

Appraisal of Solid Waste Management Practices in Enugu City, Nigeria

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Abstract

The study examined solid waste management practices in Enugu city with special interest in the techniques employed by the waste management agency in the state. Data for the study were collected through questionnaire survey, interviews, field inventory and participatory rural appraisal methods. Six locations were purposely selected for this study with a total of 250 respondents. The result of study revealed that the techniques of waste management were inadequate with the use of a central waste collection method and pattern; and that the population of the area produce much more waste than the waste dump sites can accommodate. Based on the findings, it is recommended that a door to door waste collection system be employed and that government should ensure accessibility to homes by constructing roads across the city, it was also suggested that the waste levy on residents in the area be reviewed to an affordable rate and that a community education program be put in place.

Keywords: Waste Management, Appraisal, Waste collection, Waste Disposal, Health Implication, Community Education.

1. INTRODUCTION

In most developing countries, the problems associated with solid waste management are more acute than in the developed countries (Zerbock, 2003). Lack of financial resources and infrastructure to deal with solid waste creates a vicious cycle; lack of resources leads to low quality of service provision which leads to fewer people willing to pay for services, which in turn further erodes the resource base and so on (Kuniyal et al. 1998; Zerbock, 2003). The problem is further complicated by the rapid growth in population and urbanization, which has influenced an increase in the volume of waste being generated and also on waste retrieval/disposal services in municipal areas. However, more often than not, an increase in population is not matched with an equal increase in service and revenue for the local municipalities for waste management (Zerbock, 2003).

According to Ezema (2009), wastes are useless, unwanted and discarded materials.' Douglas (2004) corroborates Ezema's stance and argues that 'waste is material which arises from animal and human life and activities and is discarded as useless and unwanted items. In the same vein, Number 16 of Lagos State Environmental Sanitation Law of 1984 defines 'domestic waste' 'refuses' and section 27 defines waste as;

- any substances which constitute scrap material or an efficient or other unwanted,
- surplus substances arising from application of a process, or;
- Any substance or article which requires to be disposed of as broken, worn out or otherwise spent.

While the United States Environmental Protection Agency defines solid waste as any useless, unwanted or discarded material with insufficient liquid content to be free flowing. While, the need for healthy environment is important to everybody; it may differ from place to place, not in the fundamentals but in complexity (Laoye, 1979).

Solid waste can also be referred to wastes from households, municipal services, construction debris and agricultural activities. This also includes non-hazardous, non-liquid wastes from institutions and industries (RA 9003). According to the World Bank (2001), waste generation is greatly influenced by a country's development. Generally, the more economically prosperous a country is, the more waste it generates per capita but the factor that seem to bridge the gap between waste generation and it's resultant effect is the method or efficiency of waste management strategy adopted by such country. A typical example could be seen when comparing the waste situation in developed countries like; Britain, United States of America, Canada where there exist much economic activities that generate more waste but with a corresponding well organized waste management system compared to the situation in developing countries like; Nigeria, Ghana and Cameroun with their steady increase in population and a corresponding increase in their rate of waste generation from industrial and human activities but without an efficient waste management system. It is realized that the waste situation in developed countries are much better than that of the developing countries irrespective of the volume of waste they generate due to the waste management strategy they practice or employ.

Solid waste management could be defined as the discipline associated with the control of generation, storage, collection, transfer and transport, processing and disposal of solid waste in a manner that is in accord with the best principles of public health, economic, engineering, conservation, aesthetics and other environment consideration that is also responsive to public attitudes (Tchobanoglous et al., 1993). Solid waste management

(SWM) pertains to the control of the generation, storage, collection, transfer and transportation, processing and disposal of solid waste in a fashion that is in accordance to societal and economic needs while at the same time compliant to environmental standards and principles (RA 9003). Solid waste is a telltale sign of how citizens' lifestyles change as a result of economic development. Furthermore, the increase of waste generation in the different regions of a country is indicative of its degree of urbanization. In cities, where standard of living is high, there is usually a higher waste output compared to rural areas.

Municipal solid waste management (MSWM) continues to be a major challenge for local authorities in both urban and rural areas throughout the world. This challenge is particularly important for the developing countries. The available statistics shows that, although the municipal solid waste generation in the developing countries is still low per-capita compared to that in the developed countries, the developing countries account for more disproportionately high share of the world's solid waste generation relative to their share of world's income (Afroz et, al. 2009).

Moreover, from a dynamic point of view, the municipal solid waste management in developing countries is predicted to face a great challenge in the future owing to their rapid urbanization and economic growth. Empirical analyses using macroeconomic data indicates that the per capita generation of solid waste is at least 0.3-0.4 kilograms per day even for the poorest people. In general, a one percent increase in population is associated with a 1.04 percent increase in solid waste generation, and a one percent increase in per capita income is associated with a 0.34 percent increase in total solid waste generation (Afroz et,al. 2009).

Irrespective of the fact that most of the developing countries are still in the early stage of their urbanization and economic development, it is generally expected that the challenges of solid waste generation and management could be avoidable in such countries considering that most cities in developing countries spends significant portions of their municipal revenue on waste management (Osumanu, 2007; Thomas-Hope, 1998; Schübeler, 1996 and Bartone, 2000; Zhuang et al., 2008), but they are often unable to keep pace with the scope of the problem.

Senkoro (2003) indicated that for many African countries, only less than 30% of the urban population has access to proper and regular garbage removal (Altaf and Deshazo, 1996). The current practice of collecting, processing and disposing municipal solid wastes is also considered to be least efficient in the developing countries. The typical problems are —low collection coverage and irregular collection services, crude open dumping and burning without air and inefficient water pollution control, the breeding of flies and vermin, and the mishandling and uncontrolled informal waste picking or scavenging activities (Bartone, 1995).

Poor solid waste management in the developing countries is a major threat to public health and environmental quality, and reduces the quality of life, particularly for the poorer residents in both urban and rural areas. One of the principal reasons for the inefficient SWM systems in the developing countries is said to be based on their financial misappropriation, mismanagement and constraint, as SWM is given low priority in the developing countries budget, except in few large cities like Johannesburg, Abuja, Soweto, Pretoria, Tunis, Cairo, Accra etc.

In Nigeria, solid waste problem started with the rapid increase in urban growth resulting partly from the increase in population and more importantly with the increase in its immigration status (Egunjobi, 1996), no town in Nigeria can boast of haven found a lasting solution to the problem of filthy and huge piles of solid waste, rather the problem continues to assume monstrous dimensions (Okpala, 2002). To urban and city dwellers, public hygiene starts and ends in their immediate surrounding and indeed the city would take care of itself. The situation has so deteriorated that today the problem of solid waste has become one of the nation's most serious environmental problem.

Waste management in Enugu city is becoming an increasing problem daily and a complex task. The Enugu state waste management agency (ESWAMA) was established to develop and implement policies on the management of solid and liquid wastes that would promote the health and well being of the people. To this end, ESWAMA has the responsibility to ensure effective and efficient collection, removal, treatment and disposal of all kinds of wastes. It also has a mandate to check the illegal dumping of refuse at roadsides, enclosures, streams in neighborhoods and in drains. The agency is further empowered to prosecute defaulters of sanitation laws, while providing waste management facilities.

The state's sanitation laws compel residents to cooperate with ESWAMA in efforts to keep the environment clean. This they are required to do by cleaning up their environment, bagging wastes and disposing them at nearby designated dump-sites. The residents are also required to pay approved sanitation rates through designated banks in various zones.

In Enugu, human activities have generated waste in various forms in gaseous (abattoirs), liquid and solid. These wastes have often been discarded because they were all considered as negative value goods. The more prevalent method of disposal of these wastes have been to first collect them from their source and then burn them in a landfill site or throw them in the surrounding deep erosion gullies in the state. However, the

steady increase of landfill site, deposition in the gullies, and waste generally has caused a lot of havoc to the potable water being extracted from downstream and ground water. In most parts of Enugu urban, there are no public facilities for disposing refuse within reasonable distance, dump sites or waste bins are non-existent and in locations where dumpsites are made available, they are observed to overflow with refuse within few hours of disposal due to the rate of waste generated by populace within the area constituting health hazards.

However, the Government of Enugu State of Nigeria adopted different methods of solid waste disposal. One time, the incinerator machines were used and recently solid waste conversion vehicles are used and yet solid waste still constitute a major health hazard in the Enugu Urban. It is believed that the refuse disposal vehicles are insufficient to cover their designated areas. The areas that are more susceptible to the endemic problem are areas within the Enugu metropolis of Abakpa-Nike, Trans-Ekulu, Ogbete market, new market, Obiagu, Achara layout owing to the highly populated nature of the areas. Some people who were recently arraigned in the Environmental Court for waste disposal related offences claimed to lack knowledge of where and how to properly dispose or manage their wastes.

In recent times, Solid waste management problem has become a major concern in an industrialized developing country, like Nigeria and in Enugu in particular, considering the high growth-rate of population and industrialization in the city, It's in this regards that this study seek to investigate and examine the current state of the waste management strategy being employed by the waste management agency (ESWAMA) in the study area (Enugu metropolis) to actually ascertain the state of waste management in the area to help the government and planners take adequate steps and decisions towards ensuring an improved standard of living the health safety within the study area.

2. MATERIALS AND METHODS

2.1 Study Area

The City of Enugu, is located between longitudes 7° 6'E and 7° 54'E and latitudes 5° 56'N and 6° 52'N. The state shares borders with Abia State and Imo State to the south, Ebonyi State to the east, Benue State to the north-east, Kogi State to the northwest and Anambra State to the west. It is 2545m (meter) above the mean sea level, with an area of about 79.25 square kilometers.

The soil characteristically consists of hydro-orphic soil which is mineral rich soil and whose morphology is influenced by seasonal water logging caused by underlying impervious shale. The annual rainfall varies between 100 to 200 meters with its peak occurring between mid March and September. The rainfall average is 1412 millimeters per month, with the lowest rainfall in February. The temperature is generally high throughout the year with monthly maximum temperature ranging between 28.1°C and 32.2°C. The mean monthly minimum has been recorded at 22°C and 24.9°C in July and March respectively. The vegetation is generally losing its original rainforest nature to Guinea Savanna type. The city has a moderate undulating temperature with slopes ranging between 1-25%, hence enhancing effective drainage as runoff which easily empties into the network of natural drainage channels crossing the city like Mmiriocha River, which is a tributary of Ajalli River (Government of Enugu State of Nigeria, 1992).

Enugu, which literally means hilltop, derives its name from its position among the Udi Hills, which is at an altitude of about 223 meters above sea level (State Land Use Decree, 1976, 78). It is an important administrative, Industrial and Commercial Center in the eastern part of Southern Nigeria. These led to its population growth primarily through immigration from the surrounding rural areas. The state has three important urban centres: Enugu, Nsukka and Oji-River. Enugu is a modern city which covers an area of 85 sq. km. with a population of about 500,000 (Government of Enugu State of Nigeria, 1992). It is a well developed coal mining, commercial, financial and industrial centre, with a booming economy and vast investment opportunities. Its intimate association with coal has earned it the euphemistic name of 'Coal city'.

Rapid urbanization and industrialization in Enugu Nigeria from the 1960s through 1989 resulted in two factors which accelerated the waste management problems. The first was the increase in population influx from rural to the urban area and the second is a poor and inadequate solid waste management system being put in place. Enugu, as one of the Nigerian cities, lacks adequate infrastructure for sanitation, clean water supply, solid waste management and open space amenities like parks and recreation. These are the basic facilities needed for the growth and functioning of a city. Much of these are due to the land use planning statutes that encompass the evolving functions and responsibilities of urban areas, as numerous Nigerian research studies have documented (Aka, 1993).

2.2 Economic Profile of Enugu

Enugu's economy in the early 20th century depended on coal mining in the Udi plateau; this industry was the pushing force towards the city's growth. The Nigerian Coal Corporation has been based in Enugu since its creation in 1950 where it controlled coal mining. With the creation of the Eastern Line, Enugu was connected with the sea via Port Harcourt to its south and later connected to the city of Kaduna to Enugu's north. The

Biafran war brought widespread devastation that forced a decline in coal production from damage or destruction of equipment. As of 2005 coal mining was no longer the major source of income and mines sites became unused. Other minerals mined in Enugu include iron ore, limestone, fine-clay, marble, and silica sand. In Enugu most goods are sold in open markets or by street hawkers; a significant number of street hawkers in Nigeria are children. As of 2003, around 44 under-16-year-olds (equally boys and girls) hawk on every street on every hour in Enugu. The production of other important cash crops such as cocoa, groundnut and groundnut oil, rubber, cassava, cotton and cotton seed and timber tumbled after the civil war and the subsequent oil boom years.

There are three main urban markets in Enugu: Ogbete Market, Awkunanaw Market and New Market. New Market is a major market for the sale of garri. Ogbete market is patronized by merchants from all over the surrounding area, including merchants from cities like Onitsha, Aguleri, Abakaliki and Aba. In Ogbete market non-food goods are also sold. Brewing and soft-drink bottling are among other industries in the city; there is also a Mercedes assembly plant as well as the production and manufacturing of machinery, pottery, tiles, steel, cement, asbestos, petroleum, and pharmaceuticals.

2.3 Population Structure and Distribution

The population history of Enugu city shows that there have been a steady increase of people in the city with the population census of 1991 recording a population of 407,756 people, 2002 census also showing an increase to 595,000 people and the most recent population census report also recording an increase to 722,664 people within Enugu city while that of Enugu state recorded a total of 3,267,837 people from the 2006 census report (1,596,042 males and 1,671,795 females) within a total area of 7,618 sq. km (Population statistics of Nigeria Population Census, 2006) (Table1). This gives a population density of about 268 persons per sq. km., which is high when compared with the average national density of about 96 persons per sq. km. expectedly; population concentration is highest in the urban centre, with densities ranging between 300 and 600 per sq.km. In a state where the great majority of the people are rural, densities affect the intensity of land use and productivity of the land. Four population density regions are recognized. Areas with over 600 persons per sq. km and between 400 and 600 persons per sq. km. make up the congested rural districts. Farmland is scarce in these two density areas. The medium density areas support between 200 and 400 persons per sq. km, while the sparsely settled areas have an average density of less than 200 persons per sq.km. The sparsely settled local government areas are UzoUwani and Oji-River, while the congested rural areas are IgboEze, IgboEtiti, Nsukka (rural) and Enugu which happens to be the study area for this study.

Table 1: Population Statistics of Enugu City.

Year	Population of Enugu city.	Population of Enugu state.
1921	3,170	
1931	12,959	
1953	62,764	
1963	138,874	
1982	349,587	
1983	385,735	
1987	446,535	
1991	407,756	2,125,068
2002	595,000	
2006	722,664	3,267,837

Source: National Population commission report, 2006.

3 Data Collection

Research design method was used to elicit data for this study since the study is largely interpretive because it focuses on qualitative and quantitative data. Primary and secondary sources of data collection were employed to obtain data for this research. The primary sources involved the use of questionnaire survey which involves the administration, completion and collation of the research instrument (Questionnaires) while interviews and the researcher's direct observation were also conducted to ensure an in-depth understanding of the subject matter under investigation and to verify some information provided by respondents. The secondary sources of data collection involved information from text-books, journals and documentaries. The population of the study is made up of house-hold heads in the residential areas that falls within the study area and shop owners in markets and shops in streets within the study area. The choice of the use of market areas and highly populated residential areas within the study area is prompted by the fact that these areas are observed to be the main generator of the highest quantity of waste in the Metropolis. A total number of 250 people (residents and shop owners above 18 years old) were used for the questionnaire survey (Table 2) while four groups were interviewed within the area as follows; the elders (comprising of house-hold heads) and youth group (comprising of street-shop owners) around the residential areas and a cross-section of market men and women group within the markets areas

employed for this study (Table 2).

The researcher adopted a systemized random sampling technique for this study where, 360 people/respondents (60 questionnaires were distributed in each of the 6 selected study sites) and these made up the targeted population for the study with a predetermined technique of using the first to be met 60 persons in each of the market areas of Ogbete market, Abakpa market and New market while 60 questionnaires were distributed in each of the other three remaining study site of Trans-ekulu, Ogbu-aghor and Ugbo-ezeji where three streets within each the areas were randomly selected and questionnaires administered to the first 60 household heads living in homes that fall within the houses along odd numbered buildings in the streets. Table 1, shows that 250 questionnaires were successfully completed and collected and this formed the basis of the analyzed data for this study and is said to be the sample size for this study.

Table 2: Population and sample size

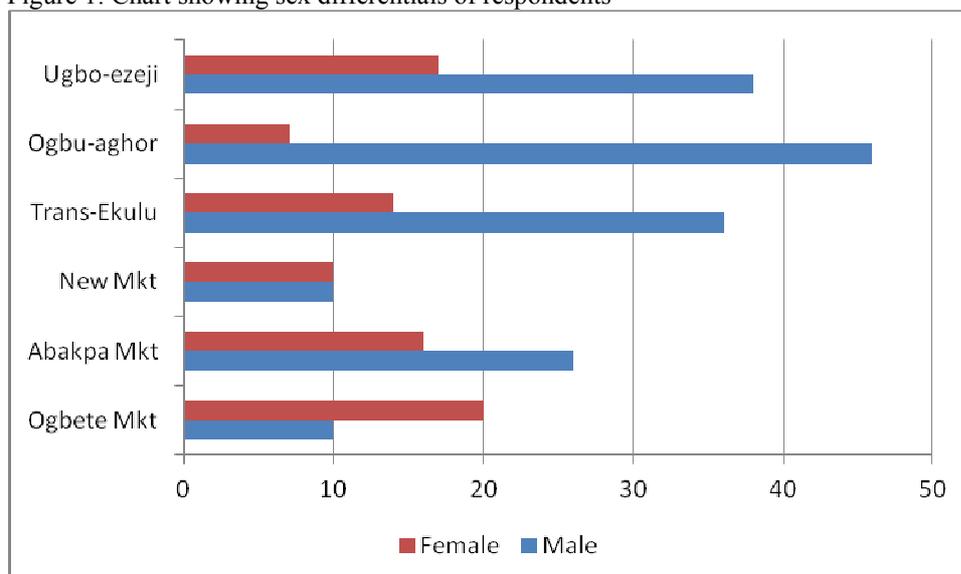
S/N	Area	Population
1	Ogbete Market	42
2	Abakpa Market	30
3	New Market	20
4	Trans-Ekulu	50
5	Ogbu-Aghor	53
6	Ugbo-Ezeji	55
7	Total	250

Source: Author's field survey, 2012.

4 RESULTS

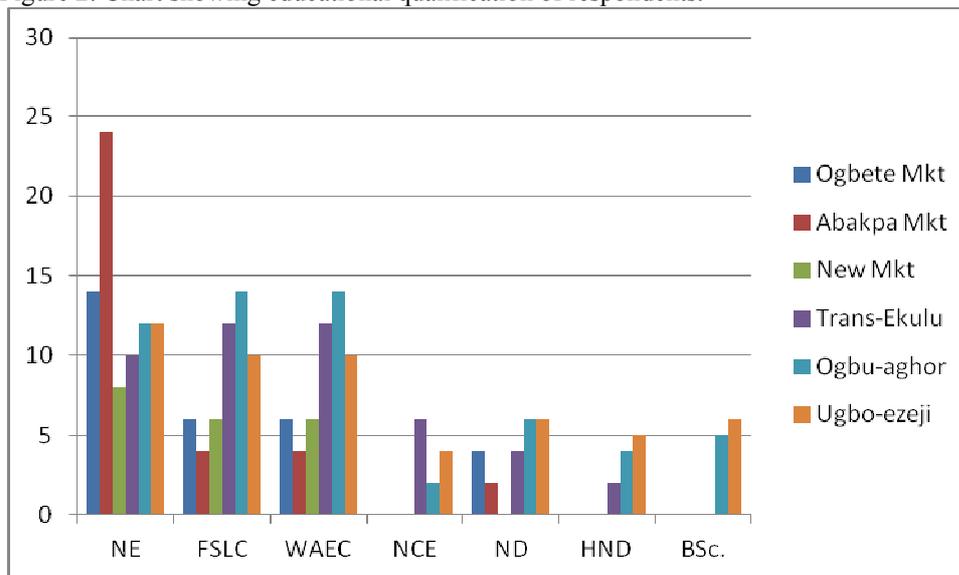
The presentation of results is based on the objective of the study. The study considered the demographic characteristics of house-hold heads resident within the study area where waste management practices are carried out and results are presented in Fig.1 and 2. The finding shows that 66 percent of the respondents involved in the questionnaire survey were male while 44 percent of the respondents were female (Fig.1). The study also discovered that most of the respondents' resident around waste management zones of the town had never acquired any form of formal education (Fig.2). This implies that the understanding of waste management regimes by government and other stake-holders are hardly considered seriously due to ignorance viz-a-viz increasing waste disposal burden in the area. This demand for a great need for sensitization or creation of awareness among the people of the area on the effect of indiscriminate waste disposal to the well-being of life existence (health) and the sustainability of our environment.

Figure 1: Chart showing sex differentials of respondents



Source: Researcher's field survey, 2012.

Figure 2: Chart showing educational qualification of respondents.



Source: Author's field survey, 2012.

NE- No Education, FSLC- First school leaving certificate, WAEC- West Africa Examination Council certificate, NCE- National Certificate in Education, ND- National Diploma, HND- Higher National Diploma, (B.Sc.)- Bachelor of Science certificate.

Furthermore, in the assessment of the waste management practices in Enugu metropolis, it is discovered that most inhabitants, especially those in the major markets; Ogbete market, Abakpa market and new market disposed their wastes at the designated waste management/dump sites. Table 3 shows that 167 respondents representing 67 percent of the entire study population use the central waste dump sites to dispose their wastes while 20 percent of the respondents disposed their wastes by burning and 8 percent disposed their wastes by burying. Meanwhile 12 respondents representing 5 percent of the entire study population used other means that could be described as indiscriminate dumping as they dump their wastes in unauthorized locations (sites) such as; middle of the road, and uncompleted buildings within their area (Figure 3).

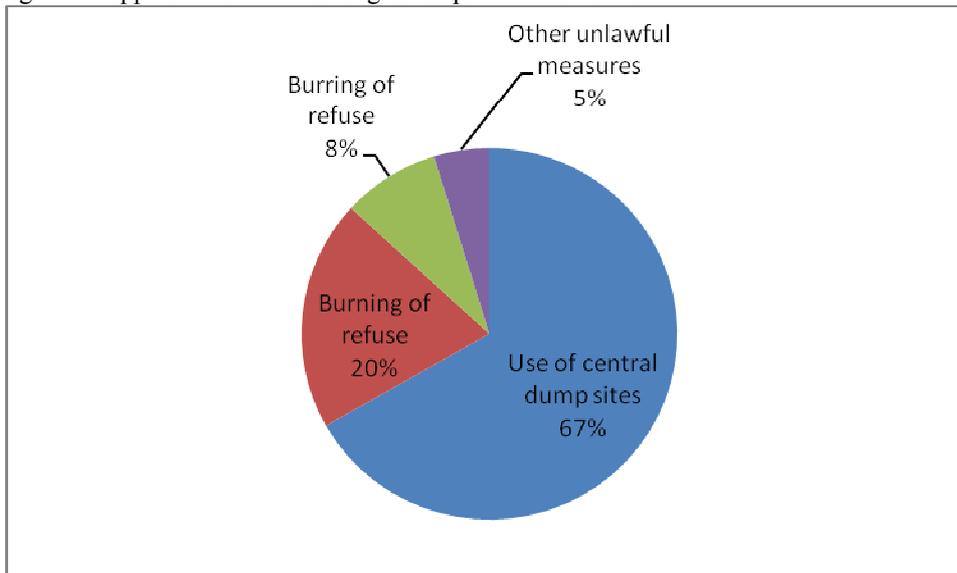
Table 3: Waste Disposal measures by respondents.

Area	Use of central dump sites	Burning of refuse	Burying of refuse	Other unlawful measures
Ogbete Market	35	7	-	-
Abakpa Market	28	2	-	-
New Market	16	4	-	-
Trans-Ekulu	30	11	6	3
Ogbu-Aghor	33	10	7	3
Ugbo-Ezeji	25	16	8	6
Total	167	50	21	12

Source: Researcher's field survey, 2012

This is further shown in figure 3.

Figure 3: Appraisal of waste management practices in the area



Source: Researcher’s field survey, 2012

In the assessment of the performance level of the government and the waste management agency on waste management in the state by various stakeholders and residents, the study revealed that a total of 17 respondents expressed satisfaction with the waste management system or technique in the study area while the remaining 233 respondents expressed dissatisfaction with the standard and system of waste management in the study area representing 93 percent of the study population.

It was also found that a total number of 34 respondents representing 14 percent of the entire study population were of the opinion that there have been improvement in the waste management system on-like what used to be the case before the last five (5) years while 216 respondents representing 86 percent refused to accept there have been a significant improvement in the waste management system within the last five years comparing its state before this time. Further investigation suggests that the above position is caused by the unavailability of a holistic approach towards waste management in the area with the scanty refuse dump sites most of which is being centralized making people to have no other option than to travel long distances with their household or generated waste to dump such in the designated dump site which within hours of disposal and evacuation becomes filled up again and poses nuisance and breeding ground for scavengers. In response to the quest of how this menace could be controlled, all the respondents advocated the introduction of door to door waste collection system as the major solution to the waste management problem or challenge faced in the study area. Most of the respondents also expressed dissatisfaction with the levy collected from residents by the government waste management agency (ESWAMA) stating that the current state of the waste management system does not befit the amount paid by residents for such services with a total number of 229 respondents representing 92 percent of the total study population supporting this view (Table 4, shows the summary of the opinion of the respondents (250) on the rating of the agency in charge of waste management).

Table 4: Rating of Waste management practices of the agency in charge of waste management.

Area	Waste mgt satisfactory	Waste mgt unsatisfactory	Improvement From what used (5yrs ago) to be	No Improvement From what used to (5yrs ago)	Support a Door to door collection system	Waste levy to too high
Ogbete Market	3	39	6	36	42	38
Abakpa Market	5	25	10	20	30	25
New Market	3	17	8	12	20	18
Trans-Ekulu	6	44	10	40	50	40
Ogbu-Aghor	0	53	0	53	53	53
Ugbo-Ezeji	0	55	0	55	55	55

Source: Researcher’s field survey, 2012

5. DISCUSSION

The outcome of data analysis and information obtained by the researcher discovered the following, that:

- The resources available for solid waste management are much less to make any impact. This has made it hard for the procurement of sufficient pay loaders, bulldozers, tippers, din chassis, compactors, incinerators, waste bins, refuse vans etc.
- Those interviewed favored public planning participation (contractors) to assist in refuse collection, treatment and disposal. Many also favored public private participation.
- More than 69% of the respondents knew nothing about procurement of dustbins, dumpsites. They do not also know the organs of government that are responsible for refuse/waste management.
- There is some legislation for refuse/waste management, either due to lack of manpower or any other reason the laws were not used or are rarely used.
- There is no environmental education at all as was observed during the administration of the questionnaire.
- Burning of waste was the order of the day with the attendant hazards associated with it.
- Some of the waste management staff was poorly trained and no plan in the future to give them further training or improved the already acquired skills.
- The turn-around waste collection and disposal time are inadequate compared to the amount of accumulated wastes at each dump site.
- In the absence of a regular and efficient solid waste collection system, waste is dumped in open spaces, on access roads and along water courses, which constitutes health hazard.
- There are no public facilities for disposing refuse within reasonable distance.
- Dump sites or waste bins are non-existent and where dumps are sited overflow with refuse, constituting health hazards.

From the above observations, it can be deduced that; the waste management strategy practiced by the Government approved waste management agency in the area is so poor and inefficient that huge waste dumps are found in most available dump sites at every time and much volume of refuse are constantly found littered all around the streets within the study area with the gutters blocked with wastes causing flooding during the raining season. With the findings above, it is being noted that the agency responsible for waste management in the area has succeeded to do more harm than good to the overall sanitation status/situation of the area and it is discovered that the offensive odor emanating from such sites or the rubbish dump in most cases resulted to a depletion in the atmospheric condition and health challenges on residents of such areas.

6. CONCLUSIONS

With the above result, it is concluded that the waste management practices in Enugu city is unsatisfactory and good strategies / measures needs to be employed to salvage the situation. Two different waste management options must be combined intelligently in a way as to reduce the environmental, social impact of waste and improving the aesthetic of the city and living conditions of residents within the area. This combined option is called integrated solid waste management and system approach which should be used for the assessment of the competing options. It is in this regards that this study here suggest the following recommendations;

1. Solid waste management should be provided in the yearly budget with a separate head for the purpose of adequate revenue allocation, implementation and monitoring.
2. There is need to enhance environmental education program and public participation as it affects solid waste management not only through the radio, television and print media but also through grassroots enlightenment campaigns via the chiefs, community leaders.
3. Effective solid waste management requires the involvement, participation and cooperation of local communities and the government.
4. Public private partnership is highly encouraged in solid waste and environmental management.
5. Government should commit itself to sponsoring more research projects into the reduction of solid waste at source, collection and efficient disposal.
6. Primary, secondary and tertiary schools curricula should inculcate detailed topics on solid waste management.
7. There should be adequate and proper town planning for effective solid waste management for example, there is a need to provide good access, roads, which should be properly linked to one another. Other needs are streetlights and good drainage system. All these will ease the evacuation of solid waste from all the nooks and crannies of the state.
8. There should be comprehensive environmental legislation that relates to environmental sanitation offences. The cases should be tried in environmental courts.
9. Refuse bins provided in all compounds with a frequent waste collection turn-around time.

10. The agency responsible for waste management and collection in the area should operate a door to door system of waste collection.
11. The access road to the entire street around the metropolis be constructed and put in good condition to aid accessibility of the waste collection trucks to all the streets and compound in the area.

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