niger state, divided into twenty - four (24) residential neighborhoods (Owoyele, 2013). Ten (10) residential neighborhoods were investigated, they are Bosso, Tayi Village, Dutsen Kura, Kpakungu, Minna Central, Makera, Maitumbi, Shango, Nasarawa, Chanchaga were randomly selected for the study, and fifty questionnaires each were administered on each of the ten (10) neighborhoods to give 500. Most of the neighborhoods are unplanned settlements with no access roads.

For purposes of data analysis, simple frequencies and percentage frequencies were used, which involved data tabulation obtained from field surveys.

Typology and Solid Wastes Generation in Minna

Waste is defined as any substance which constitutes a scrap material or an effluent, or other unwanted surplus substances arising from the application of any process and any substance or articles, which require to be disposed of as being broken, worn out, contaminated or otherwise spoiled, but does not include a substance which is explosive (The Environmental Protection Act, 1990). Ferguson (1994), therefore, suggests that anything, which is discarded, or otherwise dead, as if it were waste unless the contrary is proved as indicated in Plate 1. This means that a dealer in waste paper maybe able to make valuable materials out of the waste or sell the waste at a profit to others and for that purpose ordinary the waste paper cannot be regarded as waste. Waste is that has been discarded, unwanted, defective or of no value or further use. Thus, Ayuba (2005) defined waste as substances or objects, which are disposed of, or are required to be disposed of according to the provision of a national law. Wastes can further been broken down into refuse, when in solid form and effluents, when in liquid state.

The United States of America Federal Statute on Resource Conservation and Recovery (1976), sees solid waste, as any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant or air-pollution control facility, and other discarded materials. All these including solid, liquid, semi – solid, o contained gaseous material resulting from industrial, commercial, mining and agricultural operations and from community activities, but does not include solid or dissolved materials in irrigation return flows or industrial discharges which are point sources.

The genesis of solid wastes is as old as man's existence on the earth. The industrial revolution, according to Aremu (2002) was characterized by the inventions of power driven machineries, which gave rise to, large – scale production of goods and services in the cities. The quest by individuals to engage in all forms of cottage industry precipitated the rapid growth that caused congestions and exerted pressure on existing facilities within the cities. The consequential massive wastes which was brought about by the concentration of people with improved mode of consumption, that could not be adequately handled by traditional methods of waste management, led to the non-chalet attitude of dumping and accumulation of wastes in towns.

Solid waste which can be categorized into mono-gaseous and non-liquid wastes, results from various human activities like commercial, industrial and domestic engagements and can be disaggregated, according to a survey of waste in Minna, by Kawu *et al* (2007), as dead animals' parts, street sweepings, automobiles debris, industrial wastes and demolition wastes (See table 1).

Table 1. Constituents of Minna Domestic Solid Wastes

<i>Waste types</i>	<i>Frequency</i>	<i>Percentage</i>
Garbage	142	28.4
Ashes	118	23.6
Rubbish and polythene bags	96	19.2
Demolition debris	20	4.0
Industrial wastes	8	1.6
Dead animal parts	3	0.6
Street sweepings	92	18.4
Automobile/electrical parts	21	4.2
<i>Total</i>	<i>500</i>	<i>100.0</i>

Source: Kawu and Shaibu (2007)

Garbage: These are perishable wastes from growing, harvesting preparations, working sales and consumption of food items. Its quantity varies throughout the year, being greater in the rainy season when farm products are in abundance in the markets and constituted (28.4%) of wastes generated in Minna.

Ashes: These are the remains of firewood, charcoal, papers, and rags that are supposed to be properly disposed off in order to sanitize the environment and are very common among the indigenous areas of the area, where natives reside and accounts for (23.6%) of the domestic wastes generated as indicated in table 1.

Rubbish and Polythene Bags: These are perishable wastes products. They consist of combustible and non – combustible substances and constitutes (19.2%) of wastes generated in the study area.

Demolition Wastes: These wastes include timbers pieces, pipes, bricks masonry and other construction materials from razed buildings and other demolished structures are found both in the old and new areas of Minna town, especially in dilapidated building sites, jt accounts for (4.0%) out of the wastes generated.

Industrial Wastes: These are wastes resulting from manufacturing processes and which pose serious concern to the private and public health authorities. These wastes are toxic in nature and could be liquid or solid, in the form of discharge from industry and asbestos wastes which could result to infections. They are commonly found in the industrial areas, streams and rivers that flow within and outside the town.

Dead Animal Parts: Various remains of animal parts are at times found in many areas within the town. These are organic materials that decompose very rapidly and attract flies, emit bad odours and pollute the environment easily.

Street Sweepings: These consist primarily of materials dropped or worn away street surfaces. It constitutes (18.4%) of domestic solid wastes generated in the study area and it includes sweet wrappers, cigarette ends, leaves; pure water leathers and used nylon bags. The improper handling of these wastes usually results into littering of refuse along streets and gutters.

Automobile and Electrical Debris: These are unwanted cars, truck, bicycle, and motorcycles abandoned on public properties or open spaces and it constitutes 4.2% of wastes generated in the area. Solid wastes of these types are commonly found in the study area, especially in the mechanic workshops, where repairs of vehicles are carried out. There are such places in Bosso Estate area, Bahago roundabout area, Maitumbi, Tunga and so on.



Plate 1: Concept of Wastes



Plate 2: Blockage of Drainage Channel in Bosso



Plate 3: Indiscriminate Refuse dumping at back of House



Plate 4: Unkempt Dump site at Rafin-Yasin Minna



Plate 5: Un - evacuated heap of Waste in Jikpan, Minna



Plate 6: Wastes Scavengers at refuse dump site

Waste Generation in Minna

Many activities in Minna generate wastes or act as environmental nuisance like in any other urban area in Nigeria. In recent times, Minna has grown in both population and physical size and this has made the land use pattern to become more complex in nature.

As the land use becomes more complex so does the solid wastes generated increase in volume and variety. Unlike in the surrounding villages where the only significant land use is residential, domestic waste is mostly generated. By contrast the situation in the town is made worst by commercial, institutional, industrial and other land uses, each of which generates its peculiar type of solid wastes, though on very low basis. Residential land use constitutes the single most important generator of solid wastes in the city (Egunjobi 1986), and residential solid wastes is the most difficult to destroy satisfactorily, and most obnoxious because it is commonly accumulated near houses and backyards where it may pose serious health hazards as well as insult to sight and smell.

The socio-economic structure of Minna is a major determinant of the spatial structure of solid waste problem in the town. There is an observed relationship between the locations of the poorer segments of the residents and the number of dump sites in the town. This is why in the traditional hilly and rocky areas of Bosso, Paida, Dutsen-Kura in the town with core areas of poor people, there is a preponderance of high number of illegal refuse dump sites compared to the Government Reservation Areas (GRA) where the high income earners and the well to do individuals reside. It is, therefore, clear that as Minna has grown in population, physical size and complexity of land use over the years, so also is its increase in its refuse generation capacity. The question now is that how have these trends in the city's growth been matched by the development of organizational and management strategies to cope with the wastes generation and disposal capacity in the town.

Data Analysis and Interpretation

The data obtained from the field survey for the study are analyzed as presented below.

Distribution of Disposal Sites and Wastes Management in Minna:

Minna, like most other fast growing urban centres in Nigeria, is faced with perennial problems of wastes management because of the incessant increase in human population into the town since its emergence as the administrative headquarters of Niger State. Niger State Environmental Protection Agency (NISEPA) carries out wastes management in the state.

Solid waste management method in use in Minna is mainly collection of wastes from temporary dump sites and disposal into final dumpsites (land fill sites). There are about twenty three (23) temporary legal dumpsites recognized by the Niger State Environmental Agency (NISEPA) and many illegal temporary dumpsites. Legal dumpsites are located in Tunga, Chanchaga, Bosso, Minna Central, and Kpakungu Areas as indicated in table 2.

In addition to the above dump sites, there are three (3) designated areas as final waste disposal sites (landfill sites) in Gidan - Magoro, Rafi Yasin and landfill site at Top Medical road bye pass. The Agency (NISEPA) provides the necessary technical equipment like Tippers; unskilled workers etc to handle its enormous environmental sanitation work in the study area. The board has many skilled workers and unskilled workers in form of female street sweepers to handle solid waste collection and eventual disposal into final dumpsites.

The survey also showed that the collection of wastes from neighborhoods dump sites to final disposal sites is carried out at least three (3) times a month depending on the availability of resources at disposal of the board. The board also sells dustbins to house owners at affordable prices for the collection of wastes. Such dustbins are kept in front of individual houses for wastes collection while the board unskilled workers move around to collect waste in the dustbins, once a week, at affordable prices.

Table 2: Refuse Dump Sites Locations and Characteristics in Minna and its Environs

Site Names	Location	GPS Values	Area (Ha)	Attributes	Remarks
Tunga Area					
El Amin sites	Maitumbi	233314.98/1064959.71	1.8	No perimeter fence, bushy and unkempt	To be resurfaced
School of midwifery	Tunga	233727.96/1662274.44	0.9	No fence	To be fence with a gate
Top Medical road site	Tunga	232956.94/1062188.10	1.2	No perimeter fence	To be fence and secured
South Gate road site	Tunga	232338,25/1059941.26	1.4	No fence, no gate and unkempt	Provide fence and other necessary facilities
Tunga low cost	Tunga	231318.62/1061662.70	1.0	No defined area	Provide fence
Kasuwa Maje site	Tunga	232044.15/1061147.33	1.3	No defined area	To provide fence
Chanchaga Area					
Chanchaga bridge site	Chanchaga	234638.67/105461.30	1.6	No defined area	To be provided with barbed wire fence
Alaide Junction	Chanchaga	235503.13/1056164.52	1.8	No defined area, dusty and unkempt	To be provided with barbed wire fence
Tunga Goro site	Chanchaga	234328.71/1055544.34	1.3	No boundary limits	To be fenced round
Bosso Area					
Sarki Bosso site	Bosso	229667.01/1068114.78	0.3	Small in size and no fence. It is accessible	Recommended to be fenced round
Area court site	Bosso	229281.79/1068114.78	1.1	No fence and encroached upon. Accessible	To be fenced round
Bosso low cost Site	Bosso	227637.11/1066987.30	0.6	No fence and small in size	To be fenced with barbed wires
Western Bye pass	Bosso	226678.83/1066758.27	1.7	No fence, bushy and unkempt	To be kept clean and fenced
Dutsen Kura Hausa	Dutsen	228969.65/1066062.58	1.3	No fence and encroached upon	To be provided with

site	Kura				perimeter fence
Dutsen Kura Gwari site	Dutsen Kura	227634.65/1065312.62	1.5	Lacked fence	To be fenced round
Bosso Estate by Mypa	Bosso	228426.45/1067610.12	1.2	No fence	To be fenced round
Minna Central Area					
Old Airport road site	Minna	229583.42/1064959.03	0.9	No fence but accessible	To be fenced round
Northern bye pass site	Minna	229799.93/1063975.03	1.8	No defined boundary	To be fenced
Limawa site	Minna	229826.37/1062549.25	1.6	No defined boundary	Recommended for fencing
Kpakugu Area					
Kpakugu fly over	Kpakungu	229842.97/1061489.55	1.5	Lack of fence and defined access	Recommended to be fenced round
Bida road site	Kpakungu	228687.73/1061497.45	2.1	Undefined boundary	To be fenced round
Kpakugu Soje site	Kpakungu	228412.20/1061852.79	1.2	Lack of fence and defined access	To be fenced

Source: Author's Field Survey, 2010.

In addition to the above waste management arrangement, there are also private organizations that are charged with the responsibilities of collecting wastes from individual houses in the study area at the same rate with publicly owned board. This arrangement has not been very commendable as observed by Muhammed (2002) as many residents complain of higher charges for services rendered to them and this consequently has led to low patronage of the private waste collection agencies. It is also observed that much of the work of the private waste agencies is done in the GRA, Federal and state housing estates, along the main roads with little attention given to the interiors where the less privileged persons in the society reside. Waste is most frequently generated in the low income residential neighborhoods than the high income areas because of the population of the former in Minna.

Solid Wastes Generation

Table 3 indicated that 138 (27.6%) of the respondents generated ¼ drums of domestic solid wastes in two days, 163 (32.6%) generated ½ of drums of solid wastes in two days. In addition, 96 (19.2%) respondents said ¾ of drums of solid waste is generated in two days from their houses, while 59 (11.8%) generated a drum and above of solid waste in two days.

Table 3: Domestic Solid Waste Generation in Minna

<i>Refuse Generation</i>	<i>Frequency</i>	<i>%</i>
¼ of drums for every two days	138	27.6
½ of drums in two days	163	32.6
¾ of drums in two days	96	19.2
A drum in two days	59	11.8
Above a drum in two days	44	8.8
Others (specify)	-	-
∑ Total	500	100

Source: Field survey, 2010.

It is also shown in table 4 that a majority of the respondents, 115 (23%) disposed their waste on any available space within their vicinity, 98 (19.6%) of the respondents disposed their waste by burning, while the remaining 68 (13.6%) respondents disposed their solid waste by tipping into streams, 63 (12.6%) throw their waste into the bush and disposal sites.

Table 4. Methods of Waste Disposal in the Study Area

<i>Disposal Methods</i>	<i>Frequency</i>	<i>Percentage</i>
By burning	98	19.6
Open spaces	115	23.0
Tipped	68	13.6
Stream/drainage	105	21.0
Throwing into the bush	63	12.6
Government disposal site	43	8.6
Others (specify)	8	1.6
Total	500	100

Source: Field survey, 2010.

Satisfaction with Disposal Methods

When asked whether the respondents were satisfied with the methods of solid wastes disposal in the study area, there were divergent responses from the respondents. With regards to table 5, only 182 (36.4%) of the respondents were quite satisfied with wastes disposal methods practices in the area, while 92 (18.4%) were fairly satisfied. 207 (41.4%) respondents indicated they were not satisfied with the disposal methods in place, and only 19 (3.8%) did not pass any comment.

Table 5. Satisfaction with Methods of Solid Wastes Disposal

<i>Comments</i>	<i>Frequency</i>	<i>Percentage</i>
Satisfied	92	18.4
Quite satisfied	182	36.4
Dissatisfied	207	41.4
No comment	19	3.8
Total	500	100.0

Source: Field Survey, 2010.

Distance to Refuse Disposal Site and Agencies for Refuse Disposal

The longest distance covered by respondents to disposed their refuse generated, as indicated in table 6, was 200 metres and above with 9 (1.8%), most respondents 203 (40.6%) disposed their refuse at very close distance from their place of abode, while a majority of the respondents covered small distances to disposed their wastes products.

Table 6. Distance to Refuse Disposal Sites in Minna

<i>Distance to Site</i>	<i>Frequency</i>	<i>Percentage</i>
< 50m	203	40.6
50 – 100m	162	32.4
101 – 150m	98	19.6
151 – 200m	28	5.6
> 200m	9	1.8
Total	500	100.0

Source: Field Survey, 2010.

Table 7 indicates that refuse disposal in the study area was mostly through private efforts (43%), 98(19.6%) of the respondents indicated that public agency was in charge of refuse disposal, while 68 (13.6%) was organized by private organizations and 86 (17.2%) was through collective efforts of people in the community.

Table 7. Agencies for Disposal of Solid Waste in Minna

<i>Agencies</i>	<i>Frequency</i>	<i>Percentage</i>
Public	98	19.6
Personal efforts	216	43.2
Private organization	68	13.6
Collective efforts	86	17.2
Others (specify)	32	6.4
<i>Total</i>	<i>500</i>	<i>100.0</i>

Source: Field Survey, 2010.

Availability of Approved Disposal Sites:

The data obtained indicated that there are no approved legal disposal sites around the residence of 393 (79%) respondents, while only 103 (20%) respondents agreed that there were approved disposal sites and 4 (1.0%) declined to give comment.

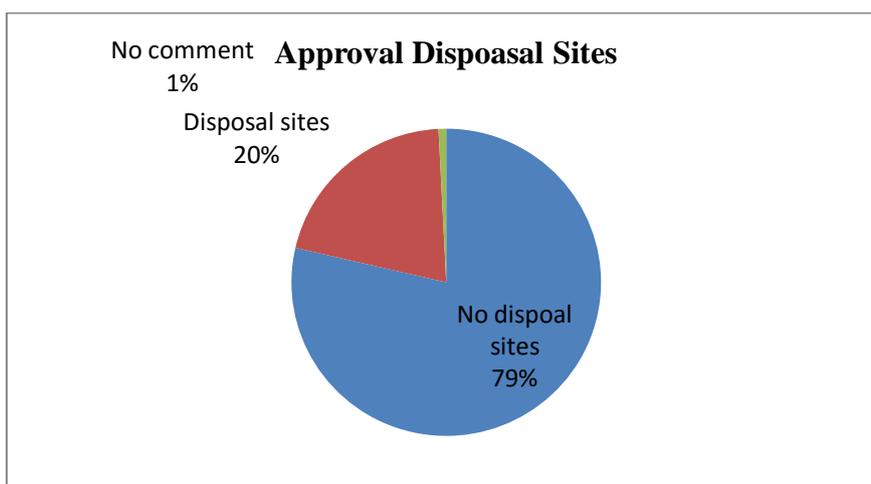


Figure 2: Availability of disposal sites in Minna

Payment of Higher Charges for Effective Disposal for Sustainable Development

The study also seek to know if with higher charges for the disposal of refuse wastes efficiency could be obtained in the management of wastes in the area for sustainable city development. On this note, the data obtained from the study showed that 168 (33.6%) of the respondents indicated intention to pay higher charges for effective refuse disposal, while 293 (58.6%) respondents were not willing to pay higher charges for refuse disposal system. The main reason given by most respondents for not willing to pay higher charges for effective refuse disposal was low financial disposition of the persons concerned and only 39 (7.8%) of the respondents declined to give comment.

Willingness to Patronize Private Refuse Disposal Agencies

On the willingness of respondents to patronize disposal agencies, a total of 280 (55%) respondents interviewed overwhelmingly indicated their readiness to patronize private refuse

disposal agencies, while 165 (33%) respondents showed no interest, and 55 (11%) declined comments.

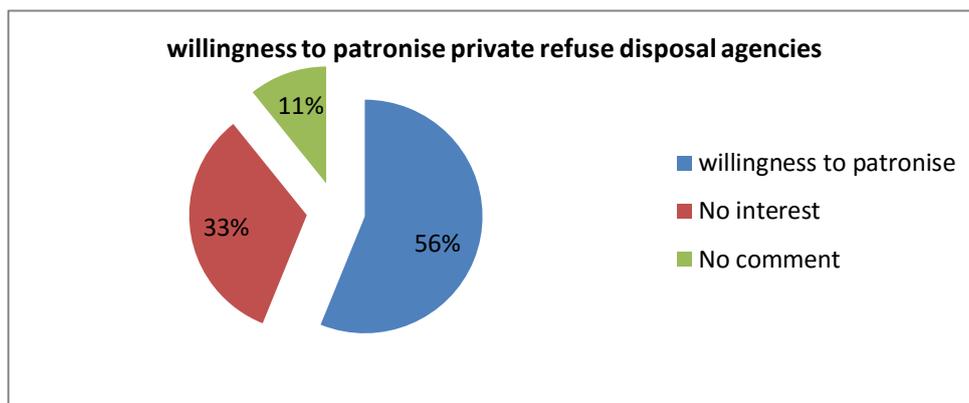


Figure 3: Willingness to patronize private refuse disposal agencies

Public Participation in Wastes Management

The rate of residents’ willingness to participate in community efforts at wastes management in the area was also investigated. From the survey conducted, it was evident that most residents do not participate in management arrangements in the area. A total of 304 (60.8%) of the respondents indicated that they do not come out to participate in domestic solid wastes management, while only 143 (28.6%) indicated that they regularly participate in waste management by clearing their surrounding and drainage on weekly basis and at times burn the wastes. Only an insignificant number of respondents 53 (10.6%) declined comments on the question on rate of participation in waste management in the area.

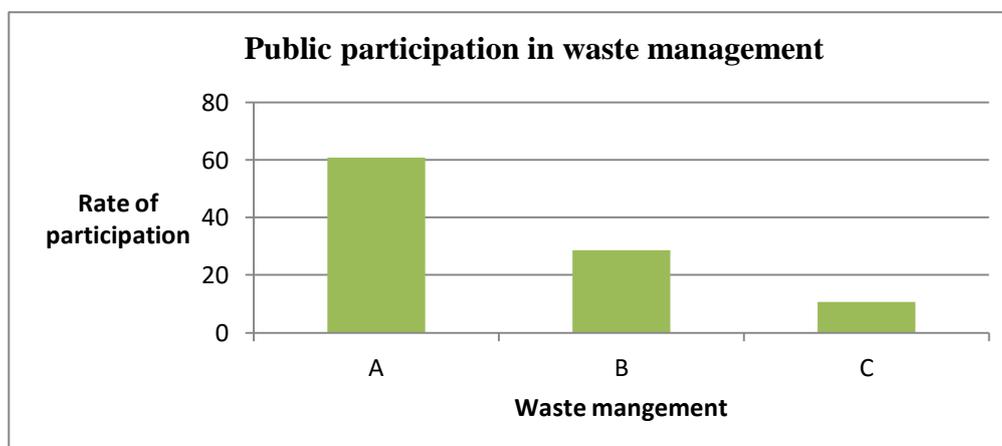


Figure 4: Public Participation in Waste Management in Minna.

IMPROVEMENT IN WASTE MANAGEMENT

The suggestions by the respondents on how to improve waste management in the study area were numerous but virtually all the suggestions were based on; as shown in table 8, (i) the state government and the Niger State Urban Development Board should strengthen the capacity of the sanitation department through the provision of enough funds, modern equipment, modern pay loaders and refuse vans and the provision of dustbins in every house; (ii) the government of Niger state through the Urban Board should employ more skilled and professional workers for the effective management of wastes in the town.

Table 8. Ways to Improve Waste Management in the Area

<i>Improvement methods</i>	<i>Frequency</i>	<i>Percentage</i>
Strengthening the capacity of NISEPA.	295	59
More employment by the government.	165	33
Others(Specify)	40	8
Total	500	100

Source: Field Survey, 2010

SUMMARY OF FINDINGS

- i. The wastes generated are garbage, ashes, rubbish and polythene bags, demolition debris, industrial wastes, dead animal parts, street sweepings and automobile/electrical parts.
- ii. The majority of the residents of Minna and its environs generate on the average a drum of domestic solid waste in two days, and they dispose their solid wastes on available unapproved open spaces around their homes.
- iii. There were no official refuse disposal and collection centres in the study area, and the available illegal collection centres were within working distance from most homes. And in the core of the town, there were cases of inaccessible dump sites, which made collection of wastes very hard, and times impossible.
- iv. It was also established that the domestic solid waste generated were a times deposited in river and stream which consequently polluted water sources in the area.
- iv. The study also indicated that majority of the residents do not want to pay for the collection and disposal of the wastes they generated either by public or private agencies, due to their low financial positions.
- v. Most of the domestic solid wastes disposed off to collection centres, as evidenced from the study, were by personal or collective efforts of the residents and that the impact of the State Environmental Sanitation Board, under Niger State Urban Board has not been felt.
- vi. The study also established that few of the residents 143 (28.6%) out of the 500 residents participate in regular wastes management by sweeping the streets occasionally, while a total of 304 (60.8%) of the residents indicated that they do not really come out to participate in environmental sanitation exercise occasionally.
- vii. The only agency handling the management of domestic solid wastes and its environs is the Niger State Environmental Protection Agency (NISEPA). The board was faced with problems of inadequate sanitation officers; lack of refuse collection and disposal vehicles, lack of chemicals, insufficient working equipment, and not the least, there was low financial support by the state government to the sanitation department.

CONCLUSIONS

As a result of constant increase in the population of the study area, heaps of solid wastes are seen in most parts of the town, which invariably points to the fact of improper management of the resource, as a result of lack of improvement in its collection, transportation and final disposal in appropriate dump sites. The grass root must be effectively educated, sanitized, and mobilized for the central leadership to produce good results. Therefore, the quest for an effective and efficient wastes management policy lead to a search for a comprehensive coordinated planning which if combined with adequate legislation, adequate fiscal allocation, public involvement and awareness would help to improve the quality of the environment of the study area and other towns in the state.

RECOMMENDATIONS

One of the findings of this study is the problem of inadequate sanitary officers.

1. It is recommended, therefore, that more sanitary officers should be employed, by the state government through the Niger State Urban Development Board (NUDB) in charge of the management of waste in the state, who should be exposed to proper training on several methods of handling solid wastes collection and disposal, and also be empowered to engage on house – to – house checking, to bring about the general cleanliness of the environment in the area.
2. Residents should be persuaded to organize and ensure thorough cleaning of their environment every week. The former practice of observing weekly general environmental sanitation should be re – introduced by the state government, with adequate monitoring and supervision to keep our surroundings and streets free of wastes of any sort.
3. The state government should make available on monthly basis adequate funds to the Sanitation Department of the Niger State Urban Board for proper solid waste management in the state capital.
4. The state government, through the assistance of the Federal government and other donor agencies, should engage in the procurement of simple, mechanically operated vehicles for the collection and disposal of solid wastes at designated locations within the study area. It is also recommended that the Vehicles and Equipment Maintenance Department of the Board, well equipped with modern spare parts should be re-energized and the young and able skilled tertiary institutions unemployed graduates in the state and elsewhere should be employed to man the department.
5. Modern sanitary equipment and implements should be made available to the Sanitation Department of the Niger State Urban Development Board (NUDB), to ensure that sufficient number of refuse collection and disposal equipment are operational at any time so that any form of interruption in refuse collection and disposal are minimized.
6. Households' plastic storage bins should be provided by the state Urban Development Board in the front of each house at very affordable price. Communal storage containers should be provided on weekly basis to avoid a situation of waste being seen scattered on the ground, when such containers are filled up.
7. As observed during the study some collection centres, especially in the indigenous core areas were highly inaccessible by vehicles and it is, therefore, recommended that proper physical re - planning of the town, through the Physical Planning Unit of the

Niger State Urban Development Board, is crucial for effective and efficient wastes management exercise.

8. Public awareness about proper environmental sanitation has been a major hindrance to solid waste management in Nigeria and the study area in particular. Therefore, intensive environmental enlightenment campaigns should be organized by both the local and state governments to sensitize the people of the town on the relevance of clean and healthy environment, and the consequential dangers of indiscriminate dumping of refuse and dirty environment to human life.
9. The local government council at the grassroots of local inhabitants should embark on the enforcement of sanitary regulations or bye-laws to discourage street littering and indiscriminate dumping of refuse in unauthorized sites in the town.
10. With regards to proper solid waste management and monitoring of disposal sites much can be achieved through the mass media, the use of information handbills, posters, and the efforts of community sanitary officers. Any person or individuals apprehended dumping refuse at unauthorized dumpsite should be made to face the wrights of the law and appropriate punishment apportioned to serve as deterrent to others in the society.
11. To further bring waste management closer to the people, efforts should be made by the state government to decentralize the sanitation department of the state Urban Board into sub-zonal offices. At present, Minna and its environs is divided into 26 neighbourhoods and it is, therefore, proposed that four (4) zones be created out of the existing (26) geographical units as described below:

Zone A: Tundu Fulani, Bosso Town, Bosso Estate, Tayi Village, Jikpan/Hayan Gwari, Dutsen Kura Hausa and Dutsen Kura Gwari, with head office at Bosso Estate

Zone B: GRA, Anguwa Daji, Nasarawa, Limawa, Fadipe, Sabon Gari, Minna Central and Makera, with head Office at Fadipe
Zone C: Kpakungu, Bariki Sale, Tunga, Maitumbi, Tudun Wada North and Tudun Wada South, and the head office at Tudun Wada North.

Zone D: Army Barracks, Sango, Sauka Kauta, and Chanchaga, with head office at Sango.

The four zonal offices may be centrally controlled at the state level for financial, personnel, administrative directives and all budgetary allocations for effective and efficient waste management.

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