# Towards A Sustainable Healthy Environment: Investigating Issues Influencing Waste Management in Akure, Nigeria

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### ABSTRACT

*Increase in waste generation has brought alongside serious environmental challenges associated with improper waste disposal, especially domestic waste which are often discarded in different ways. Hence, towards a sustainable human health and her environment this study investigated and identified issues influencing waste management in the campus environment, an empirical evidence from FUTA Akure, Nigeria. Both primary and secondary data types were employed in the study; primary data were collected through the administration of questionnaire on residents in the campus neighbourhoods and personal observation was carried out. Secondary data were sourced from existing literature; which include published and unpublished materials, dissertation and term papers and also base map of the study area. Data collected were analysed using descriptive statistical methods which included frequency counts demonstrated with tables and charts. Findings from the study shows that manpower in waste disposal facilities available at the management board and establishment, attitude of community towards waste disposal, funding for waste disposal programs and technology used in solid waste disposal are factors influencing solid waste disposal ranked in that order. From the study, it can be concluded that human capital, level of technology, funding, facilities available and community attitude are factors influencing solid waste disposal and management in the Campus environment of FUTA, Akure. The study hereby recommends public enlightenment and education, provision of functional incineration, segregation and sorting at source, enforcement of certain law, increase in waste collection frequency, and plasma gasification, primarily an electrically charged or a highly ionized gas which provides renewable energy and an assortment of other fantastic benefits from waste.*

**Keywords:** *Waste, Management, Sustainable, Environment, Healthy*

## INTRODUCTION

### Background to the Study

The ever increasing rate at which refuse is been generated in the environment today is determined by the rate of urbanization which is now common in most developing countries of the world. According to Ogedengbe and Oyedele (2006), the composition and quantities of waste generated in both developed and developing countries are astronomical, they further posited that the higher the level of economic growth and the higher the population, the greater the volume of waste generated. This increase in waste generated has brought alongside serious environmental challenges associated with improper waste disposal, especially domestic waste which are often discarded in different ways (Nze, 1980).

In discussing the effect of poor waste disposal method in Nigeria, studies have shown that most inhabitants had a very poor orientation towards waste disposal. Studies have also shown that wastes of different kinds that are indiscriminately discarded serves as breeding ground for insect and these are the major causes of disease outbreak (Onokerhoraye, 1998). Solid and domestic wastes from urban area are discarded directly into stream and other water bodies. The composition of domestic waste mainly includes garbage, household waste, nylon, plastic, paper, and refuse among others and these are often indiscriminately discarded (Ogundele, 2006).

Poor domestic waste management (either liquid or solid) represents a serious threat to the environment. The present crisis of domestic waste management is not limited to the developing countries alone, but rather a worldwide crisis. For instance, reports have shown that Americans throw out over 400,000 tons of domestic waste every day, these include

construction waste of which 160 million tons of domestic wastes are tossed out each year (Awake 1990). Nigeria urban centres now sit on heaps of refuse and this refuse is increasing and will continue to increase in the future as long as the current trend of urbanisation continues.

In the urban centers, most contemporary waste management efforts are focused at local government level and based on high technology/high energy waste disposal by methods such as landfill and incineration. However, these methods are becoming increasingly expensive and energy inefficient which is attributed to some of the challenges facing waste management in the built up area. The financial costs of managing the long-term environmental impacts of waste disposal are many times what are actually charged for this service and in many cases corrective action is not remotely feasible. The purely environmental costs such as negative effects on habitat, wildlife and biodiversity are also recognised.

Hence, towards a sustainable human health and her environment there is need to investigate and identify issues influencing waste management in the campus environment, an empirical evidence from FUTA Akure, Nigeria.

### Statement of the Research Problems

Firstly, to urban and city dwellers, public hygiene starts and ends in their immediate surrounding and indeed the city would take care of itself, thereby posing serious threat on the urban environment. The situation has so deteriorated that today the problem of solid waste has become one of the nation's most serious environmental problem.

Secondly, poor waste management is predominantly noticeable in the study area which can be attributed to several factors. In their study, Akinola and Salami (2001), opined that one of the greatest challenges facing urban centres in the developing countries is the poor management of solid waste which can be attributed to the unprecedented increase in rate of urbanisation. Nigeria is thus not exempted from this challenge and also sadly enough there has not been a noticeable adequate management capacity anywhere in the country to deal with the situation. Given the very high potential of continued escalation or increase in the rate of urbanization, the evidence of serious and very high generation of domestic waste is bound to occur (Mabogunje, 1990).

Thirdly, open dumps can be seen to be preferred method of disposing of solid waste as an alternative of landfills in most African countries. In open dumps refuse is simply dumped in low lying areas on open land they are characterized by an absence of engineered measures, no waste management or consideration of landfill gas management, and few if any operational measures, such as registration of users, control of the number of tipping fronts, or compaction of waste (Zerbock, 2003). Wastes are dumped haphazardly, this method is neither hygienic nor safe but African countries have very little choice but to hang on to this method. Local governments think that uncontrolled waste disposal is the best that is possible, because of financial and institutional constraints.

While examining the problems of domestic waste management, study shows that there exists a relationship between domestic waste characteristics and management. It observed a lot of shortcomings, particularly administrative inefficiency in the management of domestic waste in Africa generally.

### Research Problem

- What are the approach and manner of waste generation and disposal by the people in the study area?
- What are the method of waste management adopted by the people in the study area?
- What is the perspective of the people towards waste management?
- How effective is the activities of the waste management organization in the area?
- What are the factors influencing waste management in the study area?

### Aim and Objectives of the Study

#### Aim of the Study

The study is aimed at investigating and identifying issues influencing waste management in the campus environment, in order to ensure the sustainability of human health and her environment with focus on FUTA Akure, Ondo state Nigeria.

#### Objectives of the Study

- To examine the approach and manner of waste generation and disposal by the people in the study area
- To examine the method of waste management of the respondent in the study area

- To examine the perspective of the respondents towards waste management ☐ To examine the activities of the waste management organization in the area
- To investigate the factors militating against waste management in the study area

## Justification for the Study

It became very imperative to study the factors influencing waste management in the campus environment as tertiary institution of higher learning serves as a major growth pole that is responsible for urbanization in or cities. The issue of waste management in the campus environment particularly in the residential area of the campus environment which are not under the control of the school management has been a serious concern to stakeholders in the built environment, as the menace of poor management tends to be on the high gear in such area. Hence this study seeks to investigate the factors that are responsible for such phenomenon in the campus environment. The Federal University of Technology Akure, being the target of the study is choosing based on the fact that such phenomenon are visibly predominant in the student residential area generally known as off-campus.

## The Study Area

Akure became the capital of Ondo State in 1976. It lies on latitude $70^o$ 5' North of the Equator and longitude $50^o$ 15 ' East of the Greenwich Meridian. It is about 370m above the sea level, is situated within a 48kilometer radius to major towns in Ondo State, viz Ondo to the South, Owo to the East and Iju/Itaogbolu to the North. Easy access and geographical centrality of Akure to these towns have enhanced the growth prospects of the city (see figures 1 , 2, 3). The population of Akure in 1963 was put 71,006 and by 1999, the total population had risen to 239,124 (NPC, 1996). By the year 2006, the population had increased to 340,021 (NPC, 2006). The increase in annual growth of the population had been tied to the administrative role of the town and its long standing role as a centre of economic activities attracting a large spectrum of immigrants into it.
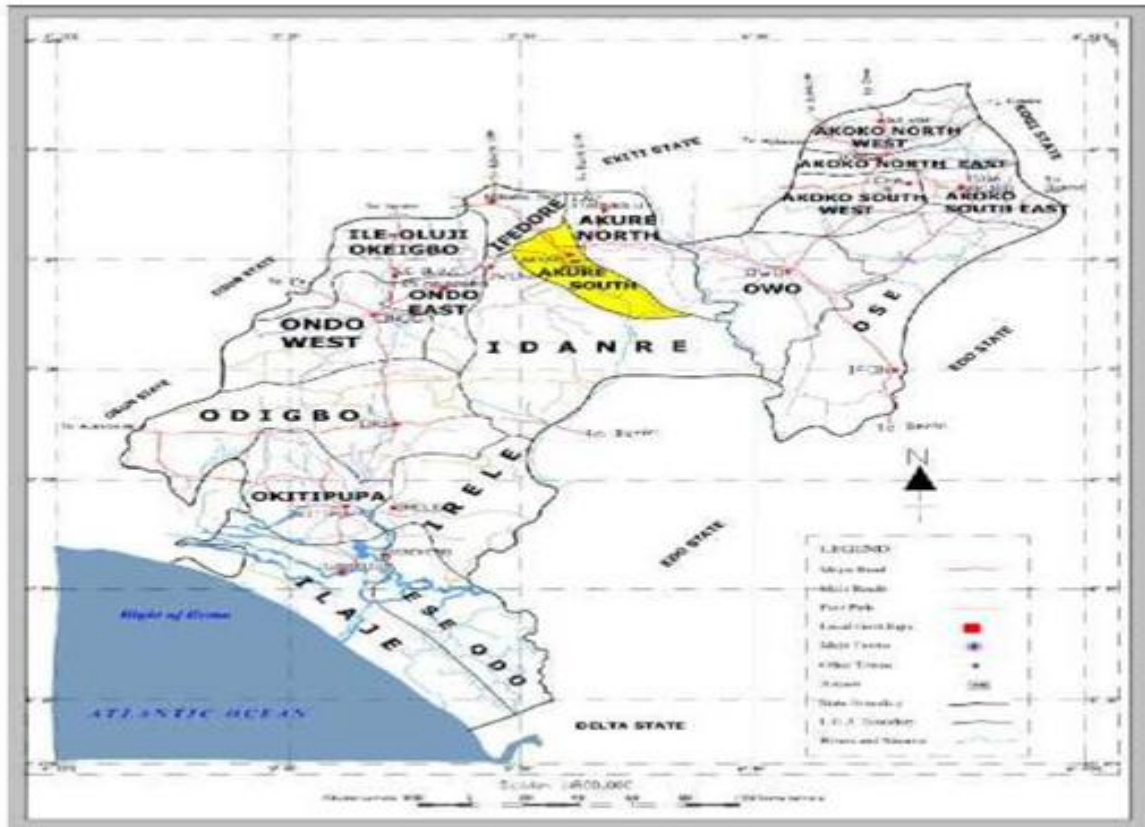


**Fig1.** *Map of Nigeria Showing Ondo State*
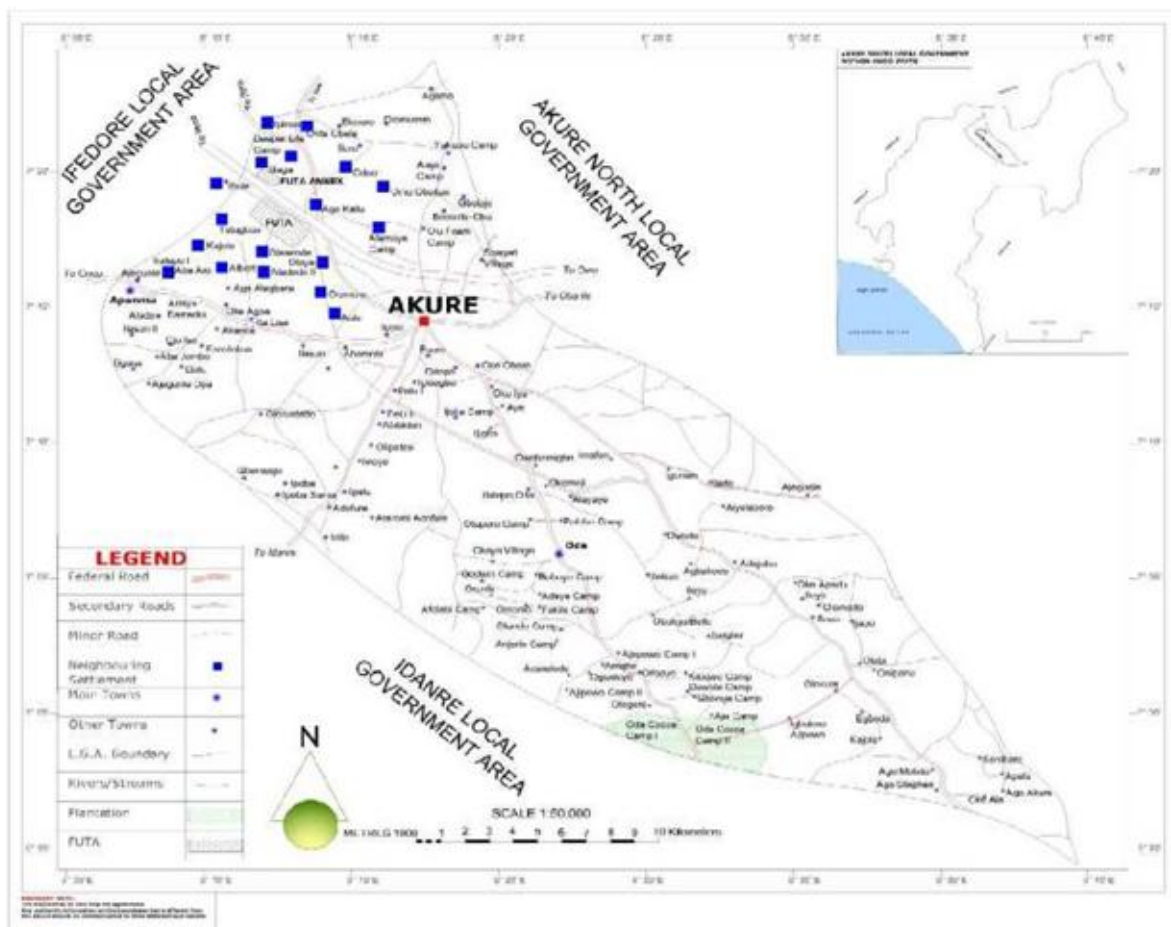
**Fig2.** *Ondo State Showing Akure south local government area*



**Fig3.** *Map showing the location of the study area.*

## LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

### Literature Review

#### Waste Management

**Waste management** or **Waste disposal** is all the activities and actions required to manage waste from its inception to its final disposal (United Nations Statistics Division, 2017). This includes amongst other things collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling etc.

The term normally relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities ( United Nations Statistics Division, 2017), including municipal (residential, institutional, commercial), agricultural, and social (health care, household hazardous waste, sewage sludge)(IFC, 2014). Waste management is intended to reduce adverse effects of waste on health, the environment or aesthetics.

Waste management practices are not uniform among countries (developed and developing nations); regions (urban and rural area), and sectors (residential and industrial)( Davidson, 2011). Waste management in cities with developing economies and economies in transition experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening. Problems with governance also complicate the situation. Waste management, in these countries and cities, is an ongoing challenge and many struggles due to weak institutions, chronic under-resourcing and rapid urbanization. All of these challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management affect the treatment of waste.

#### Waste Generation and Management in Akure

The amount of solid waste generated in Akure has increased steadily over time, from an estimated quantity of 60, 000 metric tons per year in 1996 to 75,000 metric tons in 2006 because of the increasing population, industrial and economic development. While the population of Akure was about 283,108 in 1996, it increased to approximately 983, 211 in 2016.

In 2004 government conducted a feasibility study of waste management in Ondo State. The study revealed that most of the waste arises from households, abattoirs, poultries, piggeries, markets and small scale industries with a total generation of 280 tons per day. However the total assessment revealed that about 80% of the total waste is organic in nature, followed by plastic/nylon, 15.72% and about 1% metal (Bammeke & Sridhar, 2004).

Recently there has been a considerable increase in plastic and paper in the recycled portion. The reason is due to the high demand for sachet water due to lack of potable water in Akure and the increase in use of packaging materials such as Polyethylene terephthalate ( PET ) bottles and bags. Of note a major proportion of the current useful industrial solid wastes are recyclable plastics waste, originating from sachet water production companies. Table 1 shows the mains source of solid waste generated in south western Nigeria where Akure is located. Solid waste in Akure typically consists of 70.3% from Domestic waste and while 18.6%,

6.3 % and 4.8% commerce, agriculture and industrial waste respectively.

#### Effects of Wastes and Poor Wastes Disposal

Imagine we all throw garbage, junk and rubbish away anyhow. Imagine there was no authority to supervise waste management activities. Imagine we all just sent our rubbish to the landfill, or just dumped them in a nearby river. What do you think will happen? A disaster!

#### Environmental Effects

**Surface water contamination:** Wastes that end up in water bodies negatively change the chemical composition of the water. Technically, this is called water pollution. This will affect all ecosystems existing in the water. It can also cause harm to animals that drink from such polluted water.

**Soil contamination:** Hazardous chemicals that get into the soil (contaminants) can harm plants when they take up the contamination through their roots. If humans eat plants and animals that have been in contact with such polluted soils, there can be negative impact on their health.

**Pollution:** Bad waste management practices can result in land and air pollution and can cause respiratory problems and other adverse health effects as contaminants are absorbed from the lungs into other parts of the body.

### Economic Effects

**Municipal wellbeing:** Everyone wants to live and visit places that are clean, fresh and healthy. A city with poor sanitation, smelly and with waste matter all over the place does not attract good people, investors and tourists. Such cities tend to have poor living standards.

**Recycling revenue:** Cities that do not invest in recycling and proper waste control miss out on revenue from recycling. They also miss out on job opportunities that come from recycling, composting and businesses that work with them.

### Effect of Improper Solid Waste Management

Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors;

Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil;

Toxic substances may percolate into the ground and contaminate the groundwater;

Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.

Solid waste management involves waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

### Disposal solutions

### Landfill

A landfill site (also known as a tip, dump, rubbish dump, garbage dump or dumping ground and historically as a midden (Merriam-Webster, 2014) is a site for the disposal of waste materials by burial. It is the oldest form of waste treatment (although the burial part is modern; historically, refuse was just left in piles or thrown into pits). Historically, landfills have been the most common method of organized waste disposal and remain so in many places around the world.

Some landfills are also used for waste management purposes, such as the temporary storage, consolidation and transfer, or processing of waste material (sorting, treatment, or recycling). Unless they are stabilized, these areas may experience severe shaking or soil liquefaction of the ground during a large earthquake.



**Plate1.** *A landfill compaction vehicle in action*

*Source: Wikipedia 2018*

## Incineration

Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume.

Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash.

Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste).

Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an incinerator is not always perfect and there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organic compounds such as dioxins, furans, and PAHs, which may be created and which may have serious environmental consequences.

## Recycling

Recycling is a resource recovery practice that refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, a procedure called kerbside collection. In some communities, the owner of the waste is required to separate the materials into different bins (e.g. for paper, plastics, metals) prior to its collection. In other communities, all recyclable materials are placed in a single bin for collection, and the sorting is handled later at a central facility. The latter method is known as "single-stream recycling (City of Chicago, 2013; Montgomery County, 2013).

The most common consumer products recycled include aluminium such as beverages cans, copper such as wire, steel from food and aerosol cans, old steel furnishings or equipment, rubber tyres, polyethylene and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fibreboard boxes. PVC, LDPE, PP, and PS are also recyclable. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required.

The type of material accepted for recycling varies by city and country. Each city and country has different recycling programs in place that can handle the various types of recyclable materials. However, certain variation in acceptance is reflected in the resale value of the material once it is reprocessed.

## Waste Management Sustainability

The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainabilityrelated activities. One way to do this is by shifting away from waste management to resource recovery practices like recycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal. This topic was on the agenda of the international Conference on Green Urbanism, held in Italy 12–14 October 2016.

## Avoidance and reduction methods

An important method of waste management is the prevention of waste material being created, also known as waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery) , removing any food/liquid remains from cans and packaging ("Removing food remains to reduce waste," n.d.), and

designing products that use less material to achieve the same purpose (for example, light weighting of beverage cans) (Schneider & Johnson, 2012).

*International waste movement*

While waste transport within a given country falls under national regulations, trans-boundary movement of waste is often subject to international treaties. A major concern to many countries in the world has been hazardous waste. The Basel Convention, ratified by 172 countries, deprecates movement of hazardous waste from developed to less developed countries. The provisions of the Basel convention have been integrated into the EU waste shipment regulation. Nuclear waste, although considered hazardous, does not fall under the jurisdiction of the Basel Convention.

*Benefits*

Waste is not something that should be discarded or disposed of with no regard for future use. It can be a valuable resource if addressed correctly, through policy and practice. With rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include:

**Economic**: Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and materials resulting in valuable materials being recovered for reuse and the potential for new jobs and new business opportunities.

**Social:** By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities.

**Environmental**: Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse gas emissions.

**Inter-generational Equity**: Following effective waste management practices can provide subsequent generations a more robust economy, a fairer and more inclusive society and a cleaner environment (United Nations Environmental Programme, 2013).

*The Challenges of Waste Management to Nigeria Sustainable Development*

Waste management in cities with developing economies and economies in transition experience exhausted waste collection services, inadequately managed and uncontrolled dumpsites and the problems are worsening (United Nations Environmental Programme, 2013). Problems with governance also complicate the situation. Waste management, in these countries and cities, is an ongoing challenge and many struggle due to weak institutions, chronic under-resourcing and rapid urbanization ( United Nations Environmental Programme, 2013). All of these challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management, affect the treatment of waste ( "Waste Management. Science Direct.," n.d.)

The problem of solid waste management has become a debilitating factor towards sustainable development in Nigeria. The study therefore was carried out to evaluate the chains of problems militating against solid waste management in Nigeria with particular stress on Enugu State. The study adopted survey research method. Data collected through questionnaire were analysed and hypotheses tested using Z-test statistical measure. The scientific investigation revealed among other things that resources normally voted by Government year by year to manage solid waste is always very meagre. There is no environmental education at all as was observed during the field investigation. Furthermore, some of the waste management staff were poorly trained and no plan in the future to give them further training or to improve already acquired skill. Based on the findings, some of the major recommendations are that solid waste management should be provided with a separate head in the budget for the purpose of adequate revenue allocation, implementation and monitoring.

The participation of the local communities in solid waste management should be encouraged. Environmental education should be intensified by both the state and local government. Also primary, secondary and tertiary schools curricula should inculcate detailed topics on solid waste management.

The environment of man lies at the mercy of both natural disaster and negligence on the part

of man in the course of controlling the gifts of nature. The later, takes the form of dumping solid/ industrial waste in an uncompromising, desert encroachment, erosion, depletion of ozone layer, depletion of natural resources, pollution of land, rivers, seas the air and generally the environment. In early times (pre-colonial days up till 1970s, the disposal of refuse and other wastes did not pose any significant problem.

The population was small and enough land was available for assimilation of wastes. Solid waste problem started with urban growth resulted partly from national increase in population and more importantly from immigration (Egunjobi, 1986). No towns in Nigeria especially the urban and semi-urban centers of high population density can boast of having found a lasting solution to the problem of filth and huge piles of solid waste, rather the problem continues to assume monstrous dimensions (Okpala, 1986).

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.

Problem with the disposal of solid waste in Enugu State of Nigeria especially in Enugu Urban could be traced to the period of the military rule. When the Military took over leadership in 1984, it established a full-fledged Agency called Anambra State Environmental Sanitation Agency to deal with the problem of solid waste. This is to show the importance of solid waste management to ensure the good health of the citizenry. In a survey conducted in 15 Nigerian towns in March 2002, a total of 600 people were asked to define precisely what they understand as 'waste', definitions received include 'unwanted materials' (8%), useless object (20%) , garbage (22%), rubbish (7%), dirt (15%), refuse (28%) (Nwokocha, 2012). According to Udechukwu (2009), wastes are useless, unwanted and discarded materials' Douglas (2004) corroborates Udechukwu's stance and argues that 'waste is material which arises from animal and human life and activities and is discarded as useless and unwanted. Number 16 of Lagos State Environmental Sanitation Law of 1984 defines 'domestic waste' 'refuses' and section

27 defines waste as: waste of all descriptions, any substances which constitute scrap material

or an efficient or other unwanted, surplus substances arising from application of an process, and any substance or article which requires to be disposed of as broken, worn out or otherwise spent.

## Conceptual Framework

This research made use of Healthy City Concept, Ecological Sanitation Concept Environmental Sanitation Concept and Management Concept. Different opinions of scholars on these concepts were put together while examples of different cities in the world where the concepts were applied and their outcomes were reviewed (Balogun, 2012).

### *Healthy City Concept*

Healthy City Concept has been defined by different scholars in different way, among these are briefly stated as follows; Healthy cities are clean and have good health and environmental services. They are safe, and people can live in them comfortably with their own social bonds, beliefs, customs and lifestyles (Gezairy, 1994). According to Ahmed (1999), Healthy Cities/Communities (HC) is an experiment that addresses health from a non-medical perspective. It focuses on health as a phenomenon that is not amenable to conventional scientific investigation or discussion. HC emphasizes values of community, aestheticism, relativism and private behaviour. WHO defines a Healthy City as ''one that is continually developing those public policies and creating those physical and social environments which enable its people to mutually support each other in carrying out all functions of life and achieving their full potential'' (Awofeso, 2008). The objectives of healthy city evolve around the followings; increased awareness of health and environmental issues in urban development efforts; political mobilization and community participation to prepare and implement municipal (city-wide or local) health and environment actions and projects, ideally and whenever feasible, through the development of a systematic city health and environment plan; creased capacity of the municipal government to manage urban problems using participatory approaches. The roots of the Healthy Cities concept may be traced back to 1844, when the Health of Towns Association was formed in the United Kingdom to deliberate on Edwin Chadwick's reports about poor living conditions in towns and cities. The revival of those

concerns in the ''new public health'' era dates from the Healthy Toronto 2000 convention in 1984 and, subsequently, the enthusiasm of the World Health Organization (WHO) Regional Office for Europe to translate its principles into a tangible global programme of action to promote health (Harpham, Burton, & Blue, 2001). The assumptions of healthy city concept according to World Health Organization (WHO) is to create a healthsupportive environment; to achieve a good quality of life; to provide basic sanitation and hygiene needs; to supply access to health care. The weakness of healthy city is not far from the following reasons; urban health services have a strong curative instead of a preventive bias; environmental health services suffer from severe institutional and human resources shortcomings; problems are more acute in the secondary cities where municipal authorities lack funds and machinery to run services.

When twenty-one European cities agreed on the concept of Healthy Cities (and Health for All 2000 before that), they did not consider other factors that could interfere with the applicability of the concepts in different parts of the world. Varying political systems, cultures, community structures and geographic locations could interfere in the applicability of HC projects and their outcomes. Developing countries for instance are undergoing an increasingly expanding population growth that is affecting the definition of communities (communities are growing within communities). Most of the efforts for health initiatives in developing countries were aimed to mobilize communities and address some of their more urgent problems, such as housing. In Australia, the Australian Community Health Association (ACHA) sponsored three pilot Healthy Cities projects in the cities of Canberra (capital city), Noarlunga (in South Australia), and Illawara (in New South Wales) in May 1987. The criteria that the pilot project adapted were in two main categories:

1. Getting political commitment through the formation of a high-level intersectoral management committee with members from governmental and non-governmental agencies, representatives of local organizations as well as interested individuals.
2. Targeting disadvantaged communities by all means possible such as promoting social health and establishing strong contacts

between pilot projects and the media for announcing the project for communities in similar plights (Balogun, 2012).

### Application of Healthy City Concept to the study

To have healthy market environment that would meet the following conditions which includes solid waste management, proper channelization of sewerage and surface runoff water, provision for green areas, water provision, toilet provision, traffic control, and provision of other essential facilities and amenities, the concept of healthy city cannot be undermined.

### Ecological Sanitation Concept (Ecosan)

Ecological sanitation (Ecosan) is a new holistic paradigm in sanitation, which is based on an overall view of material flows as part of an ecologically and economically sustainable wastewater management system tailored to the needs of the users and to the respective local conditions. It does not favour a specific sanitation technology, but is rather a new philosophy in handling substances that have so far been seen simply as wastewater and water-carried waste for disposal. Ecological Sanitation (ecosan) works on the fact that human excrement is not a waste product but contains the nutrients required to fertilized land and that it should be used for this purpose. The ecological sanitation cycle begins with containment, where excreta are held in the sanitation installation. The waste is then sanitized through one or several processes which cause pathogen die off, the resultant safe soil conditioner (from faeces) and fertilizer (from urine) is then recycled and used to assist crop production. Ecological sanitation is a holistic approach to sanitation and water management based on the systematic closure of local material flow-cycles (Werner et al., 2003). According to the ecosan philosophy, sanitation problems could be solved more sustainably and efficiently if the resources contained in excreta and wastewater were recovered and used rather than discharged into the water bodies and the surrounding environment. The concept thus recognises human excreta and water from households not as waste but as resources that can be recovered, treated where necessary and safely used again. Ecological sanitation can also be defined as a system that: prevents disease and promotes health, protects the environment and conserves water, recovers and recycles nutrients and organic matter. According to Ecosan Services Foundation (2009) the objectives of

ecological sanitation concept is to reduce the health risks related to sanitation, contaminated water and waste; to prevent the pollution of surface and ground water; to prevent the degradation of soil fertility; and to optimize the management of nutrients and water resources The origin of ecological sanitation concept could be traced back to 500 B.C., in China, most widely known example of the diligent collection and use of human excreta in agricultural crop production. This enables them to sustain more people at a higher density than any other system of agriculture. The value of "night soil" as a fertilizer was clearly recognized with well-developed systems in place to enable the collection of excreta from cities and its transportation to fields. Elaborate systems were developed in urban centres of Yemen enabling the separation of urine and excreta even in multi-story buildings. Faeces were collected from toilets via vertical drop shafts, while urine did not enter the shaft but passed instead along a channel leading through the wall to the outside where it evaporated. Here, faeces were not used in agriculture but were dried and burnt as fuel. In Mexico and Peru, both the Aztec and Inca cultures collected human excreta for agricultural use. In Peru, the Incas had a high regard for excreta as a fertilizer, which was stored, dried and pulverized to be utilized when planting maize. In the middle ages, the use of excreta and grey water was the norm. European cities were rapidly urbanizing and sanitation was becoming an increasingly serious problem, whilst at the same time the cities themselves were becoming an increasingly important source of agricultural nutrients. The practice of using the nutrients in excreta and wastewater for agriculture therefore continued in Europe into the middle of the 19th Century. Farmers, recognizing the value of excreta, were eager to get these fertilizers to increase production and urban sanitation benefited. The increasing number of research and demonstration projects for excreta reuse carried out in Sweden from the 1980s to the early 21st century aimed at developing hygienically safe closed loop sanitation systems. Similar lines of research began elsewhere, for example in Zimbabwe, in the Netherlands, Norway and Germany. These closed-loop sanitation systems became popular under the name "ecosan", "dewats", "desar", and other abbreviations. They placed their emphasis on the hygenisation of the contaminated flow streams, and shifted the concept from waste disposal to resource conservation and safe reuse.

The principle of Ecological Sanitation according to Esrey et al. (2003) is to return the valuable nutrients from urine and faeces back to the environment and avoid the pollution often caused by conventional sewerage whilst contributing to food production. Sewerage systems have been developed in many countries and could take on the form of conventional, simplified or settle sewerage. The alternative to these systems are on-site sanitation facilities. Supporters foresee that ecosan system can reduce the environmental pollution that other systems cause, in addition to recycling the valuable nutrients in the waste and improving food security. The types of ecosan toilet can be separated into two categories, dehydrating and composting. Within these categories there is also a distinction between urine diversion (those that separate urine from faeces to achieve a variety of benefits) and systems which mix both urine and faeces. There are a variety of models operating in slightly different ways. The most important advantages of ecological sanitation system are stated below; improvement of health by minimizing the introduction of pathogens from human excreta into the water cycle; promotion of safe, hygienic recovery and use of nutrients, organics, trace elements, water and energy; preservation of soil fertility; contribution to the conservation of resources through lower water consumption, substitution of mineral fertilizer and minimization of water pollution; improvement of agricultural productivity and food security; preference for modular, decentralized partial-flow systems for more appropriate cost-efficient solutions adapted to the local situation; promotion of a holistic, interdisciplinary approach; material flow cycle instead of disposal of valuable resources; conservation of water resources due to lower water consumption and minimal water pollution; improvement of health by properly sanitizing human excreta and prevention of disease spreading; provides more appropriate, costeffective, hence more affordable treatment solutions due to modular, decentralized, partialflow systems; substitution of chemical fertilizers with higher heavy metal content possible; preservation of soil fertility improves agricultural productivity and contributes towards food security; can help to reduce poverty by saving income and generating income by selling ecosan products like fertilizer, biogas; can support small business and enterprises to develop, e.g. construction workshops for special toilets, maintenance

services, market for fertilizer products and biogas; safe, hygienic recycling of nutrients, trace elements, water and energy; they provide a safer, more convenient, private and hygienic option. It is of primary importance when executing an ecosan program that people are correctly educated on how to operate and maintain systems. Ideally support should be provided during the first couple of cycles of operation and re-use. If users are not adequately trained and supported then the chances of them contracting disease during the operation of the facilities is high. On-site sanitation systems were created to form a barrier between deadly pathogens in faeces and householders; if ecosan is used incorrectly it holds the potential to counteract this purpose, putting householders and communities at risk.

### Application of Ecological Sanitation Concept to the study

The relevance of ecological sanitation concept to this research is the fact that there is the need to make provision for water supply and adequate toilet facilities for public use in most of our traditional markets so that we can have market environment that is free from pollution of human faeces and urine. The toilet facilities should be located strategically for easy access by people in the market. For effective management and control, the toilets can be privatised where people would pay for the service.

### Environmental Sanitation Concept

Environmental sanitation concept means the activities aimed at improving or maintaining the standard of basic environmental conditions affecting the well-being of people. These conditions include clean and safe water supply; clean and safe ambient air; efficient and safe animal, human, and industrial waste disposal; protection of food from biological and chemical contaminants; and adequate housing in clean and safe surroundings. It is also called environmental hygiene. Environmental sanitation is also defined as the art and science of applying sanitary, biological and physical science principles and knowledge to improve and control the environment and factors therein for the protection of the health and welfare of the public. World Health Organization (WHO) has been at the forefront of environmental sanitation and hygiene action over the past years and developed some key materials intended for policy-makers and technical people dealing with

these issues. For a sanitation system to provide the greatest health protection to the individual, the community, and society at large it must anchor on the following assumptions: isolate the user from their own excreta; prevent nuisance animals (e.g. flies) from contacting the excreta and subsequently transmitting disease to humans; and inactivate the pathogens before they enter the environment or prevent the excreta from entering the environment (Carr & Strauss, 2001). The limitation of environmental sanitation is not far from the fact that people do not realize the health benefits to the individual, the community and to society from improving sanitation. The high cost of improving sanitation is often cited as a barrier to implementing sanitation projects. However, to decrease the proportion of people lacking basic sanitation and water supply by 50 % worldwide by the year 2015, it is estimated that US$ 23 billion per year would be needed about US$ 7 billion a year more than is currently spent (WHO, 2000).

### Application of the Environmental Sanitation Concept to the Study

Environmental sanitation concept is considered relevance to this research because it focuses on clean and safe environment. There is the need for capacity building, attitudinal change and self-help collaborating effort of stakeholders in the commercial areas to the promotion of hygienic and safe environment.

### Management Concept

Primary definition of management is the process of achieving goals through the effort of others. Management is necessary in any organization that seeks to accomplish objectives. Without management an organization becomes a collection of individuals, each going in his or her own direction with no unifying guidance toward organizational goals. Three levels of management that are found in most medium sized and large firms are top, middle and lower management. Management is the art of getting things done through people. Management is the field of human behaviour in which managers plan, organize, staff, direct and control human, financial resources in an organized group effort in order to achieve desired individual and group objectives with optimum efficiency and effectiveness. In the past, management was not considered as an important part of development, with individual revolution during 17th and 18th century, several economists expressed their 'concepts and functions of management'. Only

in 19 century, management became the separate field of study because business organization faced various problems regarding labour efficiency and wage payment system. In search of solution of these problems people began to recognize management as a separate field of study Management thought developed gradually from past to present and passes through various distinct phases. The classical theory, it mainly consists of Bureaucratic theory, scientific management theory and administrative theory. The neoclassical theory consists of human classical theory and behavioural theory. Modern organization theory includes the system theory and contingency theory. Importance of management includes acquisition and utilization of resources, environmental adaptation, goal achievement, problem solving, performance control, and social responsibility. The leading functions of management include planning, organization, staffing leading and controlling (Balogun, 2012).

### Application of Management Concept to the Study

To achieve the aim of ideal physical environment for the markets there is the need to harmonize the efforts of all the stakeholders to improve their physical environment through effective and efficient management.

## RESEARCH METHODOLOGY

The quest for a comprehensive research influenced the study methodology. The data to be used for this study was obtained from basically primary sources. The study adopts descriptive analysis and relied mostly on primary data.

### Sources of Data

The scope of this study requires a comprehensive data set containing variables on size and institutions responsible for waste management in the study area, level of the people's awareness and their response to waste management techniques. The study is basically based on primary.

The primary data was collected from direct interviews, personal observations and responses of the respondents to questionnaires was administered in some selected streets in around FUTA area in Akure ( FUTA South gate, FUTA Junction, FUTA Hostel, and North gate and Wesco area) and interview was conducted with

an agent of a private waste management in FUTA/Aule zone (BCL zone 5).

### Research Design

The research design that was adopted in this study is the social-science design under which the survey design techniques was adopted. Interview was conducted for the agent of a waste management firm in charge of FUTA/Aule zone and also questionnaire was administered to the general community in the selected locations in the study area.

### Research Population

The population of Akure in 1963 was put 71,006 and by 1999, the total population had risen to 239,124 (NPC, 1996). By the year 2006, the population had increased to 340,021 (NPC, 2006). As a result of the scope of the study, a very few population was addressed to represent the entire study area.

### Research Frame

For the purpose of this research work, out of the numerous communities in around the Campus, five streets was selected which include FUTA South gate area, FUTA Junction, FUTA Hostels, FUTA North gate and Wesco area for better result in the survey. In these places, questionnaire was administered, focusing on the general community who are mainly adult. Focus was placed on the Elite in the area to get their view as regard waste management in the area. An interview was also conducted in the area and with the management in charge of waste collection, and probably suggest solutions to some of the challenges of physical planning administration in the area, being professionals.

### Sampling Size

The focus of the study is investigating issues influencing waste in FUTA environment of Akure, Ondo State. According to 2006 National Population Census of Nigeria credited the area with a population figure of approximately 340,021 people.

The administration of the questionnaire was targeted at the residents living within the campus environment in the study area, total enumeration of this population will be daunting task, hence the selection of a sampling size. The sampling size is a process whereby researchers select elements of the population that would describe the characteristics of a large number of items of a phenomenon.

Based on this, population of twenty-one (21) respondents was selected, amounting to twentyone (21) questionnaires, which were administered in order to have a representation of the various groups of respondent in the study area.

The first stage in the collection of primary data involved the reconnaissance survey of the study area, this is to enhance familiarization and also facilitates the easy administration of questionnaire. The second stage involves oral interview with the waste management officer in charge BCL zone 5.

As a result of the homogeneity of the target population these sample size will give a well representation of the sample frame.

## Sampling Process

In this research, **probabilistic sampling techniques** was adopted from which **cluster sampling** was used, due to the largeness of the frame of the study area, in which five streets was selected at random purposively.

## Data Collection Instruments

This generally refers to the statistical tools employed in obtaining the required facts from the target population in order to realize the objectives of the study. Therefore, for the purpose of this study, the following instruments was used: Data revolving issues influencing waste management in FUTA environment of Akure, Ondo State was collected from waste management agencies, in order to examine the existing situation.

### Direct Observation

This will adopt the reconnaissance survey, ground trothing and purposeful physical observation of the object of study in its natural environment so as to take field notes through mechanical or electronic means to the objectives of the study.

### Self-administered questionnaire

For the purpose of accuracy and exhaustive study, the use of computer based questionnaire was used for this research such that questionnaire was administered to respondents electronically. This entails the administration of questionnaire with social media software ( WhatsApp, and Email and SMS ).

The questionnaire will ensure that questions relevant to meeting the objectives of the study are posed to the respondents in a uniformly phrased way, thus permitting objectives comparison of the results. The questionnaires will contain a combination of closed and open-ended questions. The open ended questions will permit respondents to give detailed answers in cases where their experiences could not be articulated in few options.

## Methods of Data Analysis

Analysis of data for this study was done considering the different objectives that was used to achieve this study which will include the questionnaire, satellite imageries and other primary data. Each of these data set was processed and analysed separately based on each objectives of the research.

Data analysis is very important as it gives an opportunity for making meaning out of the data by interpreting the data collected from the field. In the process of analysing, efforts was made to relate the analysis to literature discussed previously. This was done by being guided by the research questions as well as objectives of the study.

The processing of data collected during the field survey (questionnaire) was carried out using Statistical Package for Social Science (SPSS) and other appropriate programs. The raw data sourced from the field through questionnaires was subjected to analysis using univariate, and bivariate analysis. Descriptive and inferential statistics was used in the analysis and presentation of data. Descriptive statistics entails the use of table, charts and graphs as well as the use of mean, median and mode among others to summarize and describe data.

Inferential statistics on the other hand is a method whereby generalization is made about the whole population via investigation of its sample.

## Coding and Analysis of Data

In this study, data collected are mainly primary data. Specifically closed ended questionnaire were dully administered in order to have the idea of people living in the area to help my research finding. The data collected were analysed with Statistical Package for Social Science (IBM SPSS Statistics 20) and Microsoft Excel 2016 respectively, which was effectively used in the analysis.

## ANALYSIS OF DATA AND RESEARCH FINDINGS

Data collected majorly covers the analysis of the scope, and mode of operation of the Ondo State

Waste Management Authority (ODSWMA) who is in charge of waste management in the area. It also involves the analysis of the understanding of the public as regards waste management, challenges militating against the effectiveness of ODSWMA and private waste managers in the area, level of understanding of the people as regard the organization in charge of waste collection, and the relationship that exist between them and the organizations. In addition, it analyzed the degree of response and compliance of the public to existing waste management policies and regulation in the area.

Sections of the number of the town were picked to get the overview of cases of the waste management in the area.

### Characteristics of the Sample Size

The respondents visited all participated well in the survey. Respondents were 57.14% males and 42.86% females with age range of 18-25 years as the maximum and 26-35 as the minimum with a prevailing education level being university graduate as illustrated in the figures below. This indicated that the survey was targeted mostly on elite in the community and this was possible because the study was also focused on Campus environment with majority of the residents being university Students. The sex distribution indicated that the male happened to by higher that the female population because the University is a mono university with focus on Technology which attracts male population than the female population.
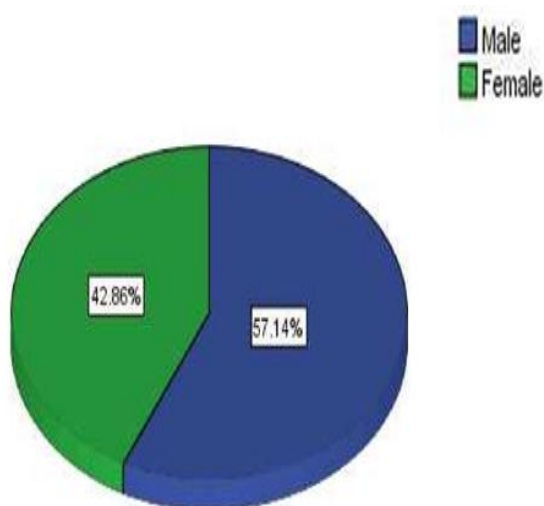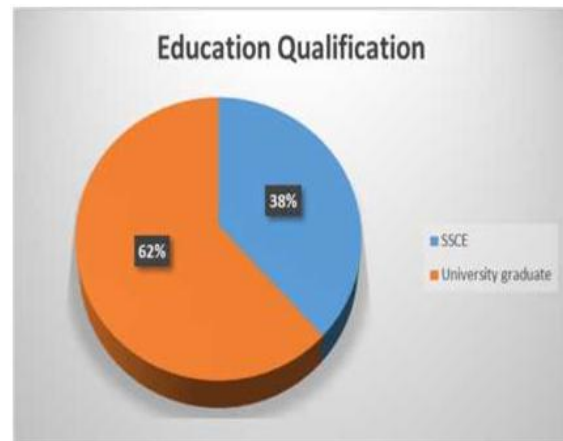


**Fig4.** *Sex of Respondents*
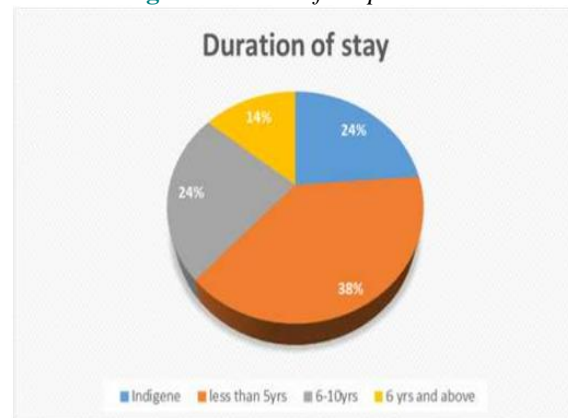


**Fig5.** *Education of Respondents*



**Fig6.** *Duration of Stay in the Town*

### Waste Management in Akure

In Ondo state, taking the FUTA Campus environment as the focus of the study, the Ondo State Waste Management Authority (ODSWMA) was instituted to ensure removal of waste form the environment, coordinate the collection of waste in the town, sensitize the public as regards how to handle waste in their environment and also to encourage the participation of both the community and private sector in waste management.

As a result of poor administration and lack of adequate funding by the Ondo state government, the vision of the establishment of ODSWMA could not be sustained by the government which was instigated the involvement private partnership. But the government still monitors the activities of these firms in order to regulate its charges, ensure their effectiveness compliance to regulations. The government also organise educating programme to sensitise the public the need to remove waste from their environment and also discourage burning in their environment.

From the interview conducted with an agent of the waste collector in charge of FUTA area and Aule (BCL zone 5) in Akure, it was emphasized

that waste collection was initiated and carried out by the government (ODSWMA) but was later halted as a result of poor maintenance techniques which could not sustain the operation of the organization in the town. In order to sustain the vision, the onus was transferred to the private sector which are very few which as a result has affected the effectiveness of waste management in particular waste collection in the town. Another militating factor is the response of the people to waste managers has been very poor as many claimed they could not afford the charges on waste collection, why others at first will comply but later opt out as a result of increase in charges coupled with ineffectiveness of the firm in charge of the process.

From the interview conducted and questionnaire administered, it can be deduced that most people are aware that they generate waste, but the fact remains that several people have different mentality and attitude towards waste management as many don't see the need for their waste to be collected by any external body as some feel insecure, while others try to manage that their waste.

**Table1.** *Acknowledgement of Waste Generation*

| Response | Frequency | Percent |
|---|---|---|
| yes | 17 | 81.0 |
| No | 3 | 14.3 |
| Undecided | 1 | 4.8 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

Obviously from table 1, 81% of the respondents attested to the fact that they generate waste. If they generate waste, why then should there be problem with how to manage such waste? This is one of the salient question that comes to mind when thinking about the elite community, because waste should be something that should not be kept personal in the environment.

Going further to ask if they see any need or reasons to properly remove their waste from their environment, table 2 shows that 90.5% of the respondents know that waste must be removed from their environment, while 4.8% said they don't see the need to manage waste and others are undecided.

**Table2.** *Necessity to Properly Manage and Remove Waste from the Environment*

| Response | Frequency | Percent |
|---|---|---|
| Yes | 19 | 90.5 |
| No | 1 | 4.8 |
| Undecided | 1 | 4.8 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

Actually merely analysing this response, one should have concluded that all environment is kept clean, but reverse is the case as further questions was asked, which tends to expose people's understanding as to how their wastes are managed. They know that it must be catered for, but the problem lies in the approach of management.

**Table3.** *How waste from the kitchen is managed*

| Response | Frequency | Percent |
|---|---|---|
| Water sink and dust bin | 6 | 28.6 |
| Pour water outside and solid waste in the dustbin | 8 | 38.1 |
| Use container for liquid waste and dustbin for solid waste | 4 | 19.0 |
| Others specify | 3 | 14.3 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

Findings as regards the method that the people adopt in managing the different type of waste ranging waste from the kitchen to the management of faeces and urine are shown in table 3 and 4 respectively. It can be deduced that a good number of the people adopt one of the best method of management of faeces and urine, but getting to kitchen waste 38.1 % confessed they pour waste liquid outside the house and possess dustbin to carter for garbage, 28.6% said they have Water sink and dust bin to carter for their garbage and sewage.

**Table4.** *How Faeces and Urine is managed*

| Response | Frequency | Percent |
|---|---|---|
| Pit latrine | 1 | 4.8 |
| Water closet | 18 | 85.7 |
| Pour flush or ventilated pit Latrine | 2 | 9.5 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

Another factor that must be considered in order to really identify the factors affecting waste management in Akure is the attitude of people in handling and managing their dustbin. Effort

was made to find out when people empty their dustbin as it has been discovered that people take less care as to hoe they empty their dustbin. From the survey, 61.9% of the respondents argued that they empty their dustbin every day, which is a very good percentage. It is amazing to know that some said they empty their dustbin once in a week while some even said as the spirit leads, not giving a specific duration.

**Table5.** *Duration of removal of waste from the Dust bin in the house*

| Response | Frequency | Percent |
|---|---|---|
| Daily | 13 | 61.9 |
| Weekly | 5 | 23.8 |
| Others, specify | 3 | 14.3 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

Table 6 shows the response of the public on how often do they remove waste from their environment. 19% argued that they remove waste on daily basis, while 47.6% said it is every week and 14.3% confessed that they remove waste from their environment every month. The result shows that most people get rid of waste entirely from their environment every week.

In Akure, before the advent of OSDWMA, most people burn their refuse, while others just gathered them on a vacant plot and never mind whether it's catered for or not. But the advent of OSDWMA has made the story changed to a considerable measure.

**Table6.** *Frequency of removing waste from the environment*

| Response | Frequency | Percent |
|---|---|---|
| Daily | 4 | 19.0 |
| Weekly | 10 | 47.6 |
| Monthly | 3 | 14.3 |
| Others, specify | 4 | 19.0 |
| Total | 21 | 100.0 |

*Source: Author's field survey, 2017*

**Table7.** *Respondent that patronize the Waste Management Board/Waste Collector*

| Response | Frequency | Percent |
|---|---|---|
| Yes | 7 | 33.3 |
| No | 11 | 52.4 |
| Undecided | 3 | 14.3 |
| Total | 21 | 100 |

*Source: Author's field survey, 2017*

When asked if the people patronize the waste collectors, table 7 shows that 33.3% responded positive while 52.4% do not patronize the waste collector. When asked further reasons for the negative response majority of the people gave different specific reasons why they don't patronize the waste collectors.

**Table8.** *Reasons why people don't patronize the service of the waste collectors*

| Response | Frequency | Percent |
|---|---|---|
| Do not need their service | 2 | 9.5 |
| Too costly to afford | 1 | 4.8 |
| Their mode of operation is not effective | 2 | 9.5 |
| They do not operate in my area | 5 | 23.8 |
| Others, specify | 11 | 52.4 |
| Total | 21 | 100 |

*Source: Author's field survey, 2017*

From the response of the public in figure 5, 71% of the respondents attested to the fact that waste collectors operate in their community, why 24% argued that they don't and 5% ar$_e$ undecided. It can be deduced that most places are touched by the activities of the waste collector.

From the interview conducted with an agent of the waste collector in charge of FUTA area and Aule (BCL zone 5) in Akure, it was emphasized that waste collection was initiated and carried out by the government (ODSWMA) but was later halted as a result of poor maintenance techniques which could not sustain the operation of the organization in the town. In order to sustain the vision, the onus was transferred to the private sector which are very few which as a result has affected the effectiveness of waste management in particular waste collection in the town.

From figure 6, 29% of the respondents said the activity of the waste collector is not effective, 24 % said it is moderately effective, 38% argued that that it is effective while 9% said it is very effective. In can be concluded that the activities of the waste operator is not as effective as expected as this was also confirmed from the interview with the waste management agent that people complain about the effectiveness.

This is one of the challenges confronting their operation, which is as a result of poor management and few private establishment in the business such that the few available ones have a very large area to cover with few staff and facility.
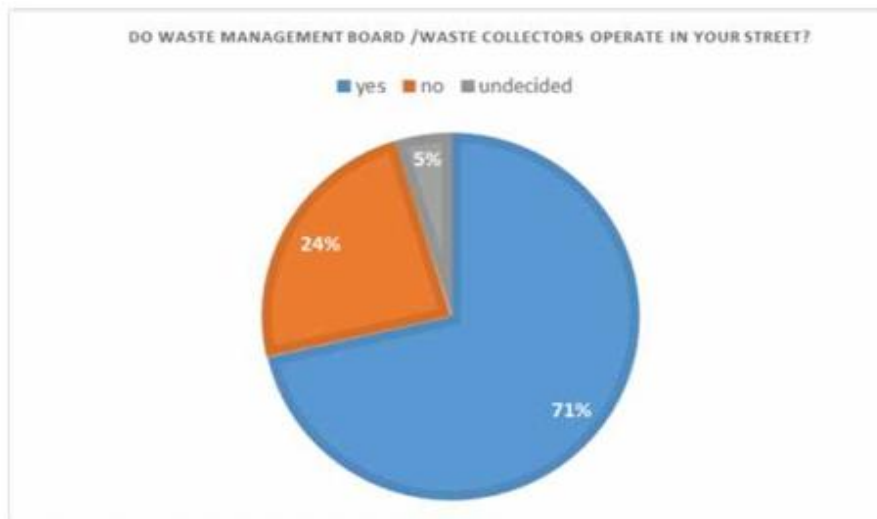
**Fig. 5:** *Chart showing the catchment area of the waste management*

*Source: Author's field survey, 2017*



**Fig. 6:** *Chart showing the effectiveness of the waste collectors in Akure*

**Table9.** *Challenges of waste management board/waste collectors in the Campus environment*

| Response | Frequency | Percent |
|---|---|---|
| Inadequate funding | 4 | 19.0 |
| Lack of cordial relationship between the operator and the community | 3 | 14.3 |
| Inadequate waste disposal facilities | 4 | 19.0 |
| poor management | 3 | 14.3 |
| I don't know because they don't operate in my area | 2 | 9.5 |
| others, specify | 5 | 23.8 |
| **Total** | **21** | **100.0** |

**Source:** *Author's field survey, 2017*

From table 9, 19% of the responded attested to the fact that inadequate funding is one of the major challenges confronting the ODSWMA and the waste collector. 19% of the respondent also said that inadequate waste disposal is one of their challenges. Meanwhile, 19% of the argued that it is lack of the cordial relationship between the operator and the public that if affecting the effectiveness of the waste management operators.

**Factors Militating against Solid Waste Management in Akure**

The study found that manpower in waste disposal facilities available at the management board and establishment, attitude of community

towards waste disposal, funding for waste disposal programs and technology used in solid waste disposal are factors influencing solid waste disposal ranked in that order. From the study findings, it can be concluded that human capital, level of technology, funding, facilities available and community attitude are factors influencing solid waste disposal and management in Akure.

Factors militating against effective waste management in Akure include:

### Indiscriminate Waste Disposal

This is practiced by the people in the metropolis. Many people throw away wastes such as pure water sachets, polythene bags, empty cans, plastic containers etc., anywhere without regard for the effects of such actions. The result is that some streets in the metropolis are littered with these waste products. During field visits, it was observed that people just want the refuse to be outside the premises of their houses. The result is dumps of refuse few meters outside their houses even though a waste disposal facility is available in the area.

### Inadequate Waste Disposal Facilities

Many residential areas outside the city wall have no refuse disposal facilities at all. This accounts for the rapid rate of filling and overflow of wastes from the few available centres. It was also observed that in some quarters, the refuse collection sites have being demolished and converted to other uses.

### Weak and Poorly Imposed Laws

There are weak and poorly imposed laws on waste disposal which allows people to breach the laws. According to ODSWMA disregard for the rule of law and other forms of indiscipline has contributed a lot to the stunted nature of achievements towards a qualitative environment for example, sign boards fixed by ODSWMA indicating that dumping refuse at particular locations is forbidden are disregarded as waste dumps can be seen there. The agency's due to weak laws also the indiscriminate disposal of refuse is mainly due to poorly imposed laws concerning refuse disposal.

### Inadequate Funding of ODSWMA

This is the most pressing problem to the agency. The agency has inadequate funds to carry out maintenance of its plants, equipment and the personnel that manned the various units (ODSWMA, 2007). The agency can effectively solve the problems of inadequate personnel,

machineries and facilities with adequate funding. Lack of adequate funding is a major problem of waste management in Nigerian cities (Abejide, 2007).

### Inadequate Participation of the Private Sector

In Ondo state, there are very few sector that participate in waste management. In some states of the federation such as Kaduna, Kano, Lagos states etc. there is private sector participation (PSP) scheme that involves the use of registered and designated refuse collectors who are assigned different areas for transfer points and collection for disposal at dump or landfill site (Osinowo, 2001). Some companies also engage in waste collection and disposal at a given rate to commercial enterprises, private clinics etc. if such private sector and companies exist in Ondo state, they would have complemented the efforts of ODSWMA.

### Corruption

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 Ondo State Waste management authority 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.

Some of the major problems confronting and militating against an effective management and sustainable development of waste collection and disposal in Ondo state have been identified in this paper. The entire above highlighted problem cannot allow for effective management and sustainable development.Therefore, it is against the background that there is an urgent need to address the effective waste management system to be adopted for a sustainable development.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

From the study it was observed that there are many waste dumps within residential areas which posed a direct threat to the health of the

people living nearby. Thus efforts must be made to get rid of these dumps for a healthy population. The burning of wastes as a control strategy can be discouraged by timely evacuation of refuse dumps in the metropolis. Composing of wastes to produce organic manure is a common practice in the agricultural region of the state. The rate of composting reduces due to the presence of polythene bags.These polythene bags posed a serious threat to waste management and control in the metropolis. Thus efforts must be made to reduce its usage and indiscriminate disposal for a quality environment in the metropolis. Based on the study it is observed that concerted efforts can be made to ensure effective waste management and control in the metropolis by adopting the recommendations outlined in this paper. This becomes necessary so that the current situation does not reach a crisis proportion.

## Recommendations

In order to have an efficient management of solid waste in FUTA Campus environment, the following recommendation are necessary.

### Public Enlightenment and Education

The public needs to be enlightened on proper waste generation and disposal practices including sorting of wastes. This can be achieved through enlightens campaign on TV, radio and postal to educate the citizen on it (WHO 2006). Adequate information should be made available for users at dump site on how to deposit their wastes. There is also a need to introduce solid waste management in the primary school curriculum so that they could be informed on the need to maintain a clean and healthy environment.

### Provision of Functional Incineration

Based on this research and findings there is no findings there is no functional incinerator at the Ondo state waste management and recycling project. Instead wastes that are not useful are burnt in the open which is not healthy for the environment. Incinerators are a source of steam for industries that require steam as their source of energy and these industries could be located near incinerating plants which in turn serves as a source of revenue.

### Segregation and Sorting at Source

There is need to separate municipal waste at source, this helps to reduce the time used in sorting at the wastes disposal and recycling site. It even helps to recover more material because once all these waste are collected at source it is difficult to achieve a 100% soring which implies that some useful wastes would not recover during sorting.

### Enforcement of Certain Law

Environmental laws exist but there laws are not adequately implemented. The environmental law shall provide appropriate prohibition against illegal dumping of wastes along drainage and road paths, but this acts still appears to be on the increase

### Increase in Waste Collection Frequency

The frequency of collection needs to be increased and also should be consistent. To do this serious efforts should be made at raising the availability ratio of vehicle through improved and prompt maintenance services.

### Plasma Gasification

Plasma gasification is another form of waste management. Plasma is a primarily an electrically charged or a highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,600 °F. With this method of waste disposal, a vessel uses characteristic plasma torches operating at +10,000 °F which is creating a gasification zone till 3,000 °F for the conversion of solid or liquid wastes into a syngas. During the treatment solid waste by plasma gasification, the waste's molecular bonds are broken down as result of the intense heat in the vessels and the elemental components. Thanks to this process, destruction of waste and dangerous materials is found. This form of waste disposal provides renewable energy and an assortment of other fantastic benefits.

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