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# Inventory Analysis of Solid Waste Management in Ikorodu Community

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**Abstract**
The challenge of managing solid waste generally in developed countries has shifted from ensuring minimum damage to public health and environment to the manner in which discarded resources are to be handled such that future generations are not deprived of its value. Statistics reveals that 3.5 billion people (half of the world's population) are without access to waste management services, and open dumping remains the prevalent waste-disposal method in most developing countries.This study was carried out on the inventory analysis of solid waste disposal and management in Ikorodu community, Lagos State, Nigeria. The study focuses on Odogunyan, Odokekere and Odonla area of Ikorodu community. Structured interviews, personal observation and review of secondary data were used to address the objectives of the study.Primary data were collected through interview in the areas which include; Banks around Motor Park, House-holds, Industries, Hospitals, Schools and Market. A total of 200 respondents were sampled.At critical region 0.05, Chi square was used to analyze the hypothesis. And the null hypothesis was rejected. The alternate or research hypothesis was accepted. Hence, there is a statistical significant relationship between education of respondent and their knowledge of waste management in Ikorodu community.
**Keywords:** Inventory, Waste, Solid Waste, Waste Management and Ikorodu.

## 1.0 Introduction

The challenge of managing solid waste generally in developed countries has shifted from ensuring minimum damage to public health and environment to the manner in which discarded resources are to be handled such that future generations are not deprived of its value (Chandak, 2010). Developing countries like Nigeria on the other hand are still battling with the protection of human health and well-being while attempting to conserve resources (Brunner and Fellner, 2007).

Lagos State Waste Management Authority was established in December 1991 by virtue of Edict No. 55 of Lagos State, which made the agency responsible for the collection and disposal of municipal and industrial waste in the State and to provide commercial services to the State and Local Governments. The 1992 Edict was repealed in 2007 with the birth of a new LAWMA under Law No. 27 volume 40 Laws of Lagos State. The rate of solid waste generation in Lagos State is increasing rapidly on daily basis as a result of increase in population and LAWMA has been alive to her responsibilities through the involvement of both the private and public operators in the waste management chain.

Statistics reveals that 3.5 billion people (half of the world's population) are without access to waste management services, and open dumping remains the prevalent waste-disposal method in most developing countries. More than 1.3 billion tonnes of municipal solid waste were estimated to have been generated in 2012 and 2.2 billion tonnes a year are expected by 2025. Urbanization, industrialization, increasing population and economic development are all contributing to the rise in waste and also to its increasing complexity and hazardousness. Figures on municipal solid waste collection rates are similarly sobering. In developing countries collection coverage could be as low as 40%, compared to the 98% for developed countries. Some middle-income countries still dispose of waste at poorly operated landfills (UNEP, 2013).

Poor solid waste management can lead to some significant environmental and health hazards. For instance, leachate from waste can contaminate underground water system, open burning of waste releases green house gases which causes air pollution, and a failure to use recycled materials from solid waste leads to accelerated depletion of 'raw' materials. Unfortunately, it is the urban poor who live and work near solid waste disposal sites that are most at risk sometimes suffering acute health impacts. These striking facts and figures, along with the reality of poor institutional capacity, financial constraints and lack of political will, makes the management of solid waste one of the most significant planning challenges faced by developing economies in the 21st century.

 

In Nigeria, attempts to have any kind of solid waste collection are found only in urban areas, as rural wastes are mainly organic and hence get returned to their local ecosystem one way or another. The habit of separating out certain types of solid waste that have direct value for reuse or recycling, such as plastic containers has not yet been popular, there is no waste separation at household level and very little at institutional level. Some individuals and informally organized groups carryout waste separation of items that can be reused or recycled in different places including at the municipal disposal site. This activity creates job opportunities for otherwise unemployed people by organizing them to have waste collection points to purchase the sorted waste from those who bring it to them. Similarly, individuals or groups will collect one type of solid waste, such as a mixture of old plastic and metal, which can be sold to artisans that create other items out of the waste.

Management of solid wastes should be considered as an integral part of environmental hygiene and infection control. The solid wastes generated within Ikorodu area should always follow an appropriate and well identified stream from their point of generation until their final disposal and recycling to create wealth. This stream is composed of several steps that include generation, segregation, collection and onsite transportation, on-site storage, offsite transportation and finally on or offsite treatment, disposal and recycling.

Once it undergoes the process of recycling, production process is inevitable. Production is said to be achieved not until the manufactured goods get to the final consumers. Without transportation, there cannot be production. Transportation plays a significant role in waste management and production of recycled solid wastes.

### *1.2 Problem statement*

The rural-urban migration that followed the oil boom era started solid waste management problems of the early 1970s'. Waste was dumped around the street corridors. Management of solid waste in Lagos State commenced with the establishment of Lagos State Refuse Disposal Board in 1977 with Powell Duffern Pollution Control Consultants as managers. It was later changed to Lagos State Waste Disposal Board due to additional responsibilities of commercial, industrial collections and drain clearing. Collection and disposal of scraps and derelict vehicles were also added in 1981.

The solid waste generation activities covers Household, Commercial, Institution, Industrial and Markets. Economic activities in communities such as squatters, low, medium and high class residential area impact differently on the stream of waste generation depending on the economic status of the area. The per capital solid waste generation rate varies from 0.5kg-0.65kg.

Experiences from many other countries show that municipal solid waste management requires more than just a collection system and recycling plants. Recycling and pollution standards are also needed in order to define the mode of operation of all actors in the management chain and additional financial sources might be needed to cover the collection costs and possibly the management of certain hazardous fractions.

Enforcement mechanisms are also needed to make sure that all the actors adhere to the established rules. Furthermore, collection and information on the fate of different solid wastes will have to be given utmost attention. (Tadesse and Sue, 2013).

In addition, the principle of extended producer responsibility has to be set up in such a way that enables producers to play an effective role in solid waste management, such as will involve the estimation of the percentage of the product that will end-up as waste, developing a framework of resource reuse whereby producers are mandated to acquire recycled waste product for future production. An efficient and sustainable waste management system like this can only be made possible with adequate inventory of products that finds its way to the market, the percentage of waste it will contribute and an efficient plan put in place to collect the generated waste.

It was found that, waste disposal habit of the people, corruption, work attitude, inadequate plants and equipment among others are factors militating against effective waste management to attain sustainable development in Nigeria as a whole (Adewole, 2009).

### *1.3 Research questions*

From the statement of the problem above, the following research questions can be deduced;

1. Is the inventory management of solid waste in Ikorodu community in a good condition?
2. What is relationship between education level of respondents and knowledge of waste management in Ikorodu community?
3. What are the challenges facing waste collection and disposal and the way forward?
4. How can the current inventory of waste management be improved to achieve robustness and sustainability?

### *1.4 Aim and objectives*

The aim of this study is establish the inventory analysis of solid waste management in Ikorodu community of Lagos State.

 

The objectives are;

1. To establish the current situation of solid waste management in Ikorodu community;
2. To analyze the relationship between education level of respondents in the communities and their knowledge of waste management.
3. To identify the challenges facing waste collection and disposal;
4. To proffer various means of improving waste management.

*1.5 Research hypotheses*

For the purpose of achieving the aim and objectives, the following hypotheses are formulated and will be proved;
$H_0$: The inventory management of solid waste in Ikorodu community is in a good situation.
$H_0$: There is no statistical significant relationship between education level of respondents and knowledge of waste management in Ikorodu community.

*1.6 Scope of study*

This study focuses on Odogunyan, Odokekere and Odonla area of Ikorodu community. This is because the areas are dominated with households, industries, schools, banks, and other sources where wastes are been generated.

## 2. Conceptual and Theoretical Framework

*2.1 Waste*

The federal environmental protection act (1988) does not define "waste", however Waste as the term implies is any solid, liquid or gaseous substances or materials which being a scrap or being super flows, refuse or reject, is disposed off or required to be disposed as unwanted, this is Environmental law, the term assumes it's ordinary literal meaning unlike in the real property Law, When "waste" is used as a term of art, having meaning completely different from its ordinary meaning.

One of the few statues in Nigeria, which attempts to define waste is the Lagos State Environmental Edicts 1985, there in Section 32, waste is define as follows:
Waste includes:

a. Waste of all description;
b. Any substance, which constitutes scrap materials or an effluent or other unwanted surplus substances arising from the application of any process.

The United Kingdom's Environmental Protection Act 1990, re-enacting an earlier U.K statue, took this statutory definition a step further in section 75(2), it defines waste in these terms:
Waste includes:

a. Any substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of any process and
b. Any substance or article, which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled.

Major classes of solid wastes
Municipal solid wastes generally can be classified in terms of three major sources of generators:

a. Residential;
b. Commercial, and
c. Industrial.
d. Sometimes, institutional sources are separated from commercial sources and, thus a fourth source is referred to as institutional.

In the traditional scheme of classification, residential (domestic) solid waste consists of household garbage and rubbish, or refuse. The garbage fraction is mostly in the form of wastes derived from the preparation and consumption of food (e.g., meat and vegetable scraps). An alternate term commonly used to describe the garbage faction is "putrescibles." In the traditional scheme, all wastes not classified as "garbage" are referred to as "rubbish." The major constituents of rubbish include glass, metal and plastic wastes, yard and garden debris, wastepaper and paper waste;

*2.2 Solid waste management*

Gilpin (1996) defined waste management as purposeful, systematic control of the generation, storage, collection, transportation, separation, processing, recycling, recovery and disposal of solid waste in a sanitary, aesthetically acceptable and economical manner. It can be deduced from these definitions that waste management is the practice of protecting the environment from the polluting effects of waste materials in order to protect public health and the natural environment. Thus, the priority of a waste management system must always be the provision of a cleansing service which helps to maintain the health and safety of citizens and their environment.

Furthermore, Gilpin (1996) regards the business of waste management as a professional practice which

 

goes beyond the physical aspects of handling waste. It also "involves preparing policies, determining the environmental standards, fixing emission rates, enforcing regulations, monitoring air, water and soil quality and offering advice to government, industry and land developers, planners and the public.

The business of keeping our environment free from the contaminating effects of waste materials is generally termed waste management. Solid waste management is the process of collecting, storing, treatment and disposal of solid wastes in such a way that they are harmless to humans, plants, animals, the ecology and the environment generally. The unhealthy disposal of solid waste is one of the greatest challenges facing developing countries (Kofoworola, 2007). In a research carried out by Gbekor (2003), there were indications that waste management involves the collection, transport, treatment and disposal of waste including after care of disposal sites.

Waste management, therefore, involves a wide range of stakeholders who perform various functions to help maintain a clean, safe and pleasant physical environment in human settlements in order to protect the health and well-being of the population and the environment. Effective waste management is, however, a growing challenge to all municipal governments, especially in developing countries.

For the first time in the history of mankind, we are witnessing an unprecedented phenomenon in the development of places of habitat: the balance of human settlement patterns have shifted from more people inhibiting rural areas to more people living in cities (UNFPA, 2001). Urbanization in developing economies has made the management of solid waste very crucial in the areas of public health and environment, especially in the capital cities, since these areas serve as the gateways to the country for foreign investors and tourists. Poor form of these cities can deter foreign investors. Nevertheless; if waste is poorly managed it becomes a danger to health, a nuisance, and possibly a major social problem. In addition, waste management occupies a vital place in the economies of both developed and developing countries (Abagale, et.al 2012).

Elements/ practices of solid waste management system.

According to Wikipedia (2016) the municipal solid waste industry has four components:

i. Recycling;
ii. Composting;
iii. Land filling, and
iv. Waste-to-energy via incineration

The primary steps are generation, collection, sorting and separation, transfer, and disposal. According to Asase et. al, (2009) also mentioned waste generation, waste composition, waste collection and transportation, and waste treatment and disposal as the main elements of solid waste management system. Labspace, (2013) also gave four main components of waste management system. However, each stage with the exception of the last stage seems to have more than one activity. The stages/ components are: onsite handling, collection and processing; collection, transfer and transport of solid waste; resource recovery and processing; and disposal of solid waste. For the purpose of this paper, we consider the following main components.

"Waste management has evolved from the simple transportation of waste to landfills to complex systems, including waste prevention and waste recycling as well as several waste treatment technologies" (Salhofer et al., 2007). This is in response to the increasing quantity and complexity of the composition of waste generation all over the world.

According to the United Nations consultative meeting in Tokyo, the main challenge regarding waste management has changed perspective to the manner in which discarded resources will be handled such that future generations are not deprived of some or all of its value. This is a shift from the older view of ensuring minimum damage to public health and environment in the process of handling waste (Chandak, 2010). "A current trend in developed countries is closing the loop, moving from the concept of 'end-of-pipe' waste management towards a more holistic resource management" (Wilson, 2007). While developed countries have achieved the first aim of waste management of providing protection to human beings and the environment and are battling resource conservation, the health and wellbeing of humans still suffer from inadequate waste management systems in developing countries and the first objective still remains a main priority (Brunner and Fellner, 2007).

In the recent past, the inability of member countries in the European Union to decouple waste growth from economic growth has imposed economic and environmental cost on society and created a pressing need to increase levels of effective waste minimization and management (Fatta and Moll, 2003). The trend in the UK has been a decline in waste growth for the past two years with the waste quantities consistent in the five years prior to 2008 (DEFRA, 2010). However, the cessation of waste growth persists for reasons that remain elusive (Fell, 2010) and not clearly attributed to the sole efforts of waste minimization and management schemes.

Waste management is regarded as a public service and those who do not pay are not totally excluded from the service generally. This is because efficient collection and safe disposal of waste, at the minimum, are essential to public health and environmental protection (Cointreau-Levine, 1994).

Challenges to urban solid waste management

 

Researchers have identified several factors that militate against solid waste management efforts in poor country cities. Linden et al. (1997) identified ten common constraints/challenges that militate against solid waste management efforts in Asian countries. These are;

a. Inappropriate technologies/processes;
b. Enforcement inefficiencies/non-existent;
c. Illegal dumping;
d. Lack of financing;
e. Lack of training/human resource;
f. Lack of political support;
g. Lack of legislation;
h. Policy conflict among levels of government/overlapping responsibilities;
i. Rapid increase in waste generation/limited data;
j. Lack of awareness among public; and
k. Limited land areas and land tenure issues.

These factors, according to the report, frustrated the waste management efforts of municipal authorities in Asia and made it difficult for them to keep their city environments clean and safe for the populations.

After studying the solid waste problem in Tanzania, Kironde (1999) has also attributed the abysmal performance of the waste sector to resource constraints including the scarcity of financial, physical, human and technical resources for the organization of waste management operations. In a study of the solid waste problem confronting the city of Kampala, Uganda, researchers from the Namilyango College (2001) identified several causes of the waste problem including the lack of dumping sites, ignorance of the masses about the need for proper waste disposal, inefficient collection methods, poor government attitude towards waste management, poverty of the people, corruption among public officials and lack of trained personnel for waste management. These have posed serious constraints to the waste sector and dampened efforts towards waste management in the city. Many other writers have elaborated on how the factors cited above (plus others) interact to aggravate the solid waste problem in poor country cities. What follows from here is a detailed examination of the factors responsible for the abysmal waste situation in poor country cities (Baabereyir, 2009).

Major effects of waste management on the quality of life

Solid waste management is an important facet of environmental hygiene and needs to be integrated with total environmental planning. Its storage, collection, treatment and disposal can lead to short risks, in the long term there may be dangers arising particularly from the chemical pollution of water supplies. The problems connected poor was management are highlighted as follows:

1. Environmental effects: The major environmental effects include air pollution, which includes odour, smoke, noise, dust, etc. Waste pollution – pollution from disposal site via flooding because of blocked drains and land degradation.
2. Health effects: This includes:
    a. Flies which carry germs on their bodies and legs and also excrete them;
    b. Mosquitoes breed in stagnant water in blocked drains in favourable location in cans, tyres etc. that collects rain water;
    c. Rats: rat's spreads typlius, salmonella, leptospirosis and other diseases; they cause injuries by biting and spoil millions of tons of food.
    d. The refuse workers also faces some hazards which includes: parasite infection and infected cuts resulting from skin contact with refuse,
    e. Other includes hazards on disposal sites are injuries from glass, razor blades, syringes, tissue damage or infection through respiration, ingestion or skin contact.

## 3.0 Methodology

### *3.1 Study area*

Ikorodu is a city in Lagos State, Nigeria. Located North East of Lagos State along the Lagos Lagoon, it shares a boundary with Ogun State. As of the 2006 Census Ikorodu had an enumerated population of 535,619.

Ikorodu is situated at a distance of approximately 36 km north of Lagos. The town is bounded on the South by the Lagoon. In the north, Ikorodu shares common boundary with Ogun State. While in the East, it has common boundary with Agbowa-Ikosi, a town in Epe Division of Lagos State.

Ikorodu in the last 40 years or so, did not extend beyond the inner circular route: Ojubode, Etunrenren, Epadi, (Ayangbunren Road) Oju Ogbe, Ireshe, Eluku Street, Ojubode Street Ojubode Orere Garage (Oriwu Hotel) Lagos Road, Ikorodu Township has now metamorphosed into a Metropolis over a million people. Therefore, extended to Aga Titun, Agbele, Erunwen, Solomade, Eyita, Agbala, Lowa, Gbasemo, Oke Ota Ona etc.

It has again extended to greater Ikorodu by the creation of Ikorodu West Development Council Area,

 

Owutu as the headquarters which includes Ipakodo, Majidun, Otowolo, Oriokuta, Ajaguro, Ogolonto, Araromi-Solebo etc. and Ikorodu North Local Council Development Area, that includes Isiwu, Odogunyan, Odonla, Odokekere, Okegbegun, Rofo, Lasunwon, Agbede, Losi Oba, Erikorodo, Araromi, Mojoda, Oke Ogbodo, Laiyeode/Akaun, Liadi, Maya, Parafa, Adamo, Aleke etc.

Surrounding major towns that make up Ikorodu Divisions are Imota, Ijede and Igbogbo and all these major towns constitute their own Local Council Development Area with their respective traditional rulers (Obas). Main occupations of Ikorodu people are trading (commerce) and farming industry (Wikipedia, 2016).

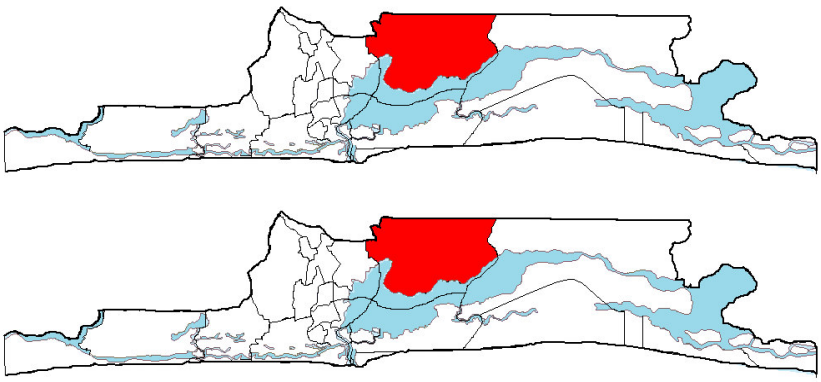

Figure 3.1: Ikorodu Map
Source: (Wikipedia, 2016)

Ikorodu Division has a large Industrial area containing many factories. In Ikorodu township alone, half of the twenty-five (25) registered banks by the Central Bank of Nigeria, (CBN) have branch offices in Ikorodu. Ikorodu's relative closeness to sprawling Lagos conurbation makes it the fastest growing exurb near Lagos metropolis. There is influx of people from Ikorodu's surrounding towns and villages and also from Lagos metropolis.

Lagos Waste Management Authority operates an alternate weekly kerbside waste collection service for household residual waste and dry recyclables. Waste materials collected for recycling include paper, card, aluminium cans, steel cans, mixed plastics, mixed glass, garden and food waste are collected together on a weekly basis from households. LAWMA runs services for the collection of wastes from: commercial organisations, street cleaning, fly tipping, and municipal parks/grounds around Ikorodu West LGA (Wikipedia, 2016).

*3.2 Research design*

This study was carried out on the inventory analysis of solid waste disposal and management in Ikorodu community, Lagos State, Nigeria. The study focuses on Odogunyan, Odokekere and Odonla area of Ikorodu community. Structured interviews, personal observation and review of secondary data were used to address the objectives of the study.

Primary data were collected through interview in the areas which include; Banks around Motor Park, House-holds, Industries, Hospitals, Schools and Market. A total of 200 respondents were sampled. Face-to-face interviews, questionnaire, and observations are the techniques used by researcher were used.

The relationship between education level of respondents and knowledge of waste management was analyzed with the use of non-parametric test (chi-square test). Also, descriptive statistics such ad bar chat and pie chat was used to analyzed other data in-line with the objectives.

**4. Discussions**

The questionnaire consists of closed ended questions which addresses the current status of solid waste disposal attitudes and practice in Ikorodu community. The questionnaire was administered to 200 respondents and was carefully and fully completed. The analysis will be considered below;

 

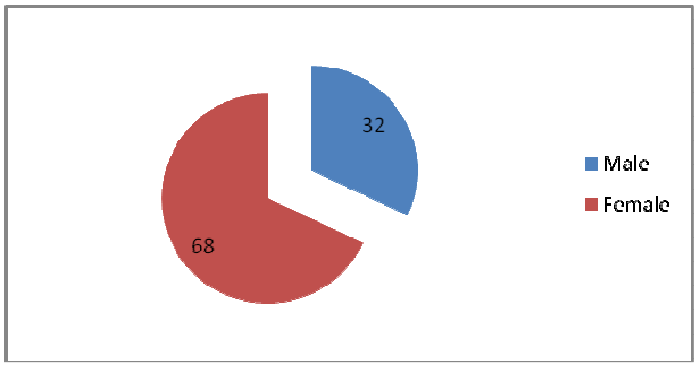


Figure 4.1: Socio-demographic characteristics (Gender) of respondents
Source: Authors' Survey

From figure 4.1 above, the socio-demographic characteristics of respondents revealed that about 68 percent of respondents are females while 32 percent are males, although solid waste management has no gender sensitivity. The mean age of female respondents is 37 years and that of male respondents is 42 years.

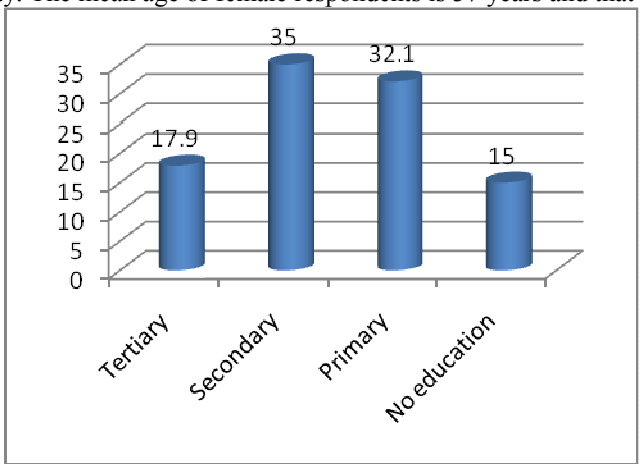


Figure 4.2: Socio-demographic characteristics (Education level) of respondents
Source: Authors' Survey

Considering figure 4.2 above which is the education level of respondents, 15 percent of the population had no formal education, 32.1 percent of respondents completed their primary education, 35 percent had at least completed secondary education, and 17.9 percent had post secondary or tertiary education. The information gathered from the above can be interpreted that there is high level of literacy among the respondents in Ikorodu community.

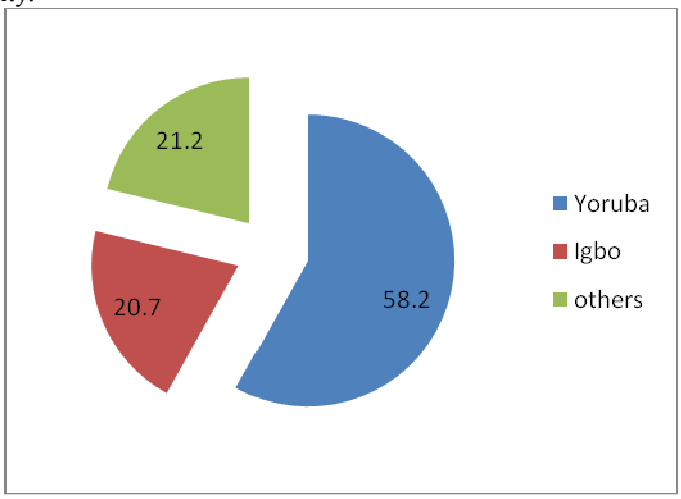


Figure 4.3: Socio-demographic characteristics (Ethnic group) of respondents
Source: Authors' Survey

Also, figure 4.3 is on ethnic composition of respondents, Yoruba ethnic group constitutes 58.2 percent, Igbo ethnic group constitutes 20.7 percent, and other ethnic group constitutes 21.2 percent. There is a very good indication that Ikorodu community is well dominated and occupied by Yoruba ethnic group, also Igbo ethnic

 

group might drastically increase over time.

Table 4.1: Attitude of respondents towards waste management

| Variables | Strongly Agree (%) | Agree (%) | Disagree (%) | Strongly Disagree (%) |
|---|---|---|---|---|
| Solid wastes are properly disposed in Ikorodu community. | 48.7 | 20.4 | 18.2 | 12.7 |
| Waste prevention is not my responsibility | 42.5 | 6.4 | 8.3 | 42.8 |
| Waste prevention is beneficial for the society and environment | 20.3 | 15.2 | 6.2 | 58.3 |
| Improper disposal and management of wastes brings problems to public health | 69.2 | 15.8 | 10.8 | 4.2 |
| Solid waste management is one of the major environmental burdens. | 53.4 | 31.7 | 7.3 | 7.6 |
| The quality of solid waste disposal services provided by private and public waste collectors is satisfactory | 60.1 | 19.9 | 11.4 | 8.6 |
| Open burning of waste is dangerous to human health and environment | 40.7 | 27.8 | 23.6 | 7.9 |
| The 3R (reduce, reuse and recycle) are important to waste management | 47.8 | 30.2 | 11.4 | 10.6 |
| Households should be encouraged to bury waste instead of burning | 58.9 | 18.5 | 9.7 | 12.9 |
| Waste prevention leads to better environment for the present and future, thereby leading to sustainable development | 60.2 | 21.6 | 16.5 | 1.7 |
| Everybody should be responsible for waste prevention and management | 72.4 | 20.4 | 5.1 | 2.1 |

Source: Authors' Survey

In the survey conducted in table 4.1 above; 48.7 and 20.4 percent of respondents strongly agree and agree respectively that solid wastes are properly disposed in Ikorodu community; they attributed the reason to the presence of the agency (LAWMA) which has been saddled with the responsibility of waste collection with token. Also 69.2 percent strongly agree and 15.8 percent agreed that improper disposal and management of wastes brings problems to public health and there is need for proper management. They also perceived that Ikorodu community should be motivated to package their solid waste in a segregated area without any form of payment; meanwhile the concerned agency will park the waste from the segregated area for further process. 42.5 percent respondents strongly agree and 42.8 percent strongly disagree that waste prevention is not their responsibility. Those that strongly agree together 6.4 percent that agree perceived that waste management process (from collection to processing) should be part of the dividend of good governance.

To test the null hypothesis which states that there is no statistical significant relationship between education level of respondents and their knowledge of waste management. Chi square test will be used.

Table 4.2: Contingency Table Showing the Relationship between Education Level and Knowledge of Respondents towards Waste Management.

*4.2 Demographic variables of parking demand*

The data sources was undertaken to identify the demographic variables of car owners with respect to the degree of private car ownership, this will have an increasing impact of parking demand.

To test the hypothesis H0: There is no significant relationship between demographic characteristics of car owners and private car ownership, Chi Square technique will be used.

| Education | High (knowledge) (%) | Medium (knowledge) (%) | Low or no (knowledge) (%) | **TOTAL (%)** |
|---|---|---|---|---|
| Tertiary | 15 | 1.9 | 1 | **17.9** |
| Secondary | 10 | 17 | 8 | **35** |
| Primary | 2.1 | 22 | 8 | **32.1** |
| No | 4 | 7 | 4 | **15** |
| **TOTAL** | **31.1** | **47.9** | **21** | **100** |

Source: Author's Survey

$H_0$: There is no statistical significant relationship between types of education for respondents and the level of knowledge about waste management.

$H_1$: There is a statistical significant relationship between types of education for respondents and the level of knowledge about waste management.

 

At 0.05 critical region (significance level), determine the table value when the Degree of Freedom is (R-1) (C-1). Where R is the row and C is the column.
Degree of freedom = (4-1) (3-1) = 6
At 0.05 significance level, the degree of freedom 6 gives a table value of 12.59
To compute the test statistics using Chi Square calculated value: $\Sigma[(O-E)^2 \div E]$
Table 4.3: Chi Square test

| Observed (O) | Expected (E) | O - E | $(O - E)^2$ | $(O - E)^2 \div E$ |
|---|---|---|---|---|
| 15 | 5.57 | 9.43 | 88.93 | 15.97 |
| 1.9 | 8.57 | -6.67 | 44.49 | 5.19 |
| 1 | 3.76 | -2.76 | 7.62 | 2.03 |
| 10 | 10.89 | -0.89 | 0.79 | 0.07 |
| 17 | 16.77 | 0.23 | 0.05 | 0.00 |
| 8 | 7.35 | 0.65 | 0.42 | 0.06 |
| 2.1 | 9.98 | -7.88 | 62.09 | 6.22 |
| 2.2 | 15.38 | 6.62 | 43.82 | 2.85 |
| 8 | 6.74 | 1.26 | 1.59 | 0.24 |
| 4 | 4.67 | -0.67 | 0.45 | 0.10 |
| 7 | 7.19 | -0.19 | 0.04 | 0.01 |
| 4 | 3.15 | 0.85 | 0.72 | 0.23 |

Source: Authors' Survey
Hence, Chi-square test is 32.97
It can be noted that the computed value is 32.97 is greater than table value 12.59; hence, we reject the null hypothesis which state that there is no statistical significant relationship between education of respondent and their knowledge of waste management in Ikorodu community. This then give a basis to accept the alternate or research hypothesis which states that there is a statistical significant relationship between education of respondent and their knowledge of waste management in Ikorodu community.
Percieved causes of the intracable waste problem
As stated by Adewole (2009), there are many perceived causes of the intractable waste problem in Lagos State among which are:

1. Waste disposal habit of the people;
2. Attitude to work;
3. Lack of adequate equipment, plant and tools necessary for waste disposal and collection;
4. Corruption;
5. Overlap of function of the state enforcement and waste management agency and
6. Population effect (Population increase)

Waste disposal habit of the people
Ignorance coupled with poverty may be adduced to the habit of most people in Lagos State especially in the densely populated areas of the state. It beats one hollow to see a man defecating in broad daylight on the side of the Highway or a woman with her wrapper pulled up doing her thing on the sidewalk or gutter in full glare of the public or where a man or woman parks his or her car and throw waste on the street, then one begins to wonder the reasons for these dirty habits of our people. Nigerians are permanently accustomed to dirt. Evidence of this can be seen every day by way of indiscriminate discharge of garbage into drains and at times on the highways. In a survey carried out by Lagos Waste Management Authority (LAWMA), which is rested with the responsibility of providing facilities for refuse collection, in all the streets within the state does not have adequate refuse collection bins in most of the streets in Lagos State. Hence the indiscriminate dumps of waste on the streets. Also, the frequency of carting away the refuse was not regular where the public refuse bins are found.
In another survey carried out, it was succinctly put that the volume of municipal waste piled up (for disposal) will be influenced by nearness to disposal sites, accessibility transportation facilities street layout, composition of wastes methods and individual attitude. Our individual attitude to waste disposal in Lagos state leaves more to be desired. A situation whereby a landfill that has been closed to the public is still being used as a dumpsite calls for questioning (Adewole, 2009).
Also where waste is placed on the road median, gutter side, inside gutter and roadside does not augur well for effective waste management. Despite the facts that illegal communal waste dumps indiscriminately located in public places have been officially cancelled yet several illegal refuse collection points, were indiscriminately created by residents which pose health hazard and loss of environment aesthetics (Adewole, 2009).
Attitude to work
In Nigeria employee productivity is low due to certain factors including sociological factor, which is felt in the manifested lack of a sense of belonging in an organization, and the tendency by employees to perceive a job as another's business. This negative attribute to work has negatively impacted on the waste management efforts of

 

the state government poor attitude to work, poor coordination and inadequate communication among workers and the institution saddled with solid waste management responsibilities due to bureaucratic impediment and administrative hitches have resulted in chaos, confusion and ineffectiveness in delivery of many urban public services (Adewole, 2009).

Inadequate vehicles, plant and equipment and tools necessary for waste management

Waste disposed or deposited at designated points of collection has to be transported either to the transfer loading station where sorting is done or to the incinerator facility or sanitary landfill or the final disposal point. It was further noted that for effective and efficient collection system, there must be enough and well maintained equipment such as trucks tippers, pay loaders, bulldozers, road sweepers, compactors and others. In Lagos State municipal solid waste transportation, collection and disposal has been epileptic, since the state realized its responsibility to the environment (Adewole, 2009).

A lot of problems such as inadequate number of vehicles, lack of spare parts, dearth of fund, poor technical know-how, poor maintenance practices, insufficient funding and lack of motivation has bedeviled the agency responsible for the disposal and collection of waste. The total numbers of vehicles required in the 20 local government area of Lagos state was 757, while the Lagos State Waste Management Authority, just received 100 brands news waste compactors. The heaps and stretch of refuse which adorn our roads pollute the environment and disfigure the landscape are nothing but the result of inefficient waste collection and disposal management method (Adewole, 2009).

Corruption tendency

Corruption is a canker worm that has eaten deep into every fabric of the Nigerian society. This we may not deny except to our collective demise and peril. The collapse in most of Lagos State Waste Management Authority infrastructure (in the past) in the state may allegedly be traced to this menace of corruption. It has also been reported in some instances that market women have had to bribe the Lagos State Waste management agency operatives (PSP) before waste could be removed from market place. Also truck pushers and scavengers have been known to bribe officials before they can be allowed to dispose their waste at designated points, this has led to illegal dumpsites springing up at different points of the state creating bottleneck to the already chaotic situation of waste management (Adewole, 2009).

Overlap of function of the enforcement agencies

Achieving waste management is inextricably linked to the promulgation and establishment and enforcement, regulations, legislation and control criteria on environmental management and pollution control, but an overlap in the agencies responsible for effective enforcement of the various laws may create problems for effective waste management. In a situation where you have Lagos State Waste Management Authority that is saddled with the responsibilities of waste collection and disposal grappling with local government authorities, Lagos State Environmental Protection Agency, the Police and other enforcement agencies in the state may not argue well for effective enforcement and sustainable waste management (Adewole, 2009).

For there to be an effective waste management in terms of waste collection and disposal effort in Lagos State, the enforcement mechanism should preferably be left with only one organization where many agencies must be involved, their role must be clear-cut and well spelt out. The enforcement of environmental laws in Nigeria generally has been problematic. The management and regulation of the environmental Laws has been beset by a host of problems, and has met with very limited success. These problems that hinder the enforcement of sanction on violators of the environment are political, social and economic. It is therefore clear that any effort towards a sustainable legal framework for successful enforcement, avoidance of overlap of environmental laws must come to terms with these issues, as a positive step towards the protection of the environment through effective waste management (Adewole, 2009).

Effect of population increase on waste management

Population growth has always affected waste generation, collection and invariably disposal due to population growth and higher standards of living. The population of Lagos state rose from 1,443,569 in 1963 to 5,685,981 in 1991 and to 6,947,191 in December 1996. It is probable that the present population of Lagos state has reached the 21 million mark. This has impacted negatively on both the environment and waste generation in the State (Adewole, 2009).

Lagos State, which is the most densely populated state in Nigeria due to its commercial activities, the quality of waste generated in the state is in proportion to population size- as population increases so also waste generated also increases (Adewole, 2009).

With many other cities in the urban developing world, cities in Nigeria (especially Lagos) are faced with the twin problems of population increases and rapid expansion. These phenomena have no doubt brought increasing strain on urban infrastructural facilities. One area in which this strains has become obvious is in waste management where the existing system appears to be incapable of coping with the mountain load of waste generated and heaped on the surface. Population growth goes hand in hand with increased pollution and environmental decay (Adewole, 2009).

 

The challenges discovered in this study have been properly discussed by Adewole (2009). Also, some other researchers have also identified several factors that militate against solid waste management efforts in poor country cities.

Linden et al. (1997) identified ten common constraints/ challenges that militate against solid waste management efforts in Asian countries. These were:

1. Inappropriate technologies/processes;
2. Enforcement inefficiencies/non-existent;
3. Illegal dumping;
4. Lack of financing;
5. Lack of training/human resource;
6. Lack of political support;
7. Lack of legislation;
8. Policy conflict among levels of government/overlapping responsibilities;
9. Rapid increase in waste generation/limited data;
10. Lack of awareness among public; and
11. Limited land areas and land tenure issues.

These factors, according to the report, frustrated the waste management efforts of municipal authorities in Asia and made it difficult for them to keep their city environments clean and safe for the populations.

Kironde (1999) identified solid waste problem in Tanzania and attributed the abysmal performance of the waste sector to resource constraints including the scarcity of financial, physical, human and technical resources for the organization of waste management operations.

In a study of the solid waste problem confronting the city of Kampala, Uganda,

researchers from the Namilyango College (2001) identified several causes of the waste problem including the lack of dumping sites, ignorance of the masses about the need for proper waste disposal, inefficient collection methods, poor government attitude towards waste management, poverty of the people, corruption among public officials and lack of trained personnel for waste management. These have posed serious constraints to the waste sector and dampened efforts towards waste management in the city.

Many other writers have elaborated on how the factors cited above (plus others) interact to aggravate the solid waste problem in poor country cities. What follows from here is a detailed examination of the factors responsible for the abysmal waste situation in poor country cities (Baabereyir, 2009).

Way forward for waste management

Expanding recycling programmes can help reduce solid waste pollution but the key to solving severe solid waste problems lies in reducing the amount of waste generated. It was noticed that only the landfill system of waste disposal is being generally adopted in Lagos State. Whereas in other places for example, there are several methods of waste disposal used to ameliorate and mitigate the issue of population effect on waste management. Such systems that can or may be adopted are:

1. Recycling;
2. Bio treatment;
3. Incinerations;
4. Neutralization;
5. Secure sanitary landfill;
6. Composting

International cooperation should be sought to learn how other countries have effectively managed their waste collection; handling and disposal. The state government should seize the opportunity to apply for assistance in an effort to mitigate the looming disaster posed by population explosion in the state in terms of waste generation and disposal.

Remediation through education is also necessary. People should be educated on the need to reduce the amount of waste generated. The Lagos government should fund LAWMA to provide adequate collection bins in most areas of the metropolis and hinterland to forestall the wrong habit of throwing waste anywhere and everywhere, creating illegal dumps and doting and adorning the major streets of the state with wastes.

As earlier mentioned, the waste disposal habit of the people may change if government stopped paying lip service to the serious issue of waste management. The availability and nearness of disposal sites will greatly enhance and improve the habit of dumping waste "anywhere and everywhere".

Research and development into areas of better waste handling method may also go a long way to assist in elaborating and interjecting the situation. Nigeria has very little or nothing to showcase for as her achievements in the area of proper waste management. Heaps of garbage is also commonplace along major roads, riverbanks, and ravines and in excavated areas, particularly places excavated to obtain sand for road construction. In States where there is organized refuse collection, such as Lagos; the disposal of such wastes is usually an open dumpsites, located not far from living areas. Such dumpsites (called landfills) are not provided with

 

environmental safeguards, and the leachates from them penetrate freely into streams and the groundwater system. Waste generated from industries

With the exception of a few places, Nigeria cannot pride herself over having a functional sewage system. Industrial effluents of all types (both toxic and non-toxic) are discharged freely; into, surface and groundwater sources. Waste is allowed to pile, up before it is ordered to be cleared with military dispatch and automatic alacrity. This leaves room for corruption and does not allow for effective waste management.

In developed countries, industries are compulsorily made to discharge all it effluents into only license on-land disposal sites, where such effluents are treated prior to re-use, recycling or discharge into streams or other approved places. There are no such controls in Nigeria and where they exist they are not enforced and most industries discharge raw, untreated and highly toxic liquid effluents into open gutters, drains, streams, lakes, estuaries and lagoons.

To most Nigerians wastes is simply a nuisance, full stop. They hardly give serious thought to tile polluting effects of wastes or their deleterious effects on human health. Increase in urban population and 'blind', haphazard industrialization has contributed a great deal to the generation of wastes in Nigeria. In the municipal areas of Lagos State, more solid wastes are produced than the generators can effectively cope with or manage. The situation of unmanageable wastes in the cities appears to worsen with perceived increase in the income of the inhabitants. The slums and the shanty neighborhoods, as expected, receive little or no waste disposal services. Attaining best practices in waste management in Nigeria revolves around the following;

1. Education (both the technical experts and residents and other sources to which wastes are collected);
2. Enforcement (through the use of sound policy) and
3. Engineering (installation of various infrastructures and equipment for the management of waste).

Also, the above 3Es also revolve around;

1. Creating a well enabling environment for the success of waste management in Nigeria;
2. Coordinating government at all levels and ensuring sustainability of waste management infrastructures.

## 5.0 Conclusion

The challenge of managing solid waste generally in developed countries has shifted from ensuring minimum damage to public health and environment to the manner in which discarded resources are to be handled such that future generations are not deprived of its value. Developing countries on the other hand are still battling with the protection of human health and well-being while attempting to conserve resources.

Waste is any solid, liquid or gaseous substances or materials which being a scrap or being super flows, refuse or reject, is disposed off or required to be disposed as unwanted.

Lagos State Waste Management Authority was established in December 1991 by virtue of Edict No. 55 of Lagos State, which made the agency responsible for the collection and disposal of municipal and industrial waste in the State and to provide commercial services to the State and Local Governments.

This study was carried out on the inventory analysis of solid waste disposal and management in Ikorodu community, Lagos State, Nigeria. The study focuses on Odogunyan, Odokekere and Odonla area of Ikorodu community. Structured interviews, personal observation and review of secondary data were used to address the objectives of the study.

Primary data were collected through interview in the areas which include; Banks around Motor Park, House-holds, Industries, Hospitals, Schools and Market. A total of 200 respondents were sampled.

At critical region 0.05, Chi square was used to analyze the hypothesis. And the null hypothesis was rejected. The alternate or research hypothesis was accepted. Hence, there is a statistical significant relationship between education of respondent and their knowledge of waste management in Ikorodu community.

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