EVALUATION OF CONSTRAINTS AFFECTING SOLID WASTE MANAGEMENT AMONG HEALTH WORKERS AND HEADS OF HOUSE HOLD IN NIGERIA

BY

ADO HALILU BELLO

JULY, 2011

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (PH.D) IN HEALTH EDUCATION.

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JULY, 2011

DECLARATION

I hereby declare that the research work entittled 'Constraints of Solid Waste Management in Nigeria' has been written and compiled by me. This research is exclusively the report of the investigation conducted. I also declare that this dissertation has not been presented or submitted in any form, whether partly or wholly for any other degree to the best of my knowledge. All sources of publications and other related studies cited in this research have been reflected in the references.

Ado Halilu Bello	Signature	Date

CERTIFICATION

This Ph.D dissertation entitled " Constraints of solid waste management in Nigeria" by Ado Halilu Bello meets the regulations governing the award of the degree of Doctor of Philosophy(.Ph.D) Health Education of Ahmed Bello University, Zaria and is approved for its contributions to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to my entire family for their encouragement and support through out this studies.

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ABSTRACT

This study examined the constraints of Solid Waste Management in Nigeria. To achieve this purpose, a stratified and systematic random sampling technique was used to draw the sample from the six geopolitical zones of the country namely North-West, North-East, North-Central, South-West, South-East and South-South. From each zone a state was selected; thus the total number of states involved in the study was six. The respondents ; totaling nine hundred and sixty (960) .. The instrument used for data collection consisted of four (4) sets of a structured questionnaire using the Likert five -point scale of measurement and Yes/No options. The first questionnaire (A) comprised the following: section A consisted of six (6) items on socio- demographic data of respondents, while Sections B, C, D, E and F consisted of 10 items each on specific variables.The second part of the questionnaire for professionals consisted of 10 items on problems of collection and disposal of solid waste in form of Yes or No options. The second questionnaire (B) consisted of 24 items on problems of collections, disposals and storage of solid wastes for the community members in form of Yes or No options, while the third questionnaire was mainly an inventory on the available materials and human resources used for collection, storage and disposal of solid wastes in the selected states.The data collected was statistically analyzed, using one sample t-test to compare the observed mean scores for the respective variables with a fixed mean of 3.5. The hypotheses tested the independent variables and the dependent variable investigated in the study.Based on the findings of this study ,the results showed that,there were constraints to effective collection,storage and disposal of solid wastes in Nigeria.Also funds available for the collection,storage and disposal of solid wastes in Nigeria were grossly inadequate.The results further showed that,there were inadequacies in the management of the available funds in the respective agencies for the collection,storage and disposal of solid wastes in Nigeria. It was also revealed in the study that available facilities and equipment for collection,storage and disposal of solid wastes are grossly inadequate in all the agencies in Nigeria.Although there are professionals and competent personnel in the agencies, the results showed that,their number was not commensurate with the required activities of the agencies in terms of collection,storage and disposal of the solid wastes generated in the states.Based on the results obtained,it was recommended that governments should endeavour to provide basic facilities and equipment,funds,personnel especially the lower cadre and ensure effective process of adequate utilization of the available funds and ensure proper accountability at all levels in the collection,storage and disposal of solid wastes in Nigeria.

OPERATIONAL DEFINITION OF TERMS

Waste: Any thing that is solid, liquid or gaseous, which has been either over used or under used, or which is considered as worthless, and therefore discarded; which if not properly disposed, could be dangerous to health.

Solid waste: This is also called refuse, It refers to wastes which are in solid form, e.g. cans, plastics, rubber, which include residential, commercial, institutional, municipal, and agricultural wastes.

Solid waste disposal: The disposal of solid waste materials which are considered useless or worthless and or hazardous,and which results from human or animal activities.

Constraints: These refer to problems of funds, personnel, equipment, non-community participation,education and environmental policies that hinder effective solid waste management in Nigeria.

Waste management: This refers to the physical means employed in other to remove waste from the community.

Urban areas: All towns designated as state capitals in Nigeria.

Solid waste management: The process of collection, storage and disposal of wastes (refuse).

Health worker- This refers to registered and lincesed environmental Health Personnel in Nigeria.

Head of household- This refers to a person who direct and coordinate the affairs of members of his families residing in the same premises.

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ABBREVIATIONS

FEPA	- Federal Environmental Protection Agency
PAI	-Population Agency Institute
EHA	-Environmental Health Assistant
EHT	-Environmental Health Technologist
USEPA	-United State Environmental Protection Agency
CP	-Cleaner Production
MSW	-Municipal Solid Waste
PSSP^{TM}	-Purpose, Structure,State and Performance
Afdb	-African Development Bank
CASSAD	-Centre-for-African-Settlement-Studies-and-Development
CBN	-Central Bank of Nigeria
CLTS	-Community-Led Total Sanitation
CSOs	-Civil Society Organizations
CWASHC	-Community Water, Sanitation and Hygiene Committee
DFID	-Department for International Development
DHS	-Demographic and Health Survey
EC	-European Commission
EDF	-European Development Fund
ESA	-External Support Agencies
EU	-European Union
FCDA	-Federal Capital Development Authority

FCT	-Federal Capital Territory
FGN	-Federal Government of Nigeria
FMAWR	-Federal Ministry of Agriculture and Water Resources
FGN	-Federal Government of Nigeria
FMAWR	-Federal Ministry of Agriculture and Water Resources
FME	-Federal Ministry of Education
FMENV	-Federal Ministry of Environment
FMF	-Federal Ministry of Finance
FMH	-Federal Ministry of Health
FMHUD	-Federal Ministry of Housing and Urban Development
FMI	-Federal Ministry of Information
FMIGA	-Federal Ministry of Inter-Governmental Affairs
FMWASD	-Federal Ministry of Women Affairs and Social Development
FMWR	-Federal Ministry of Water Resources
FOS	-Federal Office of Statistics
FRN	-Federal Republic of Nigeria
GDP	-Gross Domestic Product
GSF	-Global Sanitation Fund
HA	-Hydrological Areas
HEP	-Hydro Electric Power
IDS	-Inspectorate of Dams Safety
IEC	-Information Education and Communication
IMCs	-Irrigation Management Commissions

IYS	-International Year of Sanitation
JICA	-Japan International Corporation Agency
JMP	-Joint Monitoring Programme
LEA	- Local Education Authority
LEEDS	-Local Economic Empowerment and Development Strategy
LGCs	-Local Government Councils
LG	-Local Government
LGSCs	-Local Government Service Commission
MDAs	-Ministries, Departments and Agencies
MDG	-Millennium Development Goal
MICS	-Multi-Indicator Cluster Survey
MOU	-Memorandum of Understanding
MTSS	-Medium Term Sector Strategy
NAFDAC	-National Food, Drug Administration and Control
NEWSSP	-National Water Supply and Sanitation Policy
NBS	-National Bureau of Statistics
NCWR	-National Council on Water Resources
NDHS	-National Demographic Health Survey
NEC	-National Executive Council
NEEDS	-National Economic Empowerment and Development Strategy
NEPA	-National Electric Power Authority
NEPAD	-New Economic Partnership for African Development
NESP	-National Environmental Sanitation Policy

NESREA	-National Environmental Standards Regulations and Enforcement Agency
CSNWS	-Civil Society Network on Water and Sanitation
NGOs	-Non-Governmental Organizations
NOA	-National Orientation Agency
NPC	-National Planning Commission
NPHCDA	-National Primary Heath Care Development Agency
NTCES	-National Technical Committee on Environmental Sanitation
NTGS	-National Task Group on Sanitation
NWASP	-National Water Supply and Sanitation Policy
NWP	-National Water Policy
NWRI	-National Water Research Institute
NWRMP	-National Water Resources Management Policy
ODA	-Official Development Assistance
OPS	-Organized Private Sector
PHCN	-Power Holding Company of Nigeria
PPP	-Public Private Partnership
PRSP	-Poverty Reduction Strategy Paper
PWI	-Presidential Water Initiative
RBDAs	-River Basin Development Authorities
RBMCs	-River Basin Management Commissions
RWSSA	-Rural Water Supply and Sanitation Agency
RWSS	-Rural Water Supply and Sanitation

SEEDS	-State Economic Empowerment and Development Strategy
SEPAs	-State Environmental Protective Agencies
SPCs	-State Planning Commissions
SUBEBs	-State Universal Basic Education Boards
SWSHC	-State Water, Sanitation and Hygiene Committee
SWBs	State Water Boards
SWCs	-State Water Corporations
SWMBs	-State Water Management Boards
SWSAs	-State Water Supply Agencies
UNDP	-United Nations Development Programme
UNCEF	-United Nations Children Education Fund
USAID	-United States Agency for International Development
WASHCOM	-Water, Sanitation and Hygiene Committee
WB	-World Bank
WCAs	-Water Consumers Association
WES	-Water and Sentimental Sanitation
WHO	-World Health Organization
WIMAG	-Water Investment Mobilization and Application Guidelines
WRMP	-Water Resources Management Policy
WS&QC	-Water Supply and Quality Control
WSMP	-Water and Sanitation Monitoring Programme
WSP	-Water Sanitation Policies
WSS	-Water Supply and Sanitation
WSSSRP	-Water Supply and Sanitation Sector Reform Programme
WWD	-World Water Day

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The management of urban solid wastes constitutes one of the immediate and serious environmental problems facing governments in African cities (Baumgartner, 2003). The conventional municipal solid waste management approach, based on collection and disposal, has failed to provide efficient and effective services to all urban residents (Vancini, 2000). The urban environment steadily degrades due to large volumes of waste which are not efficiently managed. In Nigeria, it is common to find large heaps of garbage and other wastes all over the cities. Abugo (1999) reported that 35% of Ibadan's household, 33% of Kaduna's and 44% of Enugu's do not have access to waste collection and disposal services. Odeyemi and Onibokun (1997) described Lagos as the dirtiest capital in the world. In most parts of the cities, streets are partially or wholly blocked by solid wastes. Similarly, open spaces and market places are littered with solid wastes. In most cases, drains are clogged or totally blocked and many compounds are hemmed in by solid wastes. However, this deplorable situation is not peculiar to Nigerian cities.

In Accra, Ghana, only 11% of the 1.4 million residents benefit from home collection Mentel, 2006), while the remaining 89%, dispose their wastes at community dumps, in open spaces, in water bodies and in storm drainage channels (Baumgartner, 2003). Similarly, Baumgartner (2003) observed that on the average, city authorities in Tanzania collected only 24% of the refuse. In Kinshasa, household waste collection and street cleaning are restricted to wealthy neighborhoods, while in the remaining areas,

household wastes are dumped along roads, at illegal dumps and in storm water drains or buried (Izeze, 1999).

The concern over solid waste is generated from an aesthetic desire to live in a clean environment and also from the realization that a dirty and cluttered environment is unhealthy and unsafe for the population. This is evident in the incorporation of environmental sanitation as a component of primary health care adopted by the World Health Organization at the Alma Ata Declaration in September, 1978 (WHO, 1978). This was also clearly pointed out at the Istanbul Declaration and the Habitat Agenda for 1988. It was stated that sustainable human settlements depend on the creation of better environment for human health and wellbeing which will improve the living conditions of people and of their lives (United Nations for Human Settlement, 1998).

Advanced nations of the world have recorded remarkable achievements in their efforts to address the problems posed by solid waste management yet; much is still to be done in areas of proper management of wastes, as well as instituting appropriate approaches of the populace to waste collection and disposal practices. In most third world countries, particularly African countries, the challenges posed by waste management system are more pronounced primarily due to the inherent limitations of development in the continent. Unlike the dispositions of the advanced nations in terms of technological know-how and levels of awareness, most nations of Africa lack the where-withal necessary to meet these challenges.

In spite of the landmark achievements recorded by the developed countries, they are still faced with the potential risks to health and to environment from handling solid and liquid wastes. Field workers are directly affected by the risks involved due to

possible skin contact with wastes if adequate protection is not taken (Bell, 2000). In 1980, the National Environmental Engineering Research Institute, India carried out studies that showed a higher incidence of intestinal parasites in collectors of domestic wastes than for the population as a whole. Other harmful effects may range from toxic effect of chemical wastes such as those produced in laboratories and homes to those of chronic, mutagens following prolonged exposure. Accidental cuts, burns and constant dermatitis are also direct health risks. In Nigeria, the problem of solid waste is manifested with its consequent effects on pollution of water, air and land with the hazards to health and other natural resources of social and economic importance (Federal Ministry of Housing and Environment, 1982).

There has been an increasing concern about the serious health implications from waste management in Nigeria. The desire for environmental protection in Nigeria was ignited by the Stockholm Conference on Environment in 1972 (David, 1975). By 1975, a division of Urban Development and Environment was created in the Federal Ministry of Economic Development to handle among other things, pollution and other related industrial matters. Since then, there has been various re-allocation of this division to ministries with change of names, resulting eventually in the setting up of Federal Environmental Protection Agency (FEPA) in 1988. FEPA was established to serve as the apex and rallying government agency in an attempt to combat both national and global environmental problems. Among other functions, it was to halt and prevent further degradation of the Nigerian environment by solid wastes. This laudable innovation was to be achieved through policy formulation, setting of standards, establishment of guidelines

and regulations, enlightenment and compliance promotion and the monitoring and enforcement of standards, guidelines and regulations (FEPA,2003).

Some priority programmes embarked upon by FEPA include waste management education, awareness and publication of relevant information, commitment of appreciable amount of fund, renewal of equipment/facilities and training of manpower. However, solid waste management is still one of the most serious challenges facing the country. This research therefore, tried to find out the constraints of solid waste management in Nigeria.

1.2 Statement of the Problem

When wastes are not collected, in sanitary conditions develop and pose environmental and human health risks. The prevalence of parasites, vectors, tetanus, malaria, hookworm, cholera and diarrhea in most African cities is attributed to the in sanitary conditions in these cities (Agbola,1997). Mentel (2006) observed that malaria, diarrhea, intestinal worms and upper respiratory tract infections were among the most common health problems reported at out- patient facilities in the Greater Accra Region of Ghana. In the city of Accra, major health problems are diseases attributed to poor environmental sanitation, which is exacerbated by ignorance and poverty (Vancini,2000). In Tanzania, Pohjola and Tanskanee (1998) reported that poor sanitation, and improper waste disposal practices result in the spread of infectious diseases, which are believed to be the most frequent causes of morbidity and mortality.

Wastes dump into storm drainage channels, creeks, lagoons and other water impoundment points create serious environmental problems which can result into disastrous situations. The loss of lives and property, which occurred due to the 1982,

2010 and 2011 floods in Ibadan, Lagos, Port Harcourt, Aba, Kano, Jigawa and Sokoto were attributed to the accumulation of refuse which blocked drainage channels(Love,2002).

The alarming rate at which heaps of solid wastes continue to occupy our cities, coupled with the fact that 87% of Nigerians still use disposal methods, adjudged to be in sanitary, has not only constituted visual blight and odour nuisance, but also encouraged the breeding of rodents, mosquitoes and other pests of public health importance, which lead to disease outbreaks in Nigeria(Johnstone,2000). The ineffectiveness of contemporary municipal solid waste management practices,(which culminates in a number of health and environmental problems), has necessitated the need to evaluation of solid waste management practices among the Health workers and Head of house hold in Nigerian cities.

1.3 Research Questions

Specifically, this research attempts, to find answers to the following questions:

- How adequate are funds provided for solid waste management in Nigeria?
- How adequate are facilities/equipment provided for solid waste management in Nigeria?
- How adequate are personnel for solid waste management in Nigeria?
- How is the existing policy on environmental issues affect solid waste management in Nigeria?
- What is the level of community participation in solid waste management in Nigeria?

- What is the adequacy of public enlightenment for solid waste management in Nigeria?

1.4 Purpose of the Study

The main objective of this study was to assess the constraints of solid waste management in Nigeria. The specific objectives of the study include:-

- To determine whether the funds provided are adequate for solid waste management in Nigeria.
- To determine whether facilities/ equipment are available for solid waste management in Nigeria.
- To determine whether personnel are adequate for solid waste management in Nigeria.
- To determine whether existing environmental policy is adequate for solid waste management in Nigeria.
- To determine whether community participation is adequate for solid waste management in Nigeria.
- To determine whether public enlightenment is adequate for solid waste management in Nigeria.

1.5 Significance of the Study

1. The findings of this study will bring to light the problems associated with solid waste collection and disposal in Nigeria.
2. The findings of this study will show whether adequate facilities and equipment are provided for solid waste management in Nigeria.

3. The study will help in providing accurate information, education and health messages suitable for sensitizing the people on the importance of effective waste management practice and how it would positively promote their health.

4. The study will highlight effective methods of waste disposal, as well as help to identify specific roles of both the government and the individual in terms of waste collection and final disposal.

5. The result will also reveal the institutional constraints to solid waste management, and highlight the effective systems of storing and evacuation of wastes, which would help both policy makers, professionals in the field of environmental health, researchers and the public to know the appropriate disposal sites and equipment to be used in disposing solid wastes in their communities.

1.6 Basic Assumptions

On the basis of available research evidence and professional opinion, the following assumptions were made for the purpose of this study:

1 Adequate funding is necessity for solid waste management.

2 Adequate environmental facilities/ equipment are necessities for solid waste Management.

3 Adequate and trained personnel are part of the solution to effective solid waste management.

4 Lack of effective environmental policies is a factor in solid waste management.

5 Community participation and involvement are the answers to effective solid waste management .

6 Public enlightenment is key to a successful solid waste management.

1.7 Hypotheses

Based on the research questions, the following major and sub- hypotheses were generated for the purpose of this study:

Major Hypothesis

Adequacy of constraints is not significant in solid waste management among Health workers and Heads of household in Nigeria.

Sub-hypotheses

1. Adequacy of funds is not a significant constraint to solid waste management among health workers and heads of house hold in Nigeria
2. Adequacy of facilities/equipment is not a significant constraint to solid waste management among Health workers and heads of household in Nigeria
3. Adequacy of trained personnel is not a significant constraints to solid waste management among Health workers and heads of household in Nigeria
4. Adequacy of environmental policy is not a significant constraint to solid waste management among Health workers and heads of household in Nigeria
5. Community participation is not a significant constraint to solid waste management among Health workers and Head of house hold in Nigeria.
6. Adequacy of public enlightenment is not a significant constraint to solid waste management among Health workers and heads of household in Nigeria.

1.8 Delimitation of the Study

This study is delimited to evaluating solid waste management constraints among Health Workers and Heads of house hold in the states selected from the six(6) geo-political zones of Nigeria.

1.9 Limitation of the Study

The study has the following limitations:

- There is a limitation as to the accuracy of the responses given by the subjects. They were skeptical to give information because of the fear that the information gathered might be used against them by government. However, this limitation was taken care of by assuring the respondents of confidentiality of all information given and also their names were not required.
- Another problem in conducting this study was the inability of some community members to either read or interpret the information on the questionnaire. The study incorporated oral interviews and research assistants to interprete the questionnaires for the respondents during the data collection.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

In order to set a theoretical framework for the study, this chapter attempted to review related literature on the concept of solid waste management as well as problems and constraints related to solid waste management. Therefore, a considerable review of scholarly positions on wastes and related issues of relevance to this study were consulted.

The chapter is divided into the following sections:

- Theoretical Framework on the study
- Concept of solids wastes management defined.
- Wastes storage
- Health and environmental implications
- Solid waste management in developed countries
- Solid waste management in developing countries
- Sanitation in Nigeria
- Organization of sanitation sector.
- Financing of sanitation
- Constraints and opportunities for sanitation
- Recycling of solid waste

- Benefit of source reduction
- An overview of community participation in solid waste management and control
- Different institutions involved in solid waste management
- Technology and equipment used
- Role of all concerned actors of the community
- Role of elder people
- Role of youths
- Motivational aspect
- An overview of sanitary inspectors
- Waste management practices in Nigeria.
- Problems of solid waste management in developing countries
- Problems of inadequate waste management in Nigeria
- Summary

2.1. **Theoretical Framework**

To be able to design and adopt an appropriate waste management system and constraints, a proper theoretical background has to be established. It can be asserted that when one is looking for a scientific systematization, and ultimately aiming at establishing

an explanatory and predictive order among the domain problems of waste management, a theory is required and the theories to be discussed includes:

1. Industrial ecology and waste management.
2. Waste management theory.
3. Waste minimization- resource use optimization

2.1.1 Industrial Ecology and Waste Management

Wastes Management Theory (WMT) is constructed under the canopy of Industrial Ecology (IE), as applied in manufacturing, it involves the design of industrial processes and products from the dual perspectives of product competitiveness and environmental interactions. A systems-oriented vision, built on the principle that industrial design and manufacturing processes are to be considered in partnership with the environment (Ekulgo, 1999), is what sustainable waste management needs to grow into. Embracing the principles of Industrial Ecology(IE), Waste Management Theory(WMT) will be instrumental to optimizing resource use.

Waste Management Theory (WMT) is positioned between other related theories, and what tools need to be used to achieve the objectives of IE. The 'world of waste' is emphasized from "Empiria," to highlight the influencing factors on designing waste management. It draws data from the existing waste management infrastructure, and is restricted by its legislative constraints. On the plane of waste management, WMT seeks to optimise resources use from virgin raw material, to discard. The goals and values for resource optimization originate from the paradigm of Industrial Ecology. It was argued that the goals in IE have to be adapted by WMT and to translate the goals of IE so that they are applicable to an industrial unit (Pongrácz,2004). The majority of tools that are to

be adapted to industrial waste management originate from IE, though, some tools are also influenced by Design Theory. Social aspects are also taken into account. Principles such as sufficiency, morals and responsibilities will have to be introduced into the goals and values to be followed. From the "real world" surrounding the waste management domain, human needs and expectations also affect the objectives set out by Waste Management Theories(WMT). Finally, theory is continuously developed and updated based on facts, regularities and observations as well as the process of explaining observation and answering domain specific queries(Pavoni,2000).

2.1.2 Waste Management Theory

Pavoni (2000), argued that Waste Management Theory is to be built on the paradigm of Industrial Ecology, and their side-by-side advancement can greatly contribute to the development of a sustainable agenda of waste management. The Theory of Waste Management is based on the considerations that waste management is to prevent waste causing harm to human health and the environment, and application of waste management leads to conservation of resources(Odeyemi,1997).Industrial Ecology successfully combines waste minimization and resource use optimization measures, and ensures that resources are effectively circulated within ecosystems. Research continues to evolve the Theory of Waste Management, which will assist in incorporating environmental concerns into industrial process and product design (Love,2002).

Waste Management Theory (WMT) has been introduced by Pavoni (2000) to channel environmental sciences into engineering design. WMT is a unified body of knowledge about waste and waste management. It is an effort to organize the diverse variables of the waste management system as it stands today. WMT is considered within

the paradigm of Industrial Ecology, and built side-by-side with other relevant theories, most notably Design Theory. Design Theory is a relatively new discipline; still under development. Following its development offers valuable insights about evolving technical theories. According to Love (2002), it is crucial for a theory development to integrate theories from other bodies of knowledge, as well as the clarification of the definitions of core concepts, and mapping out key issues, such as domains, epistemologies and anthologies. At the present stage of WMT development, scientific definitions of key concepts have been offered, and evolving of WMT under the paradigm of Industrial Ecology is in progress(Odeyemi,1997).

The function of science is to build up systems of explanatory techniques; a variety of representative devices, including models, diagrams and theories (Toulmin, 1953). Theories can be considered to be milestones of scientific development (Pohjola,1998). Theories are usually introduced when previous study of a class of phenomena has revealed a system of uniformities. The purpose of theory is then to explain systems of regularities that cannot be explained with scientific laws (Hempel, 1966). Formally, a scientific theory may be considered as a set of sentences expressed in terms of a specific vocabulary. Theory will always be thought of as formulated within a lingustic framework of a clearly specified logical structure, which determines, in particular, the rules of deductive inference (Hempel, 1966).

Take the example of the definition of waste. The European Commission and Member States were gathered for a two-day workshop in Leipzig on February 25-26 2004, to discuss the classification of treatment operations and of the waste definition. One of the observations of the Leipzig workshop was that “using the definition of waste

is a tricky affair when determining when something becomes waste and when it stops being waste." To the first situation belongs, among others, the placing of re-use, the application of the definition of waste to end-of- life vehicles. To the second belong, for example, treated construction and demolition waste (ISWA, 2004). The basic proposal of WMT is that it is able to define waste unambiguously. Four classes of waste have been defined by. Pongracz and Pohjola (1997) as shown in Table 2.1 below;

Table 2.1 Classification of Waste

Class 1	Unwanted things, created not intended, or not avoided, with no purpose.
Class 2	Things that were given a finite purpose, thus destined to become useless after fulfilling it.
Class 3	Things with well-defined purposes, but whose performance ceased being acceptable due to a flaw in their structure or state.
Class 4	Things with well-defined purposes, and acceptable performance, but their users failed to use them for their intended purpose.

Source:(Pongracz et al,2002).

The classification of waste in Table 2.1 above was formulated using an object-oriented modelling language, PSSP™, which is based on the ontological commitment that every real thing can be formalized as an object having four attributes: Purpose, Structure, State, and Performance (Pssp) (Pohjola, 1998).

Using the Taxonomy on Table 2.2 all of the problem waste definition areas defined in the Leipzig workshop were possible to identify as follows (Pongrácz *et al*. 2004):

- Re-use happens when a thing that has just performed its purpose and momentarily no new purpose is assigned to it. This generally applies to wastes of class 2. A thing that has fulfilled its purpose is not necessarily useless. It is because usefulness is defined by structure and state, while re-use is subject of purpose (Roger,1989). As long as structure and state allow performance with respect to the assigned purpose, re-usable things shall not be considered wastes. An empty bottle, whose structure is undamaged is still a useful non-waste.

- End-of-life vehicles represent wastes of class 3. They are aggregates of things composed of numerous structural parts. The loss of performance can be attributable to the inability of one or several structural parts to perform their purpose. Repair or changing the faulty structural parts can extend useful life (Vancini, 2000).

In the case of owner abandonment despite acceptable performance, the car represents waste class 4, unless the owner argues that the car did not meet his expectations of superior performance usually attributable to newer cars. On the positive side, finding a new owner willing to tolerate the shortcomings of a new car would render it non-waste.

- Demolition waste can be viewed as waste of class 2, one that has fulfilled its purpose. When a structurally intact tile is separated from the aggregate object of demolition waste, it can be assigned a new purpose and thus it shall no longer be considered waste (Pavoni,2000).

Table 2.2 **Waste Minimization Measures vs. Industrial Ecology Principles**

Waste minimization measures	Industrial Ecology principles
Strict avoidance of waste creation/ prevention at source	Every molecule that enters a specific manufacturing process should leave that process as part of a saleable product. Every erg of energy used in manufacture should produce a desired material transformation.
Reduction of waste by application of more efficient production technologies	Industries should make minimum use of materials and energy in products, processes and in services
Source-oriented improvement of waste quality, e.g. substitution of hazardous substance	Industries should choose abundant, non-toxic materials when designing products.
Re-use of products or parts of products Disassembling of complex products and re-use of components	Every process and product should be designed to preserve the embedded utility of the materials used. An efficient way to accomplish this goal is by designing modular equipment and by remanufacturing
Internal recycling of	Industries should get most of the needed materials

production waste	through recycling streams (theirs or those of others) rather than through raw materials extraction, even in the case of common materials
External recycling	Every product should be designed so that it can be used to create other useful products at the end of its life.
Every industrial landholding or facility should be developed, constructed or modified with attention to maintaining or improving local habitats and species diversity, and to minimising impacts on local and regional resources.	
Close interactions should be developed with materials suppliers, customers, and representatives of other industries, with the aim of developing co-operative ways of minimising packaging and of recycling and reusing materials	

Source: (Pongrácz *et al*,2002).

- **Waste Minimization – Resource- Use Optimization Theory**

Prevention of waste creation is the main priority of waste management, which corresponds to the principal goal of waste management: conservation of resources. Moving toward waste minimzation requires that the firm commits itself to increasing the proportion of non-waste leaving the process. It has been agued that, it follows from the laws of thermodynamics, that producing by-products is concomitant of a main product (Baumgärtner & de Swaan Arons, 2003). For this reason, industrial firms have to look beyond their factory walls, and seek for external utilization of their waste in accordance with the principles of Industrial Ecology (IE). If we accept that waste minimization and resources use optimization is the most important objective of waste management

(Pongrácz *et al*, 2002), it is essential that WMT is to be considered together with IE, as resource use optimization considerations reach beyond the tradition scope of waste management. It was argued that there is considerable overlapping between the goals of IE and waste management where waste minimization in concerned. In Table 2, the principles of IE (Ekulgo, 1999), and waste minimization measures (Vancini, 2000) are listed.

From Table 2 one can clearly recognize goals and principles similar in IE as well as waste minimization. The main difference comes from the larger scale of IE: it reaches far beyond the walls of an industrial facility, and encourages responsible co-existence with the surrounding environment and creating interlocking eco-systems with other companies to achieve an efficient circulation of materials. It is, however, important that industrial facilities learn to internalize global objectives into their local solutions, and it is here where WMT can assist. (Pongrácz et al,2002)

From the discussion of the three (3) theories above, the researcher believes that waste minimization resources use optimization theories best explain the critical issues in waste management especially solid waste management in Nigeria and its attendant problems and therefore form the theoretical underpinning for this study.

2.2 Concept of Solid Waste Management

Solid wastes can be defined as unwanted, or any discarded materials arising from human's activities and which are not free-flowing (Jensen,1990) These include, garbage, rubbish, ashes, house sweeping and other bulky wastes (Mentel,2006)

Conceptually, solid waste or refuse is described as any solid material which is discarded by its owner, user or producer. Solid wastes are left-over arising from human,

animal or plant activities that are normally discarded as useless and not having any consumer value to the person who is abandoning them. The fact that they are not having either economic or social value to the person discarding them does not mean that they cannot be valuable to any other persons. Solid wastes, at times, are like the cornerstones of the builders. “One man’s meat, is another man’s poison” (Johnstone,2000).

Solid wastes are also extremely heterogeneous mixture of constituents that appear to vary according to season, the social characteristics of the neighborhood and which change in response to evolving situation. Timaru, 2007 define solid wastes as “any material that is primarily not a liquid or gase, that is unwanted and/or unvalued and is discarded or discharged by its owner. Solid wastes may include materials that may potentially be re-used, recycled and composted. Solid waste that has been disposed in the landfill is called rubbish.

In general, the composition of solid wastes especially in urban cities in Nigeria includes: papers, glass, food, ceramic, plastics, leather, cardboards, rubber, wood, products, bones, straws, nylons, textile, vegetables, foams, tins, irons, sands, aluminum, copper, dust, motor parts, e-wastes etc. The relative concentration varies with the economic sophistication of different communities. As a community or the nation expands, so also its solid wastes “The prospect of harnessing wealth from wastes increases with increasing volume of wastes” (Olufemi, 2006). Solid wastes can be classified in terms of their degradation into biodegradable and non-biodegradable wastes; or into types as: agricultural wastes, auto wastes, municipal wastes, construction, demolition works, mineral activities, radioactive, e-waste and sewage residues. Solid wastes can also be grouped as organic and inorganic wastes. Plastics, tyres, nylon are

organic while vegetables, wood, papers are inorganic. In the rural areas, agricultural wastes form over 80 per cent of their wastes; hence management of wastes becomes a problem. Apart from the fact that proper waste management is a political tool as it is one of the features of a good polity, it is a necessity for good health. Improperly stored or managed wastes can act as harbours to pathogens; bear pests such as rats, flies and mosquitoes which can endanger public health. Wastes can reduce the usable land area of the society. It can cause obstruction on motorable roads and can become nuisance and social problems in residential areas. It has negative impact on the values of properties surrounding it (Agbola,1997).

Human beings have always caused environmental pollution of all sorts. Since pre-historic times, people have created wastes through numerous land- related activities, like garbage. This waste was either burned, tossed into waterways, buried or dumped above ground. However, the waste of early peoples was mostly food scraps and other substances that broke down easily by natural decay processes (Pavoni, 2000) Pre-historic populations were also much smaller and were spread out over large areas. As a result, pollution was less concentrated and caused few problems. The problem of waste management and disposal becomes increasingly pressing as human population, industrial activities and material consumption expand. To most Americans, collection and disposal of municipal wastes pose the most visible and costly solid waste management problems (Mentel, 2006).

Basically, management of solid waste should be such that reflects each country's environmental parameters or local socio-economic circumstances. This is quite important and necessary because each volume of solid waste treatment and disposal is proportional

to the type of activity taking place. In other words, the composition of solid wastes and management differs from one locality to the other.

In the light of the above, within this complexity of what solid wastes constitute, many apparent differences in concepts of solid waste management and its intrinsic and extrinsic importance to man's livelihood becomes glaring, most especially taking into cognizance the relevance of solid waste as a sustainable resource to man and his environment. However, to be more pragmatic and realistic, stemming from different ways of translating similar concepts of solid waste management into simple reasoning, we always need to reiterate the fact that solid waste generation, composition, and management are a non- static concept. They change in accordance with changes in the factors interacting with them, which makes solid waste management a continuous dynamic process (Pavoni, 2000).

2.3 Waste Management

Waste management includes all activities that seek to minimize the health, environmental and aesthetic impacts of wastes. This statement is concerned only with middle and lower-income countries. The problems and opportunities relating to waste management in industrialized countries are very different. Solid wastes are generated by many different activities. Very large quantities are produced by agriculture and mining. Wastes from houses, streets, shops, offices, industries and hospitals are usually the responsibility of municipal or other governmental authorities; and it is these wastes which form the subject of this study http://environment.nsw.gov.au/waste/index.htm).

Many people feel that waste management is a simple affair and simply entails putting waste into a vehicle and unloading it at a dump site. Successful waste

management is rarely achieved without thought, effort and much learning from mistakes. It may be assumed that any engineer, without special training or experience, can solve waste management problems. There is much evidence to show that this is not true, perhaps mainly because waste management is much more than a technological issue, it usually involves managing a large workforce and working together closely with the public. Problems with maintenance and financial aspects are common. Engineers often make mistakes in the selection of equipment, since vehicles and machines which work well in industrialized countries are often grossly inadequate in developing countries, the preparation and management of a good waste management system needs inputs from a range of disciplines, and careful consideration of local conditions (ww.enviroment/conservationprograms.htm).

Historically, waste management has received scanty citizen attention and this lack of interest has allowed a number of potentially serious situations to develop. Increased generation and accumulation of wastes are beginning to produce social, economic and environmental problems of significant proportion. The indiscriminate disposal of wastes has resulted in air pollution, water pollution and also constituted aesthetic eyesore in the environment. It has also been detrimental to human health both directly by serving as breeding ground for infective organisms such as salmonella species, clostridium species amongst others, and cuts; and indirectly through increase in rodent infestation, vector population, surface water pollution, floods and fire disaster (http://environment.nsw.gov.au/waste/index.htm).

In 1982, there was the Ogunpa river flood in Ibadan, Oyo State in which several lives were lost and properties destroyed. This flood was due to blockage of drainage

systems as a result of indiscriminate disposal of solid wastes. In 1969, there was an outbreak of Lassa fever in West Africa. This was propagated by rodent infestation in the region. There has been high prevalence of diarrheal diseases.

The concern over wastes is generated from an aesthetic desire to live in a clean environment and also from the realization that a dirty and cluttered environment is unhealthy and unsafe for the population. This is evident in the incorporation of environmental sanitation as a component of Primary Health Care adopted by the World Health Organization (WHO), the Alma Mata Declaration in September 1987. This was also clearly pointed out at the Istanbul Declaration and the Habitat Agenda for 1998. It was stated that *the sustainable human settlements* programme depends on the creation of better environment for human health and well being which will improve the living conditions of people and of their lives (http:www.evasnsorg/eilgarbage/dumping/htm.com).

There has been an increasing concern about the serious implications for health of waste management problem now facing developing as well as highly industrialized countries. This concern has reached a remarkable dimension in developing countries because of the poorly organized or non-existent solid waste management (http:/www.evasns.org/eilgarbage/dumping/htm.com).

The desire for environmental management in Nigeria was ignited by the Stockholm Conference on Environment in 1972. By 1975, a division of Urban Development and Environment was created in the Federal Ministry of Economic Development to handle among other things, pollution and other related industrial matters. Since then, there had been various relocations of this division to ministries with change

of name, resulting eventually in the setting up of the Federal Environmental Protection Agency (FEPA) in 1988. This followed the discovery of five ship loads of toxic wastes of Italian origin at a small Port town of Koko in Southern Nigeria (Philips, 1992).

FEPA was established to serve as the apex and rallying government organ in an attempt to combat both national and global environmental problem. It was aimed to halt and prevent further degradation of the Nigerian environment among its role of waste management. This laudable innovation was set to be achieved through policy formulation, setting of standards, establishment of guidelines and regulations, enlightenment and compliance, promotion and the monitoring and enforcement of standard guidelines and regulations. Some of its statutory powers were delegated to the states and local governments with the setting up of states Environmental Protection Agencies and related organs with which they work hand-in-hand. Some priority programmes have been outlined by FEPA amongst which are waste management and Outreach Education, Awareness and Publications. Constitutionally, municipal waste management is the responsibility of the local government authorities. However, there has been shortcomings in the discharge of this responsibility and this led to FEPA setting up an Urban Compliance Unit which oversees environmental issues in the area of waste management and urban sanitation amongst others. The outreach education , awareness and publications focus on creating awareness on environmental problems, media campaigns on environmental issues, identification, education and training of officials that would form the core of the environmental education network (Philips, 1992).

Waste Management is capital- intensive and its sustainability is determined by the availability of resources and adequate planning. Planning here is all inclusive. This of

course might be responsible for the neglect of waste management in the developing countries with its attendant health implications (http://www.evasns.orge/eilgarbage/dumping/htm.com). However, in Nigeria, following the establishment of the various environmental protection agencies at all levels of government, an appreciable amount of fund has been invested. The processes involved in the management of wastes include, collection, storage, transportation, disposal and treatment(Encyclopedia Britannica, 1999-2000).

2.3.1. Wastes Storage

Waste storage involves the proper placement and keeping of wastes during the period between generation and collection (Encyclopedia Britannica, 1999-2000). Containers and soak away (septic tanks) are required for this interim storage which varies in size and several factors influence the sizes used. This is usually determined by the volume of waste generated at the site, the space available for the soak away, the container, the frequency and manner of collection. Some containers are used per household while some others are used in multifamily dwelling units and are usually larger in size and more centralized (Philip, 1992).

Storage containers are made of various materials which include plastics, galvanized metals, paper bags, chutes, in-ground pits and recently house hold refuse compactors. In communities where communal refuse receptacles have been provided, diverse forms of storage facilities are provided to cope with the ever- increasing volume of wastes generated. These include portable steel bins, enclosure of bricks, concretes, steel or timber, 200-litre drums, concrete pop sections and fixed storage bins (Philip,1992).

A study on waste generation in some major Nigerian cities conducted in 2006 showed a close correlation with the population of the cities. In another study carried out in Kaduna metropolis on waste disposal in 2004, it was shown that of the 97.2 per cent of the respondents that use storage containers, only 47 per cent had storage containers with cover (Ameenu,2006). The failure of the appropriate authority to produce public toilet facilities and communal refuse receptacle has led to the adoption of alternatives such as open dumping of wastes and sometimes in drainage systems.

Open dumping of wastes is usually done on undeveloped pieces of land, roadsides and sometimes at sites where communal receptacles have been provided but the refuse is not collected regularly. These usually constitute a nuisance, an aesthetic eye sore, odours and also serve as suitable and conducive for the culture of micro organisms which more often than not have proved to be hazardous, causing water pollution especially during the rainy season. It also serves as breeding ground for rodents. The aesthetic eye sore resulting from open dumping of refuse has once earned Lagos State the dirtiest capital city in the World (Ameenu, 2006).

Dumping of wastes in the drainage system is also not without hazards. This includes the obstruction of the drainage with resultant stagnation and thus providing a good breeding ground for mosquitoes. It can also result in outright blockage of the drainage system resulting in flood which can be disastrous. This was the situation in Ibadan, Oyo State in 1982 when there was a flood disaster, which was eventually traced to dumping of refuse in the drainage and the flooding was a direct consequence of the obstruction of the river by leaves used in preparing and packaging local good such as *eko and moimoi* made from grounded maize and beans respectively (Ameenu,2006).

2.3.2 Collection, Evacuation and Transport of Solid Wastes

Waste evacuation and collection is the process of transferring solid wastes from the water ways to the drainage system and from the storage receptacle to the place of disposal respectively. It essentially involves free flow of waste waters from the household to the drainage systems as well as emptying the storage container into a vehicle with which wastes are transported. This is a major element of the total waste management and accounts for most of the total cost. Because of this, the vehicles used and methods of collection vary from one locality to another with the adoption of collection system which is most appropriate to the local conditions in terms of quality of service and cost of operation. Thus, while in some places, rakes, buckets, shovels and hand carts are used, heavy equipment and up to 30- tonne vehicles are used elsewhere (Philip, 1992).

Vehicles in use include open-body non-compacting trucks, trucks with side shutters, enclosed-body compacting trucks. In some developing countries, hand carst, animal carts, pedal tricycles, motor tricycles and trailers with tipping gears are still in use. The development of compaction vehicles has been heralded as the most significant technological improvement made in waste collection to date (Philip, 1992).

The labourers employed in the collection of waste are exposed to high health risk. This ranges from cuts, infections and skin lesions from contact with the waste to the odour and dust they have to contend with. Collection process has been shown to have the highest rate of injuries when compared with other aspects of waste management.

The main factors which determine the frequency of collection are character, climate, communal or home storage and cost.

2.4 Waste Disposal Strategies

Disposal completes the waste management chronological cycle. There are basic methods of disposal: recycling, incineration and sanitary land filling. However, another method known is composing, but this is applicable only to biodegradable waste. Land-filling is the only complete and final means. This is because regardless of the operational efficiency of any incinerator, total consumption can never be achieved as some residues will remain which will require disposal (WHO Expert Committee, 2003).

Waste recycling may also be referred to as recovery and reuse. It is widely used by industry in developed countries. It is the process of removing a substance from waste and re-forming to productive use. Generators commonly recycle solvents, acid and metal (Ekulgo,1994). The constituents commonly extracted from domestic-trade waste for industrial use are: paper for resulting, textile for paper- making, machinery wipers etc. glass for remelting or abrasives manufacture etc. metal for remitting, rubber for downgraded use, plastic for the production of an inferior grade. Recycling would get rid of a lot of the refuse and would conserve raw materials. Incineration, however, is commonly used in both developing and developed nations but more so in developing countries and refer to the burning of waste. It is especially preferred when dealing with medical waste. It also helps reduce the volume of waste to about 10% of the original volume for further disposal on land. The incinerator consists of a furnace into which the refuse is charged and ignited. This method, however, contributes greatly to air pollution (Ekulgo,1999). In order to prevent odour and smoke nuisance from an incinerator, all consumption gases are passed through a furnace temperature of 724.4c average and

641.1c minimum. Other disadvantages of incinerator are high operational and maintenance cost, residue of ash, can and bottles (http://enviroment.nsw.gov.au/waste/index.him).

Land disposal is by far the most common method of waste disposal. Various types exist and the waste may first be treated e.g. by decomposing or shared lined before finally being disposed of by these methods.

Sanitary land -fill is one of the land disposal means and can be defined very simply as the use of waste for land-recrimination, a typical example being the restoration, by filling to the original level of man-made surface dereliction such as disused surface mineral excavation. Sanitary land-fill is also called controlled tipping. It is an ideal method provided it is properly carried out and supervised, and creates fewer nuisances than indiscriminate dumping. Each covered layer of refuse should be allowed to settle and become thoroughly compacted before another is placed on top of it. The disadvantages are: land requirement, which may result in long hauls, thus creating big limiting factor in some big urban areas. It also requires selected soil for cover, leading to additional pollutants to underground and surface water, it may also create harborage for rodent if improperly prepared and fire may arise (Ekulgo,1999).

Sanitary land- fill is a method of disposing wastes on land without creating nuisance or hazards to public or safety but utilizing the principles of engineering to confine the waste to the smallest practical area, reducing it to the smallest practical volume and covering it a layer of earth at the conclusion of each day's operation or at such frequent intervals as may be necessary. It is a well designed, operated and controlled facility for the disposal of wastes on land. It consists of the following steps:

- Wastes are deposited at the working area or face.
- Wastes are spread into layers and compacted by heavy equipment.
- The waste layers are covered with earth material daily and further compacted (Love,2002).

Another means of waste disposal and treatment is the wet separation process. This is a combined processing recycling system. It was developed by the Black Clawson in Franklin, Ohio and is a modification of paper processing technology to accommodate municipal wastes. This facility is the most advanced municipal waste treatment complex in the world. It is able to dispose of solid wastes and waste water treatment plant sludge while recovering such usable materials as metals, paper and glass (Pavoni,2000).

There is also pyrolysis, otherwise known a destructive distillation. It is a chemical conversion process in which wastes are treated at high temperatures (1000 to 2000 ^{o}F) in an oxygen- deficient atmosphere. After the moisture in the wastes has been expelled, the organic matter is distilled to approximately equal percentages of gases, liquids and solids. Pyrolysis can achieve volume reduction of 90% and relatively pollution free (http://environment.nsw.gov.au/waste/index.htm).

Similarly, there are waste piles, which are most commonly seen in developing nations like Nigeria. They may be legal or illegal as there are usually specifically designated for this purpose. However they may arise illegally when people simply dump their wastes indiscriminately in inappropriate places. Waste piles are non-containerized accumulation of solids,

As is common in most developing economies, Nigerians seem to see pollution by domestic and industrial wastes as a necessary outcome of development (Abugo, 1999).

Domestic waste production is increasing and is compounded by a cycle of poverty, population explosion, decreasing standard of living, bad governance, and the low level of environmental awareness (Ayeni,1987). According to Izeze (1999), many of the current problems associated with waste disposal have resulted from increasing urban populations, rapid and haphazard industrialization and inevitable increases in waste generation. Many municipal areas generate more solid wastes than they can manage, and this situation tends to increase with income levels and the economic development of the area. Traditionally, slums and shanty neighborhoods receive least attention in regard to waste collection and disposal services (Agbola, 1997) .Urban workers who redeem recyclable materials from richer refuse have few or no incentives to service poor sub- urban settlements with the result that wastes are dumped indiscriminately (Agbola, 1997).

Nwankwo (1994) indicates that growing popu1ation, rising incomes, and changing consumption patterns combine to complicate solid-waste problems in Nigeria. The problem of adequate solid waste management in Nigerian cities and urban centers has reached mammoth proportions, as heaps of refuse are found along major roads, riverbanks, and in open spaces (Roger, 1989). Domestic refuse in Lagos alone has been estimated to be 4.5 million tonnes by year. Agbola (1990). Statistical analyses have shown that the daily amount of domestic solid waste generated and collected in this urban area in 1998 varied from 0.1 to 0.5kg person, depending on location and economic standing of the individual (Izeze, 1999). In recognition of these problems, successive governments in Nigeria (like Shagari and Buhari governments) have attempted to tackle waste management issue through the Task Force Approach. This approach has been

counter- productive in the long run as it created more problems due to lack of coordination and technological know-how in responsible agencies (Ayeni,1987).

In 1985, the Federal Government of Nigeria introduced a major initiative, the Environmental Sanitation (clean-up campaign). All resident Nigerians were mandated to carry out compulsory environmental clean-up every last Saturday in the month. The initiative was good, but its implementation generated more problems. Garbage/wastes from the exercise were dumped along roadsides instead of at the dump sites designated by the local authorities for the purpose. The waste was left to decompose naturally (micro-organisms), to be eaten by animals, picked by scavengers, or washed away by rainwater/floods in the estuarine, environment. These wastes are carried away by the tidal floods into the larger creeks and rivers and thus, will affect surface-water quality (Nweke,2000). When the dump sites are eventually cleared, the waste materials end up somewhere on the outskirts of town in, example abandoned, excavation pits, river channels, ravines and even open spaces; basically a transfer of waste from locations where some people feel inconvenienced by its presence to other locations where its nuisance value is believed to be lower (Pavoni, 2000). However, there is little or no consideration given to the ecological consequences. This type of waste transfer practice cannot be considered as an appropriate environmental management option, as it simply appeases one environmental segment at the expense of another.

One of the major multinational oil companies operating in Nigeria, has since 1993 initiated plans to set-up land-fill facilities for disposal of domestic and industrial wastes generated from operations in the Niger Delta. The socio-economic questions now

prevalent in the Niger Delta area are impeding the execution of this project in Etche, Rivers State (Abugo, 1999).

Other waste-management systems utilized in Nigeria include, incineration and composting. Incineration methods involve reduction of combustible waste to inert residue by burning at high temperatures (650° - 850°C). This process effectively reduces the volume of waste that must be disposed of by 75 to 95%. However, only the Lagos State Government has incinerators, but due to poor management and maintenance, these have been out of use for some time. Composting, a biochemical process in which organic materials are biodegraded and decomposed to useful humus-like materials, is practised on a small scale in some rural areas. This technique is particularly useful especially in those areas where land for arable farming is decreasing in area, bush fallowing is no longer tenable, and the demand for compost as an alternative to artificial fertilizers has increased in order to sustain intensive agriculture (Agbola *et al*, 1997).

A major drawback of composting is the necessity to separate biodegradable waste materials from others, which could be achieved by segregation at source. It is therefore economically advantageous when the wastes are carefully sorted right at the source (Chukwuekezie, 1998; Ekugo, 1998).

Most industries dispose of their wastes untreated into nearby rivers or creeks, or at open dump sites. Oil- drilling companies dispose of their wastes, especially cuttings (treated and partially treated), by disposal in nearby waters (offshore) or dug-out open pits (onshore). Recently, due to more stringent regulations, the Federal Ministry of Environment and Department of Petroleum Resources, have adopted the total containment approach in which cuttings and waste drilling fluid are re-injected into

abandoned wells. Also, the waste minimization policies are adopted in which on-site treatment of solid wastes are carried out and waste recycling are encouraged (Ekugo, 1998).

2.5 Waste Disposal/Treatment

Disposal completes the wastes management chronological cycle. There are basic methods of waste disposal. They include recycling, incineration and sanitary land- filling. However, another method known is composting but this is applicable only to biodegradable wastes. Land- filling is the only complete and final means. This is because regardless of the operational efficiency of any incinerator, total combustion can never be achieved as some residue will remain which will require further disposal (WHO Expert Committee, 2003).

Waste recycling may also be referred to as recovery and reuse. It is widely used by industry in developed countries. It is the process of removing a substance from waste and re-forming it into productive use. Generators commonly recycle solvents, acid and metal (WHO Expert Committee, 2003) the constituent, which are commonly extracted from domestic-trade waste for industrial use are: paper for regulping, textile for paper making, machinery wipers etc, glass for remelting or abrasives manufacture etc metal for remelting, rubber for downgraded use, plastic for the production of an inferior grade. Recycling would get rid of a lot of the refuse and would conserve raw materials.

Incineration, however, is commonly used in both developing and developed nations but more so in developing countries and refers to the burning of waste. It is especially preferred when dealing with medical waste. It also helps reduce the volume of waste to about 10% of the original volume for further disposal on land. The incinerator

consists of a furnace into which the refuse is charged and ignited. This method however contributes greatly to air pollution (Philip,1992). In order to prevent odor and smoke nuisance from an incinerator, all combustion gases are passed through a furnace temperature of 724.4c average and 641.1c minimum. Other disadvantages of incinerator are high operational and maintenance cost, residue of ash, can and bottles (http://environment.nsw.govau/waste/index.htm)

Land disposal is by far the most common method of waste disposal. Various types exists and the waste may first be treated by decomposing or shredding before finally being disposed of by these methods. Sanitary land fill is a method of disposing wastes on land without creating nuisance or hazards to public safety but utilizing the principles of engineering to confine the waste to the smallest practical area. It reduces waste to the smallest practical volume and covering it with a layer of earth at the conclusion of each day's operation or at such frequent intervals as may be necessary, it is a well designed, operated and controlled facility for the disposal of wastes on land. It consists of the following steps:

i. Wastes are deposited at the working area or face.

ii. Wastes are spread into layers and compacted by heavy equipment.

iii. The wastes layers are covered with earth material daily and further compacted (http://environment.nsw.gov.au/waste/index.htm)

Another means of wastes disposal and treatment is the wet separation process. This is a combined processing recycling system. It was developed by the Black Clawson in Franklin, Ohio, USA and is a modification of paper processing technology to accommodate municipal wastes. This facility is the most advance municipal waste

treatment complex in the world. It is able to dispose of solid waste and waste water treatment plant sludge while recovering such usable materials as metals,paper and glass(Public Health Engineering Research Institute, 2003).

There is also Pyrolysis, otherwise known as destructive distillation. It is a chemical conversion process in which wastes are treated at high temperatures (1000 to 200F) in an oxygen deficient atmosphere. After the moisture in the wastes has been expelled, the organic matter is distilled to approximately equal percentages of gases, liquids and solids. Pyrolysis can achieve volume reduction of 90% and relatively pollution-free environment (http://environment.nsw.gov.au/waste/index.htm).

Similarly, there are waste piles, which are commonly seen in developing nations like Nigeria. They may be legal or illegal. They are specifically designated for this purpose. However, they may arise illegally when people simply dump their waste indiscriminately in inappropriate places. Waste piles are non-containerized accumulation of solid, non- flowing wastes that may be hazardous. While many are used for final disposal, many waste piles are used for temporary storage until the waste is transferred to its final disposal site.

There are also surfaces impounding, which are natural or man-made depressions or dyked areas. They can be used to treat, store or dispose of waste water. They could be in any shape and size. Surface impoundments include lagoons and basins (Daniel, 1987). Underground injection wells are also used to dispose and treat wastes. They are steel and concrete-encased shafts placed deep in the earth into which hazardous waste are deposited. This is more common in the developed nations than in developing nations because of the cost of the process in spite of it having been described as relatively

inexpensive. The procedure requires little pre-treatment of the waste, but poses a danger of leaking hazardous waste and eventual pollution of subsurface water supplies (United Nations for Human Settlement, 1998).

Composting is another means of waste disposal and treatment. It is the conversion of wastes into organic fertilizer because of their high vegetable-putrescible content. The five pre-conditions for successful composting are: suitability of the waste, a market for the product within 25km of the city; the support of the agricultural authorities, particularly the Ministry of agriculture; Price of the product which should be acceptable to most farmers and a net disposal cost (plant costs minus income from sales) which can be sustained by the local authority (http://environment.nsw.gov.au/waste/index.htm).

Composting can be aerobic or anaerobic. This process could be used for wastes consisting of a mixture of compostable. Organic materials and non-organic matter. Non-compostable material should be sorted out and buried. Shredding of wastes may be done to hasten decomposition by rendering it homogenous and susceptible to bacterial invasion and provides good initial aeration. Excess moisture content must be avoided because it displaces air from spaces between particles; giving rise to an aerobic decomposition. Too little moisture deprives micro-organisms of the moisture which they require and inhibits their activity. Turning the waste enhances adequate aeration and so promotes rapid nuisance-free decomposition. First turning of the waste should be done on the third day and then turned at three- day intervals until the 12^{th} day for proper aeration (http://environment.nsw.gov.au/waste/index.htm).

Composting is an excellent method of recycling biodegradable wastes from an ecological point of view. However, many large and small composting schemes have

failed because composting is regarded as a disposal process, and not a production process. It is essential as in any production process to pay careful attention to the marketing and the quality of the product. Composting should be an activity of the agricultural sector, not the waste management sector.

Waste or garbage is also grinded for discharge into sewage system. This method may be used in cities which discharge untreated sewage into large body of water or those equipped with sewage treatment plants designed for handling garbage. Its disadvantages are that: it is adaptable to the disposal of garbage only, high gas production is greatly increased; the clogging of the sewage system by ground bones, eggshells and bottle caps due to hug -specific growth disrupts the plant too often. The supernatant fluid puts too much heavy load on the aeration system.

Grinding and disposal into drainage: this is where the soft garbage is reduced by dividing them into particles by means of a special apparatus in kitchen such as shredder and the ground material is disposed into drainage which carry off the liquid waste from the kitchen. The garbage is collected, but is grounded into minute particles at the disposal plant and then put through the disposal process into the sewage (http://environment.nsw.gov.au/waste/index.htm).

Pulverization is another means of disposal and treatment of wastes. Due to the nature of wastes in industrialized countries which sometimes contain many bulky and hollow articles even pieces of furniture, pulverization is sometimes used as a preliminary treatment before land- filling. By shredding cartons, breaking bottles and crushing cans in a hammer mill, a fairly homogenous mixture of wastes of reduced particle size is produced; this occupies less space at the time it is deposited and ultimately decomposes

to form a consolidated fill without voids, which could cause a protracted period of settlement (http://environment.nsw.gov.au/waste/index.htm).

2.6 Health and environmental implications of wastes

If wastes are not managed properly, there are many negative impacts that may result. Some of the most important negative impacts are mentioned below. The relative importance of each depends very much on the local conditions.

- Uncollected wastes often end up in drains, causing blockages which result in flooding and in -sanitary condition.
- Flies breed in some constituents of wastes, and flies are very effective vectors that spread disease.
- Mosquitoes breed in blocked drains and in rainwater that is retained in discarded cans, tyres and other objects. Mosquitoes spread disease, including malaria and dengue fever.
- Rats find shelter and food in waste dumps. Rats consume and spoil food, spread disease, damage electrical cables and other materials and inflict unpleasant bites.
- The open burning of waste causes air pollution; the products of combustion include dioxins which are particularly hazardous.
- Aerosols and dusts can spread fungi and pathogens from uncollected and decomposing wastes.
- Uncollected waste degrades the urban environment, discouraging efforts to keep streets and open spaces in a clean and attractive condition. Waste management is a clear indicator of the effectiveness of a municipal administration. Plastic bags

are a particular aesthetic nuisance and they cause the death of grazing animals which eat them.

- Waste collection workers face particular occupational hazards, including strains from lifting, injuries from sharp objects and traffic accidents.
- Dumps of waste and abandoned vehicles block streets and other access ways.
- Dangerous items (such as broken glass, razor blades, hypodermic needles and other healthcare wastes, aerosol cans and potentially explosive containers and chemicals from industries) may pose risks of injury or poisoning, particularly to children and people who sort through the waste.
- Heavy refuse collection trucks can cause significant damage to the surface of roads that were not designed for such weights.
- Waste items that are recycled without being cleaned effectively or sterilized can transmit infection to later users (Examples are bottles and medical supplies)
- Polluted water (leachate) flowing from waste dumps and disposal sites can cause serious pollution of water supplies. Chemical wastes (especially persistent organics) may be fatal or have serious effects if ingested, inhaled or touched and can cause widespread pollution of water supplies.
- Large quantities of wastes that have not been placed according to good engineering practice can slip and collapse, burying and killing people.
- Waste that is treated or disposed of in unsatisfactory ways can cause a severe aesthetic nuisance in terms of smell and appearance.
- Liquids and fumes, escaping from deposits of chemical wastes (perhaps wastes), can have fatal or other serious effects.

- Land-fill gas (which is produced by the decomposition of wastes) can be cellars of buildings.
- Methane (one of the main components of land-fill gas) is much more effective than carbon dioxide as a greenhouse gas, leading to climate change.
- Fires on disposal sites can cause major air pollution, causing illness and reducing visibility, making disposal sites dangerously unstable, causing explosions of cans, and possibly spreading to adjacent property.
- Former disposal sites provide very poor foundation support for large buildings, so buildings constructed on former sites are prone to collapse (http://environment.nsw.gov.au/waste/index.htm).

According to the World Health Organization (1976), apart from the general implications of solid waste to health and environment, each of the waste disposal/ treatment methods has their respective implications. The potential hazards associated with land-fills are numerous. These affect both the operators and people residing in the neighborhood of such land-fills. The operators are exposed to the dust and odour of the land-fills. Landfills attract rodents, sea gulls and pigeons, which are potential reservoirs of bacteria and fungi such as salmonella and histoplasmosis. Water percolating downward through landfills can produce harmful refuse leachate and is capable of leaching various chemical and biological pollutants resulting in water pollution.

Generator of methane gas (which is highly flammable) during the decomposition process can be dangerous and could be a cause of fire hazard. The carbon dioxide (Co2) produced during aerobic decomposition is less offensive but can combine with water to form carbonic acid. The water can then react with limestone or certain other materials

and increase the risk of ground water contamination. A study carried out in 1998 showed an increase in the outbreak of gastroenteritis due to the use of a site as land-fill waste disposal area. It has also been shown that living near land-fill sites increases the risk of having congenitally malformed babies. Fatigue, headaches, eye infection, dry throat, nausea and spontaneous abortions have all been reported due to location of land-fill sites within a community.

Incineration affects mainly the operators. Incinerators are adorous, dusty and often slippery. They attract rodents and vermin. The waste often overflows from the pit and the danger of fire is always present. The pit atmosphere may be dangerous to anyone who falls into it, since oxygen levels are not often sufficient to support life. The operators of the crane and the men in the charging floors are constantly exposed to the dangers of fire, heat and dust. The firemen are exposed to smoke, the danger of burns and constant danger of possible explosion of chemicals or aerosol cans. Stationary firemen may have a prevalence rate of chronic pulmonary disease (Public Health Engineering Research Institute, 2003).

Generally, there are potential risks to human health from improper handling of wastes. These health risks can be broadly subdivided into direct and indirect effects. The direct health implications of indiscriminate solid waste disposal include:

i. Accidental cuts, burns and occupational dermatitis (contract dermatitis) are common disorders to workers in the field.

ii. High incidence of intestinal parasites in workers (i.e. collector of domestic wastes). For example, the larva of hook worm (ankylostoma) enters the

body through the skin of the feet resulting in the disease ankylostomiasis characterized by anaemia, fever, weakness and abdominal pain.

iii. Cut and un-bandaged wound get infected easily if exposed to rubbish-infested area with spores of clostridium tetani and this could cause tetanus infection.

iv. Consumptions of insufficietly cooked pork from hog fed with uncooked garbage, is believed to be the chief source of human trichinosis, a serious disease resulting in gastro-intestinal disturbances, remittent fever and muscular pain.

Similarly, the indirect health implications of indiscriminate waste disposal include:-

i. Breeding of disease vectors primarily flies, culex mosquitoes and rodents. The garbage component of wastes provide maternity ward and free haunh counter for flies and rats. The rubbish and debris provide housing or habitat for rats and flies.

ii. Solid and liquid wastes pollute surfaces due to high organic nutrient intake leading to eutrophication.

iii. Fire and disaster occur where solid wastes are disposed indiscriminately (Public Health Engineering Research Institute, 2003).

In the same vain, there are environmental implications of solid and liquid wastes. In his quest to dominate nature, man has generated wastes that have tremendous effects on the environment and hence, on man himself. The burning of refuse in poorly designed or operated incinerators and open dumps generate a pall of dense smoke that pollutes the

environment. It also increases the carbon dioxide content of the atmosphere, thereby altering the ozone layer level and sulfur dioxide content of the air which also contributes to the formation of acid rain. The smoke generated obscures visibility and could lead to accidents at such areas in town.

In similar ways, when rain passes from an open refuse dump to surface water, it pollutes it. The toxic water kills aquatic life and could also impede effective sea transportation in areas where water is used as a means of transportation (Public Health Engineering Research Institute, 2003).

More so, passing through the crowded part of a humid tropical city, a traveler is immediately aware of the pervading odour, which is due to the combination of rotting organic components and faecal matter from wastes indiscriminately discarded. When this stink persists all day long and high, it constitutes a major environmental nuisance which can be avoided by removing all wastes before it begins to decay and by covering dumps as is done in controlled tipping.

Another environmental implication of wastes is the ugliness of street littered and the destruction of the beauty of country side by uncontrolled dumping of wastes. Aesthetic eye sore accompanies the bad odour of indiscriminately discarded rotting wastes which can be seen littering pavements, roads, gutters and the general environment. Thus, the area becomes very unpleasant to look at and therefore becomes an eyesore (Public Health Engineering Research Institute, 2003).

One of the most important implications of wastes is the impact on economic activities. Labour and transport absorb the major part of the operating cost of waste management services. It is usual for a city to employ between two and five workers for

each 1000 persons. Three workers per 1000 people may represent about 1% of the total national workforce. Transport is required on a scale of about one heavy vehicle per 15,000 persons. Thus, waste management services can absorb up to 1% of the gross national product which make it one of the most expensive services in a city (Public Health Engineering Research Institute, 2003).

According to Scotney (1995), the rats which come from refuse dumps cause considerable economic damage by destroying goods, dislocating electric wire and weakening foundations of buildings by digging the tunnels in the soil. Rats are also known to be reservoirs of host of horrifying disease such as histoplasmosis, trichinosis and many other diseases. Thus, by insinuation, the dislocated electric wires may also result in fire outbreaks and electric shocks thereby affecting life and property.

According to kawal (2002), collection of solid waste is an integral part of the urban solid waste management system. It is labour- intensive and also affects the people when it ceases to function effectively, causing refuse to accumulate in an unwholesome fashion. WHO Expert Committee, after carrying out a survey in India, found that, apart from diseases which insects and rats carry, the handling of refuse can cause illness to workers especially if night soiling contaminates the waste.

2.7 The Impact of Local Conditions

There are many factors that vary from place to place and that must be considered in the design of a waste management system. Amongst them are:

- The waste itself-Typical domestic wastes from industrialized countries have a high content of packaging made of paper, plastic, glass and metal, and so the waste has a low density (In other words, one person can lift a typical bin when it

is full). The large amount of paper and the use of pre-processed food result in low proportions of moisture in the waste. In many developing countries there is a high proportion of sand (because of the material used for paving and construction, and climatic factors) which makes the waste very dense (If the waste is dense, it means that two people may have difficulty in lifting a typical bin when it is full). In addition, the waste may contain large amounts of moisture because of the high usage of fresh fruit and vegetables.

- There are several important consequences of this density factor. Perhaps the main one is that containers, vehicles and systems that operate well with low-density wastes in industrialized countries are not suitable or reliable when the wastes are heavy. The combination of the extra weight, the abrasiveness of the sand and the corrosiveness caused by the water content, can cause very rapid deterioration of equipment.

Another important consideration is the possibility of incinerating the wastes (meaning, the burning of wastes under controlled conditions to minimize pollution).

If the wastes contain a high proportion of moisture, or are mostly inert material, it is not suitable for incineration, and so this treatment option is ruled out. Recycling or salvaging operations often reduce the proportion of combustible paper and plastic in waste before it reaches the treatment stage.

- Access to waste collection points-Many sources of waste might only be reached by roads or alleys which may be inaccessible to certain methods of transport because of their width, slope, congestion or the surface in which they are found.

- Pubic awareness and attitudes to waste-This can affect the readiness to carry waste to a shared container, the willingness to accept the proximity of a shared container, the willingness to segregate waste to assist recycling, the frequency at which wastes should be collected, the amount of litter and animal excreta that are left on the street, the willingness to pay for waste management services, the opposition to the sighting of waste treatment and disposal facilities, gender issues with regard to waste recycling and collection activities, and the social groups from which waste management staff can be drawn.
- Selection of equipment-In addition to the factors already mentioned, the selection of waste collection vehicles should be influenced by the type of vehicles and chassis that are already widely used and for which spare parts and maintenance expertise are available. Taxes, duties and import restrictions should also be considered.
- Institutional issues include the current and intended legislation and the extent to which it is enforced. Standards and restrictions may limit the technology options that can be considered. The policy of government regarding the role of the private sector (formal and informal) should also be taken into account. The strength and concerns of trade unions can also have an important influence on what can be done (Public Health Engineering Research Institute, 2003).

2.8 Resource Recovery

Resource recovery is another important aspect of waste management and it means the obtaining of some economic benefit from material that someone has discarded as waste. It includes:

- Re-use-being used for the same purpose again (such as refilling a soft drinks bottle);
- Recovery-processing material so that it can be used again as the same material, such as the processing of waste paper to make pulp and then new paper:
- Conversion-processing the material to make something different (such as producing padding for clothing and sleeping bags from plastic bottles, or producing compost from food waste)
- Energy recovery-usually referring to the burning of waste so that the heat can be used (for example, for heating swimming pools). Another method of energy recovery is to collect the gas that is produced in very large sanitary land-fills and use it as a fuel or to generate electricity (Ameenu, 2006).

Some key factors that affect the potential for resource recovery are the cost of the separated material, its purity, its quantity and its location. The costs of the separated material, its purity, its quantity and its location, the costs of storage and transport are major factors that decide the economic potential for resource recovery. In many low-income countries, the fraction of material that is won for resource recovery is very high, because this work is done in a very labor-intensive way, and for very low incomes. In such situations, the creation of employment is the main economic benefit of resource recovery. The situation in industrialized countries is very different, since resource recovery is undertaken by the formal sector, driven by law and a general public concern for the environment, and often at considerable expense.

It can be a big mistake to try to impose on low-income countries the methods of recycling that are used in industrialized countries. Besides, a recent study showed an

increase in the outbreak of gastro-enteritis due to the use of a site as a land -fill waste disposal area.

2.9 Effects of Solid Wastes on the Environment

In an attempt to justify the basis for solid waste management either locally, nationally or even internationally, a glimpse of the effects of the wastes, be the residential, commercial, industrial or agricultural wastes, should be understood. Suffice it to say that an in-depth knowledge of the effects, paves way for treatment and management of wastes on the basis of wastes characteristics.

Pavoni (2000) pin-pointed that the residential and commercial wastes of municipalities cause problems of litter, open dumps, air pollution from burning wastes and wasted resources. He pointed out that the environmental effects of solid wastes include:-

- Accidental fire outbreak
- Atmospheric air pollution
- Emission of offensive odour
- Attraction of rodents and flies infestation
- Flooding and blockage of drains
- Traffic accidents
- Pollution and contamination of water sources
- Transmission of diseases.
- Breeding of mosquitoes.

By using solid urban wastes as fertilizers on farm lands, literature have reported that these wastes pollute the land or soil. Soil pollution in turn leads to the pollution of

nearby water sources, the plants growing in the fields may also be affected. On the other hand, Davies and others (1982) observed that solid sludge which is of potential value to the farmer as an organic manure rich in nitrogen and potassium, is also a potential hazard when metals are present in large amounts and because once soil is contaminated by metals it remains so indefinitely as the metals are strongly absorbed and they do not leach to any extent. The cumulative effect of this will be reflected on man's health who feeds on the flora and fauna growing in the soil, drinks from the nearby water sources and respires the surrounding air (Fitzpatrick, 1982 ; Roger, 1989).

It is a truism that any particular soil polluted by hazardous substances will obviously have an adverse effect upon both the plants and animals that depend on soil for growth especially plants (Roger,1989). Wenner (1994) reported that domestic refuse can cause significant environmental pollution and may also contain small quantities of hazardous substances such as mercury (Hg) from cell batteries, solvents from paint residues, heavy metal sludge and solutions, especially those containing the toxic metals like; cadmium, cromium, lead, mercury, Nickel and Curium which are all wastes generated from a wide range of manufacturing processes, including homes and commercial centres.

Rowland and Wenner (1994) asserted that inadequate collection, and disposal of solid waste is the major factor in the spread of gastrointestinal and parasitic diseases primarily caused by the proliferation of insects and rodents vectors. In a nutshell, the aforementioned reviewed literature indicated that solid wastes have adverse effects directly and indirectly on soil, water, air, plants; as such, the management of solid wastes

need to be tackled with all seriousness and commitment as it poses danger to man and the environment in which his livelihood depends.

2.10 Solid Waste Management in Developed Countries

The disposal of garbage in the world is a problem that continues to grow with the development of industrialization and the growth of population. It is therefore pertinent to look for a way by which the increasing magnitude of solid waste generation could be controlled.

In the United Kingdom, refuse is collected mostly by house-to- house methods, while the remaining (a small percentage) is by special collection arrangement from markets and civic amenity points (Odeyemi *et al*, 1997). Ideally, it is the responsibility of the municipal authorities to dispose garbage as well as encourage residents to deposit their wastes in manner that would reduce costs.

Considering the various forms of solid waste management strategies, cost-benefits implications, technology, environment and waste composition, developed countries are finding management of municipal solid wastes expensive (Bassi, 1999). Therefore, all states are still searching for ways and means of reducing cost. Thus, each country devices a workable solution, that will conform to its waste composition, environment and economic viability (Jensen, 1990).

In a broader view of waste management, Johnstone (2000) pin- pointed that much emphasis should be on the importance of the waste hierarchy which has four steps namely:

(a). Source reduction: which refers to any practice which eliminates or reduces the volume of material produced. Another step toward waste management is:

(b). Re-use: This refers to repeated use of an item in the same form.

(c). Recyling:The separation of a product which is no longer usable in its present form from the waste stream, so that it can be used in the manufacture of a new product.

(d). Disposal: is another management of solid wastes practised which is the release of material into the environment. In addition to the aforementioned, Bassi (1999) identified sanitary land-fill,Incineration and recycling as methods of waste disposal. The land- fill probably accounts for more than 90% of Americans municipal refuse, while the latter (the biological treatment of organic waste) can divert up to 50% of municipal solid wastes from other disposal routes and can make avaluable contribution to sustainable wastes into deep wells. However, this method is strongly opposed because of the apparent explosion and even earthquakes that have resulted from waste injection techniques (Johnstone, 2000).

In view of the cost of waste management in developed countries, the emphasis now is on waste minimization and reduction (which does not form part of waste disposal). They are in fact another part of waste management (Cointreau, 1982). However, three major factors or attributes of the developed countries make the issue of solid waste management not a mere mirage. They are societal enlightenment, dedication and commitment of getting rid of unwanted waste by exportation and the syndrome of turning garbage to wealth through recycling (Rowland and Wenner, 1994).

2.11 Solid Waste Management in Developing Countries

Today, urban solid waste management is considered to be one of the most immediate and serious environmental problems confronting urban governments in

developing countries. This is mainly due to the rapid urbanization - taking place on an enormous scale in Asia, Africa and Latin America (Rowland *et al*, 1994). Thus, disposing refuse economically, without harming or endangering the environment is a problem shared by both developed and developing countries alike but pose many more formidable challenges to developing countries. While some affluent countries can contemplate investing in modern, less polluting incinerators to destroy waste surpluses, poverty severely limits the range of options open to cities in the developing world. Thus, in many developing countries, disposal of solid wastes created by household consume up to half of municipal budgets in Nigeria (Adepide *et al*,1997).

Inadequate management and disposal of solid waste is an obvious cause for the degradation of the environment in most cities of the developing world (Odeyemi,1997). Many cities face serious environmental degradation and health risks due to uncollected domestic refuse on streets and in public areas, clogged urban drainage systems by indiscriminately dumped refuse, and by contamination of water sources near uncontrolled dumping site (Rowland *et al*, 1994).

Paradoxically, while the developed countries experiment and pontificate on the desirability of refuse recycling and reclamation of waste as a potent strategy towards waste management, the practice is much higher in the poorer parts of the developing world; here, scavengers and beggars perform very efficiently by sorting out recyclable items from landfill sites or dumps to be sold to waste dealers (Adepide *et al*,1997).

In much of the literature on resource recovery, there has been a tendency to argue that the slum dwellers are there, not simply because they love it, but because they earn their living by collecting, sorting and utilizing waste materials from land-fill sites and or

dumps (e.g. selling discarded bottles or plastics to garbage processors)(Bassi,1999). To buttress the aforementioned, Ajiye (2000) pointed out that mountains of refuse on the outskirts of Lima, Lagos, Calcutta or Manila with rugged children, youths, men and women rummaging through refuse for usable materials is a picture or scene which probably almost everyone has come across in different variations again and again in magazines, books and films. Odeyemi and others (1997) reported equally that recycling is one of the cardinal strategies in managing solid waste in most developing countries like India, Brazil, Mexico, Columbia, Philippines and Nigeria.

Waste collection, sorting and utilization have been an age- old profession and also a system of managing solid waste in some developing countries. For instance, literature has shown that waste recycling in Cairo dates back to at least 1880s (Ekugo, 1998).

Suffice it to say that, in spite of the various systems of managing solid wastes, an important solid waste management often recommended for most developing countries is composting. The waste in many developing countries is ideal for conversion into organic fertilizer and economic factors favour composting in those countries where high food production is of great importance. Thus, composting is by the far the most viable technical solution for many developing countries (Odeyemi and Onibukun,1997).

The cardinal fact of life in urban waste management is that only a part of the problems can be tackled by direct house-to-house collection of waste. This system, using side and rear-end loading vehicles and tippers is possible only in city centers and in the middle and upper income suburbs where good access and western housing standards allow their efficient use (Odeyemi and Onibukun, 1997).

Rowland and Wenner(1994) pointed out that some problem areas have been identified with respect to solid waste management. They are inadequate coverage of the population to be served, operational inefficiencies of municipal solid waste services and management, unlimited utilization of the informal and formal private sector in recycling management of (non-industrial) hazardous waste (Rowland, 1994).

2.12 Sanitation in Nigeria

Nigeria has a total land area of 923, 768km2, an estimated population of 144.7 million people (2.7% population growth rate) and illiteracy rate of 28% in 2008. Nigeria is the most populous in Africa, second largest economy in sub-Saharan Africa after South Africa and the tenth largest producer of crude oil in the world at 2.1 million barrels per day. Despite the country's crude oil reserve, poverty in the country is multi-dimensional and has many faces as poverty vary by regions, state, location (urban and rural) and by gender. Most notable are health and hygiene poverty which has been attributed to poor water supply and sanitation situation. In 2007, maternal mortality rate was estimated to be 800 per 100,000 live births (UNDP) and was rated as one of the highest in the world. Infant and under-five mortality differs across location (81for urban with a life expectancy of 54 years in 2007 (FMH & NBS, 2008).

The National Water Sanitation Policy recognized the importance of sanitation by noting that the mortality rate due to poor sanitation in the country is alarming with approximately 5-20% resulting from diseases such as diarrhea, cholera, typhoid, paratyphoid, guinea worm, bilharzia, etc. Cholera also has its incidence rate on the increase within the some period, as well as typhoid and paratyphoid. Half of the population has at least one episode of malaria every year. Though there is strong

evidence of a high decline of dracunculiasis (guinea worm) from 653,620 cases in 1988 to only 1, 460 cases in 2003, the disease still exists in 16 states especially in the rural areas.

Table 2.3: Basic social and poverty indicators across regions and location in Nigeria

Indicator	North –East	North-West	South - Central	South-East	South-West	South-South	National	Rural	Urban
Poverty incidence (%)	72.2	71.2	67.0	26.7	43.0	35.1	54.4	63.3	43.2
Health access (%)	48.4	55.3	61.1	37.1	73.1	45.9	55.1	47.8	70.9
Water treated before drinking (%)	4.6	7.5	14.1	11.4	20.4	5.8	11.3	14.5	9.7
Percentage of population	13.6	25.6	14.5	11.7	19.7	15.0	100.0	65.0	35.0
Population growth rate								5.10	4.90
Male- headed households (%)	95.6	97.5	88.3	76.2	80.0	76.6	85.7	83.0	87.1
Female- headed households (%)	4.4	2.5	11.7	23.8	20.0	23.4	14.3	17.0	12.7
Safe water source (%)	30.7	50.6	48.9	40.8	73.5	45.9	51.4	40.0	73.4
Safe sanitation (%)	45.4	61.6	46.6	69.5	62.1	55.0	57.6	47.6	77.0
Improved waste disposal (%)	6.2	10.7	8.8	9.0	36.0	13.2	16.1	4.8	37.9
Incidence of diarrhea (%)	5.5	4.8	5.5	5.7	4.1	4.1	4.9	5.1	4.3

Source: Computed from National Bureau of Statistics Annual Abstract of Statistics 2007

Water and sanitation situations vary across regions, state, location (urban and rural) and gender. At the regional level, coverage was lowest (about 42%) for the three

northern zones, while the south-east and south-south geopolitical zones had about 54% with the south-west at 71.1%. The JMP 2008 also shows that only about 30% of the population used improved sanitation; leaving a gap of 70% without improved sanitation facilities. According to the NDHS (2003), 10.1% of the urban population has no toilet facilities of any kind while 6.1% use pit latrines and 28.7% use flush toilet rural areas are less served. The report also indicated that 34.1% of rural households have no toilet facilities at all and as a result, make use of bushes and rivers.

Institutional sanitation and water coverage rates are also low in Nigeria. A UNICEF-sponsored study in 2003 showed that on average there is only one toilet for every 500 students in schools, ten times an acceptable standard of 50. Recent MDG monitoring figures from the WHO/UNICEF JMP suggest that, assuming an average of ten people per household, 7.75 million toilets need to be built by 2015 in order to meet the Nigeria MDG sanitation target of 70% coverage by 2015. However, in practice more than this number of household latrines will need to be constructed because of the inevitable collapse, breakdown and abandonment of some low-cost latrines during the period 2008-2015.

In Nigeria, many policy guidelines for water resource management as well as sanitation exist at the federal level. Some of the policies associated with water resources and sanitation include the 1989 National Policy on Environment, the National Water Supply and Sanitation Policy 2000, the National Water Resources Management Policy 2003, the National Water Sanitation Policy, the Draft National Water Policy 2004 and the NESP of 2004. Other instruments (acts, edicts, decrees, bills and policies) for the WASH also exist. These policy documents and instruments were guided by the MDGs, various

development plans like the NEEDS, NEPAD and the objectives and resolutions of various conferences, conventions and meetings. These polices also have as their main driving force the importance of eradicating poverty and enhancing and improving public health through optimal use of water resources and sanitation for development.

The main sanitation actors in Nigeria are a wide range of stakeholders including policy makers (top elected government functionaries at different levels including the legislature, bureaucrats in respective MDAs of government, the donor community, international NGOs, service providers, the private sector, civil society organizations (CSOs), the media, and the communities. Major existing sanitation and hygiene programmes or initiatives include the construction of sanitation facilities as championed by the WSSSRP, UNICEF and others, the Community- led Total Sanitation (CLTS) and the mass media campaigns on hand -washing launched in various states.

Coordinating mechanisms for sanitation in the country include: the NTGS inaugurated in May 2002; the NCWR made up of the ministers and commissioners responsible for water resources at the federal and state levels; and the FGN/UNICEF WASH programme aimed at scaling up successful sanitation models in Nigeria.

The financing strategy for sanitation is based on the premise that individual families are solely responsible for paying construction of their household sanitation facilities. The focus of the rural water supply and sanitation programme is generating demand for improved environmental sanitation and thus creating a self -sustaining market for widespread construction of latrines. Looking at the consolidated expenditure trend of the WASH sector from 2001-2008 reveals a growing trend but at irregular intervals. Also there are donor interventions like the EU WSSSRP currently providing funds for

construction of water and sanitation facilities with co-funding from the three tiers of government and the UNICEF. Similarly, other ESA like UNICEF, Water Aid and EU among others have been financing sanitation activities in their respective focal states and LGAs with counterpart funding from the state and the LGs. Despite all these funds from government and donors alike, the country still have a shortfall of over USS50 million annually to meet with the projected WASH MDG requirement.

In the light of the shortfall which has resulted to the escalation of water-borne, sanitation and hygiene- related diseases and the recorded achievements so far, there is need for more funds to sector but such funds should recognize the impact of sanitation on health, poverty reduction and economic and social development which must be in line with the United Nations General Assembly Declaration objectives of 2008 International Year of Sanitation (IYS) domesticated in Nigeria as NYS.

Therefore, there is need for more collaboration which has been instituted through NTGs with households, communities, government; support agencies, civil society and the private sector for the country to achieve the sanitation target. In the light of this, funding should be targeted at software components such as:

- Advocacy to help solve basic problem of awareness which has resulted in to socioeconomic, cultural and security factors inhibiting sanitation in Nigeria.
- Funding should be geared towards building such capacity at all the three tiers of government especially the local government (WASHCO members) and the communities as well as CSOs working on WASH issues. Achieving this aim will automatically boost the process, prospects and results of the monitoring and evaluation as well as information management of WASH. Such capacity -building

should be designed to boost expertise in sanitation programming, management sustainability, corporate planning, integration of sanitation management and creation of platforms for private sector involvement.

- Institutionalizing of sanitation development process including implementation, communication, mobilization, documentation of routine checks, best practices and technologies, establishment of sustainable structures at the local level like the creation of WASH units that will generate budget lines.
- Proper monitoring and evaluation systems with improved capacity on information gathering techniques and management, identification and strengthening existing information sources and the sustainable usage of the gathering techniques and management, identification and strengthening existing information sources and the sustainable usage of the media for hygiene education.
- Generally, data streams are not harmonized and sector data literacy is poor. This is an important area where funds can be channeled.
- Research and development of technology options, information- gathering and management systems as well as technological options to meet the physical, geographic, cultural, religious, and economic and gender, social (physically challenged) needs of both the rural and urban population across Nigeria.
- Strengthening of collaboration and coordination with legal structure to coordinate sanitation especially at the state and local government levels.
- Scaling up sanitation in all 36 states including the federal capital territory, 774 LGAs and all communities.

Having identified some of the gaps that funding should be channeled, it is also interesting to note that some existing opportunities are already in place to strengthen the process, if funding is provided. Such opportunities that funding could benefit from include: the newly created water- sanitation division in the FMAWR; the resuscitation of the environmental health officers in the FMEnv, FMH, LGAs; formulation of WASH policies in some states; creation of WASH units/departments at the local government level, the national year of sanitation plan, the presence of NEWSAN in almost all the states of the federation and the establishment of the National Environmental Standards Regulation and Enforcement Agency (NESREA) among others.

There are several internationally accepted sanitation technologies. Some internationally accepted sanitation technology which are absent at the moment but may be applicable in Nigeria include: double-vault urine-diverting latrine; double-vault non-urine-diverting latrine; sand-enveloped pit latrines; borehole latrines; twin-pit composting latrines; biogas latrines; raised pit latrines; over-hung toilets' floating latrines; portable chemical toilets and temporary dismountable latrines.

Some knowledge gaps exist but the most important is the fact that financing strategy for sanitation in particular and WASH in general will be incomplete without appropriate institutional arrangement. There is also the need for a bridge in knowledge gaps on drivers that will trigger demand for improved sanitation systems/ models for households in Nigeria based on international best practices. In principle, change, either positive or negative, happens when certain influencing factors are triggered on and sustained. Positive change is driven both internally and externally but the basic principles

governing transformation remain the same. Once these are violated, then stagnation or retrogression becomes inevitable.

2.13 Sanitation Status Data

According to the National Policy on Water and Sanitation 2000, access to water is defined as the percentage of the population that uses drinking water from improved sources while access to sanitation refers to the percentage of the population that uses improved sanitation facilities. Improved drinking water in Nigeria includes households' connections, public stand pipes, boreholes, protected wells and springs while improved sanitation includes public sewer or septic system, pour flush latrines, ventilated improved pit latrines and pit latrines with slabs. Access therefore, seeks for the provision of sufficient, safe, improved and accessible potable water and adequate, safe, improved, sustainable and accessible sanitation to all Nigerians in an affordable and sustainable way through a cost- sharing formula on investment and operational costs between government and the beneficiary according to the National Water Policy (2004). This implies that there will be a real challenge for the policy implementation a regards careful balance between affordable tariffs for the poor and a high degree of cost recovery. According to the National Water Resources Management Policy (NWRMP) 2003, sanitation refers to the principles and practices relating to the collection, removal or disposal of human excreta, household waste water and refuse as they impact upon people and the environment. Good sanitation includes appropriate health and hygiene awareness and behaviour, and acceptable, affordable and sustainable sanitation service. The minimum acceptable basic level of sanitation must satisfy the following: be associated with appropriate health and hygiene awareness and behaviour; include a system for disposing of human excreta;

household waste water and refuse, in a manner that is acceptable and affordable to the users; be safe, hygienic and easily accessible and which does not have an unacceptable impact on the environment' and provides a toilet facility for each household.

Coverage definition in terms of water supply and sanitation in Nigeria is defined as efforts that will lead to increased services nationwide to meet the level of socio-economic demand of the nation through the designs of new projects that will avoid over sizing at the same time meet with the needs of the population, combat leakages and losses as well as reducing unaccountability for the WASH sector. Unaccountability here refers to the ratio between produced water and sanitation and paid for in water supply and sanitation supply systems.

Such access and coverage of water supply and sanitation should enable each Nigerian to have, as a basic human right, sufficient access to safe drinking water and adequate sanitation to ensure that public health needs are met; allow water and sanitation to be managed in a manner that ensures its sustainability as a resource for current and future generations of Nigerians; allow the treatment of water and sanitation as national assets and managed, developed and exploited in such a way as to promote equitable and sustainable social development of the Nigerian people as a whole; allow for the recognition of water as a scarce and vulnerable resource that is managed efficiently with its economic value realized; the ownership of water to be vested in the federal government on behalf the Nigerian people with effective management of water and sanitation exhibiting clear accountability as well as the management of water resources and sanitation at the lowest appropriate level.

Adequate sanitation must meet social, cultural, technology, user satisfaction and environmental- friendly criteria which then imply that adequate sanitation in Nigeria means access to safe excreta disposal facilities, services to household, public facilities and disposal of liquid and solid wastes without contamination of water sources, health hazards to people or deterioration of the environment.

There are lots of sources with different figures for WASH every year. The defunct Federal Ministry of Water Resources in 2000 estimated that only 48% of the inhabitants of the urban and semi-urban areas of Nigeria and 39% of rural areas have access to potable water supply. In spite of these low figures, the average water delivery to the urban areas is only 32 litres per capita per day (litres per capita per day (lpcd) and that to rural areas is 10 lpcd.

According to the NDHS (2003), 10.1% of the urban population has no toilet facilities of any kind while 6.1% use pit latrines and 28.7% use flush toilets. Rural areas are less served. The report also indicated that 34.1% of rural households have no toilet facilities at all and as a result, make use of bushes and rivers. Open defecation is common practice everywhere. These unsanitary methods of excreta and sewage management have remarkable effects on the health of the people and environment.

Acceding to CBN (2006), the proportion of the population with access to potable water rose from 30 % in 1999 to 65% in 2005. A breakdown of the 2005 figures showed that 67% coverage was achieved for state capitals, 60% for urban areas, 50% for semi-urban areas and 55% coverage for rural areas. It was also estimated, according to MICS of 1999 by the FOS, that only 52% of the urban (48% if peri-urban areas are included) and 39% of rural dwellers have access to potable water. About 71% of those living in

rural communities do not have access to safe and adequate sanitation according to the Federal Ministry of Water Resources in 2000.

The FMAWR, in the yet to be released Baseline Survey conducted in 2006, found that national sanitation stands at 60.52% with urban and rural at 67. 56% and 65.62% respectively. The EU WSSSRP has national sanitation coverage at 30% (35% for urban and 25% for rural) with 47% water coverage (65% urban and 30% for rural). The above data source shows a marginal increase of 4% from the 26% for urban and 22% for rural) sanitation coverage in the 1990.

Institutional sanitation and water coverage rates are also low in Nigeria. A UNICEF-sponsored study in 2003 showed that on average there is only one toilet for every 500 students in schools, ten times an acceptable standard of 50. Recent MDG monitoring figures from the WHO/UNICEF, JMP suggest that, assuming an average of ten people per household, 7.75 million toilets needs to be built by 2015 in order to meet the Nigeria MDG sanitation target of 70% coverage by 2015. This figure implies that 775,000 household toilets per year must be constructed every year over the next eight years (including 2008). However, in practice, more that this number of household latrines will need to be constructed because of the inevitable collapse, breakdown and abandonment of some low-cost latrines during the period 2008-2015 (Okay Sanni and Associates, 2009).

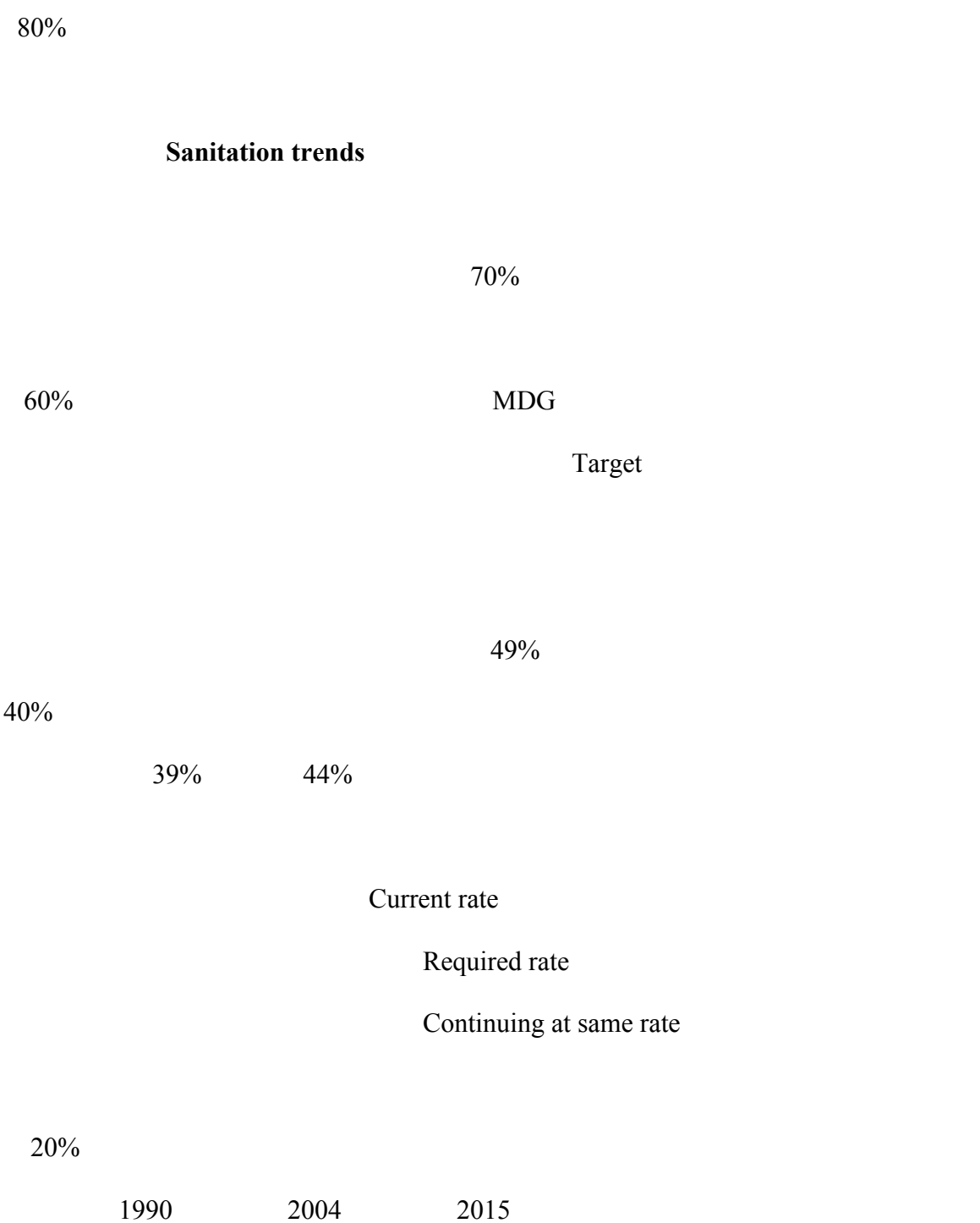
United Nations sources estimated that in the last fifteen years rural sanitation access rates have risen just 3% from 33% in 1990 to 36% in 2004, while urban sanitation access has gone from 51 to 53%[4]. While these access and progress rates are comparable to sub-Saharan Africa averages, Nigeria's large population means that more people are

living without sanitation (72 million in 2004) than in any other country in Africa (WHO/UNICEF JMP 2006). See figure 1.1 below for details.

Figure 2.1 below shows the actual rate of progress so far made in sanitation in Nigeria compared to the required rates for achieving MDG come 2015. According to the defunct FMWR reported that water supply coverage in Nigeria increased from 30% in 1999 to 68% in December 2005 but contrary to that the JMP figures for 2008 is lower, at 47% (65% for urban (2007) estimated an improved drinking water coverage of 49.1% with 75 .7% for urban and 37.4% for rural areas.

At the regional level, coverage was lowest (about 42%) for the three northern zones, while the south-east and south-south geopolitical zones had about 54% with the south- west at 71.1% The JMP 2008 also shows that only about 30% of the population Leaving a gap of 70% without improved sanitation facilities. Further Local Government Areas (LGAs) by Water Aid in 2006 paints a work Only 25% of the rural population surveyed have access to safe water Improved sanitation. Although the divergent water and sanitation deplorable, none of the sources paints a desirable picture of the notion In summary, figure 2.1 below presents WASH fact sheet that organizations in Nigeria. These figures vary by region (geopolitical and rural). More desegregation in respect of region and location is presented in Figure 2.1 below

FIGURE 1.1: ACTURAL RATE OF PROGRESS COMPARED TO REQUIRED RATES FOR ACHIEVING MDG SANITATION TARGET



Source: Strategy for Scaling-up Rural Sanitation and Hygiene to Meet Millennium Development Goal in Nigeria; Prepared by The Task Group for Sanitation and Hygiene, July 2007.

Table 2.1: WASH fact sheet-sheet-basic indicators

Indicators	***As at 2007***
Access to improved water sources (%)	47
Access to improved sanitation (%)	30
Primary schools with improved sanitation facilities (%)	41.35
Primary	51.46

Source: FMAWE, FMH, FME, FMEHIUD, Water Aid 2008 and JMP 2008

The JMP (2008) also highlighted and summarized WASH issue as follows:

- The MDG7, target 10 is to halved by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. In Nigeria, this means 70% must have access by 2015 but currently, the country is not on track towards meeting water and sanitation target as reveled by most studies.
- An estimated additional 43 million and 62 million Nigerians must gain sustainable access to safe drinking water and basic sanitation respectively from now until 2015
- If Nigeria does not meet the MDG targets of WASH, neither will Africa as a whole.

There are many types of sanitation services but a few of these are nationally accepted as meeting the required technical norms and standards. These are considered

acceptable in terms of latrine types and designs as well as wastewater management. They were also recognized as acceptable by the Water Sanitation Policy after due consideration of the negative effects on the environment, e.g sanitary land- fill sites, large scale construction and the discharge of sewage effluent.A summary of such types is depicted in Table 2.5 below showing not only the type but issues the estimated cost of construction.

Table2.5: Acceptable sanitation technical standards, designs and costs

S/No	Sanitation Type	Remarks	Cost (US$)
1.	Upgraded traditional pit latrine	In use in different states	Less than 50 for one
2.	Sanplant latrine	In use in different states	Less than 100 for one
3.	Ventilated improved pit (VP) latrine	In use in different states	10,000- 15,000
4.	Pour flush tank or soak-away system	In use in different states	Same as 3 above
5.	Septic Tank or soak-away system	In use in different states	500-1,000 for one
6.	Conventional sewerage system	In use in different states	10,000 and above
7.	Sullage disposal system	In use in different states	
8.	Storm water disposal system	In use in Abuja only	

These service types also satisfy different communities and individual demands based on the user's capacity to pay for operation, maintenance and replacement. There is also research looking at other options such as Aqua-Privy and ECOSAN (Dry Toilet).

2.14 National Sanitation Policies

In Nigeria, numerous policy guidelines for water resource management as well as sanitation exist at the federal level. Some of the policies associated with water resources and sanitation include the 1989 National Policy on Environment, the National Water

Supply and Sanitation Policy 2000, the National Water Resources Management Policy 2003, the National Water Sanitation Policy, the Draft National Water Policy 2004 and the NESP of 2004. Other instruments for the WASH sector include the Minerals Act of 1990 and relevant states water edicts in the development and management of the nation's water resources. Other Decrees associated with WASH are those of FEPA. Decree 101, 1993; Minerals Act of 1990; NIWA Decree 13 of 1997; RBDA Act of 1990 and State Water Edicts, the Land Use Decree, the 1999 National Environment Policy, the 2006 Irrigation Policy; the National Policy on Integrated Rural Development; the draft 2007 Water Resources Act and the Draft National Water Resource Bill of 2008.

The above policy documents and instruments were guided by the MDGs, various development plans like the NEEDS, NEPAD and the objectives and resolutions of various conferences, conventions and meetings. These polices have as their main driving force the importance of eradicating poverty and enhancing and improving public health through optimal use of water resources and sanitation for development.

A good look at these policy documents revealed the following as regards the main features and targets as well as the institutions that developed the policies (Table 2.6) below.

Table 2.6 Key WASH Policy Documents, Main Features and Targets

No	Policy Document (s)	Date and Institution	Main Features	Targets
1.	National Water Supply and Sanitation Policy	Developed in 2000 by the defunct Federal Ministry of Water Resources	The policy main features include: historical perspective, situational analysis/funding arrangement, the need for a policy, existing legislative perspective, sanitation issues, operating agencies and	i. The initial target is to meet the national economic target of improving service coverage from 40% to 60% by the year 2003. (ii) Extension of service coverage to 80% of the population by the year 2007. (iii) Extension of service coverage to 100% of the population in the year 2011.

No	Policy Document (s)	Date and Institution	Main Features	Targets
1.			Institutional responsibilities and manpower development.	(iv) Sustain 100% full coverage of water supply, sanitation and wastewater services for the growing population beyond the year2011.
2.	Water Resources Management Policy	Developed in 2003 by the defunct Federal Ministry of Water Resources	The main features are: water resources management; irrigation and agriculture; environmental issues; institutional responsibilities; sanitation and institutional responsibilities; legal changes and implementation requirements.	The target of the management policy was to correct: (a) Fragmented public investment programming and sector management, which has failed to take account of the interdependencies among agencies, jurisdictions and sectors. (b) Excessive reliance on overextended government agencies that have neglected the need for economic pricing, financial accountability, and user participation and have not provided services effectively to the poor and (c.) Public investments and regulations that have neglected water quality, health, and environment issues.

No	Policy Document (s)	Date and Institution	Main Features	Targets
4.	National Water Sanitation Policy	Developed in 2004 by the Federal Ministry of Water Resources	The features are: historical perspective; policy objective, targets and guiding principles; policy strategy and institutional framework, roles and responsibilities'	Targets include: (a) Review and improve coverage of sanitation to 60% of the population by 2007. (b) Extension of sanitation coverage to 65% by 2010. (c) Extension of sanitation coverage to 80% by 2015. (d) Extension of sanitation coverage to 90% by 2020 (e) Achieve 100% sanitation coverage by 2025. (f) Sustain 100% sanitation coverage beyond 2025.
5.	National	Developed in	The features are:	Targets include: (a) increase access to toilets

No	Policy Document (s)	Date and Institution	Main Features	Targets
1.	Environmental Sanitation Policy	2004 by the Federal Ministry of Environment and published, after approval by the President of the FEN, and the NEC, in January 2005.	Environmental sanitation and public health issues; constraints and strategic challenges; implementation strategies; institutional roles and responsibilities; funding mechanisms and monitoring and evaluation.	Facilities by 25% in public places and 50% in households by 2006, and 75% and 100% in the above places by 2010; (b) increase sanitary management of sewerage and excreta by 25% in 2006 and 75% in 2010; (c) institute school sanitation programme in 50% of the schools by 2006 and 75% in 2010; (d) build capacity of 25% of food handlers on sound food sanitation practices; (e) improve knowledge, attitude, behaviour and practice of the general population and sound environmental sanitation; etc.

The coordination mechanisms for policy implementation were part of some of these policies as follows:

- The National Water Supply and Sanitation Policy (2000) rested its coordination mechanisms on the defunct Federal Ministry of Water Resources as the agency responsible for policy advice and formulation, data collection, resources and demand surveys, monitoring, evaluation and coordinating of water supply development and management, studies, as well as research and development. Other agencies included in the policy implementation according to the policy are the River Basin Development Authority (RBDA), the National Water Resources Institute (NWRI), SWSAs and the LGs. The policy did not go beyond these agencies which are part of the ministry in terms of coordination. Private sector involvement in water supply industry according to the policy is to attract resources for lasting development of the sector as well as their critical role in the planning, design, financing, implementation and operation of water supply and sanitation systems. The privet sector is also important for greater transparency, efficiency, accountability to the consumer, and self-sufficiency. The policy aimed at promoting and coordinating other collaborative activities by other government and non-governmental agencies in the sector but such agencies were not mentioned as well as provide technical support and assistance to the State and Local Government Water Supply and Sanitation Agencies and the Community water supply and sanitation committees. In summary, the policy coordination mechanisms were more on the vertical (across tiers of government to the

community level) than horizontal (among line MDAa of governments) including a funding formula vertically.

- The WRMP (2003) in its coordination mechanism assigned FMWR the major responsibility or overseeing water resource management in Nigeria while the FMEnv has responsibility for a range of environmental issues including many that had previously been under the FMH including the provision of potable water and excreta and sewage management but it is recognized in the policy document that the FMWR will collaborate with the FMEnv on water sanitation activities including sewage, storm water control and quality control of water supply sources.

- The Draft National Water Policy (2004) recognized that water management is a complex function which includes regulatory, support and operational . Hence, any review of water management institutions must look at whether there are any services that could be more cost effectively and more efficiently undertaken outside of the public service through both beneficiary management or through Private Sector Participation. Coordination mechanisms of the policy were hinged on the water sources. Other coordinating mechanisms rotate around funding where both private sector and external support agencies are encouraged to be part of the process. Also private sector role is recognized in the delivery of water services to improve efficiency and effectiveness and to enhance development and sustainability of service delivery through ensuring a regulatory framework which allows the private sector initiatives to evolve without being object to illegal practices such as corruption.

- The National Water Sanitation Policy (2004), in its coordination mechanisms, defined the institutional roles of relevant government agencies involved with sanitation at the three tiers of government, the Private Sector, NGOs and Development Partners as well as specifying roles and responsibilities of communities and individuals and the financing mechanism. In its coordination mechanisms, the policy specified that all tiers of government shall appropriate and timely release a separate vote for water sanitation of an amount, which is equivalent to not less than 15% of their annual appropriation for water supply to implement sanitation programmes. The policy to boost coordination suggested a National Steering Committee on Water Sanitation with representatives from FMWR, FMH, FMEnv, FME, FMHUD, FMWASD, FMI and the NOA, FM1GA, NPC, NAFDAC, NPHCDA, External Support Agencies and CSOs to coordinate and monitor implementation of the policy. The FMWR shall be the lead-coordinating Agency while at the state level there should be a State Steering Committee on Water Sanitation with representatives from Ministry of Water Resources, Ministry of Environment (or SEPAs), Ministry of Health, Ministry of Education, Ministry of Works and Housing, Ministry of Urban Development, Ministry of Finance, Ministry of Women Affairs, Ministry of Local Government and Chieftaincy Affairs, State Water Supply and Sanitation Agencies, SPCs, ESPs and CSOs to coordinate and monitor implementation of the 100% total sanitation programme at the state and local government levels. At the local government level the policy recommended a Local Government Steering Committee on water sanitation with membership of all departmental heads and representatives of religious leaders,

traditional leaders, civil societies, women groups, youth groups etc. In summary, the policy coordination mechanisms looked at both vertical and horizontal coordination.

- The current NESP rested its coordination strategy on the technical committees which. have been already set up for implementation of the policy with the FMAWR represented on the National Technical Committee on Environment Sanitation (NTCES) by its Department of WS&QC. The committee cuts across tiers of government with the State Technical Committee on Environment Sanitation (STCES) and Local Technical Committee on Environment Sanitation (LTCES) coordinating at the state and local levels. Other MDAs at the federal, state and local levels are representatives of agriculture, culture and tourism, women affairs, NOA, NPC/SPC, education, health, transport, water, CSOs, market association, etc.

A good look at the above policies revealed that most of these polices are still in their draft forms; hence, are yet to be approved. Such policies include the Water Resources Management Policy (2003), the Draft National Water Policy (2004), and the National Water Sanitation Policy (2004).

Further analysis of the above policies both approved and drafts show that FMEnv has the responsibility for a range of environmental issues including many that had previously been under the Ministry of Health. These responsibilities include the provision of excreta and sewage management. The FMAWR is expected to collaborate with the Ministry of Environment on, water sanitation activities including sewage, storm water control and quality control of water supply sources. The FMEnv is charged with the institutional arrangement of overall coordination of environmental management in

Nigeria as well as the coordination of policies on environment and natural resources conservation.

The FMAWR is expected to collaborate with FMEnv on water and sanitation activities including sewage, storm water control and quality control of water supply sources but has a clear mandate of ensuring access to adequate potable water supply for all Nigerians. Further analysis reveals an overlap on the mandate of school sanitation and hygiene between the FMEnv and FME just as hygiene promotion and education among FME, NOA and FMH. Such overlap has been managed through the activities of the NTGS. All the MDAs at the federal level provide policies and guidelines while the actual implementation is carried out at the state and local government levels.

In summary, there are in existence, WASH policies (approved or draft) but under the present laws, different agencies at all tiers of government pursue different WASH agenda. This approach has led to the fragmentation of water resources development policy issues, including abstraction, pollution control and watershed management.

2.15 Organization of the Sanitation Sector

The main sanitation actors in Nigeria are a wide range of stakeholders including policy makers (top elected government functionaries at different levels including the legislature), bureaucrats in respective MDAs of government, the donor community, international NGOs, service providers, the private sector, civil society organizations (CSOs), the media, and the communities, in the annex for vertical and horizontal mandates in the Nigerian WASH sector. MDAs involve in sanitation across tiers of government in Nigeria include:

• *Federal Government Level:* The major actors are FMAWR, FMH, FME, FCDA, FMEnv, FMHUD, FMW, FMWASD, FMI, FMF, NPC, NOA, NCWR, RBMC, IMC, IDS, NBS, NAFDAC, NPHCDA, FEPA, NESRA.etc. *State Government Level:* Major actors include: State Ministries/Bureau of Water Resources/Public Utilities/Infrastructure, Agriculture, Information, Land, Housing and Environment, Education, Health, Rural Development, Finance, Justice, SPCs, LGCA, SWCs or SWBs, SWMBs, SEPAs, SUBEB, State RUWASA; LGSCs; States arm of the NOA among others.

• *Local Government Level:* Actors are the Works Department; Agriculture Department; Health Department; Education Department; Community Development Units; Social Development Department; Finance and Supplies Department; Council Committee of WES; LEA; Women Development Unit; WASHCOM; WASH units; and the Local Government of the NOA.

Major Donors and International NGOs involved in WASH activities in Nigeria include: the African Development Bank (AfDB); WaterAid Nigeria; United Nations Children Fund (UNICEF); World Health Organization (WHO); The European Union (EU); The World Bank; Department for International Development (DFID); Japan International Cooperation Agency (JICA); United Nations Development Programme (UNDP); UN-Habitat; German Development Cooperation -GTZ; United States Agency for International Development (USAID), etc.

Major CSOs and associations involved in WASH activities in Nigeria include: CASSAD, NGO Network, Nigerian Society of Engineers, National Association of Hydrogeologists, Nigerian Hydrological Association, National Association of Public Analysts of Nigeria, Reps of Sanitation Workers, and Children's Parliament as well as the

NEWSAN. NEWSAN is a large pool network of NGOs operating in the sector with branches in many states of the country but it is worth noting that there is still low capacity on WASH, especially on sanitation issues among the CSOs. Example of the NGOs members list in one of the states (Cross River State). Other CSOs networks working in WASH exist in different forms in different states and regions.

Major existing sanitation and hygiene programmes or initiatives include the construction of sanitation facilities as championed by the WSSSRP, UNICEF and others, the Community- Led Total Sanitation (CLTS) and the mass media campaigns on hand washing launched in various states.

Although most of the policies recognized the importance of private sector,there is no known platform for integration of the private sector. Hence, financial institutions such as micro finance banks and other big firms in Nigeria are yet to intervene in sanitation issues. A close private sector involvement exists at the state level where the State Environmental Protection Agencies (SEPAs) collaborate with few firms for refuse disposals and sanitation tariffs collection. Such arrangements allow these firms to retain some percentages of the total tariffs collected as profits and overheads while the government agencies take the balance. Private sector involvement in some states is under the build and transfer approach where the state builds toilet facilities and hands over to private firms to manage. The FMAWR is currently working on a platform that will integrate the private sector with support from EC through the NTGS; though the support has no funding backup yet. The above situation has limited the involvement of the private sector to households sanitation facilities and other profit- oriented facilities in public places like markets, motor parks, etc. Awareness is a major gap inhibiting the private

sector involvement in sanitation and hygiene. Evidence suggests willingness from private sector in terms of collaboration if adequate platform exists through awareness- creation. UNICEF collaborated with UNILEVER which is a private sector firm in hygiene promotion in about 10 states under the auspices of the FMenv.

The National Task Group on Sanitation (NTGS) was inaugurated in May 2002 by the then Honourable Minister of State for Water Resources, Precious Ngelale, to serve as the national coalition group on sanitation, focusing only on that aspect of sanitation dealing with the management of human excreta and domestic waste water. The NTGS has as its coordinating body and secretariat, the FMAWR through the Division of Water Sanitation Technology and her members include representatives from FMAWR, FMH, FME, FMEnv, Water Aid, UNICEF, WHO, EC, DFID, JICA, AfDB, NAFDAC, NAO, MDGs Office, NEWSAN, the Media Network, etc. Some of NTGS major achievements so far include:

- A stand-alone Draft National Water-Sanitation Policy developed and approved by NCWR
- Strategy for Scaling-Up Rural Sanitation and Hygiene in Nigeria for MDG developed in June 2007
- National evaluation of the CLTS pilot conducted by the NTGS
- National IYS plan developed and shared with stakeholders which have resulted in state level IYS plans and actions too.
- IYS launched at the NCWR meeting with a media briefing on WWD by the Lagos state governor representing the president in the presence of the Minister, FMAWR and the flag of hand- wash campaign launched in various states

- The development of implementation Guidelines for National-Water Sanitation Policy

Another coordinating mechanism is the NCWR made up of the ministers and commissioners responsible for water resources at the federal and state levels. It is the highest decision- making body for the sector. They usually meet once a year with options for emergency meetings. Their meetings are preceded by a technical meeting of permanent secretaries and directors to prepare memos for council consideration. Some CSO groups are invited to participate in the technical sessions and to observe the council meetings. It is meant to provide strategic direction nationwide for the sector.

One other coordinating mechanism is the FGN/UNICEF WASH programme aimed at scaling up successful sanitation models in Nigeria. The initiative has gone a long way in strengthening of structures and developing capacities at the national and sub-national levels for sanitation and hygiene programme delivery through the establishment of the NTGS. Among other achievements of the FGN/UNICEF initiative include the development and production of training manuals, IEC materials, tools for hygiene and sanitation promotion as well as advocacy kits for sanitation promotion. Other achievements include: the resuscitation of sanitary inspection of premises for effective sanitation promotion and enforcement of public health laws; the building a critical mass of skilled personnel for effective and efficient hygiene and sanitation promotion; a comprehensive review of training curricula for environmental health courses in schools of health technologies and universities as well as the introduction of the CLTS as a major approach for sanitation delivery speeding up. This mechanism has created a regular water

and sanitation monitoring platform that has been monitoring WASH issues nationally, regionally and even through a gender lens.

Although sanitation has not been given the priority despite the need for this, the existence of the CLTS, mass media campaigns on hand- washing as well as construction of sanitation facilities in various states has contributed to a significant improvement in the country's sanitation situation. The JMP (2008) found that on the sanitation and hygiene fronts, despite Nigeria not being on track with regards to the MDGs, an additional 163,740 people had access to improved-household sanitation facilities in 25 states through the promotion of community approaches to total sanitation, additional 122,710 pupils have access to improved sanitation facilities in schools, over 2 million reached with hand- washing messages through campaigns and rallies, and the harmonization of funding from firms and donors for hygiene promotion. With the introduction of CLTS, 55 out of 584 triggered communities have attained open defecation free status in six focal states of WSSSRP; hence, making CLTS a catalyst for scaling up sanitation development in such states. In other words, CLTS may have worked because it is participatory, easily adopted with little cost, allows households climb sanitation ladder gradually and takes into consideration the cultures of different communities. The CLTS as well as other measures (mass media campaigns and collaborative sanitation facilities construction) currently adopted encompass education and capacity- building that affects behavioural change and cultural beliefs and evidence has shown significant increase in access through rise in number of improved latrines. A telling indicator can be found in the EU WSSSRP focal states of Anambra, Osun, Jigawa, Kano, Cross River and Yobe states with about 8,259 improved household latrines constructed in a year period.

CLTS approach has made some communities ODF through the effort of sanitation coordination bodies like NTGS and the building of latrines using local materials. The success of CLTS, mass media campaigns on hand- washing as well as construction of sanitation facilities have been attributed to the fact that these measures made sanitation to be demand- driven because the approach in adoption is the bottom-top approach unlike the traditional approaches in existence before which used the top-down approaches. See table 2.7 below for more details on the difference.

The CLTS approach has been responsible for the improvement in the sanitation and hygiene fronts more than the subsidy approach. Evidence from Water Aid shows that less than 15% of the materials provided through the subsidy approach was accessed by the communities while on the other hand, CLTS has led to more pit latrines and the creation of Sani-Centres with the availability of materials like washing facilities, slabs which saves costs and time. Success of CLTS has been witnessed more in Benue and Jigawa states. The proceeds from CLTS in Jigawa state was used to build a mosque while some are ploughed back for the establishment of new Semi-. Centres.

Table 2.7: Comparison of the Tradition and CLTS Approaches

Traditional Approach	Community- Led Total Sanitation
Starts with latrine	Starts with people
Fixed designs of latrines prepared by engineers	Flexible design innovated by community people
Fewer options to choose from	Many options to choose from accordingly to affordability
Expensive materials (Cement, pipes, brickworks) used	Local inexpensive materials (Bamboo plastic, tin) used
Success measured by number of latrines constructed	Success measured by ending the practice of open defecation in the entire community
Subsidy is the main motivation	Self respect is the main motivation
Household is targeted for individual action	Entire community is targeted for collective action
Promotes subsidy approach for latrine construction	It does not promote subsidy approach for latrine construction

Most of the sanitation projects and programmes during the era of traditional approach failed to be sustainable because they were not planned and designed to meet the needs of the end user. During the traditional approach days, most facilities were neglected because one poor use of this facility could trigger a lot of other misuse and cumulatively render the facility improper for usage. There is plenty of visible evidence of projects which have failed because they did not take into account the expressed needs and

demands of the target population. The new success story of CLTS and other current programmes has been attributed to the concentration on managing the facilities.

2.16 Financing of Sanitation

The level of financing sanitation from the government angle has been very discouraging with unclear line budgets and releases in almost all MDAs. There may not be a realistic disaggregating for sanitation financing rather WASH expenditure and financing. The financing strategy for sanitation is based on the premise that individual families are solely responsible for paying for the construction of their household sanitation facilities. The focus of the rural water supply and sanitation programme is generating demand for improved environmental sanitation and thus creating a self - sustaining market for widespread construction of latrines.

Sharing of responsibilities among the three tiers of government led to cost-sharing formula as contained in the provisions of the 2000 National Water Supply and Sanitation Policy (NWASP) which showcased respective percentage costs to be borne by different tiers of government with special attention to capital investment in water resources. For rural water supply, the formula allocates 50% to the federal, 30% to the states, 15% to the local governments and 5% to the communities and for small towns' water supply 30% to the federal, 60% to the states and 10% to the local governments. The FG is proposing pulling out of the cost- sharing formula with a new policy that makes the federal government share in all three settings to be 0% being proposed but has not yet been approved. The argument behind this is that the FG should concentrate at WASH policy formulation and coordination while the state and local governments should do the actual implementation.

Similarly, in 2006, the Federal Ministry of Agriculture and Water Resources launched a strategic partnership approach known as WIMAG framework and MOU which intended to operate as a central mechanism in implementing a strengthened National Water Policy and in achieving the objectives of the NEEDS and SEEDS programmes, specifically as they relate to improving water supply and sanitation services in urban and peri-urban areas.

WIMAG intended to provide a single mechanism by which funding for capital projects in the urban water services sector can be made available and applied. The WIMAG MOD is a voluntary agreement between the federal and state governments, under which the federal government makes a conditional commitment to make available funding, on a co-funding basis, to projects in the state, where agreed conditions are met. In return, the state government commits to ensuring that service delivery improves through implementing sector reforms.-

The above financing mechanisms seem very good on paper but the implementation has not been smooth at all levels of government. Studies have shown that no tiers of government has strictly complied with these commitments. Budgeting and expenditure at all tiers in the WASH sector is done without considering such commitments but rather the political interests of different political blocks.

Sectoral priority can also be measured by the expenditure of the sector. This is so because redefining and sharpening the role of government in an area has become one of the key issues in modern development policy. Also sectoral budget and expenditure do provide a basis for understanding government's financial operations which will ultimately contribute to the goals of resource usage efficiency and fairly balance spread

of budget allocation and subsidies. Looking at the expenditure trend of the entire sector since 2001 as shown in Table 2.8 below reveals a growing trend at irregular intervals.

Table 2.8: Government revenue and expenditure (Billions of US$)

	2001	2002	2003	2004	2005	2006	2007	2008
REVENUE								
Federal	7.15	5.95	7.92	9.43	12.67	11.87	14.69	13.30
States	5.14	5.56	6.62	8.38	9.58	11.08	12.34	11.49
LGs	1.54	1.43	2.86	3.52	4.56	4.69	5.40	5.30
Consolidated Revenue	13.83	12.94	17.40	21.32	26.80	27.64	32.43	30.09
EXPENDITURE								
Federal	9.13	8.45	9.49	10.72	13.90	14.64	18.12	15.68
States	5.35	6.01	7.13	8.46	9.68	11.54	12.69	11.76
LGs	1.54	1.41	2.80	3.47	4.49	4.78	5.32	5.28
Consolidated Expenditure	16.02	15.88	19.42	22.65	28.07	30.96	36.13	32.72
WASH EXPENDITURE {Millions of US$)								
Federal	76.04	80.02	52.54	46.47	71,01	•70.08	76.27	57.86
States	16.05	19.42	19.27	29.92	33.71	40.19	46.30	42.70
LGs	3.59	4.23	11.30	11.65	14.87	18.89	21.91	21.02
Consolidated	95.59	103.68	83.11	88,04	119.60	129.23	144.4 8	121.58

% Growth Rate of WASH Consolidated		8.46	19.84	5.93	35.85	8.05	19.54	-14.82
% of Consolidated WASH to Total Consolidated Expenditure	5.97	6.53	4.28	3.89	4.26	1.96	1.03	1.29
Required for WASHMDG Achievement						189.87	191.8 2	173.82
Shortfall to MDG WASH Projection	-	-	-	-	-	60.64	47.34	52.17

Source: Computed from various sources including CBN Annual Reports and NBS sources

The growth rate of WASH consolidated expenditure was highest in 2005 and has been on a decreasing trend since then with 2008 at -14.82%. Also, the last row shows the shortfall of WASH expenditure based on the projection from the office of the Special Assistant to the President on MDG. The row reveals that in 2006 the expenditure of all the three levels of government on WASH fell short of what is required to meet MDG by US$60.64, US$37.34 and US$42.17 in 2006, 2007 and 2008 respectively.

For donor intervention in the WASH sector, it is true that most of the off budget projects in water supply and sanitation are being implemented by the FMAWR; to ensure transparency, these projects have to go through the National Planning Commission (NPC) and federal ministry of finance for approval. Both the NPC and the federal ministry of finance have a department of International Cooperation that attends to such issue not only for WASH but all other sectors. The funds for off budget projects are released from the

federal ministry of finance. Table 2.9 below shows the external (donor) capital project funding for the period 2005-2007.

Table 2.9: External Funding in the WASH Sector (2005-2007)

S/No	Major off-budget programmes by donors	Allocation	Start Date	Major implementing agency	Target region/beneficiary group
1.	Small Towns Water Supply and Program-European Union- assisted Project	Euro 15m	March 2005	FMWR	Adamawa, Delta and Ekiti States
2.	EC-Assisted STWSSP	Euro 15m	March 2006	FMWR	Adamawa, Delta and Ekiti states
3.	EC-Assisted STWSSP	Euro 15m	Feb 2007	FMWR	Adamawa, Delta and Ekiti states
4.	WaterAid Nigeria water supply and sanitation programme	Euro1.9m	April 2007	28 LGAs in 6 states	Bauchi, Benue, Ekiti, Enugu, Jigawa and Plateau states

Source: Federal Ministry of Finance and CBN publications

Apart from the above projects, other WASH projects with donor interventions abound. The EU WSSSRP is currently providing funds for construction of water and sanitation facilities with co-funding by the three tiers of government and the UNICEF. The project is carried out in a sustained and integrated manner in up to 1,400 rural communities and up to 60 small towns in 25% of the LGAs in the six EU focal states

with a total cost of Euro 119.63 million (EOF contributing Euro 87million, the three tiers of government contributing Euro 31.43 million and Euro 1.2 million contribution from UNICEF). Similarly, other ESA like UNICEF, WaterAid and EU among others have been financing sanitation activities at the federal level and their respective focal states and LGAs with counterpart funding from the state and the LGs though available evidence reveals that states and LGs have not been up and doing in the provision of such counterpart funds.

2.17 Constraints and Opportunities for Sanitation

Going by the JMP report of 2008, it is obvious that less than a third of the population in Nigeria has access to improved sanitation while less than half of the population have no access to potable water supply. Such evidence supports the claim that sanitation in Nigeria has not been given the priority despite the need for it. This is visible through the fact that sanitation does not have a clear institutional "home". In most cases it is shared amongst a number of ministries at the federal level and is the responsibility of a number of different authorities at the state and local levels. It is usually shared between health, water resources and environment. Sanitation most times does not have comprehensive budget lines even in the budget of most of the WASH MDAs. In some cases, existing budget lines are vied in favour of other projects. As a result, sanitation programmes are generally weak and ill-conceived with inadequate funding. This problem requires top level evidence based- advocacy and policy makers' sensitization (federal, state and local governments including the legislative arm). The findings from the ongoing monitoring and campaigns will provide evidence that can be used to buttress the facts.

Overall funding in the Nigerian sanitation sector should recognize the impact of sanitation on health, poverty reduction and economic and social development which must be in line with the United Nations General Assembly Declaration objectives of 2008 International Year of Sanitation (IYS).

The IYS was implemented in Nigeria to help accelerate progress on sanitation with five key messages as follows: Sanitation is vital for human health; Sanitation generates economic benefits; Sanitation contributes to dignity and social development; Sanitation helps the environment and improving sanitation is achievable. Working together, households, communities, governments, support agencies, civil society and the private sector have the resources, technologies and know-how to achieve the sanitation target.

The IYS plan sets three targets for Nigeria:

- Develop enabling environments to sustainably expand sanitation and hygiene programmes
- Build one million latrines. Using the MDG monitoring figures from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), about 800,000 household latrines/toilets must be constructed every year from 2009 to 2015 to meet the Nigeria MDG sanitation target of 70% coverage by 2015. Based on the national standard of ten people per latrine, one million latrines per year starting in 2008 is the requirement for Nigeria based on the MDG target of 70% for sanitation access come 2015.
- Conduct hand-washing campaigns at federal level, in all states and in all LGAs to reach 30 million people.

Through the IYS, Nigeria launched a Nigeria Year of Sanitation (NYS) which adapted the above, targets and is still pursuing those targets vigorously. The NYS is a domesticating IYS in Nigeria as part of the effort of the country to have the general targets as burning issues every time. The above targets which are in line with the policy targets must be the first priority for any .funding attracted to the sanitation sector in Nigeria. These targets reflect the IYS focus on excreta disposal and hygiene promotion as the two key interventions for maximum benefit as well as the need to stress the development of the policies, institutions and other enabling environments to ensure progress in the years to come. Achievement of these targets can be accelerated through ongoing sanitation programmes like CLTS and campaigns which is bottom-up approach that will concentrate on latrine and hygiene promotion efforts but be scaled. up to cover more states and communities to achieve 100% coverage. The existence of CLTS as well as hand- washing campaigns are opportunities the GSF fund can build upon to contribute meaningfully towards achieving the above targets and other targets set in the national, state and LGAs polices of sanitation. This will complement the activities of RUWASSA with funding support from UNICEF, EU, Water Aid, etc which is already working on similar issues in different states and LGAs. The above organizations have supported states and LGs through RUWASSA with viable sanitation models but there is need for scaling up because of the challenges that still' exist in other states and LGAs.

The above promotion which will involve advocacy will help in solving the basic problem of awareness which has resulted into socio-economic, cultural and security factors inhibiting sanitation in Nigeria. Other promotion activities and strategies that will

increase demand for 'improved sanitation and integration of the private sector in sanitation and hygiene to be employed in increasing awareness include:

- Participatory community- led efforts like community dialogues and meetings, focused group discussions, local stage stand-up comedy, etc.
- Putting up billboards and hand bills including fliers that will be translated into major languages in every state of the federation.
- Painting promotional messages on the walls of houses
- Use of a "sanitation road show"
- Media jingles, radio drama, media briefing and advertisements, etc.

One of the challenges responsible for low access to WASH in Nigeria is the capacity level of the major WASH actors (stakeholders) including federal, state and local institutions, CSO networks, the communities, environmental health officers and sanitary inspectors, the private sector and other institutions/organizations which advocate for and/or are involved with the provision of sustainable water, sanitation and hygiene services. Most studies have found low capacity and the dearth of skills among government institutions at all levels with the situation worst at the local government level. The result of this skill deficit has been poor programme development, distorted and stunted implementation and inefficient service delivery in the WASH sector. Funding should be geared towards building such capacity at all the three tiers of government especially the local government (WASHCOM members) as well as the CSOs working on WASH issues. Achieving this aim will automatically boost the process, prospects and results of the monitoring and evaluation as well as information management of WASH.

Other key sanitation areas with inadequate funding include:

- Capacity building for sanitation programming, management sustainability, corporate planning, integration of sanitation management and creation of platforms for private sector involvement. The FMAWR as well as the FMEnv are currently developing such platforms with some NGOs while the WSSSRP is already carrying out the capacity building components in some states and LGAs. which is an opportunity for the GSF. Good service delivery requires proper integration of the private sector and transparency in planning particularly for the urban poor and the rural communities. Such move will improve not only service delivery but also maintenance of WASH facilities as well as reduction in incidences of corruption and mismanagement of funds. The rural poor especially women and children, the physically challenged, and other vulnerable groups who have been most times left out in service delivery will automatically be integrated.
- Institutionalization of sanitation development process including implementation, communication, mobilization, documentation of routine checks, best practices and technologies, establishment of sustainable structures at the local level like the creation of WASH units that will generate budget lines. The current creation of WASH units and conversion of these units to full departments by some local governments is an opportunity that will help achieve this target.
- Proper monitoring and evaluation systems with improved capacity on information- gathering techniques and management, identification and strengthening existing information sources and the sustainable usage of the media for hygiene education. At the national level, government sectoral monitoring systems are inadequate to properly and inform decisions on national

sector investments, sub-sector resource allocation, sub-national disbursing, accountability of funds and actual disbursement. Equally, some civil societies do not have the capacity to analyze the relevant information needed to make useful and sustainable contributions in the sector.

- Generally, data streams are not harmonized and sector data literacy is poor. This is an important area where funds can be channeled and this can also benefit from the existing EC- funded Water and Sanitation Monitoring Platform (WSMP) with technical support from UNICEF whose overall objective is to contribute to-wards accelerated progress of MDG targets on safe drinking water and basic sanitation, which will ensure a pro-poor focus for drinking water and sanitation in the country.
- Research and development of technology options, information - gathering and management systems as well as technological options to meet the physical, geographic, cultural, religious, and economic and gender, social (physically challenged) needs of the both the rural and urban population across Nigeria.
- Strengthening of collaboration and coordination with legal structure to coordinate sanitation especially at the state and local government levels. Such collaboration already exists to a certain level at the federal government level with the NTGS, NCWR, Donor coordination, etc. Such coordination will also include the harmonization of WASH-polices and instruments in different MDAs of government, review of policies, stepping down of policies to lower tiers of government (state and local governments), repel and review of obsolete laws as well as dissemination of these polices and laws.

- Scaling up sanitation in all 36 states including the federal capital territory, 774 LGAs and all communities. The activities of UNICEF, WaterAid, the EU, the MDG Office, etc are opportunity for GSF in this area.
- Small towns and urban sanitation scaling up including the slumps. The FMAWR has conducted a baseline study on the way forward which is an opportunity for the GSF for proper planning, data management, progress monitoring and assessment, etc.
- There is poor sector information management in existence apart from the WASH JMP. This is an important area of intervention and requires lots of skills to be able to do that. Such gap can also be attributed to skills deficit. The few actors involved in the JMP have benefited from capacity building exercises carried out by different donors and international NGOs working in the sector like UNICEF, Water Aid, etc though evidence on ground still suggests this need for more.
- The other aspect of capacity building involves the communities. This is necessary for the sustainability of projects through ownership as well as models and technological transfers.

Evidence from the implementation of the CITS in most communities attests to this. Capacity building of community- based facilitators. CLTS facilitators through campaigns and advocacy is one way to change the cultural beliefs of most of these communities boosting the ownership level and enhancing their resource contributions to the projects and programmes; hence, creating sustainability paths for the projects and programmes.

Intervention to the above mentioned issues have been on-going but not to every state, LG and communities in the country and have resulted to attitudinal and behavioral changes. More intervention will help reduce the incidence of water- related diseases more; especially the excreta-related diseases like diarrhea, cholera outbreaks, dysentery and other worm infestations. It will also boost the capacities of both public and private sector stakeholders with a positive effect on sanitation strategy development, planning and management, budget preparation, sector advocacy and hygiene for public health among others.

Having identified some of the gaps that funding should be channeled, it is also interesting to note that some opportunities are already in place to strengthen the process, if funding is provided. Such opportunities that funding could benefit from include: the newly created water sanitation division in the FMAWR; the resuscitation of the environmental health officers and inspectors in the FMEnv, FMH, LGAs; formulation of WASH policies in some states; creation of WASH units/departments at the local government level, the national year of sanitation plan, the presence of NEWSAN in almost all the states of the federation and the establishment of the National Environmental Standards Regulation and Enforcement Agency (NESREA) among others.

2.18 Recycling of Solid Wastes

On September 17, 1981, the first ever blue box recycling programme was launched in Kitchener, Ontario, Canada. Today, more than 90% of Ontario households have access to recycling programmes and annually they divert more than 650,000 tonnes of secondary resource materials. The “blue box” programme has expanded in various forms throughout Canada and to countries around the world such as United Kingdom,

France and Australia, serving more than 40 million households in countries around the world.

The modern recycling movement in the United States began in 1987 when a barge called the mobro 4000, containing a little over 3,000 tonnes of garbage from slip, New York to deposit its load garbage in Morehead city, North Carolina. However, before it reached destination, rumors that it contained medical waste caused officials at Morehead city to deny the barge permission to unload its garbage. As a result, the barge traveled down the East coast of the United States searching for a place to unload, eventually being denied in Mexico and Belize. The barge finally returned to slip, where the trash was incinerated after a brief legal battle. The barge's journey became a small media event in 1987 which culminated in environmentalists claiming that the United States had run out of land-fill space, if it had no room for one single barge. Although scientists disagreed then, and still disagree with this claim, the modern recycling movement had begun.

A recycling rubbish bin in a Berlin public-transport station; another major event that initiated recycling efforts occurred in 1989 when the city of Berkely, Califonia, banned the use of polystyrene packaging for keeping McDonald's hamburgers warm. One effect of this ban was to raise in the area of management at Dow chemical, the world's largest manufacturer of polystyrene, which led to the first major efforts to show that plastics can be recycled. By 1999, there were 1,677 companies in the USA alone involved in the post-consumer plastics recycling business.

Recycling is a series of activities that includes collecting recyclable materials that would otherwise be considered wastes sorting and processing recyclables into raw material such as fibers, and manufacturing raw materials into new products. In other

words, waste recycling generally means any process by which waste materials are processed and returned to the economic mainstream in the form of raw materials or product to be manufactured in the same or a similar product. It is essential to clarify in detail which activities are covered under the term "recycling" by different countries and in which hierarchy the activities are applied e.g. if the use as fuel substitute or for energy recovery is included or not.

In other words recycling is the collection and reuse of materials that would otherwise be considered waste to produce new products. Motivations for recycling include environmental concerns, as recycling reduces the use of energy and raw materials and the need to dispose wastes, and for cost reasons, in situations where production from recycled material is less expensive than from new material. While extensive variety of waste is recyclable, materials commonly recycled on an industrial scale include glass, paper, aluminum, asphalt, and steel. Recycled materials can be derived from pre-consumer wastes (materials used in manufacturing), or post-consumer wastes (materials discarded by the consumer).

According to the USEPA, a material is "recycled" if it used, refused, or reclaimed. A material is "used or refused" if it either (1) employed as an ingredient (including its use as an intermediate) to make a product; however, a material will not satisfy this condition if distinct components of the material are recovered as separate end products (as when metals are recovered from metal containing secondary materials or (2) employed in a particular function as an effective substitute for a commercial product. A material is "reclaimed" if it is processed to recover a useful product or if it is regenerated.

Examples include the recovery of lead values from spent batteries and generation of spent solvents.

Many manufactured products are not readily biodegradable and take up space in land-fills or must be incinerated. Recycling is an alternative to this. In theory,it would allow a continuing refuse of materials for the same purpose. In practice, recycling most often extends the useful life of a material, but in a less-versatile form. For example, when paper is recycled, the fibers shorten, making it less useful for high grade papers. Other materials can suffer from contamination, making them unsuitable for food packaging.

The primary benefits of recycling are conservation of natural resources and landfill space; however, the collection and transport of materials require substantial amounts of energy and labour. The most important individual materials that are now recovered from MSW for recycling are: paper, rubber, polythene and so on.

2.19 Benefits of Source Reduction

There are a number of compelling incentives for minimizing waste. If waste is reduced at source it reduces the hazards and costs of managing the waste from handling to storage to treatment and to final disposal. Many success stories show that cleaner production can often give both environmental and economic benefits. According to the Environment Protection Agency (EPA, USA), pollution prevention is the most cost-effective method of environmental protection because it promotes facility efficiency, reduces the need for expensive end-of-pipe treatment and disposal technologies, and reduces the long–term liabilities associated with releases into the environment.

Through waste reduction, particularly hazardous waste reduction, a company can reduce its cost of waste management; reduce long-term liability for disposal of hazardous

materials, and become more efficient to enhance profit margins. In the case that waste minimization strategy has not completely solved the waste problem and end-of-pipe technology is still required, it is always observed that the end-of-pipe equipment is smaller, cheaper to operate and needs less investment than without waste minimization.

Cleaner production (CP) is good for business and the environment. While the main goal of waste minimization is to reduce or eliminate waste, it may also bring about an improvement in a company's production efficiency. The intention is to achieve a lower level of pollution and environmental risk. More efficient use of materials and process optimization result in less wastes and emissions, which in turn result in lower operating costs. CP also focuses on occupational health and safety and also positive effects on worker productivity and decrease in accidents. For a new process such benefits are usually built into the equipment. For older plants, economic incentives can be achieved from process changes and modifications.

There are several benefits of implementing cleaner production. The following is a summary of some of them.

Financial benefit

- Reducing waste management costs
- Reduction in water costs
- Saving in raw materials
- Reducing facility clean up cost
- Reducing energy costs
- Reduced production costs through greater efficiency and increasing profits
- Recovery of valuable by-product

- Opening of green markets

Specifically, reduction in waste management costs could mean reduction in:

- Off site treatment, storage and disposal charges
- Levies and taxes on producers of hazardous wastes
- Transport levies on other emissions
- On-site treatment, storage and handling
- Licenses, reporting and recording

Environmental benefits

- Reducing quantity and hazardous nature of waste or both
- Reducing energy-related pollution, for example pollution from thermal power plants
- Reducing water pollution from industrial activities
- Slowing the global warming and climate change process
- Reducing air pollution
- Reducing soil and general land customization
- Sustaining a country's environment

Legislative compliance benefits

- Reducing liability. Cleaner production helps a company to reduce the risk of both civil and criminal liabilities by decreasing the volume and the potential toxicity of waste generated
- Reduced exposure to future liability costs. Past disposal practices, even though they may have been legal, have often caused environmental damage

that has proved to be expensive for industrial facilities as well as damaging to their public image

Improved company image

- Creating positive community attitudes will be more positive toward companies that operate and publicize a thorough cleaner production programme.
- Producing environmentally acceptable products. In more industrialized countries, environmental issues are of great importance and concern to their societies and it is factored in as consumers do their purchases.
- A green/eco-friendly image is likely to create more positive attitude in the employees towards their company.

Improved health and safety

- Improved worker health and safety. CP focuses on occupational health and safety and therefore has positive effects on worker productivity and safety.
- By reducing or eliminating toxic substance use, the safety of the work environment can be improved and personal protective equipment requirements decreased.

Cleaner production can minimize or eliminate the need to make trade-offs between economic growth and environment, between worker safety and productivity, and consumer safety and competition in international markets. Optimizing several goals at the same time in this way leads to "win-win" situation in which everyone gains. Cleaner production is such a "win-win" strategy that protects the environment, the consumer and worker while improving industrial efficiency, profitability and competitiveness.

Thus, countries that start to adopt cleaner production now will be able to take full advantage of a rare window of opportunity, which for once favours development in poorer countries over those in the industrialized nations.

Resource Efficiency

Resource efficiency means to reduce the demand and the costs for energy, water and materials within industries and communities by utilizing innovative management practices and new technologies. Resource efficiency generally covers materials, water and energy efficiency. The results are monetary savings which benefit the local economy, reduced environmental impact, and conservation of resources.

The terms efficiency and conservation are often used interchangeably, but in fact they have different meanings. Efficiency means getting the same or better service while using fewer resources. Conservation means simply using less and reducing waste; without efficiency, conservation generally implies a reduction in the level of service.

Industrialized society's veracious consumption are of virgin and synthetic material resources such as timber, minerals, metals, plastics, glass and concrete. They increasingly deplete our ecosystems natural capital and produce enormous amounts of wastes and pollution.

Using our material resources much more efficiently to prevent resource depletion, waste, and pollution is a critical component of sustainability. Material efficiency requires the following:

- Designing all goods and services to require much less virgin material (see Design for Environment)

Recycling of municipal solid waste (MSW) component

Resource extraction hurts the environment;manufacturing of product pollutes the air and water. Wastes continue the pollution cycle to the detriment of public health and environment. People now realize that mass production, mass consumption, mass disposal systems must be designed for environmental protection and suitable development.

The recycling of MSW component is universally accepted to be an excellent strategy for controlling the solid waste pollution problems. It also conserves the natural resources and land-fill space.

2.20 An Overview of Community Participation in Solid WasteManagement and Control

Community participation can comprise varying degress of involvement of the local community. This can range from the contribution of cash and labour to consultation, adaptation of behaviour, involvement in administration, management and decision-making. With community management often the highest level of community participation is meant.

The role of community members: from behaving well to decision-making, community members and local leaders in urban communities play different roles in solid waste management. These roles correspond to different levels of community participation as derived from the solid waste management. Community members can participate in solid waste management by showing proper sanitation behaviour, by contributions in cash, kind or labour by participation in consultation and by participation in administration and management of solid waste services.

Proper sanitation behaviour is behaviour that facilitates solid waste management system.

It may include:

- Adapt daily habits to agreed solid waste system (rules, schedules, e.g. to offer it at the right time and place to the collection team).
- Bring garbage in a plastic bag, a special bin etc
- Cooperate in clean-up campaigns
- Keep house and immediate environment clean (drains, streets in front of the house)
- Separate waste in organic and non-organic, wet and dry, keep plastic, paper etc apart.
- Contributions in cash, kind or labour are more direct
- Contributions to the operation of solid waste management.

Local leaders play the role of intermediaries between communities and municipalities. Local leaders can be divided into traditional, formal and informal leaders. Traditional leaders derive their authority from hereditary rights and from their status in the local culture. Formal leaders are appointed by the government or elected as local representatives of the government. Informal leaders are influential members of a community on the basis of their personal status or of their activities in community-based organization (CBO) such as political parties, Churches, Mosques, youth and women organizations, neighbourhood committees etc. All three types of local leaders may have different roles in solid waste management. Usually, formal and informal leaders are more involved in solid waste management than traditional leaders. Involvement in management of solid waste services includes participation in the management of solid waste services and keeping in contact both with the municipality and the community.

2.20.1 The Different Institutions Involved in Solid Waste Management

A number of government, non-governmental and donor agencies are directly or indirectly responsible for the improvement of the solid waste management services, environment, health and sanitation conditions of African people.

- ***National Level:*** The Ministry of Environment at federal level is the prime responsible government institution for physical planning of urban areas in the country and environmental issues.
- ***Municipality:-*** Municipalities are local government formed under the Municipality Act. The organizations, although technically under local government ministry, function autonomously with little interference from the government. Municipalities have the responsibility for sanitation in the towns. This is centered on the collection and disposal of solid waste management of public toilets, emptying of septic tanks, construction and maintenance of towns drainage system.
- ***Donor Agencies:-*** Donor agencies such as UNICEF, the World Bank, UNDP and the NGOs all provide technical and financial support in this area to various sector institutions, municipalities and NGOs.
- ***Private Sector:-*** Private sector involvement in solid waste management has so far been very limited. Some household compost the refuse in their backyard later to be used as fertilizer in the fields or garden.

2.20.2 Technology and Equipment Used

Traditional street- cleaning equipment includes short- handed broom and bamboo baskets as waste carriers. Transportation of wastes is done by sweepers, carrying the baskets on their shoulders. This method of carrying wastes is traditional, inefficient, unhygienic and time- consuming. With increasing size of cities, traditional means of transporting waste have become inadequate though this method is still practised by sweepers.Improved brooms with a longer handle allow higher efficiency. The municipality programme introduced improvised wheel barrows to collect wastes.

Nowadays in Nigeria, a daily collection of wastes is done by using these barrows which could be operated by one person and it is narrow enough to fit through even in the narrowest allies and thus reaches even the core area of the community. Collected garbage is transferred from the wheel barrows or cart to a skip by self help groups which then is transferred into a container at a transfer station. Ultimately, large waste quantities from transfer stations is then brought to the land- fill site for final disposal.

A few household in the community use tranditional method of composting which is unhygienic (at times human and animal wastes are used directly in the field). In this process, a pit is dug and all types of day- to -day waste is thrown into it for composting without any further process. Time and again, the waste heap is turned manually upside down for maturation.

2.20.3 The Role of all Concerned Actors of the Community

Role of Leaders

The hustle and bustle of most urban cities make it difficult for people to relate closely or participate in community services.Generally,awareness programmes are hardly

taken with any pinch of salt.This is because from peoples past experience,most of such programmes are not usually backed by actions.Thus,doubts and reluctance are introduced,specifically,creating awareness and introducing sanitation programmes suffer the same fate. However,sanitation workers understand peoples reluctance and lack of or low confidence. To deal with the situation carefully and to build up the confidence of people, the working team must look for the best approach to enter into the community. They found out that the best way to convince people about programmes would be to identify some influential persons or leaders of the community to whom community people have much trust and listen to them.

2.20.4 The Role of Elders:

One of the major thrusts of the sanitation agency had been to build upon the experiences of the elderly population, both male and female. They are considered as the resource tank that provide necessary input to programmes based on their experiences and observations made with different development processes. In traditional communities like the ones in Nigeria, those groups also have a lot of influence within the communities.Many a times, no activities can be implemented without their consent. That is a sort of honour and respect they enjoy and of course also deserve for their contributions in the community feelings, be it traditional, cultural; behaviour etc.

Therefore, a sanitation committee was formed with representation from elder group. Mainly, their role in the community and programme was as decision makers and advisers.

2.20.5 The Role of women

In Africa as in other parts of the world, women are responsible for the cleaning of the house and looking after her children. Her involvement in the sanitation programme is

necessary as she is responsible for daily domestic waste disposal. Therefore, while establishing the youth group, females were encouraged to be members of the youth group so that it would be easier to motivate the other women in the community. Surprisingly, involvement or participation of female youth in selfhelp group was found to be more than expected.

This programme of sanitation laid special emphasis with regard to awareness building for community women and provided different trainings because of the fact that women in this society are less educated. During the programme women's participation was very enthusiastic.

They attended most of the meetings and received training in different areas. They played key role in proper disposal of household wastes and their overwhelming participation in weekly street cleaning contributed a lot in making a community clean and making the programme a success. Women facilitators, fluent in local language were found useful to ensure consultation and motivation at the community level.

2.20.6 Involvement of Children

They are the future generation of any community. Educating, orienting and involving them in the whole process of projects was considered very important. While planning the programmes, it was taken care that the children's interest are also addressed. Children of a community were organized into junior groups, thus making them participants of working groups right from their childhood. They participated in those activities which were suitable for them and in this way they were being prepared for better future environment. Children's participation in a weekly street cleaning programme is highly appreciable.

2.20.7 The Role of Youths

Since youth generation is the most active and dynamic stratum of a community, sanitation agencies involved them as one of their most important partners. Almost all the activities were conducted through those groups. They actually were the vehicles of sanitation agencies that provided a link between the agencies and communities. They motivated community to participate in the programme and supervision and monitoring of the activities were also done by them. In the success story of any agency responsible for waste management special credit goes to this group in the community.

2.20.8 Motivational Aspect

On the motivational front, it is a sad reality that people are not fully aware of the relationship between health and sanitation. Old habits die hard, so a constant motivation campaign to increase awareness is necessary. However, this awareness can not be achieved automatically.

Intensive attention and motivation is needed for maximizing participation by informing the community about the health implications of improper management of solid wastes. This is done by using available media and direct motivation measures. Special attention is given to women who are the most powerful change agent within the family context. Awareness activities at community meetings, social works gathering will be carried out to inform people about the adverse impact of dirty environment.

There is a saying that children are raw mud whom can be moulded to desired shape. It is also applied in changing the behaviour about health and sanitation starting from childhood. The ability of a society to improve its living condition will not be fully utilized if the younger generation is excluded from the process of consciousness

development. Without direct participation of children and adolescents in the responsibilities for their environment, it will not be possible to find solutions to the problem of insanitary environment. On the long run, the young people in a community will be those who benefit most from the new development.

2.21 An Overview of Sanitary Inspectors

According to Public Health Encyclopedia, "A sanitarian is a person who is trained in sanitary sciences, biology, chemistry, geology, physics and mathematics, and who operates as an inspector or health official in the public sector or private industry, reviewing programmes and enforcing different categories of laws to protect the public health. He/she is a public health professional whose responsibilities may include food sanitation and safety, air, water and environmental protection, inspection of water, well and sewage disposal systems, control of insect pests, and animals; disease control and epidemiology, housing, occupational and institutional safety and sanitation as well as nuisance control.

The history of the sanitarian and his work did not start in Nigeria. The profession was introduced to Nigeria by the British Colonial Government. Any history of the profession therefore would start from the earlier dates. The earliest record mentioned of any form of health control is contained in the Holy books.

Sanitary reforms gained more ground and recognition by the appointment of William Macgregor, a doctor as Governor of Lagos State, who was passionately interested in sanitation. Macgregor's period of office as Governor of Lagos (1899-1904) was referred to as a "Golden Age" by Nigerians. The entire government house was protected by copper wire gauze to prevent the entrance of mosquitoes.

Public health movement was very lucky in the appointment of the first African medical officer of health, Dr. Isaac Ladipo Oluwole, the son of a famous father who was consecrated Bishop in 1893. Dr. I.L. Oluwole, on his appointment as Assistant Medical Officer of Health on 1st October, 1925, faced immense problems of public health. Before he was appointed, little attention was paid to sanitation and hygiene. Outbreaks of epidemics were common occurrences. The menace of the plague which broke out in Lagos in 1924 had been completely eradicated, while the outbreak of other epidemics continued. Other infectious diseases like dysentery, small pox and tuberculosis spread virtually uncontrolled within the community. Also the incidence of yellow fever was on the increase.

Furthermore, the public health department itself was not well organized to deal effectively with those problems. Although the township ordinance to enforce the observance of the health regulation had been passed as far back as 1917, there were no trained staff to give it practical effect and there was no training programme to make up for the deficiency.

The first preoccupation of Dr. Oluwole was therefore the implementation of a training programme for sanitary inspectors in order to provide the personnel for educating the public in health matters and enforcing sanitary regulations. In this respect, sanitary inspectors were most important because they would bear the brunt of any health programme so initiated. He also started the first Nigerian School of Hygiene at Yaba, Lagos in 1925 (now School of Health Technology), where qualified persons from all over Nigeria were trained as Sanitary inspectors. At the end of their training, they obtained the Diploma in the Royal Institute of Heath (R.I.H.) London, which was later changed to

Royal Society of Heath (R.S.H.) Diploma, London. The work of sanitary inspectors was greatly noticed during the outbreak of bubonic plagues in 1924 when Dr. Oluwole revitalized port health services and sanitary inspection of ships and port premises.

Their impact was much felt during the control of Yaws of 1930 and small pox of 1970s. Since then the development of environmental health in Nigeria has continued to increase in terms of the number of practitioners trained and number of schools training the personnel. He further established more schools of hygiene in Kano and Aba in 1932 respectively to train more sanitary inspectors.

To a greater extent, the development of environmental health in Nigeria has been retarded due to the dominant influence of the medical profession, which assumed superiority and erroneously annexed everything health into medical practice. Again, unlike in other countries where people other than physicians initiated some environmental health control in Nigeria, environmental health services were initiated by a physician. This strange marriage existed for so long that it was nearly impossible to establish or convince any one that environmental health was a profession. Whereas World Health Organization (WHO) has recognized environmental health as a profession, it was totally impossible to say so among policy makers in the health sector in Nigeria. That is why the profession is very dormant, and does not have any positive impact to the society for years.

The struggle for the legal recognition of environmental health in Nigeria started in 1980, with the introduction of a Bill in the then National Assembly that eventually was not passed. Furthermore, in 1986, the environmental health profession faced its greatest challenge when the then Minister of Health (Prof. Ransome Kuti) considered it

inappropriate to have the profession in his health care scheme. This unfortunate incident made many of the professionals to go back to school to change profession while others left the profession completely.As if this was not enough, the B.Sc programme in environmental health and epidemiology established in the 1980s at the Obafemi Awolowo University Ile-Ife by the World Health Organization (WHO) in collaboration with the Federal Government was scrapped. This was sequel to the request by the same Hon. Minister to the National Universities Commission (NUC) to have the B.Sc programme scrapped during the course rationalization exercise carried out by the NUC at that time.

To breath in a sigh of relief by the professionals in this profession, in 1989 through the Medical and Health Workers Union, the government was dragged to the Industrial Arbitration Panel (IAP). The panel ruled in favour of the union and the famous IAP Award was granted to some health workers including the environmental health professionals.Similarly in 1999, the office of establishment and management services of the office of the Head of Service of the Federation accepted that the environmental health officer could rise from his entry grade point of GL- 08 to GL 17 as a Director in the Federal Civil Service and GL. 16 in the State Civil Service through a new scheme of service.

In the year 2000, Senator Dalhatu Sarki Tafida, the then Minister of Health but now a senator introduced a Bill in the National Assembly for the regulation of Environmental Health Officers (Registration etc) Bill 2002. Interestingly, both Houses of the National Assembly successfully passed this Bill into Law in 2002 and assented by His Excellency Former President Olusegun Obasanjo on the 5th of January, 2003.This indeed

ended the over 20 years struggle for the profession to exist as a profession (EHORECON, 2002). For the new sanitary programme to work, the excesses of the past must be avoided in the present exercise.

2.22 Waste Management Practice in Nigeria

Waste management includes all activities that seek to minimize the health, environmental and aesthetic impacts of waste, and is concerned only with middle and lower-income countries. The problems and opportunities relating to waste management in industrialized countries are very different. Solid and liquid wastes are generated by many different activities. Very large quantities are produced by agriculture and managing wastes from houses, streets, shops, offices, industries and hospitals is usually the responsibility of municipal or other governmental authorities.

*(*http://environment.nsw.gov.au/waste/index.htm).

Many people feel that waste management is a simple affair simply putting waste into a vehicle and unloading it at a dump. Successful waste management is rarely achieved without special training or experience can solve waste management problems. There is much evidence to show this that is not true, perhaps mainly because waste management is much more than a technological issue, it usually involves managing a large workforce and working together closely with the public. Problems with maintenance and financial aspects are common. Engineers often make mistakes in the selection of equipment, since vehicles and machines which work well in industrialized countries are often grossly inadequate in developing countries. The preparation and management of a good waste management system needs inputs from a range of

disciplines, and careful consideration of local conditions (www.environmental/conservationprograms.htm).

Historically, waste management has received scanty citizen attention and this lack of interest has allowed a number of potential serious situations to develop. Increased generation and accumulation of wastes are beginning to produce social, economic and environmental problems of significant proportion. The indiscriminate disposal of wastes has resulted in air pollution, water pollution and also constitute aesthetic eyesore in the environment. It has also been detrimental to human health both directly by serving as breeding ground for infective organisms such as salmonella species, clostridium species amongst others, and cuts; and indirectly through increase in rodent infection, vector population, surface water pollution, floods and fire disaster *(*http://environment.nsw.gov.au/waste/index.htm*)*. In 1982, there was the Ogunpa river flood in Ibadan, Oyo state in which several lives were lost and properties destroyed. This flood was due to blockage of drainage systems as a result of indiscriminate disposal of solid waste. In 1969, there was an outbreak of Lassa fever in Waste Africa. This was propagated by rodent infestation in the region. There has been high prevalence of diarrhea diseases (Odeyemi *et a*l, 1997).

The concern over wastes is generated from an aesthetic desire to live in a clean environment and also from the realization that a dirty and cluttered environment is unhealthy and unsafe for the population. This is evident in the incorporation of environmental sanitation as a component of primary health care adopted by the World Health Organization (WHO), the Alma- Mata declaration in September 1987. This was also clearly pointed out as the sustainable human settlements programme depend on the

creation of better environment for human health and well being which will improve the living conditions of people and of their lives (http:/www.evasns.org/eilgarbage/htm.com).

There has been an increasing concern about the serious implications for health of waste management problems now facing developing as well as highly industrialized countries. This concern has reached a remarkable dimension in developing countries because of the poorly organized or non-existent solid waste management *(http:/www.evasns.org/eilgarbage/htm.com)*.

The desire for environmental management in Nigeria was ignited by the Stockholm Conference on Environment in 1972. By 1975, a division of Urban Development and Environment was created in the Federal Ministry of Economic Development to handle among other things pollution and other industrial matters. Since then, there had been various relocations of this division to ministries with change of name, resulting eventually in the setting up of the Federal Environment Protection Agency (FEPA) in 1988, following the discovery of five ship loads of toxic wastes of Italian origin at a small Port town of Koko in southern Nigeria (Ekulgo, 1999).

FEPA was established to serve as the apex and rallying government organ in an attempt to combat both national and global environmental problems, halt and prevent further degradation of the Nigerian environment among which is waste management. This laudable innovation was set to be achieved through policy formulation, setting of standards, establishment of the guidelines and regulations, enlightenment and compliance promotion and the monitoring and enforcement of standard guidelines and regulations. Some of its statutory powers were designated to the States Environmental Protection Agencies and related organs with which they work hand-in-hand. Some priority

programmes have been outlined by FEPA amongst which are waste management and out reach education, awareness and publications. Constitutionally, municipal wastes management is the responsibility of the local government authorities. However, there has been shortcomings in the discharge of this responsibility and this led to FEPA setting up an Urban Compliance Unit which oversees environmental issues in the area of waste management and sanitation amongst others. The outreach education, awareness and publications focus on creating awareness on environmental problems, media campaign on environmental issues identification, education and training officials that would form the core environmental education network (Ekulgo, 1999).

Waste management is capital- intensive and its sustainability is determined by the availability of resources and adequate planning. This of course might be responsible for the neglect of waste management in the developing countries with its attending health implications. (http://www.evans.org/eilgarbage/dumping/htm.com).

However, in Nigeria, following the establishment of the various Environmental Sanitation Boards, an appreciable amount of fund has been committed to this.The process involved in the management of wastes include collection, storage, transportation, disposal and treatment (Encyclopedia Britanica, 1999-2000).

2.23 Problem of Solid Waste Management Developing Countries

A typical solid waste management system in developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste- picking or scavenging activities. These public health, environmental and management problems are caused by

various factors which constrain the development of effective solid waste management systems (Izeze,1999). They can be categorized into technical, financial, institutional, economic, and social constraints. Each of these constraints is discussed, below.

(a) **Technical Constraints**

In most developing countries, there is typically a lack of human resources at both national and local levels with the technical expertise necessary for solid waste management planning and operation. Many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management of solid wastes (Ajiye,2000).

Another technical constraint in developing countries is the lack of overall plans for solid waste management at the local and national levels. As a result, a solid waste technology is often selected without due consideration for its appropriateness in the overall solid waste management system. In some cases, foreign assistance is given to a component of solid waste management system for which the use of resources may not be most cost-effective (Jensen,1990). For instance, an external support agency provided its support to improve a general disposal site, however, the coverage of solid waste collection service is so low that solid waste generated is dumped at many undesignated sites (e.g open areas, water channels, streets, etc). As a result, improving the disposal site, although it may not be a bad project, would have little impact on the overall solid waste management effectiveness. In such cases, the low collection coverage is a bottleneck in the overall solid waste management system in the city, and it would be most cost-effective to provide resources to upgrade the collection service.

Research and development activities in solid waste management are often a low priority in developing countries. The lack of research and developed activites in developing countries lead to the selection of inappropriate technology in terms of the local climatic and physical conditions, financial and human resource capabilities, and social or cultural acceptabilities (Ekulgo,1999). As a result, the technology selected can never be used, wasting the resources spent and making the project unsustainable. Several guides/manuals on appropriate solid waste management technologies in developing countries are available in the literature, and the selection of technology could be made sometimes based on these guides/manuals.

However, in most cases, these guides/manuals must be modified to the local conditions prevailing in the country, and therefore local studies are normally still needed. Such studies can be relatively easily incorporated into a collaborative project and, to the extent possible, should involve local research institutions.

(b) **Financial Constraints**

In general solid waste management is given a very low priority in developing countries, except perhaps in capital and large cities. As a result, very limited funds are provided to the solid waste management sector by the governments, and the level of services required for protection of public health and the environment are not attained(Jensen,1990).

The problem is acute at the local government level where the local taxation system is inadequately developed and, therefore, the financial base for public services, including solid waste management, is weak. This weak financial base of local governments can be supplemented by the collection of user service charges. However,

users ability to pay for the services is very limited in poorer developing countries, and their willingness to pay for the services which are irregular and ineffective either. An effective strategy for raising funds needs to be searched in any collaborative project to ensure its sustainability.

In addition to the limited funds, many local governments in developing countries lack good financial management and planning. For instance, in a town in a developing country, over 90% of the annual budget provided for solid waste management was used up within the first six months. The lack of financial management and planning, particularly cost accounting, depletes the limited resources available for the sector even more quickly, and causes the solid waste management services to halt for some periods, thus, losing the trust of service users(Ayeni,1987).

(C) **Institutional Constraint**

Several agencies at the national level are usually involved at least partially in solid waste management. However, there are often no clear roles/functions of the various national agencies defined in relation to solid waste management and also no single agency or committee is designated to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in different agencies becoming the national counterpart to different external support agencies for different solid waste management collaborative projects without being aware of what other national agencies are doing. This leads to duplication of efforts, wasting of resources, and unsustainability of overall solid waste management programmes (Agbola,1997).

The lack of effective legislation for solid waste management, which is a norm in most developing countries, is partially responsible for the roles/functions of the relevant

national agencies not been clearly defined and the lack of coordination among them. Legislation related to solid waste management in developing countries is usually fragmented, and several laws (e.g. Public Health Act, Local government Act, Environmental Protection Act, etc) include some clauses on rules/regulations regarding solid waste management. The rules and regulations are enforced by the different agencies (Pavoni,2000). However, there are often duplication of responsibilities of the agencies involved and gaps/missing elements in the regulatory provisions for the development of effective solid waste management systems. It should be also noted that legislation is only effective if it is enforced. Therefore, comprehensive legislation, which avoids the duplication of responsibilities, fills in the gaps of important regulatory fuctions, and is enforceable is required for sustainable development of solid waste management systems.

Because of the low priority given to the sector, the institutional capacity of local government agencies involved in solid waste management is generally weak, particularly in small cities and towns.Local ordinance on solid waste management is not also well developed. These weak local government institutions are not provided with clear mandates and sufficient resources to fulfill the mandates. In large metropolitan areas where there are more than one local governments, coordination among the local governments is critical to achieve the most cost-effective alternatives for the solid waste management in the area (Roger,1989). For instance, the siting of solid waste transfer station or disposal facility for use by more than one local government is cost-effective due to its economy of scale. However, as these facilities are usually considered unwanted installations and create not-in-my-backgyard (NIMBY) syndromes among the residents, no local government is willing to locate them within its boundary. The lack of a

coordinating body among the local governments often leads to disintegrated and unsustainable programmes for solid waste management.

(d) **Economic Constraint**

Economic and industrial developments play key roles in solid waste management. Obviously, an enhanced economy enables more funds to be allocated for solid waste management, providing a more sustainable financial base. However, by definition, developing countries have weak economic bases and, hence insufficient funds for sustainable development of solid waste management systems (Pohjola *et al*,1998).

Local industry which produces relatively inexpensive solid waste equipment and vehicle will reduce, or in some cases could eliminate totally, the need for importing expensive foreign equipment/vehicles and therefore, foreign exchange. Such local industry can also supply associated spare parts, lack of which is often responsible for irregular and insufficient solid waste collection and disposal services. However, the lack of industries to manufacture solid waste equipment and spare parts and limited foreign exchange for importing such equipment/spare parts are the rule rather than the exception in developing countries (Uba,2007).

Also in small developing countries, waste recycling activities are affected by the availability of industry to receive and process recycles materials. For instance, the recycling of waste paper is possible only when there is a paper mill within a distance for which the transportation of waste paper is economical. The weak industrial base for recycling activities is a common constraint for the improvement of solid waste management in developing countries, such as those in the pacific region where a large volume of package waste is generated (Pavoni,2000).

(e) **Social Constraint**

The social status of solid waste management workers is generally low in both developed and developing countries, but more so in developing countries then developed countries. This owes much to a negative perception of people regarding the work which involves the handling of waste or unwanted materials. Such peoples perception leads to the disrespect for the work and in turn produces low working ethics of labourer and poor quality of their work(Ekulgo,1994).

Because of insufficient resources in government , collaborative projects often have attempted to mobilize community resources and develop community self-help activities. Results are a mixture of success and failures. Failed projects with inactive communities usually did not provide people in the community with economic as well as social incentives to participate in activities. The social incentive is based on the responsibility of individuals as part of the community for the improvement of the community, and is created by public awareness and school education programmes. The lack of public awareness and school education about the importance of proper solid waste management for health and well-being of people severely restricts the use of community-based approaches in developing countries(Love,2002).

At dump sites, transfer stations, and street refuse bins waste- picking or scavenging activities are common scenes in developing countries. People involved have not received formal education and vocational training to obtain the knowledge and skills required for other jobs. They are also affected by limited employment opportunities in the formal sector. The existence of waste pickers/scavengers often creates an obstacle to the operation of solid waste collection and disposal services. However, if organized properly,

their activities can be effectively incorporated into a waste recycling system. Such an opportunistic approach is required for sustainable development of solid waste management programmes in developing countries (Rowland *et al*,1994).

2.24 Problem of Adequate Waste Management in Nigeria

Domestic waste management in Nigeria has many problems, ranging from economic, environmental, socio-cultural to socio-political issues. The level of awareness and environmental education about potential hazards relating to a polluted environment is still abysmally low. People are more concerned with daily survival and will not be bothered with elitist concepts like waste management (Agbola *et al*, 1997). At the municipal level, poor management skills in the handling of domestic wastes are also a major problem. Under this scenario, government technocrats encourage open dumps as a waste-disposal method. In many cases, these dumps are located wherever land is available without regard to safety ~ health hazards~ on the aesthetic values of the locations (Ekugo,1998). In some instances, the waste is ignited and allowed to burn slowly in the open as is the case along Port-Harcourt, Enugu Express Road to Aba. Due to the varied/complex nature of these wastes, this practice introduces hazardous combustion products into the atmosphere. Notable among these are carbon monoxide, sulfur dioxide, oxides of nitrogen, halogenated carbons, polyaromatic hydrocarbons, and particulate matter. In addition, the low level of financing for the agencies responsible for handling wastes in Nigeria has to a large extent affected performance. Nweke (2000) reported that very small amounts of revenue are realized directly from their services, as only a very limited fraction of the population is served by the house-to-house collection system. Tenement rates and/or property taxes are not collected regularly. Consequently, authorities handling waste-management efforts often depend on government subsidies, which are often inadequate. The total waste generated in Nigerian

cities is affected by the ever – increasing population growth, High levels of industrial developments, and concentration of major government establishments in cities have resulted in a massive influx of peoples from rural to urban areas. Ekulgo (1999) stated that an acute shortage of accommodation results in the indiscriminate construction of shanties and substandard housing without regard for the initial town- planning relations. This leads to associated problems of effective planning for the collection and disposal of wastes. It is only recently that the Rivers State Government contracted refuse collection and disposal to waste-disposal companies. These companies, however, cannot adequately take care of solid waste management, as some of the municipal areas are not included and the methods of refuse collection are not always adequate, (Abugo, 1999).For instance, these companies use shovels and open trucks, which leave droppings from wastes along the streets. Also, the issue of sorting the waste at the point source is not addressed. This effort by government could be better planned and expedited to ensure wider coverage and more effective participation by the people. Waste management issues are the concern of every body. (Agbola *et al*,1997).

In 1980, the Lagos State Government observed that many of the popular towns and cities around the Lagos metropolis had sprung up as settlements in contravention to official planning regulations, and in most cases the necessary infrastructure was lacking. This was one of the reasons advanced for the demolition of Maroko town in 1990. (Agbola, 1997). In Port-Harcourt, cases of illegal development of' squatter settlements along the waterfronts without regard to urban development regulations abound. Basic infrastructure like adequate water supply and waste-disposal systems are virtually absent in these settlements. Due to low rent and substandard accommodation, these settlements are usually grossly overpopulated. Household and human wastes are often disposed

directly into the water body or simply dumped along the streets, contributing substantially to environmental pollution and health problems (Ekugo, 1998).

2.25 Summary

The aforementioned inadequacies with respect to solid waste management in some cities in Nigeria seems to depict a general situation in virtually all cities in Nigeria. References were made to the indiscriminate dumping of waste in which large population and sanitary facilities are not proportional. Hence, the linkage and or similarities of solid waste management situation in other cities in Nigeria is evident and only differ in terms of location but share peculiar problems in different magnitudes.

CHAPTER THREE

RESEARCH METHOD

3.1 Introduction

The purpose of this study was to evaluate the constraints of solid waste management among health workers and heads of house hold in Nigeria. To achieve this purpose, the research design, population, sample and sampling technique, instruments, method of data collection and data analysis are described in this chapter.

3.2 Research Design

Ex-post- facto research design was used. It is an appropriate study design because the information required is already available with the respondents and may not be manipulated. It also helps to collect information about evaluative judgment of the respondents regarding the constraints to solid waste management in Nigeria.

3.3 Population

The population for the study consisted of one thousand one hundred and forty (1140) registered professional environmental health assistants, and technologists working in Environmental Waste Agencies, Ministries of Environment and five million one hundred and fifty-three thousand two hundred and forty three (5,153,243) Heads of household in states capital selected in the six geo-political zones of Nigeria.(See table 3.1) .

.3.4 Sample and Sampling Technique

To determine the minimum number of respondents included in the study, the table for determining the sample size by Morgan and Kreycie (1970) was used. This table

indicates the sample size to be drawn from any given population ranging from 10 to 1,000,000(see appendix H).

In this study, Nigeria was divided into six (6) strata on the basis of the six (6) geo-political zones as shown in Table 3.1. This is because it is not possible to cover the nation within the period specified for this research. In each of the selected state, one hundred and sixty (160) subjects were selected for the study (50 from health workers and 110 from heads of household). For the purpose of selecting the samples in this study, the investigator used three different sampling techniques-stratified random sampling, proportionate sampling technique and systematic random sampling. In the case of stratified random sampling techniques, the states were grouped into 6 geo-political zones of Nigeria. The sampled state from each zone was randomly selected by dip and pick method. Frank *et al* (1994) stated that this method will ensure equal opportunity to all (see Table 3.1 The Heads of house hold were selected using proportionate sampling technique. After the researcher has divided the population into strata, he then uses simple random sampling method to select required sample size from each stratum.20% of the house hold in the state capital were selected from each stratum. This yielded a total sample of one hundred and ten (110) subjects in each stratum. Thus, the household were selected by house numbering ,using houses with odd numbers of each street in the state capital while the health workers were selected using systematic random sampling technique from the register of each health unit in the state. A total of nine hundred and sixty (960) respondents were selected from the six (6) selected states.

Table 3:1 Summary of States in the Geo-political Zones

Zones	States	Sample State	No. of households of both sexes in the state	No of Registered EHO/EHA	No. of households in state capital
South-South	Delta, Rivers, Edo, Bayelsa, Akwa Ibom and Cross River	Bayelsa	1,704,515	156	3,018
South-East	Imo, Abia, Anambra, Enugu, Ebonyi	Anambra	4,177,828	80	3,243
South-West	Ondo, Oyo, Lagos, Osun, Ogun and Ekiti	Lagos	9, 113,605	537	5,168
North-East	Bauchi, Gombe, Taraba, Borno, Yobe and Adamawa	Taraba	2,294,800	101	1,617
North-West	Katsina, Jigawa, Kaduna, kano, Kebbi, Sokoto and Zamfara	Kano	9,401,288	147	4,624
North-Central	Kogi, Kwara, Niger, Plateau, Nassarawa and Benue	Plateau	3,206,531	119	2,986

Source: Federal Republic of Nigeria, 2006 population and housing census. Priority Table, Vol. IX

3.5 Instrumentation

The instrument used for data collection was consisted of four sets of researcher developed questionnaire. The first questionnaire [A] comprised of the following: Section A consisted of 6 items on socio-demographic data of the respondents. Section B consisted of 10 items on facilities and equipment, Section C consisted of 10 items on funding. Section D consisted of 10 items on personnel. Section E consisted of 10 items on problems of trained and adequate personnel. Section F consisted of 10 items on community participation and involvement, and Section G consisted of 10 items on public enlightenment/education (in form of Modified Likert scale). The second questionnaire (B) consisted of 10 items on collection, disposal and storage of solid waste in Nigeria for the professionals. The response mode of the questionnaire items was in form of Yes or No option. The third questionnaire [C] consisted of 24 items on collection, disposal and storage of solid wastes for the community members. The response modes of the questionnaire items was in form of Yes or No option, while the fourth questionnaire (D) was mainly an inventory of the available materials and human resources used for collection, storage and disposal of solid wastes in respective agencies to be completed by the directors.

In order to ascertain the content and face validity of the instrument, seven professional experts from the Department of Physical and Health Education and Department of Water Resources and Environmental Engineering, Ahmadu Bello University, Zaria vetted the questionnaire. Their suggestions were incorporated into the final instrument. Also a pilot test was conducted to further validate the content of the instrument for its reliability. Thus a final questionnaire was prepared and administered

on a total of 960 respondents which include Health workers and Heads of household in the six geo-political zones in Nigeria.

The questionnaire for the professionals was measured in a modified five points Likert interval scale rating as :

Strongly agree -5

Agreed -4

Disagreed -3

Strongly Disagreed -2

Undecided -1

Therefore 3.5 was used as constant mean.

3.6 Procedure for Data Analysis

The data collected were analyzed using Statistical Package of Social Sciences (SPSS) 17th edition. The data were subjected to different statistical tools. The statistical procedures for analysis of the data collected were descriptive statistics (frequencies/ percentages),and one sample t-test procedure. Descriptive statistics was used to analyze the demographic characteristics of the respondents. In the test of the study's hypotheses, the one sample t-test procedure was used because of the need to compare the observed mean scores for the respective variables with a fixed mean. The fixed mean used in the test is 3.5 which stands for the least level of agreement on the five- point interval scale used in the test. This is because the opinions of the respondents to the questionnaires which were used in the test of the hypotheses were measured in interval scale and subjected to quantitative assessment. Mean scores for the variables were used in arriving at conclusions. The hypotheses were accepted or rejected at 0.05 level of significance.

- **Administration of Instrument**

Six staff from Ministry of Environment of selected states were recruited to serve as research assistants to administer the questionnaire. They were trained by the researcher on the instrument and method of data collection.

The researcher obtained permission from the selected states via Ministry of Environment of the state before administering the questionnaire. In each of the selected states, the respondents were briefed on the purpose of the study. After a brief introduction, each questionnaire was administered to each respondent in the state. Each copy of the filled questionnaire was collected by the research assistants and posted through mail to the researcher for onward analysis

3.8 Pilot Testing

In order to establish validity and internal consistency of the questionnaire, a pilot test was conducted using 60 respondents from Kaduna Waste Disposal Agency and Sabon Gari Local Government Area of Kaduna State Health Workers and Head of house holds that will not be part of the main study. The data collected were analyzed to test the validity and reliability of the items in the questionnaire. Of the four sets of questionnaires designed for the study, three were subjected to a pilot study in order to establish the consistency of the items within each of the instrument. The fourth set was an inventory of the available human and material resources used for the collection, storage and disposal of solid waste in the respective organizations in the state.

The first set of questionnaire dealt with the constraints to solid waste management in Nigeria. This was measured in five -point Likert interval scale. This set of questionnaire was designed for the individuals in government agencies and professionals

in the ministries of Health and Environment. A total of 30 questionnaire was administered randomly to professionals in Kaduna waste Disposal Agency and 30 questionaire to Head of household in Sabon-Gari Local Government Area of Kaduna State. The selection was based on proximity and subjects possess the unique characteristics of the population of the study and were not intended to be used for the final study. A total of 58 questionnaire was successfully filled and returned for the test. These were coded and subjected to statistical analysis using the Statiscal Package for the Social Sciences (SPSS) 17th edition. The equal length Spearman-Brown reliability co-efficient of items that had 0.80 and above and Guttman Split half correlation co-efficient of 0.70 and above were retained. Those items that have reliability index of 0.25 and 0.80 were re-structured, while those below 0.25 and 0.80 with discrimination index below 0.20 were rejected as suggested by Lee,1931,cited in the work of Ogwu(2003).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

Data from two groups of respondents were involved in this analysis of solid waste management in Nigeria. These were the officials from the state government Ministries of Health and Environment and members of the respective communities in the selected states. The other data collected were used as an appendix to the opinions of the two groups as an inventory of the facilities and equipment available in the respective agencies for the collection, storage and disposal of solid waste. The opinions of members of the communities were summarized into two categories (Agree and Disagree) in frequencies and percentages, as appendages to the opinion of the agencies' officials on the management of the solid wastes. The opinions from the government officials, were analyzed with mean scores and the standard deviations based on the five point interval scale, which are presented in tables with the respective items.

The chapter presents, among others the demographic characteristics of these two groups and their opinions on the constraints to the management of solid wastes and the opinions of the communities on the management of solid wastes in the respective states of Nigeria. Variables on the management of the solid waste were analyzed along the respective research questions and objectives of the study. Where items were measured on interval scale (five point scale); the decisive mean scores were fixed at 3.5 and above for agreement, while 3.4 and below were regarded as disagreement. The hypotheses of the study were tested and the findings were presented in tables.

4.1 Results

4.1.1 Demographic Characteristics of the Respondents

Demographic characteristics of the respondents selected for analysis along their expressed opinions on the related variables in the study were presented for the officials and community members respectively A total of 610 community members and 295 officials of the related environmental and health related agencies in the respective state participated in the study. The classifications of the demographic characteristics of the two groups are presented in Table 4.1.

Table 4.1: Classification of the respondents by demographic characteristics

Variables	Options	Gov. Official		Comm. Members	
		Freq	Per cent	Freq	Per cent
Age	18-27years	106	35.9	156	25.6
	28-37years	77	26.1	190	31.1
	Above 37years	112	38.0	264	43..3
	Total	295	100.0	610	100.0
Sex	Male	175	59.3	482	79.0
	Female	120	40.7	128	21.0
	Total	295	100.0	610	100.0
Marital status	Married	162	54.9	469	76.9
	Single	129	43.7	120	19.6
	Widowed	4	1.4	15	2.5
	Divorced	-	-	6	1.0
	Total	295	100.0	610	100.0
Professional qualification	Env. Health Asst	26	8.8	-	-
	Env.Health Technologist	188	63.7	-	-
	Engineer	33	11.2	10	1.6
	Other	48	16.3	600	98.4
	Total	295	100.0	610	100.0
State of Domicile	Bayelsa	49	16.6	97	15.9
	Kano	51	17.3	120	19.7
	Lagos	50	16.9	91	14.9
	Plateau	50	16.9	99	16.2
	Rivers	48	16.3	99	16.2
	Taraba	47	15.9	104	17.0
	Total	295	100.0	610	100.0

From the classification in Table 4.1, 106(35.9%) of the officials were between ages 18 and 27 while 77 (26.1%) were between ages 28 – 37, while the rest of the respondents 112 (38.0%) were 37and above. Among the community members, 25.6% were within the ages 18-27 bracket, while 190 (31.1%) of them were between ages 28 and 37. Those who were above 37years were 264 (43.3%) of the total respondents in the group. From this age distribution, the respondents in both groups were regarded as mature and therefore capable of understanding the intricacies of solid waste management in their respective areas.

On the item of sex, 175 (59.3%) of the officials were males, while 120 (40.7%) were females. The corresponding grouping among the community members was 482 (79.0%) males and 128 (21.0%) females. This predominance of the male is not strictly based on proportional representation but accessibility, which was found to be a major problem in some of the states where the data were collected. However, the inclusion of females, helps to eradicate any possible gender influence that could have been adjudged to be partial. Moreover, some females were found to be either householder or were directly responsible for the management of solid wastes in their respective homes.

Indications on Table 4.1 showed that most respondents in the two groups were married. Among the officials, 162(54.9%) were married, while 469 (76.9%) community members were married. Those who were single among the officials were 129 (43.7%) while among the community members were 120 (19.6%).Those widowed among the officials were 4 (1.4%) while other members in the community showed 15 (2.5%.) None of the officials was divorced, but 6 (1.0%) of the community members were divorced.

The officials professional qualifications indicated on table 4.1 showed that 26 (8.8%) of the officials had EHA, 188 (63.7%) had EHT, 33 (11.2%) were engineers, while the remaining 48 (16.3%) had other unspecified qualifications. From the distribution, the agencies could be said to have the necessary professionals for the management of solid wastes in their respective states. However, the adequacy or otherwise of this manpower is based on the tasks relating to the management of solid wastes in their respective areas.

As for the location of the respondents, effort was made to select equal representations from each of the states. Though, this was not exactly possible, a close proportional representation was made as indicated by the figure in the table. The unequal number is not expected to have any impact on the study because variables to be analyzed are not based on location and in most cases means are used which invalidate the numerical value of respondents by location.

4.1.2 Assessment of Solid Waste Collection, Storage and Disposal in Nigeria

Among the major objectives of this study was to evaluate the constraints to the management of solid wastes in terms of the collection, storage and disposal in Nigeria. The components of this constraints selected in the study included funds(required for the purchase of equipment for waste conveyance and others and for providing solid wastes management facilities).The available facilities/equipment, adequacy of personnel, effectiveness of environmental policies, community participation in waste management and public awareness of waste management. The opinions of the agencies' officials on each of the items used in the assessment of the solid waste management were scored in means and standard deviation. The opinion of the community members were presented in

a different table as an appendage to the expressed opinion of the officials. Table 4.2 presents the opinions of the officials.

Table 4.2: Opinions of officials on the collection, storage and disposal of solid waste in the states in Nigeria

Management of solid wastes in the community	**Mean**	**Std Dev**
• There are dust bins in the houses for waste collection	3.62	1.024
• Solid wastes are disposed off regularly	3.56	0.574
• There are refuse collection centres close to residential houses	2.35	1.302
• The community organizes waste management in your area	2.14	1.421
• There is a site for the final disposal of solid wastes in your area	2.01	1.256
• There are standard vehicles for transporting solid wastes generated to the final disposal sites by health agencies	2.50	0.952
• There are financial contributions from residents for solid waste management in your area	2.31	0.478
• There are personnel available to look in to the manner in which refuse is collected and finally disposed in your area	2.64	0.658
• The public is involved in solid waste management	3.20	1.214
• There are accessible sites for final disposal of solid wastes in your area	3.58	1.056
Aggregate score	2.791	0.994

The officials were of the view that there were dust bin in their houses for solid waste collection, storage and disposal and that collected solid wastes were disposed off

regularly in their respective areas. These are indicated in items 1 and 2 of Table 4.2 respectively. This is indicated with mean score higher than 3.5 which stands for the least level of agreement in the table. But the officials did not agree that there were refuse collection centres close to their residential houses. This is indicated in item 3 of the table with a mean score of 2.5.In item 4, the officials did not agree that the communities usually organize solid waste management activities in their respective areas. The mean score of the item is 2.14 while in item 5 they completely disagreed with the notion that there were sites for the final disposal of solid wastes in their respective areas. They did not agree that there were adequate and standard vehicles for transporting solid wastes generated in the respective communities for onward disposal to sites by health and environmental agencies personnel in their respective areas. These are indicated in items 5 and 6 of the table respectively.

The financial requirement for the management of solid wastes is also a constraint as indicated in item 7 of the table. In response to the item, the officials did not agree that there was any form of financial contribution from residents for solid waste management in their respective communities. And in item 8, they did not agree that there were adequate personnel for the effective management of the solid wastes generated in their respective states. The participation of the public in the management of solid waste tended to be limited to the personal level as indicated in the first and second item in the table. However, the officials agreed that there were accessible sites for the disposal of solid wastes in their respective communities. This, in no way, indicated that such sites were provided by the environmental or health agencies in the respective areas. From the aggregate mean score of 2.791, it could be said that the collection storage and disposal of

solid waste in the states involved in the study did not meet the needed requirements. In other words, the officials did not agree that the collection, storage and disposal of solid wastes in the selected states are adequate.

The opinions of the members of the respective communities in the states where the data were collected on the collection, storage and disposal of the solid wastes is presented in frequencies and percentages (Table 4.3). The opinions are summarized into two categories to enable the comprehension of the direction of the respondents.

Table 4.3: Community members' opinions on problems of collection, storage and disposal of solid waste in Nigeria

Management of solid wastes in the community	**Agree** (%)	**Disagree** (%)
• Do you have a dust bin in your house for waste collection	563 92.3%	47 7.7%
• Do you dispose of refuse regularly	503 82.5%	107 17.5%
• Is there a refuse collection centre close to your residence	325 53.3%	285 46.7%
• Has there been any gathering organized in your community where waste management issues were discussed	238 39.0%	372 61.0%
• Have you ever been invited to a forum where waste management issues were discussed	218 35.7%	392 64.3%
• Were your opinion sought on how manage solid waste	182 29.8%	428 70.2%
• Are there self help groups in your community that collect and dispose solid waste	283 46.4%	327 53.6%
• Have you ever heard any information on solid waste collection and dispose	436 71.5%	174 28.5%
• Do you think proper waste collection and disposal is important	554 90.8%	56 9.2%
• Do you know that malaria, typhoid, diarrhea diseases are attributed to indiscriminate waste disposal	527 86.4%	83 13.6%
• Is the solid waste in your area collected and disposed regularly	336 55.1%	274 44.9%
• Is there a standard refuse collection centre in your area	285 46.7%	325 53.3%
• Is there a site for the final disposal of solid waste	333 54.6%	277 45.4%
• Are there standard vehicles for transporting waste generated to the final disposal sites	281 46.1%	329 53.9%
• Is there any financial contribution from residents for solid waste management in your area	186 30.5%	424 69.5%
• Are there personnel available to look in to the manner in which refuse is collected and finally disposed in your area	271 44.4%	339 55.6%
• Is the public involved in solid waste management	308 50.5%	302 49.5%
18. Is there an accessible site for final disposal of solid waste in your area	301 49.3%	309 50.7%

In table 4.3, item 1 indicates that the members of the communities agreed that they had dust bins in their homes for the collection of solid wastes. In the item, 92.3% of the members were of this opinion. This is generally expected since most people would naturally not allow waste of any kind to litter their surroundings. In the second item, 82.5% of the members agreed that they usually disposed of their solid wastes regularly but only 53.3% of the members agreed that they had refuse collection centre close to their residence. This is indicated in item 3 of the table.

With regards to community participation in solid waste collection, storage and disposal in Nigeria, not much could be said to be on the positive side. In item 4, only 39.0% of the members of the communities agreed that they had attended any gathering where waste management issues were discussed in their respective communities while 61.0% of the members disagreed with the opinion that they had ever attended such organized meetings. In line with this opinion, 64.3% of the members of the communities disagreed with the notion that they had ever been invited for such meetings. Only 35.7% of the members said they had been invited for such meetings in their respective communities where the collection of solid wastes, storage and disposal was discussed in the selected states for the study. For the members who were present in such meetings, only 29.8% said their opinion was sought. This is indicated in item 6 of the table.

The participation of the communities in solid wastes collection, storage and disposal was not very strong. This is indicated in item 7 of the table where only 283 or 46.4% of the members agreed that there were self help groups in their communities that collected and disposed solid wastes. Most (53.6%) of the members did not agree with this

opinion. But 71.5% of the members agreed that they had heard of information on solid wastes collection and disposal as indicated in item 8 of the table. In item 9, (90.8%)of the members agreed that proper waste collection, storage and disposal is important. This could explain why 86.4% of the members agreed that malaria, typhoid, diarrhea diseases could be associated with indiscriminate solid waste disposal as indicated in item 10 of the table.

Though 55.1% of the members agreed that solid waste in their respective areas are collected and disposed of regularly, 53.3% of the members were of the opinion that there were no standard refuse collection centres in the areas involved in the study. These are indicated in items 11 and 12 of the table respectively. Though 54.6% of the members agreed that there were sites for disposal of solid wastes, most (53.9%) of them were of the opinion that there were no standard vehicles for transporting wastes generated to the disposal sites. In line with this opinion, 55.6% of the members were of the view that there were no adequate personnel to look in to the manner in which refuse is collected and finally disposed in the respective areas. And in item 15 most (69.5%) of the members did not agree that there were any financial contribution from residents in the respective communities for solid waste collection, storage and disposal.

However, 50.5% of the members were of the view that the public is involved in the collection of solid wastes, storage and disposal in the respective communities but 50.7% of the members did not agree that there were accessible sites for the final disposal of solid wastes in their respective communities. From this observation, the absence of official intervention tended to be very prominent in the generated solid waste collection, storage and disposal in the respective communities. This explains the absence of a

centralized collection centre, and places for final disposal of solid wastes in the respective communities involved in the study in Nigeria.

An inventory of the required equipment for the management of the solid waste in the respective states is presented in Table 4.4

Table 4.4: Solid waste management equipment in the states

Equipment	Kano			Bayelsa			Lagos			Plateau			Rivers			Taraba		
Vehicles/Equipment	O	F	D	O	F	D	O	F	D	O	F	D	O	F	D	O	F	D
Covered lorries	20	0	0	4	0	1	10	2	2		6	0	2	1	1	30	6	5
Tippers	20	0	0	0	0	0	8	1	0	2	1	1	0	0	0	12	5	7
Tip trailers (dustbins)	2	0	1	0	0	0	40	9	2	3	6	1	0	0	0	10	6	4
Mammoth vehicles	100	0	2	0	0	0	10	3	2	4	4	0	0	0	0	40	20	20
Mammoth containers	1	0	0	0	0	0	10	2	1	3	2	2	0	0	0	14	8	6
Dinosaur vehicle	0	0	0	0	0	0	12	4	2	1	3	2	0	0	0	17	7	10
Dinosaur container	2	0	0	0	0	0	4	1	0	2	4	6	0	0	0	12	6	6
Skip vehicle	50	0	1	0	0	0	5	2	1	3	1	1	0	0	0	32	12	20
Mechanical shovel	2	0	3	1	0	0	6	1	1	1	2	3	0	0	0	22	10	12
Excavator	7	0	0	0	0	1	5	0	2	2	2	0	0	0	0	10	5	5
Fork lifter	50	0	0	0	0	0	3	0	0	0	0	0	0	0	0	7	4	3
Site loader	70	0	0	0	0	0	4	1	1	1	1	0	0	0	0	10	5	5
Wheel loader	2	0	0	1	0	0	4	0	0	0	0	0	0	0	0	12	6	6
Pay loader	3	0	7	0	0	0	5	1	2	3	2	1	2	0	0	10	6	5
Lowloader	5	0	2	0	0	0	5	0	0	3	4	2	0	0	0	12	7	5

Equipment	Kano			Bayelsa			Lagos			Plateau			Rivers			Taraba		
Max press	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	10	7	3
Retrievars	2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	14	7	7
Compacter/rollers	2	0	0	0	0	0	2	0	0	0	0	0	1	0	1	10	2	8
Grader	0	0	0	0	0	0	2	1	1	1	1	0	0	0	0	14	10	4
Tractor	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	20	15	5
Bull-dozer	1	0	0	0	0	0	2	0	0	2	0	0	0	0	0	12	6	6
Caterpillars	1	0	0	0	0	0	2	0	1	0	0	0	0	0	0	10	4	6
Rakes	400	0	0	50	0	0	136	32	14	20	30	10	500	0	0	120	100	20
Pick axes	50	0	0	10	0	0	20	4	5	120	110	50	0	0	0	160	120	40
Brushes	100	0	6	20	0	0	10	2	1	3	6	1	0	0	0	200	160	40
Wallington boots	100	0	0	50	0	0	80	20	2	3	2	1	0	0	0	400	300	100
Hand gloves	300	0	0	100	0	0	80	20	10	1	1	1	20	0	0	420	320	100

O=OPTIMUM, F=FUNCTIONAL D=DYSFUNCTIONAL

From the inventory, it was observed that items like covered lorries for the conveyance of solid wastes were grossly inadequate in most of the states. In some of the states, vehicles like tippers, tip trailers (dustbins), mammoth vehicles, mammoth containers, dinosaur vehicle, dinosaur container and skip vehicle were not available. Where such were available, they were grossly inadequate. In the case of equipment for the management of solid wastes, most of the states did not have the required equipment. equipments such as excavator, fork lifter, site loader, wheel loader, pay loader and a host of others as indicated in the Tale 4.4 were just not available. The only exception to this generalization was Taraba state where most of the items listed were found. In the case of the state, half of what was found were dysfunctional and in most cases the functional ones were not really adequate. This was also the case with the human resources requirement for the management of the solid wastes as indicated in the appendix(ix)

From the members of the communities, only 107 or 17.5% of the 610 members agreed that the state government usually intervened in their management of solid waste. This means that the individual members of households or the householders in the respective communities usually managed their solid wastes. This opinion is further emphasized by the responses of the members on the manner of collection, storage and disposal of wastes as indicated in Table 4.5.

Table 4.5: Community members' opinions on the collection , storage and disposal of solid wastes

Where is solid waste kept for collection in your homes	Yes	No	Total
19. In the yard	130 (21.3%)	480 (78.7%)	610 (100%)
20. Infront of the yard	189 (31.0%)	421 (69.0%)	610 (100%)
21. At community's waste depot	291 (47.7%)	319 (52.3%)	610 (100%)
Where in your opinion would you like the solid wastes to be kept for collection			
22. In the yard	95 (15.6%)	515 (84.4%)	610 (100%)
23. Infront of the yard	180 (29.5%)	430 (70.5%)	610 (100%)
24. At community's waste depot	335 (54.9%)	275 (45.1%)	610 (100%)

The distribution in the table clearly indicates that there were no centralized collection centres operated by any of the government agencies involved in the study for

the collection, storage and disposal of solid wastes in the respective communities. This is indicated in items 19 and 20 of the table where 21.3% of the members were of the opinion that their solid wastes were collected and stored in their yard for onward disposal and 31.0% were of the view that such wastes were collected and stored at the front of their yards for onward disposal. Only 47.7% of the members were of the view that their solid wastes were collected and stored in community's waste sites as indicated in item 21 of the table above. From the previous observation, in these communities, dump sites are poorly designated places of convenience which in most cases would be far or near to residential places in the respective communities. This process is devoid of government intervention thus placing same emphasis on the inadequacies in the collection, storage and disposal of solid wastes expressed by the agencies' officials in Table 4.2.

4.3. Assessment of Constraints to the Collection, Storage and Disposal of Solid Wastes

The identification of the possible constraints to the effective collection, storage and disposal of solid wastes is the major objective of this study. The focus here is the identification of some independent variables that tended to constrain the management (collection, storage and disposal of solid wastes) in the selected states of the country. Among such constraints investigated in the study were facilities and equipment for the collection, storage and disposal of solid wastes, funds for the management of the related activities, human resources, the participation of the communities in the collection, storage and disposal of solid wastes, government policy regarding waste management and the awareness of the public on the collection, storage and disposal of solid wastes, were the

independent variables. These independent variables are analyzed separately along the research questions and objectives of the study.

4.3.1 Assessment of Funding as a Constraints to Management of Solid Wastes in Nigeria

The first research question of this study is the identification of the effect of the provision of funds on the collection, storage and disposal of solid wastes in the country. The respective agencies responsible for the collection, storage and disposal of solid wastes depend on funds for their activities. In this perspective therefore, the rate at which such fund is given, and the adequacy of the funds in relation to the collection, storage and disposal of solid wastes were assessed. Table 4.6 presents the opinions of the agencies' officials on the effect of funding on their activities relating to the collection, storage and disposal of solid wastes. The opinion is scored in means and standard deviations for each of the item on the five point interval scale

Table 4.6: Opinions of the officials on problems of funding in relation to solid wastes collection, storage and disposal

Problems of funding	Mean	Std Dev
1. Sufficient funds are not allocated and released by government for the collection and disposal of solid wastes in the state	3.93	1.515
2. Funds allocated to solid waste management in the state is properly utilized by the agencies	2.89	1.408
3. Fund budgeted in the financial year is not regularly released to the agency responsible for waste management	4.35	1.331
4. There is no additional funding on the management of solid wastes in the state	3.69	1.253
5. Solid wastes are not regularly and efficiently collected and disposed of as a result of inadequate provision of funds to the agency by the state government	3.98	1.389
6. There are no adequate funds for the maintenance of solid waste vehicle in the state	3.89	1.406
7. There is no proper arrangement for the provision of fund to hire vehicles in case of breakdown of the agency's own	3.61	1.204
8. There is no adequate provision of funds to replace obsolete equipment in every year's budget in the state	3.81	1.388
9. No adequate provision of funds are made for the purchases of wheel barrows, shovels, diggers on regular basis in the state	4.04	1.410
10. There is no adequate provision of funds for the purchase of protective devices for the workers in the state	4.02	1.414
Aggregate mean score	3.82	1.372

The mean score (3.93) for item 1 on Table 4.5 implied agreement on the part of the officials on the notion that sufficient funds are not allocated and released by the respective government to the agencies for the collection, storage and disposal of solid

wastes in the states. In item 2, the officials were of the opinion that even where insufficient fund were released to the agencies for solid waste collection, storage and disposal in the respective states, such funds were not properly managed or utilized for the purpose.

The officials somehow agreed with a mean score of 4.35 for item 3 that funds budgeted in each of the financial year were not regularly released to the agency responsible for solid waste management in the respective states. There was a consensus among the officials on the notion that no additional funding was granted for the management of solid waste management by the agencies in the selected states. This could explain their opinion on item 5 of the table where they agreed that solid wastes were not regularly and efficiently collected and disposed of as a result of inadequate provision of funds to the agency by the state governments. Therefore, the officials agreed in item 6 that there were no adequate funds for the maintenance of solid waste vehicles in the states.

On maintenance of available equipment, the officials agreed that there was no proper arrangement for the provision of fund to hire vehicles in case of breakdown of the agency's own vehicles. The main issue here is that of availability of such fund and not planning. This opinion is further collaborated in item 8 where the officials agreed with the notion that there are no adequate provision of funds to replace obsolete equipment in the yearly budget of the states for the respective agencies responsible for the collection, storage and disposal of solid wastes. This dearth of funds is further reflected in item 9 where the officials agreed that no adequate provision of funds were made for the purchases of wheel barrows, shovels, diggers on regular basis in the respective states.

And in item 10, the officials agreed with the notion that there is no adequate provision of funds for the purchase of protective devices for the workers responsible for the management of solid wastes in the respective states. From the aggregate mean score of 3.82, it could be deduced that inadequate funds adversely affects the collection, storage and disposal of solid wastes in the respective states of the federation. In other words, provision of fund is a major constraint to the collection, storage and disposal of solid wastes in Nigeria.

4.3.2. Effect of Available Facilities and Equipment for the Management of Solid Waste

The second research question of the study deals with the effect of facilities and equipment for solid waste collection, storage and disposal in the country. The focus here is how the adequacy or otherwise of available facilities and equipment affects the collection, storage and disposal of solid wastes in the country. The problem of facilities and equipment for the collection, storage and disposal of solid waste was investigated at the agencies' officials' level. The reason for this is that the officials would be in a position to know the problems associated with the collection, storage and disposal of solid waste as they affect the respective agencies. The focus here is on the availability of storage facilities for the solid wastes, the equipment for collection of such wastes, the necessary vehicles for transportation of the solid wastes to disposal sites and the facilities for final disposal of the solid wastes in the respective communities of the states involved in the study. The opinions of the officials were scored in mean and standard deviation along the five point scale used in the instrument as indicated in Table 4.7.

Table 4.7: Opinions of the officials on problems of facilities and equipment on the collection, storage and disposal of solid wastes in Nigeria

Problems of facilities and equipment	Mean	Std Dev
1. Modern equipment and facilities are not readily available for the activities of solid waste management in the state	4.05	1.541
2. The equipment available for solid waste management in the state is obsolete	3.64	1.447
3. Solid wastes are not collected and disposed of regularly because of obsolete and inadequate supply of equipment to the agency by the state	3.70	1.296
4. Shortage of equipment/facilities are a major constraint to effective solid waste management in the state	3.61	1.072
5. There are no adequate loaders to convey solid wastes generated in the state	3.60	1.321
6. There are no adequate tippers for collection and disposal of solid waste in the state	3.82	1.537
7. There is no adequate equipment like wheel barrows, shovel for collecting solid wastes from the interior of town to the collection centres in the state	4.33	1.413
8. There are no adequate shovels for collection of solid wastes in the state	3.74	1.501
9. There are no adequate containers for storing solid waste to the final depot in the state	3.56	1.313
10. There is no adequate transport to remove solid waste from the household to the collection centre in the state	3.73	1.098
Aggregate mean score	3.78	1.354

The problem of equipment for the collection, storage and transportation of solid waste is acknowledged by the officials as indicated in item 1 of the Table 4.7. The mean

score is 4.05 which implies that they agreed that modern equipment and facilities were not readily available for the collection, storage and disposal of solid wastes' activities in the selected states involved in the study. To further buttress this , the officials were of the opinion that the available equipment for the management of solid wastes in the respective states were obsolete. The inadequacy of equipment for the management of solid wastes is further indicated in item 3 of the table where the officials agreed with a mean score of 3.70 that solid wastes were not collected and disposed of regularly, because of obsolete and inadequate supply of equipment to the agencies by the states governments. This implies that at the official level, the management of waste is directly impaired by such inadequacies on the part of the agencies. In item 4, the officials agreed that shortage of equipment and facilities are major constraints to the effective management of solid waste in the respective states.

As a confirmation to the inadequacies of the equipment for the management of solid wastes in the respective communities, the officials agreed in item 5 that there were no adequate loaders and in item 6, they agreed with the notion that there were no adequate tippers for the conveyance of solid wastes generated in the respective states for proper disposal. These opinions could be associated with the agreement with the notion that there are no adequate tippers for collection and disposal of solid wastes in the respective states in item 7 of the table..

The inadequacies of the equipment for the collection, storage and disposal of solid wastes is reflected in items 8, 9 and 10(Table 4.7) where the officials were of the opinion that the listed items were not adequate or not available for the collection, storage and disposal of solid wastes generated in the respective state. The aggregate mean score

(3.78) revealed that the officials could be said to have agreed that the dearth of facilities and equipment could be associated with the inadequacies in the collection, storage and disposal of solid wastes in the country. In other words, facilities and equipment are major constraints to solid waste collection, storage and disposal in Nigeria.

4.3.3. Effect of Personnel in the Management of Solid Waste in Nigeria

The third research question of this study is the assessment of the effect of human resources of the respective agencies on the collection, storage and disposal of solid wastes in the country. The investigation here concerns the professional competence of the available personnel in the respective agencies, their adequacy and their educational qualification in the collection, storage and disposal of solid wastes in the country. The opinions of the officials on the adequacy of the personnel available for the collection, storage and disposal of solid wastes are expressed in means and standard deviation in Table 4.8.

Table 4.8: Opinions of the officials on problems of adequate and trained personnel and the management of solid wastes

Problems of adequate and trained personnel	Mean	Std Dev
1. There are no adequate personnel employed to manage the evacuation of solid waste in the state	4.01	1.402
2. There are no professional and competent personnel to manage the solid waste in the state	3.86	1.443
3. There are competent personnel available to co-ordinate the activities of solid waste management in the state	3.98	1.379
4. Technical and trained personnel employed to maintain the facilities and equipment are not adequate in the state	3.78	1.476
5. Training and re-training of personnel for solid waste management are not provided to boost their capacity in carrying out their activities properly	3.98	1.331
6. There are no adequate trained operators to manage solid wastes in the state	3.87	1.429
7. Solid wastes are not efficiently collected and disposed of because of shortage of professional manpower in the state	3.59	1.526
8. There are no adequate personnel for solid waste control at the collection centre in the state	4.05	1.528
9. Personnel are not adequately trained to disseminate health information and education on solid waste control and management in the state	3.36	1.484
10. Personnel are not adequately trained on proper procedures for collection and disposal of solid waste in the state	3.44	1.471
Aggregate mean score	3.79	1.447

The opinion of the officials as indicated in item 1 of the table is that there were no adequate personnel for the collection, storage and disposal of solid wastes in the

respective agencies of the states involved in the study. This is indicated with a mean score of 4.01. The officials agreed that the issue is a problem of professional competency. This is indicated with a mean score of 3.86 for item 2 in the Table 4.8where the officials disagreed with the notion that lack of professional and competent personnel is the major problem of solid waste management in the respective states. In item 3, the officials agreed that there were competent personnel available to co-ordinate the activities of solid waste management in the states. The problem then is the number of personnel employed for the purpose of waste collection, storage and disposal. This inadequacy of personnel is therefore the major problem. This is revealed in the response of the officials in item 4 of the table where they were of the view that technical and trained personnel were not employed to maintain the facilities and equipment for solid waste management in the respective states.

The officials were of the opinion that even on the job- training was not adequately provided for personnel already on the job. In item 5, they agreed with the suggestion that training and re-training of personnel for solid waste management were not adequately provided to boost their capacity in carrying out their activities properly in the respective agencies. This same opinion is reflected in item 6 of the table where the officials were of the opinion that there were no adequate trained operators to manage the equipment for collection, storage and disposal of solid wastes in the respective states.

These inadequacies observed above could explain why the officials were of the opinion that solid wastes were not efficiently collected and disposed of in their respective communities. This is indicated in item 7 of the table with a mean score of 3.59. At the agencies' level, the officials were of the opinion that there were no adequate

personnel for the collection, storage and disposal of wastes. This is indicated with a mean score of 4.05 for item 8 in the table.

In what could be seen as an irony, the officials did not agree that the available personnel were not adequately trained to disseminate health information and education on solid waste control in terms of collection, storage and disposal in the state and they disagreed with the notion that they were not adequately trained on proper procedures for collection and disposal of solid wastes in the state. These are indicated with mean scores of 3.36 and 3.44 for items 9 and 10 respectively in the table. The point then is that there was no adequate number to effectively carry out these activities in relation to the collection, storage and disposal of solid wastes in the respective states involved in the study. Therefore, human resources is a major constraints to the collection, storage and disposal of solid wastes in Nigeria.

4.3.4 Effect of Effective Environmental Policies on Solid Waste Management in Nigeria

The involvement of the states' health and environmental agencies in the collection, storage and disposal of wastes is guided by government environmental policies. The effectiveness of these policies in the respective states was investigated from the officials point of view as it relates to their collection, storage and disposal of solid wastes in the country. The opinions of the officials on the items used in the assessment are scored in means and standard deviation (SD) in Table 4.9.

Table 4.9: Opinion of the officials on problem of effective policies on environmental issues and the management of solid wastes

Problems of effective policies on environmental issues	Mean	Std Dev
1. Solid wastes are not disposed and stored in a proper disposing centre by individuals and community members as a result of ineffective environmental policies in the state	4.01	1.162
2. Laws/rules and codes pertaining to solid waste collection and disposal are not properly enforced in the state	3.80	1.364
3. Rules and regulations governing solid waste collection and disposal are effectively enforced in the state	2.65	1.479
4. Laws related to environmental issues are obsolete in the state	3.87	1.313
5. There is no legal backing to the activities of solid waste collection and disposal in the state	2.44	1.543
6. Political instability usually affects policies on solid waste management in the state	3.85	1.243
7. Law makers are not properly guided on the consequences of solid waste collection and disposal in the state	3.69	1.258
8. There is no political will to supplement policies on solid waste control and management in the state	3.55	1.276
9. Corruption by the officers enforcing environmental law is a serious constraint to implementation of solid waste control and management in the state	3.64	1.340
10. Conflict among the agencies responsible to enforce environmental laws is a major problem affecting policy development on solid waste control and management in the state	3.74	1.154
11. Lack of clear responsibilities between the agencies and ministries on environmental policy is a set back to policy implementation on solid waste control and management in the state	3.77	1.183
Aggregate mean score	3.55	1.301

The officials unanimously agreed on the ineffectiveness of the related policies on the collection, storage and disposal of wastes. For example, in the first item of the Table 4.9, the officials agreed that solid wastes were not disposed or stored in a proper disposing centre by individuals and community members as a result of ineffective environmental policies in the respective states. In the second item, the officials agreed that the laws and regulations on solid waste collection and disposal are not properly enforced in the states. This explains their disagreement with the suggestion in item 3 that the rules and regulations governing solid waste collection and disposal are effectively enforced in the states.

The timeliness of the policies on the environment is another problem faced in the agencies management of solid wastes. This is indicated by the officials in item 4 where they agreed with a mean score of 3.87 that the relevant laws on the environment, where they relate to the collection, storage and disposal of solid wastes, were obsolete. But the officials did not agree that there were no legal backing to the activities of solid waste collection and disposal in the states. This was indicated with a mean score of 2.44 for item 5 in the table. They, however, agreed in item 6 that political instability usually affects policies on solid waste management in the states. This was indicated with a mean score of 3.85 for item 6 in the table. In the opinion of the officials, this instability emanated from the fact that policy makers were not really guided by the prevailing circumstances in the respective states. This is indicated in item 7 with a mean score of 3.69 in the table, where the officials were of the opinion that the people responsible for making laws governing the environment were not properly guided on the consequences of solid waste collection and disposal in the states.

The officials therefore agreed that there was no political will on the part of the governments of the respective states to implement policies on solid waste control and management. This is expressed in item 8 with a mean score of 3.55. This opinion was buttressed with the officials' response to item 9 in the Table 4.9 where the officials agreed that corruption by government officers enforcing environmental laws is a serious constraint to the implementation of solid waste control and management in the states. Coupled with corruption is the conflict among the different agencies responsible for the enforcement of environmental laws which the officials agreed was a major constraint to the collection, storage and disposal of solid wastes in the country. This conflict of interest affects effective policy development on solid waste control and management in the states. This is indicated in item 10 of the table. Thus, in item 11 of the table, the officials agreed that lack of clear responsibilities between the agencies and ministries on environmental policies is a set back to policy implementation on solid waste control and management in the states. From the opinion of the officials, the policies relating to solid waste collection, storage and disposal could be seen as another major constraint to the effective collection, storage and disposal of solid wastes in the states.

4.3.5 Effect of Community Participation in the Management of Solid Wastes in Nigeria

The participation of the communities here is considered on broad or macro basis which limits that of the individuals. This is because the responsibility of collection, storage and disposal of solid waste as practised in the state currently is practically at the level of the individuals in the respective communities. This was observed from the above analysis so far made. The involvement of the community was therefore considered as a whole rather than at the individual level. The opinion of the officials on such involvement is scored in means and standard deviations in Table 4.10

Table 4.10: Opinions of the officials on community participation on the management of solid wastes

Problems of public participation in solid waste management	Mean	Std Dev
1. Public participation in solid waste management was not well planned or coordinated and atimes was in conflict with good environmental management	4.88	.399
2. Environmental issues are best handled with the participation of all concerned citizens at a relevant level	4.83	.419
3. Opportunity to participate in decision making process on solid waste management in the community should be encouraged by the states	4.72	.509
4. The ineffectiveness of contemporary municipal solid waste management practices is attributed to non-participation of community leaders	4.65	.513
5. Sound participatory process must inform the planning of solid waste management that are very complex as every one in the country is a stakeholder	4.60	.504
6. Participation of community can be facilitated by public education and awareness and inclusion of special programmes and contests to raise public awareness on solid waste management	4.60	.550
7. An appropriate monitoring and evaluation system in the community is critical for the management of solid waste system	4.63	.544
8. There is need for private public sector partnerships in solid waste management activities that should be guided by a system of incentives and disincentives, rules and regulations etc	4.70	.481
9. There is need to resolve issues that may result in public protest and threaten the participation of the community	4.73	.504
10. Public participation should be up-streamed in to solid waste policy	4.67	.500
Aggregate mean score	4.70	0.492

The officials agreed that public involvement in the management of solid wastes is not well coordinated by the respective government agencies in the respective states of the federation. This is indicated in the first item of the Table 4.10 where the officials agreed that public participation in solid waste collection, storage and disposal was not well planned or coordinated and that it was in conflict with good environmental management. They therefore agreed in item 2 that environmental issues are best handled with the participation of all concerned citizens at the various levels where such decisions were made. This is indicated with a mean score of 4.83 in item 2 of the table above. This implies that the opinion was a consensus one among the officials.

The officials were of the opinion that community participation in environmental issues especially where it relates to the management of solid waste should be encouraged. This is indicated in item 3 of the table where the officials agreed that opportunity to participate in decision making process on solid waste management in the community should be encouraged by the states. This perception could be seen in the officials' response to item 4 where they agreed that the ineffectiveness of contemporary municipal solid waste management practices could be attributed to non-participation of community leaders in the states. Therefore, the officials agreed with the notion that sound participatory process by community must inform the planning of solid waste management especially where such are very complex since every one in the society is a stakeholder.

As a way of encouraging such participation, the officials agreed that public education and awareness with inclusion of special programmes and contests could be engendered to enhance the knowledge on solid waste management. This is indicated in item 6 of the table with a mean score of 4.60. To further enhance the community

participation, the officials agreed that appropriate monitoring and evaluation system for the public is critical for the management of solid wastes in the states. A further enhancement of such participation was seen in the form of organizational participation on a private basis. In item 8, the officials agreed that there is a need for private and public sector partnerships in solid waste management activities that should be guided by a system of incentives for both groups with necessary rules and regulations in the states.

The involvement of the public would be necessary to reduce protests on the part of individuals and communities in policies relating to the environment. This is indicated in item 9 Table 4.10 where the officials agreed that there is a need to resolve issues that may result in public protest and threaten the participation of the community in the collection, storage and disposal of solid wastes in the state. Therefore, the officials agreed that the public should be involved in the management of solid wastes in the states. From the aggregate mean score of 4.70 in the table, community participation in the collection, storage and disposal of solid wastes could be a significant factor but a constraint to the collection, storage and disposal of solid wastes in Nigeria.

4.3.6 Effect of Public Enlightenment on Solid Waste Management in Nigeria

Awareness of the effects of the management of solid wastes could be a boost or a constraint to the collection, storage and disposal of solid wastes in the country. In this assessment, the impact of public awareness on the effect of effective solid waste collection, storage and disposal is assessed on the basis of the knowledge of the public in terms of the menace which solid wastes could constitute on the environment and on the health of the public in such a community. The opinions of the officials on the selected items used in the investigation are scored in means and standard deviations in Table 4.11

Table 4.11: Opinion of the officials on public enlightenment and education of solid waste collection, storage and disposal in Nigeria

Public enlightenment and education	Mean	Std Dev
1. There is no public enlightenment on solid waste management in Nigeria	4.27	.528
2. There is need for education and awareness to better understand the solid waste problem	4.14	.606
3. States should facilitate and encourage public awareness and participation by making information widely available	4.18	.652
4. Individuals should have appropriate access to information concerning the environment that is held by public authorities including information on hazardous materials	4.24	.743
5. Public are not aware of consequences of indiscriminate waste disposal	4.32	.690
6. Ignorance on the appropriate methods of solid waste disposal creates a great problem in the disposing process in the community	4.26	.731
7. There is no organization structure in the community that will properly educate the public on solid waste management	4.25	.768
8. There is no information by the public on how and where to report their grievances on waste issues	4.35	.682
9. Public are not aware that malaria, cholera, typhoid, fever, diarrhea are attributed to indiscriminate waste disposal	4.35	.648
10. There is no mobilization vehicles and personnel to sensitize the public on solid waste- related issues	4.32	.701
Aggregate mean score	4.27	0.675

From the opinion of the officials on (Table 4.11), all the aggregate mean score showed high agreements that public awareness on the management of solid wastes has not been officially conducted. This fact is confirmed in response to the first item of the

Table 4.11 where the officials agreed that there is no public enlightenment on solid waste management in the country. In item 2, the officials agreed that there is a need for public education and awareness for a better understanding of the problem of solid wastes in the country.

As a solution to the dearth of public awareness of the management of solid wastes, the officials were of the opinion that the states should facilitate and encourage public awareness and participation by making information on solid wastes management widely available to the public. They therefore agreed in item 4 that individuals should have appropriate access to information concerning the environment that is held by public authorities including information on hazardous materials especially solid wastes. As at present, the officials were of the opinion that the public was not aware of the consequences of indiscriminate disposal of solid wastes in their respective communities.

The officials were of the opinion that ignorance on the part of the public on the appropriate methods of solid waste disposal tended to create a great problem in the management of solid wastes in the community. This is indicated in item 6 of the table. But in item 7 of the table, the officials were of the opinion that there were no organizational structures in the states that could effectively educate the public on solid waste management. Thus, they agreed that there were no pieces of information available to the public on how and where to report their grievances on solid waste issues in the states. This is indicated in item 8 of the table above.

The officials were of the opinion that the indiscriminate disposal of solid wastes by the public was informed by their ignorance of the effects of such actions. In item 9 of the table, the officials agreed that the public was not aware that malaria, cholera, typhoid

fever, diarrhea and other such diseases could be associated with indiscriminate disposal of solid wastes in the states. As an appendage to this opinion, the officials agreed that there were no mobilization vehicles and personnel to sensitize the public on solid waste related issues in the states. From the aggregate score, the officials could be said to have agreed that public knowledge could be a major factor of solid waste collection, storage and disposal in the country but it is a constraint to such activity.

4.4 Test of Hypotheses

The null hypotheses raised in this study were aimed at providing the necessary statistical validation to the solutions provided for the questions raised in the study. The hypotheses tested the evaluation between the independent variables and the dependent variable investigated in the study. They are made up of one major null hypothesis and six sub-hypotheses. The hypotheses are as follows:

Major hypothesis: **Adequacy of constraints is not significant in solid waste management among Health Workers and Heads of household in Nigeria.**

This hypothesis was tested with the aggregate mean scores of the six constraints (funding, facilities/equipment, personnel, environmental policies, community participation and public awareness) examined in relation to the collection, storage and disposal of solid wastes in Tables 4.5 to 4.11. The aggregate mean score was compared with a fixed mean of 3.5 which stands for the lowest level of agreement on the five point scale used in the study. The point here is that if the athletes are in agreement that all the six constraints were actually impeding the collection, storage and disposal of solid wastes in Nigeria, their mean score should be 3.5 and above. The reverse is expected to be the case where

they disagreed with the significance of the constraints in the management of the solid wastes in the country. In Table 4.12, the summary of the one sample t-test procedure used in the test is presented.

Table 4.12: One sample t-test on constraints to collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Aggregate mean	3.984	1.1068	0.1725	2.808	294	0.006
Fixed mean	3.500	0.0000	0.0000			

t-critical = 1.96 at 0.05 level of significance

The result in the table reveals that the respondents agreed that all the six constraints are significant impediments to the collection, storage and disposal of solid wastes in Nigeria. The observed t-value is 2.808 at 294 degree of freedom and the probability level of significance observed in the test is 0.006 ($P < 0.05$). The critical value of t at 294 degree of freedom is 1.96. This means that, all the six variables (funding, facilities/equipment, personnel, environmental policies, community participation and public awareness) are considered as significant constraints to the collection, storage and disposal of solid wastes in Nigeria. The null hypothesis that, there are no significant constraints to solid waste collection, storage and disposal in Nigeria is therefore rejected.

Sub-hypothesis I: Adequacy of fund is not a significant constraint to solid wastes management among Health workers and Heads of house hold in Nigeria

This hypothesis is based on the mean scores of the opinion expressed by the officials concerning the provision of funding for the collection, storage and disposal of solid waste

examined in Table 4.56 To test the hypothesis the one sample t-test was used because of the need to test the observed mean score with a fixed constant of 3.5 which stands for the minimum score for agreement on the five point scale used in the test. The result of the one sample t-test is shown in Table 4.13.

Table 4.13: One sample t-test on funding for collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Funding	3.821	1.3724	0.1219	2.633		0.007
Fixed mean	3.500	0.0000	0.0000			

t-critical = 1.96 at 0.05 level of significance

From the result in the table, the respondents agreed that funding is a significant constraint to the collection, storage and disposal of solid wastes in Nigeria. The observed mean score for the test is higher than the fixed score of 3.5 in the test. The observed t-value (2.633) is higher than the critical value of 1.96 and the observed level of significance is 0.007 is lower than the fixed value of 0.05 ($P < 0.05$). Therefore, the null hypothesis that, availability of fund is not a significant constraint to solid waste collection, storage, and disposal in Nigeria is thus rejected.

Sub-hypothesis II: Adequacy of facilities/equipment is not a significant constraints to solid waste management among Health workers and Heads of house hold in Nigeria

This hypothesis was tested with the scores in Table 4.7 where the status of the facilities and equipment for the collection, storage and disposal of solid wastes in the country were

assessed. The one sample t-test was used in the test of the hypothesis as indicated in Table 4.14 because of the stated conditions in the major hypothesis.

Table 4.14: One sample t-test on available facilities and equipment for collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Facilities/equipment	3.78	1.354	.07577	3.669	294	0.000
Fixed mean	3.50	0.000	0.0000			

t-critical = 1.96 at 0.05 level of significance

The result in the table reveals that the respondents agreed that available facilities and equipment were a significant constraint to the collection, storage and disposal of solid wastes in the country. The observed t-value is 3.669 at 294 degree of freedom and the probability level of significance observed in the test is 0.000 ($P < 0.05$). The critical value of t at 294 degree of freedom is 1.96. This means that, the null hypothesis that available facilities/equipment is not a significant constraint to solid waste, collection, storage and disposal in Nigeria is therefore rejected.

Sub-hypothesis III: Adequacy of trained personnel is not a significant constraint to solid waste management among Health workers and Heads of house hold in Nigeria.

The adequacy of personnel of the different categories required for the effective collection, storage and disposal of solid wastes in the country was assessed in Table 4.7. In the test of this hypothesis, the one sample t-test was used to compare the observed mean value of the respondents on the adequacy of the personnel with a fixed mean which will indicate whether the respondents were of the opinion that personnel is a significant

impediment to the collection, storage and disposal of solid wastes in the country. The result of the one sample t-test used in the test is summarized in Table 4.15.

Table 4.15: One sample t-test on adequacy of personnel for the collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Personnel	3.79	1.447	.07796	3.746	294	0.000
Fixed mean	3.50	0.000	0.0000			

t-critical = 1.96 at 0.05 level of significance

The result in the table reveals that in the opinion of the respondents, personnel is a significant constraint to the collection, storage and disposal of solid wastes in the country. The observed t-value (3.746) for the test is higher than the critical value of 1.96 and the observed level of significance is 0.000 ($P < 0.05$). This implies that the null hypothesis that, trained personnel is not a significant constraint to solid waste collection, storage, and disposal in Nigeria is therefore rejected.

Sub-hypothesis IV: Adequacy of environmental policy do not constitute a significant constraint to solid waste management among Health workers and Heads of house hold in Nigeria.

To test this hypothesis, the mean scores in Table 4.9 were subjected to a one sample t-test to determine whether the respondents were of the opinion that effective environmental policies could constitute a significant constraint to solid waste collection, storage and disposal in Nigeria or not. The one sample t-test was used for the test and the result is summarized in Table 4.16.

Table 4.16: One sample t-test on effect of environmental policies on the collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Environmental policies	3.55	1.301	0.1562	0.297	294	0.773
Fixed mean	3.500	0.000	0.000			

The result in the table reveals that in the opinion of the respondents, environmental policies could be a major factor in the collection, storage and disposal of solid wastes in Nigeria. But the score was not significantly different from the fixed mean compared in the table. The observed t-value (0.294) for the test is lower than the critical value of 1.96 and the observed level of significance is 0.773. This implies that respondents did not really see the environmental policies as significant constraints or impediments to the collection, storage and disposal of solid wastes in Nigeria. The null hypothesis could thus be retained.

Sub-hypothesis V: Community participation is not a significant constraint to solid waste management among Health workers and Heads of house hold in Nigeria.

Community participation in the collection, storage and disposal of solid wastes in Nigeria was assessed in Table 4.10. In the test of this hypothesis, the one sample t-test was used to compare the observed value of the respondents on the variable with a fixed mean (3.5) which will indicate whether the respondents considered the variable as a significant constraint to solid waste management or not. The result of the one sample t-test used in the test is indicated in Table 4.17.

Table 4.17: One sample t-test on effect of community participation on the collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Community participation	4.70	0.492	.02961	40.565		0.000
Fixed mean	3.50	0.000	0.0000			

The test revealed that respondents were of the opinion that the participation of the community in the collection, storage and disposal of solid wastes is a significant factor in Nigeria. This is indicated with a mean score of 4.70 and observed significance of 0.000 in the table. The observed t-value (40.565) is higher than the critical value of 1.96 ($P < 0.05$). This means that the null hypothesis that, community participation is not a significant constraint to solid waste collection, storage, and disposal in Nigeria is therefore rejected.

Sub-hypothesis VI: Adequacy of Public enlightement is not a significant constraint to solid waste management among Health workers and Heads of house hold in Nigeria.

In the test of this hypothesis, the mean scores of the respondents in Table 4.11 where the enlightenment of the public on the management of solid wastes was assessed was compared with a fixed mean score of 3.5 using the one sample t-test. The summary of the test is presented in Table 4.18

Table 4.18: One sample t-test on public enlightenment effect on the collection, storage and disposal of solid wastes in Nigeria

Variables	Mean	Std. Deviation	Std. Error	t-value	DF	P
Public enlightenment	4.27	0.675	.02215	34.671	294	0.000
Fixed mean	3.50	0.000	0.0000			

The test revealed that public enlightenment was considered to be a significant factor in the collection, storage and disposal of solid wastes in Nigeria by the respondents. The observed mean score (4.27) for the test is higher than the fixed score (3.5) in the table. The observed t-value (34.671) is higher than the critical value of 1.96 and the observed level of significance is 0.000 ($P < 0.05$). These are all indications that lack of public enlightenment could constitute a significant constraint to solid waste collection, storage, and disposal in Nigeria. Therefore, the null hypothesis is thus rejected.

4.5 Discussion

The major objective of this study was the establishment of the significance of the constraints to the collection, storage and the disposal of solid wastes in Nigeria. The constraints selected for investigation in relation to the collection, storage and disposal of solid wastes were: poor funding, inadequate facilities/equipment, inadequate personnel, inconsistent environmental policies, lack of community participation and lack of public awareness on the management of solid wastes. The collection, storage and disposal of solid wastes in the country was mainly at the individual level instead of the responsibility

which ought to lie with the states' respective agencies or the federal government. This observation is in consonance with Baumgartner and Arons (2003) where it was reported that producing by products is concomitant of a main product and that for this reason, industries and firms have to look beyond their factory walls to seek for external utilization of their wastes.

From the test of the major hypothesis of the study, the constraints (funding, facilities and equipment, personnel, environmental policies, community participation and public awareness) identified in the study were major impediments to effective collection, storage and disposal of solid wastes in the country. Results of the major hypothesis revealed that these were significant constraints. This observation is consistent with Pavoni (2000); where it was reported that solid wastes change in accordance with factors interacting with them which make their management a continuous dynamic process. Another dimension of solid wastes is that they change with time. For example plastic and polythene bags now constitutes the most significant solid waste in the country. Generally, the cost of managing wastes is relatively high. This finding is in line with Mentel (2006); where it was reported that collection and disposal of municipal wastes pose the most visible and costly problems of solid waste management.

From the test of the first sub- hypothesis, funds were observed to be a significant constraint to the collection, storage and disposal of solid wastes by the respective agencies whose officials were involved in the study. The officials of the respective agencies were unanimous in their agreement on the inadequacy of funds for the solid waste management activities in their respective agencies. The officials were of the opinion that even where insufficient funds were released to the agencies for solid waste

management in the respective states, such funds were not properly utilized for the purpose because of the inherent corruption among government officials. This finding agrees with Ayeni (1987) where the inadequacy in funding was attributed to mismanagement on the part of government officers. The inadequacy in the funding of solid waste management is also in line with the report of Jensen (1990), where it was reported that the management of solid wastes was given low priority in developing countries of which Nigeria is one. As a result, it was opined that very limited funds were provided for the sectors by the government.

Another significant constraint to the effective collection, storage and disposal of solid wastes in the country is the problem of inadequate facilities and equipment. In the test of the second sub-hypothesis of the study, inadequate facilities and equipment were found to constitute significant constraints which adversely affect the collection, storage and disposal of solid wastes in the country. The observation was that, though some states like Taraba reported high presence of those equipment but most of them were not functioning. This development was a common phenomenon in all the states involved in the study. In the absence of functional facilities and equipment, all activities relating to collection, storage and disposal of solid waste are left to the individuals who generated them. This responsibility dictates no direction. The result is the indiscriminate disposal of such wastes by individuals concerned. For effective collection of solid wastes, earth moving vehicles are required. This is in line with Pavoni (2000); where it was reported that heavy equipment vehicles are required for the movement of solid wastes as well as container vehicles This finding is consistent with the report of Love (2002); where it was

reported that most members of the communities in Nigeria do not have solid waste containers or are not provided with such.

The agencies could be said to have the required personnel with the required knowledge at the management level as observed in the analysis in Table 4.7. But this adequacy was not translated to other categories of the required personnel who should maintain the facilities and equipment for the collection, storage and disposal of solid wastes where they are available in the states covered by the study. Another dimension here is the number of the personnel which was found to be grossly inadequate for the effective collection, storage and disposal of the solid wastes in the respective states. What is observed here is that whereas the agencies have the technical know-how but they did not have the lower cadre of personnel such as enough labourers who could effectively carry out the task of collecting the solid wastes and disposing them off appropriately in the respective states. This was revealed in the test of sub-hypothesis III and in the analysis of Table 4.7 respectively. The finding of this study is contrary to the report of Ajiye (2000); where it was reported that the technical know-how was the main problem of solid waste collection and disposal. In this study, the agencies have the technical know-how but lack the numerical staff strength to effectively carry out their tasks.

The existing environmental policies were observed to be constrains in the collection, storage and disposal of solid wastes in the study. In the test of sub-hypothesis IV, no significant observation was made but the result revealed that the respondents agreed with the opinion that environmental policies could be a major factor in the collection, storage and disposal of solid wastes in the country. However, the officials were of the opinion that the policies regarding the management of solid wastes did not

really have the political enforcement required to make them effective in the respective states; implying that such policies were in existence. This gives room for the indiscriminate disposal of solid wastes by individuals in the respective communities. This finding is consistent with Agbola (1997); where it was reported that duplication of programmes, wasting of resources and unsustainability of overall solid waste management could be associated with the collection, storage and disposal of solid wastes in Nigeria.

Another significant factor observed to have significant impact on the collection, storage and disposal of solid wastes in the country is the participation of the community. This was tested in sub-hypothesis V. The result revealed that community participation is a significant factor in the collection, storage and disposal of solid wastes in the country. This aspect did not just mean the involvement of the individuals in the collection, storage and disposal of solid wastes but involving members of the communities in the making of policies relating to the management of solid wastes in the country. This, as observed in the study would reduce antipathy on the part of the community members to policies that emanated from such joint discussions. This observation is consistent with Agbola (1997) where it was reported that waste management is the concern of everybody in the society.

Public enlightenment was found to be a significant constraint to the collection, storage and disposal of solid wastes in this study. It was observed that this variable could be a motivator to the individual in the respective communities in the country. By creating a sense of involvement and responsibility, this would help to engender an effective management of solid wastes in the country. This then calls for the accompanying variables such as effective policy, funding and provision of facilities and equipment for

the management of such wastes by the respective agencies in the country. The implication here is that enlightenment is just not enough. From all indications and as observed in this study, awareness is exhibited by the individuals in their management of solid wastes but their efforts could not be said to meet a set standard since they are constrained by a number of issues as enumerated above. Therefore, most people dispose of their solid wastes as dictated by these limitations. Hence this is what is thus regarded as indiscriminate disposal, which in itself, is another health and sanitation problem in the society.

HAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

- **Introduction**

In this chapter, the summary of the study on the constraints to the collection, storage and disposal of solid wastes in Nigeria is presented. The chapter also highlights consisted of the recommendations on how the constraints could be mitigated towards effective collection, storage and disposal of solid wastes in the country.

- **Summary**

This study investigated the constraints to the effective collection, storage and disposal of solid wastes in Nigeria. Two groups of respondents were involved in the survey carried out in six states of the federation of Nigeria. The first group was made up of the officials of the states agencies of environment and health. This group was used principally in the analysis because of their in-depth knowledge of the constraints vintage positions. The second group was made up of members of the different communities from the states. Their opinion was used as appendage to the opinion of the agencies' officials. Another set of data briefly used in the study is the inventory of the facilities and equipment available for the collection, storage and disposal of solid wastes in the respective states in the country which were directly under the control of the states' agencies.

A total of 295 officials of the agencies and 610 of the community members were selected through a stratified random process for the study. Two structured questionnaires were designed by the researcher and used for the collection of the data from the two groups. The constraints whose significance in the collection, storage and disposal of the

solid wastes investigated in the study were: funding, facilities/equipment, personnel, environmental policies, community participation and public awareness. The study was divided into five chapters for effective chronological analysis.

The study gives an insight into the background of the study and statement of the problem, research questions and the study's hypotheses. Other aspects of the chapter were the purpose of the study, significance of the study and delimitation of the study. In chapter two, the related literature to the study was reviewed. These included the concept of solid wastes and their implications to the environment and health of members of the communities, constraints to their management and empirical review of related studies. The research methodology was given in chapter three. This was made up of the research design, the population of the study, sample and sampling method used in selecting the population size for the study. Other aspects of the chapter were instrumentation and the statistical techniques used in the analysis of the collected data. The statistical analysis and interpretation of the findings from the analyzed data were presented and is made up of the description of the demographic variables of the respondents as well as the test of the study's hypotheses. One major hypothesis and six null sub-hypotheses were tested in the study.

5.3 Conclusion

On the basis of the findings and in view of the limitations of study,the following conclusions are drawn

1 There were constraints to the effective collection, storage and disposal of solid wastes in Nigeria.

2 Funds available for the collections, storage and disposal of solid wastes in the country are grossly inadequate.

3 That there were inadequacies in the management of available funds in the respective agencies for the collection, storage, and disposal of solid wastes in the country.

4 That available facilities and equipment in the country are grossly inadequate for the collection, storage and disposal of solid wastes by the respective agencies in the states.

5 There are professional and competent personnel in the respective agencies but their number is not commensurate with the required activities of the agencies in the collections, storage and disposal of solid wastes generated in the states.

6 The environmental policies related to the collection, storage and disposal of solid wastes in the country are not effectively enforced.

7 That individuals in the community are generally responsible for the management of solid wastes in the country. This development accounts for the indiscriminate dumping of such solid wastes in some undesignated places in the respective communities within the country.

8 That public enlightenment is another constraint to collection, storage and disposal of solid wastes in the country.

5.4 Recommendations

Based on the findings from the statistical analysis of the data collected for this study, the researcher recommends as follows:

1. That state governments should endeavour to provide basic facilities and equipment for solid waste disposal; if not for the aesthetic value, then for the health of the public. This is especially important in view of the current epidemic of cholera sweeping across the country.
2. The states should ensure the process of accountability. This is very important in the face of dwindling income. This will enhance effective allocation and utilization for purpose of solid waste management.
3. Maintenance is one source of continuity in any form of effective organization. This could be engendered by ensuring that obsolete equipment and facilities are replaced regularly.
4. Lower cadre of staff should be employed in the respective agencies who will be responsible directly for manning the activities regarding the collection, storage and disposal of solid wastes in the states.
5. The states should facilitate and encourage public awareness and participation by making information on solid waste management widely available to all in the community especially the hazardous wastes.
6. One major alternative to direct responsibility of solid waste collection by the agencies could be the provision of dump sites for solid wastes for individual communities in the states. The agencies could then collect such wastes periodically for proper disposal.
7. This study also recommends, among others, the privatization of solid waste management system as well as adequate funding of agencies responsible for refuse collection and disposal in Nigeria.

5.5 Suggestions for Further Studies

1. It was observed that the management of solid wastes in the country is purely at the level of individuals in the communities. It would be of academic interest to investigate the ways in which the management of solid wastes could be made to be an economic venture.
2. This study did not investigate the solid waste generation and disposal It will therefore, be interesting to find out the solid waste generation and disposal in Nigerian cities.

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APPENDIX I

QUESTIONNAIRE FOR OFFICIALS

QUESTIONNAIRE FOR THE AGENCIES AND PROFESSIONALS IN THE MINISTRIES OF HEALTH AND ENVIRONMENT ON THE CONSTRAINTS OF SOLID WASTE MANAGEMENT IN NIGERIA.

Dear Respondent,

This is to introduce a questionnaire designed to collect relevant data on the constraints of solid waste management in Nigeria.

Your full and honest cooperation in answering all the attached questions to the best of your ability will be highly appreciated.

All information given will be kept confidential and at no time be made public to the detriment of the organization.

Thank you

Yours faithfully,

ADO H. BELLO
Researcher

SECTION A: DEMOGRAPHIC INFORMATION

Instruction: Please tick [√] the alternative that is most appropriate to you as provided below

1. Age 18-27 years [ ] 28-37 years [ ] 38 years and above [ ]

2. Sex: Male [ ] Female [ ]

3. Marital Status: Married [ ] Single [ ] Widowed [ ] Divorced [ ]

4. Professional Qualification: Env. Health Asst [ ] Env. Heath Techn [ ]

   Engineers [ ]

others please specify ……

5. Name of the Agency:……

6. State of Domicile ……..

The following statements are based on a five-point Likert scale relating to the constraints to solid waste management in Nigeria. Please tick [√] against each statement that best describes your feeling.

Key:	Strongly Agree	-	SA
	Agree	-	A
	Undecided	-	U
	Disagree	-	D
	Strongly Disagree	-	SD

SECTION B: Management of solid waste in the community

	Management of solid waste in the community	SA	A	U	SD	D
1	There are dust bin in your house for waste collection					
2	Solid waste are disposed off regularly					
3	There are refuse collection centres close to residential houses					
4	The community organizes waste management in your area					
5	There is a site for the final disposal of solid waste in your area					
6	There are standard vehicles for transporting solid waste generated to the final disposal sites by health agencies					
7	There are financial contribution from residents for solid waste management in your area					
8	There are personnel available to look in to the manner in which refuse is collected and finally disposed in your area					
9	The public is involved in solid waste management					
10	There are accessible sites for final disposal of solid waste in your area					

SECTION C: Facilities and Equipment

		SA	A	U	SD	D
1.	Modern equipment and facilities are readily available for the activities of solid waste management in the State.					
2.	The equipment available for solid waste management in the state is obsolete					
3.	Solid Wastes are not collected and disposed off regularly because of obsolete and inadequate supply of equipment to the agency by the State.					
4.	Shortages of equipment/facilities are a major constraint to effective solid waste management in the state.					
5.	There are no adequate loaders to convey solid waste generated in the State					
6.	There are adequate tippers for collection and disposal of solid waste in the state					
7.	There is no adequate equipment like wheel barrows, shovel for collecting solid waste from the interior of town to the collection centres in the state.					
8.	There are adequate shovels for collections of solid waste in the state					
9.	There are no adequate containers for storing solid waste to the final depot in the state.					
10	There is no adequate transport to remove solid waste from the household to the collection centre in the state.					

SECTION D: Funds

		SA	A	U	SD	D
1.	Sufficient funds are allocated and released by Government for the collection and disposal of solid waste in the state.					
2.	Funds allocated to solid waste management in the state is properly utilized by the agencies.					
3.	Fund budgeted in the financial year is not regularly released to the agency responsible for waste Management.					
4.	There is no additional funding on the management of solid waste in the state					
5.	Solid Wastes are not regularly and efficiently collected and disposed off as a result of inadequate provision of funds to the agency by the State Government					
6.	There are adequate funds for the maintenance of solid waste vehicle in the state.					
7.	There is no proper arrangement for the provision of fund to hire vehicles in case of breakdown of the agency's own.					
8.	There is adequate provision of funds to replace obsolete equipment in every year's budget in the state.					
9.	Adequate provision of funds are made available for the purchases of wheel barrows, shovels, diggers on regular basis in the state.					
10.	There is adequate provision of funds for the purchase of protective devices for the workers in the state.					

SECTION E: ADEQUATE AND TRAINED PERSONNEL

		SA	A	U	SD	D
1.	Adequate personnel are employed to manage the evacuation of solid waste in the state.					
2.	Lack of professional and competent personnel is a major problem to solid waste management in the state.					
3.	There are competent personnel available to coordinate the activities of solid waste management in the state.					
4.	Technical and trained personnel are employed to maintain the facilities and equipment for solid waste management in the state.					
5.	Training and re-training of personnel for solid waste management are provided to boast their capacity in carrying out their activities properly.					
6.	There are no adequate trained operators to manage solid waste in the state					
7.	Solid Wastes are not efficiently collected and disposed off because of shortage of professional manpower in the State.					
8.	There are adequate personnel for solid waste control at the collection centre in the state					
9.	Personnel are not adequately trained to disseminate health information and education on solid waste control and management in the state.					
10	Personnel are not adequately trained on proper procedures for collection and disposal of solid waste in the state.					

SECTION F: ISSUES ON ENVIRONMENTAL POLICIES

		SA	A	U	SD	D
1.	Solid Wastes are not disposed and stored in a proper disposing centre by individuals and community members as a result of ineffective environmental policies in the State.					
2.	Laws/rules and codes pertaining to solid waste collection and disposal are not properly enforced in the State.					
3a.	Rules and regulations governing solid waste collection and disposal are effectively enforced in the state.					
3.	Laws related to environmental issues are obsolete in the State					
4.	There is no legal backing to the activities of solid waste collection and disposal in the state.					
5.	Political instability usually affects policies on Solid Waste Management in the State.					
6.	Law makers are not properly guided on the consequences of solid waste collection and disposal in the state.					
7.	There is no political will to supplement policies on solid waste control and management in the state.					

		SA	A	U	SD	D
8.	Corruption by the officers enforcing environmental laws is a serious constraint to implementation of solid waste control and management in the state.					
9.	Conflict among the agencies responsible to enforce environmental laws is a major problem affecting policies development on solid waste control and management in the state.					
10.	Lack of clear responsibilities between the agencies, and ministries on environmental policies is a set back to policies implementation on solid waste control and management in the state.					

SECTION G: Community Participation and Involvement

		SA	A	U	SD	D
1.	Public participation in solid waste management was not well planned or coordinated and a time was in conflict with good environmental management.					
2.	Environmental issues are best handled with the participation of all concerned citizens on a relevant level.					
3.	Opportunity to participate in decision making process on solid waste management in the community should be encourage by the states					
4.	The ineffectiveness of contemporary municipal solid waste management practices is attributed to non-participation of community leaders.					
5.	Sound participatory process must inform the planning of solid waste management that are very complex as every one in the country is a stakeholder.					
6.	Participation of community can be facilitated by public education and awareness and inclusion of special programmes and contests to raise public awareness on solid waste management.					

		SA	A	U	SD	D
7.	An appropriate monitoring and evaluation system in the community is critical for the management of solid wastes system.					
8.	There is need for private public sector partnerships in solid waste management activities that should be guided by a system of incentives and disincentives, rules regulations etc.					
9.	There is need to resolved issues that may result in public protest and threaten the participation of the community.					
10.	Public participation should be up-streamed into solid waste policy.					

SECTION H: Public Enlightenment/Education

		SA	A	U	SD	D
1.	There is no public enlightment on solid waste management in Nigeria					
2.	There is need for education and awareness to better understand the solid wastes problem.					
3.	State should facilitate and encourage public awareness and participation by making information widely available					

		SA	A	U	SD	D
4.	Individual should have appropriate access to information concerning the environment that is held by public authorities including information on hazardous materials.					
5.	Public are not aware of et consequences of indiscriminate wastes disposal.					
6.	Ignorance on the appropriate methods of solid wastes disposal create a great problem in the disposing process in the community					
7.	There is no organizational structure in the community that will properly educate the public on solid wastes management					
8.	There is no information by the public on how and where to reports their grievances on wastes issues.					
9.	Public are not aware that malaria cholera, typhoid fever, diarrheal diseases are attributed to indiscriminate wastes disposal.					
10	There is no mobilization vehicles and personnel to sensitize the public on solid wastes related issues.					

APPENDIX I A

QUESTIONNAIRE FOR PROFESSIONALS

QUESTIONNAIRE ON PROBLEMS OF COLLECTION, DISPOSALAND STORAGE OF SOLID WASTE IN NIGERIA.

Dear Respondent,

This is to introduce a questionnaire designed to collect relevant data in relation to constraints to effective solid waste management in Nigeria.

Your full and honest cooperation, in answering all the questions to the best of your ability will be highly appreciated.

All information given will be kept confidential and will at no time be made public to the detriment of the respondent.

Thank you.

Yours faithfully,

Ado H. Bello
Researcher

SECTION A: DEMOGRAPHIC INFORMATION

Instruction: Please tick [ ] the alternative that is most appropriate to you as provided below

1. Age 18-27[ ] 28-37 years[ ] 38 years and above[ ]
2. Sex: Male [ ] Female [ ]
3. Marital Status: Married[ ] Single[ ] Widowed[ ] Divorced[ ]
4. Professional Qualification please specify----------
5. State of Domicile:----------

The following statements require you to answer Yes or No.

1. There are dust bins in your houses for waste collection.

   Yes ( ) No ( )
2. Solid waste are disposed off regularly

   Yes ( ) No ( )
3. There are refuse collection centres close to residential houses

   Yes ( ) No ( )
4. The community organises waste management in your area

   Yes ( ) No ( )
5. There is a site for the final disposal of solid waste in your area.

   Yes ( ) No ( )
6. There are standard vehicles for transporting solid waste generated to the final disposal sites by health agencies

   Yes ( ) No ( )

7. There are financial contribution from residents for solid waste management in your area.

   Yes ( ) No ( )

8. There are personnel available to look in to the manner in which refuse is collected and finally disposed in your area.

   Yes ( ) No ( )

9. The public is involved in solid waste management.

   Yes ( ) No ( )

10. There are accessible sites for final disposal of solid waste in your area

    Yes ( ) No ( )

APPENDIX II

QUESTIONNAIRE FOR COMMUNITY MEMBERS

QUESTIONNAIRE ON PROBLEMS OF COLLECTION, DISPOSAL AND STORAGE OF SOLID WASTE FOR THE COMMUNITY MEMBERS

Dear Respondent,

This is to introduce a questionnaire designed to collect relevant data in relation to constraints to effective solid waste management in Nigeria.

Your full and honest cooperation in answering all the questions to the best of your ability will be highly appreciated.

All information given will be kept confidential and will at no time be made public to the detriment of the respondent.

Thank you.

Yours faithfully,

ADO H. BELLO
RESEARCHER

SECTION A: DEMOGRAPHIC INFORMATION

Instruction: Please tick [√] the alternative that is most appropriate to you as provided below

1. Age 18-27 years [ ] 28-37 years [ ] 38 years and above [ ]
2. Sex: Male [ ] Female [ ]
3. Marital Status: Married [ ] Single [ ] Widowed [ ] Divorced [ ]
4. Professional Qualification please specify ……..
5. State of Domicile :……..

The following statements requires you to answer Yes or No as provided please.

1. Do you have a dust bin in your house for waste collection?

   Yes( ) No [ ]

2. Do you dispose of refuse regularly?

   Yes [ ] No [ ]

3. Is there a refuse collection centre close to your residence?

   Yes [ ] No [ ]

4. Has there been any gathering organized in your community where waste management issues were discussed?

   Yes [ ] No [ ]

5. Have you ever been invited to a forum where waste management issues were discussed?

   Yes [ ] No [ ]

6. Were your opinion sought on how to manage solid waste?

   Yes [ ] No [ ]

7. Are there self-help groups in your community that collect and dispose solid waste?

   Yes [ ] No [ ]

8. Have you ever heard any information on solid waste collection and disposal?

   Yes [ ] No [ ]

9. Do you think proper waste collection and disposal is important?

   Yes [ ] No [ ]

10. Do you think that malaria, typhoid, diarrheal diseases are attributed to indiscriminate waste disposal?

    Yes [ ] No [ ]

11. Is the solid waste in your area collected and disposed regularly?

    Yes [ ] No [ ]

12. Is there a standard refuse collection centre in your area?

    Yes [ ] No [ ]

13. Is there a site for the final disposal of solid waste in your area?

    Yes [ ] No [ ]

14. Are there standard vehicles for transporting waste generated to the final disposal sites?

    Yes [ ] No [ ]

15. Is there any financial contribution from residents for solid waste management in your area?

    Yes [ ] No [ ]

16. Are there personnel available to look into the manner in which refuse is collected and finally disposed in your area?

Yes [ ] No [ ]

17. Is the public involved in solid waste management?

Yes [ ] No [ ]

18. Is there an accessible site for final disposal of solid waste in your area?

Yes [ ] No [ ]

Where is solid waste kept for collection in your homes?

19. (i) In the yard Yes [ ]No [ ]

20. (ii) In front of the yard Yes[ ] No [ ]

21. (iii) At community's waste depot Yes[ ] No [ ]

Where in your opinion would you like the solid waste be kept for collection?

22. (i) In the yard Yes[ ] No [ ]

23. (ii) In front of the yard Yes [ ] No [ ]

24. (iii) At community's waste depot Yes[ ] No [ ]

APPENDIX III

VEHICLE AND EQUIPMENT AVAILABLE FOR SOLID WASTE MANAGEMENT IN YOUR AGENCY

NAME OF AGENCY----------STATE……..

Instruction: Please fill the most appropriate in the space provided below as it affects your agency**.**

S/N	**Vehicles & equipment**	**QUANTITIES**			**Remark**
•	Covered Lorries	Optimum required	Functional	Non-functional	
•	Tippers				
•	Tip Trailers(dustbins)				
•	Mammoth vehicles				
•	Mammoth containers				
•	Dinosaur Vehicle				
•	Dinosaur container				
•	Skip vehicle				
•	Skip container				
•	Mechanical shovel				
•	Excavator				
•	Fork lift				
•	Site loader				

S/N	Vehicles & equipment	QUANTITIES			Remark
•	Wheel loader				
•	Pay loader				
•	Low loader				
•	Max press				
•	Retrievers				
•	Compacter/Rollers				
•	Grader				
•	Tractor				
•	Bull-dozer				
•	Caterpillar				
•	Rakes				
•	Pick Axes				
•	Brushes				
•	Wallington Boots				
•	Hand Gloves				

APPENDIX IV

PERSONNEL USED FOR SOLID WASTE MANAGEMENT IN YOUR AGENCY

NAME OF AGENCY----------STATE……..

Instruction: Please fill the most appropriate in the space provided below as it affects your agency.

S/N	LABOUR DESCRIPTION	Number	Adequate	Inadequate	Optimum required	Remark
1	**Environmental Health Professionals**					
2	**Engineers**					
3	**Operators**					
4	**Drivers**					
5	**Sweepers**					
6	**Refuse Labourers**					

Personnel	Kano			Bayelsa			Lagos			Plateau			Rivers			Taraba			O
	N	A	I	N	A	I	N	A	I	N	A	I	N	A	I	N	A	I	
Environmental officers	150	1	0	19	0	1	4	0	1	13	1	0	7	0	1	50	0	1	120
Engineers	0	0	1	3	0	1	2	0	1	3	0	1	1	0	1	10	0	1	25
Operators	5	0	1	5	0	1	2	0	1	5	1	0	2	0	1	12	0	1	30
Drivers	100	0	1	10	0	1	10	0	1	2	0	1	50	0	1	11	0	1	30
Sweepers	90	0	1	1258	1	0	10	0	1	16	0	1	500	0	1	120	0	1	180
Refuse labourers	50	0	1	100	1	0	20	1	0	4	0	1	50	0	1	200	0	1	420

N=number available, A=Adequate, I=inadequate, O=optimum required