AN ASSESSMENT OF SOLID WASTE MANAGEMENT IN KUBWA, FEDERAL CAPITAL TETTRITORY, NIGERIA

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M. TECH/SSSE/2006/1503

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF TECHNOLOGY (M. TECH) DEGREE IN GEOGRAPHY (ENVIRONMENTAL MANAGEMENT)

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DECLARATION

This is to affirm that I, DZIKWI, Askira Adamu with registration number M.Tech/SSSE/2006/1503 carried out this project titled "An Assessment of Solid Waste Management in the FCT a case study of Kubwa Satellite Town of the Federal Capital Territory, Abuja, Nigeria". This thesis is a part of the requirement for the award of the degree of Master of Technology (M.TECH) in Environmental Management (Pollution and Waste Management) of the Department of Geography, School of Science and Science Education, Federal University of Technology, Minna. Within current knowledge, this same thesis has never been produced elsewhere by other researchers.

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Dzikwi Askira Adamu.

03/01/2011

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Date

CERTIFICATION

This thesis titled: An Assessment of Solid Waste Management in Kubwa, Federal Capital Territory, Nigeria by: DZIKWI, Askira Adamu (M.Tech/SSSE/2006/1503) meets the regulations governing the award of the degree of M.Tech of Federal University of Technology, Minna, and is approved for its contribution to scientific knowledge and literary presentation.

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ABSTRACT

The issue of managing waste has been one of the major challenges facing developing countries such as Nigeria. Solid waste generation is increasing at a rapid rate while the rate of evacuation and disposal perpetually lags behind; this is due to the increase in population, standard of living, weak technical and human capacity. The absence of sanitary facilities has led to environmental deterioration as refuse is dumped along streets, drainages and around residential areas. This study was carried out to examine waste disposal and management characteristics within Kubwa Satellite Town with a view to making suggestions towards improving the situation. This was achieved by identifying about 19 illegal solid waste disposal locations within Kubwa, determining the average quantity and nature of waste generated per household along the high, medium and low population density areas. Based on the responses from questionnaires distributed the level of community participation was also found to be low, while the residents were found to patronize the scavengers who double as the cart pushers for waste collection and disposal as against the Bwari area council who are solely responsible for solid waste management within Kubwa. Recommendations were made to the Area Council to collaborate with the Community to set up Community Based Organisations and get the scavengers organized by providing them with protective clothing, while they carry out recycling activities at a larger scale to generate income for the community that could be channeled towards creating sanitary facilities that are environmentally friendly.

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CHAPTER ONE

0 INTRODUCTION

1 Solid Waste Management: A Preview

omestic waste production is increasing daily and this is compounded by the cycle of poverty, opulation explosion, decreasing standards of living, bad governance, and low level of nvironmental awareness. Many of the current problems associated with waste disposals have sulted from increasing urban population, rapid and haphazard industrialization and inevitable creases in waste generation. Many municipal areas generate more solid wastes than they can anage, and this situation tends to increase with income levels and the economic development of e area (The Guardian Newspaper, 1999).

developing countries 30 to 60 percent of all the urban solid waste is uncollected, less than 50 ercent of the total population can access waste removal services, and 80 percent of the llection and transport equipment is out of service. Despite this, municipalities around the orld spend 20 to 50 percent of their recurrent budgets on solid waste management (Bartone, 00). Because this essential service is lacking, multiple adverse effects result affecting the erall health of communities and touches on diverse social issues (Bartone, 2000).

owing populations, rising incomes and changing consumption patterns combine to complicate id-waste problems in Nigeria. The problem of adequate solid-waste management in Nigerian es and urban centers has reached mammoth proportions, as indiscriminate disposal and nping of waste has become common practice (Sule, 1982; Adedibu, 1986; Nwanko, 1994)). st of the waste dumps are located close to residential areas, markets, farms, roadsides, and cks. The compositions of waste dumps vary widely, with many human activities located close dump sites (Olorunfemi, 1998; Odita, 1998). Familiar examples include domestic and

industrial wastes. Industrial waste are generated from industrial activities such as chemical, pesticides, paints, grease, inorganic materials, oil sludge, and so on. Domestic wastes are those generated from commercial establishments and household activities. They occur in different forms, water-borne waste from households, including sewage, rubbish, human and animal remains as well as chemical and laboratory waste.

Both solid and human waste may ,for example, contain pathogens or provide food or breeding areas for vectors such as rodents, insects' among others that spread disease. Waste dumpsites are also located near the most vulnerable communities, especially in densely populated urban environs, which cause health problems for the poor (Bernstein, 2004) and add increased healthcare expenses to their plight.

Apart from various diseases and toxic conditions inherent in and derivable from wastes products, the presence of waste degenerates the aesthetic value of the environment. This brings about the need of an effective solid waste management which includes activities that seek to minimize the health, environment and aesthetic impacts of solid wastes (Zurbrugg, 2003). Also the constant open burning of waste contributes to atmospheric pollution and leaves residue to be disposed of in dumpsites. This really captures the situation of waste in Kubwa. Incineration produces ash, metal and non combustibles, while composting yields residues like glass, ferrous, material and plastics (Ezeigwe, 1995). These eventually end up in a landfill. Landfill involves placing the waste on the Land surface, although it is regarded as one of the least costly option in solid waste disposal, allocation of land for waste disposal would be practically impossible, since areas with the largest generation and concentration of solid waste are also areas of serious scarcity of land.

1.2 Statement of the problem.

Driving round the town of Kubwa will not only show beautiful houses but also heaps and wide-spread litters of un-cleared solid waste. This has become an eyesore as every notable corner of the town has been taken over by debris and heaps of solid waste. This is inevitable as the town is highly populated, with increase in daily waste generation, managing it has become a nightmare. This has given rise to the problem of waste accumulation along road sides leading to being a nuisance to the environment, air pollution, and other health hazards.

Much as the desire of the erstwhile administration to return Abuja to its original master plan is laudable, the absence of a well established waste management plan or agency is a big drawback for the future of Kubwa.

The dearth of adequate research work on solid waste management in Kubwa, contributes in no small way to the problem facing the town management of solid waste. This is actually what gives rise to this research work, with the aim of recommending a solution.

1.3 Aim and Objectives

Aim

The aim of this work is to assess waste management in Kubwa, Federal Capital Territory, Abuja.

Objectives

1. To determine the nature and quantity of waste generated.
2. To examine the location and distribution of refuse dumps.
3. To assess the existing waste management practices and facilities.
4. To recommend possible solutions to the identified problem.

1.4 Scope and Limitation

This study focuses on assessing the solid waste management practices in Kubwa satellite town by reviewing the operational solid waste management practices and facilities, determining its effectiveness by comparing it with best practices such as Integrated Solid Waste Management, establishing the effectiveness of the approaches used by the bodies responsible for the solid waste management and identifying the efforts by the general public towards having a clean and safe environment.

The study is limited to Kubwa satellite town only; it does not include other neighboring settlements like, Gwarimpa, Deidei or other parts of the Federal Capital Territory. Also the inability to verify the validity of responses filled out on the questionnaires.

1.5 Justification of the Study

The problems and issues of municipal solid waste management due to rapid urbanization is increasing by the day as the population grows due to rural-urban migration increases in a bid for greener pastures. The urbanization of developing cities has with it a two-faced dilemma; wealth accumulation accompanied by alarming growth in the incidence of poverty, with the rich being able to pay for the limited solid waste services provided by municipal authorities and their rising incomes further increases the amount of waste generated. The Semi-urban areas which are the habitat of the urban poor serves as the location for most of the dumpsites which results in environmental degradation due to insufficient solid waste management.(Zurbrugg, 2003)

The study is aimed at contributing to the existing body of knowledge, raising public awareness and community involvement. It is also to serve as a reference material for Students, Individuals, Government bodies responsible for designing effective policies on solid waste management,

International Organizations, Community based Organizations (CBOs), NGOs, and other Private sector businesses that would like to invest in the solid waste management sector in a bid to curb the menace of indiscriminate dumping towards attaining a sustainable environment for the residents of Kubwa.

1.6 The study Area

Kubwa is the oldest satellite town within the Bwari Local Government Area along the northern borders of the Federal Capital Territory of Nigeria. It covers an approximate area of 860 hectares. It is bounded to the north by Bwari-Aso range and to the south by the outer northern express Way. The area is generally low, undulating and dotted with rock out crops. The heights range from 406.0 meters to 448.8 meters at the highest point. The slopes range from 1-10 percent except the rocky out crops and valley sides where the slopes range from 20- 30 percent. Generally the entire area slopes in a south ward direction. Kubwa is traversed from the north east to south west by the Usuma River. The numerous tributaries and distributaries of Usuma River notably Sudna and Garudna provide natural drainage channels from the north to south throughout the area. The Usuma River dammed up stream provides water to Abuja City but despite this, the down flow of the river is remarkably heavy especially during rains.

The Vegetation can best be described as parkland savannah with scattered trees and a soil rich in humus which is considerably fertile and hence suitable for farming. There are galleries of forest along numerous river valleys and the landscape is heavily covered by tall elephant grasses especially during rains. Erosion control and flora conservation is highly recommended for the area to maintain a stable ecological environment. The climate of Kubwa area is not at significant variance with that of the Federal Capital Territory as a whole with its annual temperature ranging between 21°C and 32°C. The annual rainfall is about 117 millimeters with the highest recorded in

the months of July, August and September. Another significant phenomena associated with the wet season is not only the occurrence of lightening but also the thunderstorm severe winds and intensive rainfalls both at the onset and end. The thunderstorms and high speed easterly winds have resulted from the Jos Plateau squall lines or the sudden updraft of wind due to the Bwari-Aso ranges enclosing the City. (Kubwa Resettlement Master Plan, 1989) Kubwa was the resettlement area of the Garki, Jabi One and Two, Durumi One and Two, Kukwaba, Maitama Sabo, Maitama Tsoho all of which are located in the first phase of the Federal Capital City. The people Mostly Gwari are known to be energetic and hard working farmers. They produce a wide variety of food crops ranging from yams, cow pea, rice, cereal, vegetables and fruits. However, Kubwa is now inhabited by people of various culture and languages. With the demolition of illegal structures and houses within Abuja Municipal at its peak, migration to Abuja satellite towns like Kubwa reached an all time high, this coupled with high cost of accommodation within Abuja Municipal Council lead to high rate of migration to Kubwa. Definitely a higher population is higher and larger waste churned out.

Most of its residents are civil servants of the middle and low income earners, being the first satellite town that was developed when the Federal Capital Territory was moved from Lagos to Abuja; Kubwa was hit by the pangs of development increased population leading to heaps of refuse found along major roads, riverbanks, and open spaces.

Also the widespread demolition of houses done by El Rufai, the former FCT administrator adversely affected Kubwa; this gave rise to rubbles of demolished buildings around the town, turning it into a nightmare to the inhabitants of the town.

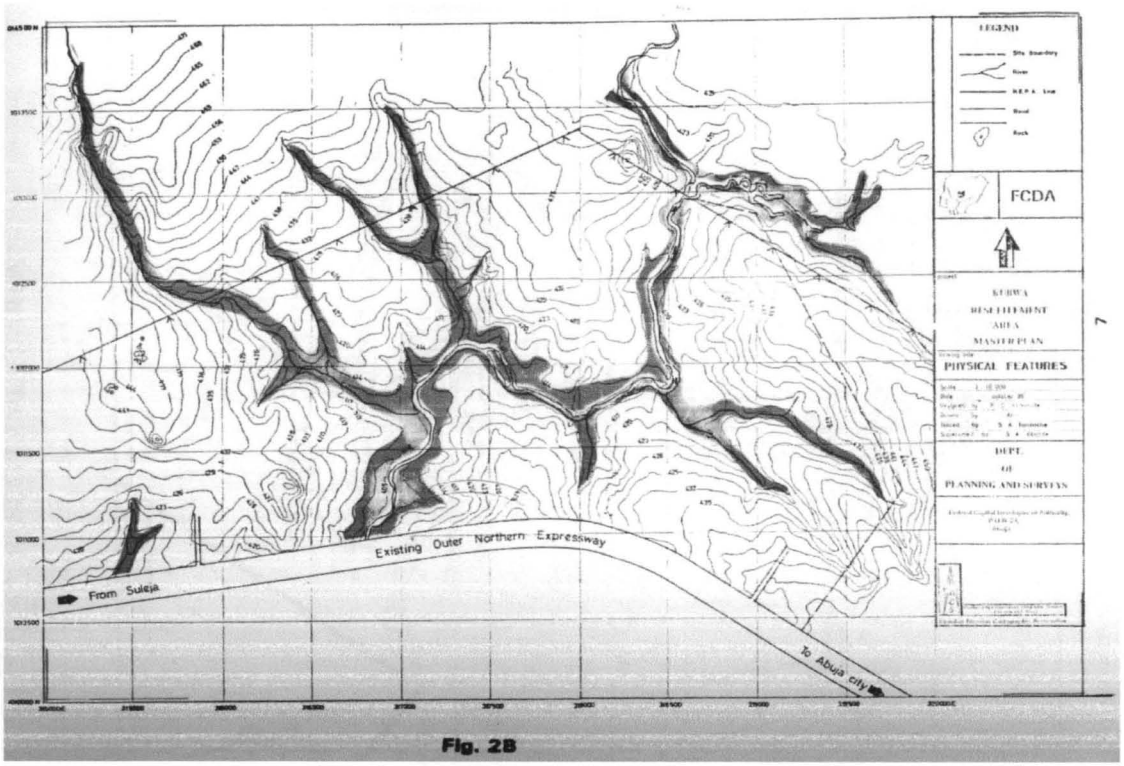


Figure1.1: Map Of Kubwa.

Source: Kubwa Resettlement Plan.

CHAPTER TWO

.0 LITERATURE REVIEW

.1 Solid Waste a Historical Perspective:

Many scholars have conceptualized the word "waste" with different meaning depending on their reas of interest and understanding. Solid waste is material, which is not in liquid form and has o value to the person who is responsible for it and it is not intended to be discarded through a ipe. The term "waste" refer to household refuse, market waste, street sweeping and waste aterials from institutions such as schools, colleges, hospitals and commercial establishments. ynonyms to solid waste are terms such as "garbage", "trash" , "refuse" , and rubbish".(Zurbrugg, 2003) Furthermore, The World Health Organization (WHO) defines waste" as something, which the owner no longer wants at a given time and space and which has o current perceived market "value". More so, what one regards as waste may not be totally seless, as much can be recycled to produce new products. Waste may be categorized as liquid, aseous or solid. We however limit our scope to solid waste. (Ogbonna, 2002)

Vaste is everyone's business; we all produce waste in nearly everything we do. According to nvironmental Protection Agency of the United States of America (U.S.A), the country produces billion tons of solid waste yearly. About half of that amount consists of agricultural waste, as crop residue and animal manure, which are generally recycled into the soil on farms y are produced. However, they constitute the single largest source of nonpoint air and ution in the country. More than one-third of all solid wastes are mine tailings, rom strip mines, smelter slag, and other residues produced by mining and primary

metal processing. Road and building construction debris is another major component of solid waste. Industrial waste other than mining and mineral production amounts to some 400 million metric tons per year in the United States and about 60 million metric tons of industrial waste fall in a special category of hazardous and toxic waste. Municipal waste is a combination of household and commercial refuse amounts to more than 200 million metric tons per year in the united states that approximately two-thirds of a ton for each man, woman, and child every year twice as much per capita as Europe or Japan, and five to ten times as much as most developing countries (Cunningham and Cunningham, 2008)

Smith, 2003; in an article" What is Solid Waste Management" points out that solid waste has an issue as long as humans have been living in settled communities. He is of the opinion nodern societies however, generate far more solid waste than early humans ever did, as life in industrialized nations generate several pounds of solid waste per consumer, not only directly in the home but indirectly in factories that manufacture goods purchased by consumers. Barbalace,2003 in his review of the trash timelines from 6500BC to 1979 also shows that there has been a problem with trash from man's earliest time as humans are by their nature careless with trash since; "they let it fall where it may", and not just a trait of the 20th century. However, he did not totally agree with the notion that modern societies were wasteful rather he was of the opinion that the nature of waste varies greatly from one civilization to another as some cultures were very wasteful, considering everything disposable. Also in his review archeological findings of many Mayan sites demonstrated such careless consumption. An example of such was an account of Native Americans in Colorado about 6500BC who killed 200 buffalos in one day and butchered 150 of them, carrying away enough meat to feed 150 people for 23 days. Leaving about 18,380 pounds of bones, this had remained for 6500 years. Soft tissue had decomposed

years ago. 150 modern day Americans would produce about 14,150 pounds in 23 days most of which would decompose rapidly. Based on the weight of the bones that remained, the Native Americans in that clan produced 5.3 pounds of waste a day as compared to 2.5 pounds per day, which is a moderate figure for middle class American consumption. He also noted that Consumption and waste of resources is probably related to supply being more available than any other factor. With an analogy of automobiles being larger when gasoline is cheap and smaller when expensive and scarce. He however, acknowledged the fact that comparing the amount of trash generated today with that of past civilizations is a bit hard, noting also that until recently trash quantity was calculated by volume not weight. Volume is dependent upon how much the trash is compacted while weight is influenced by moisture content, which varies greatly depending upon climate and weather conditions. The various studies vary too greatly to get a clear picture of per capita refuse per day. (Barbalace, 2003)

Trash has played a tremendous role in history. The Bubonic Plague, Cholera and typhoid fever to mention a few, were diseases that altered the populations of Europe and influenced monarchies. They were perpetuated by filth that harbored rats, contaminated water supply. It was not uncommon for Europeans to throw their garbage and even human waste out of the window having figured out that stray dogs would eat whatever they threw out. The study of garbage has given us much insight into past civilizations. It has been instrumental in solving crimes. It has even resulted in the fall of an American President. (Barbalace, 2003) One of the most significant events in American history took place in Memphis in 1968 involving the city's garbage collection when Reverend Martin Luther King Jr., a national leader for civil rights was assassinated at the Lorraine Motel in downtown Memphis while leading striking City of Memphis garbage collection employees who were protesting conditions within the city's

sanitation Department. Revered King's death was a tragic moment in the Memphis history; however, from this tragedy dramatic improvements were made in the work conditions and rights of Memphis sanitation workers, while influencing the civil rights movement nationwide. (www.cityofmemphis.org)

2.2 Solid Waste Management in Developing Countries

The common problem faced by all the developing countries, is the disposal of solid waste and availability of dumping grounds. The insufficient collection and inappropriate disposal of solid wastes represent a source of water, land and air pollution, and pose risks to human health and the environment. Over the next several decades, globalization, rapid urbanization and economic growth in the developing world tend to further deteriorate this situation. The importance of Solid waste management is acknowledged by most governments however, rapid population growth over-whelms the capacity of most municipal authorities to provide even the most basic services. Typically one to two thirds of the solid waste generated is not collected. As a result the uncollected waste, which is also mixed with human and animal excreta, is dumped indiscriminately in the streets and drains, so contributing to flooding, breeding of insects and rodent vectors and the spread of diseases, furthermore even collected waste is often disposed of in uncontrolled dumpsites which are burnt polluting water resources and air. (Zurbrugg, 2003; Medina, 1995)

2.2.1 Challenges in Solid Waste Management Facing Developing Countries

Thousands of tons of solid waste are generated daily in developing countries of Africa, Asia, Latin America and Eastern Europe and most of it ends up in the open dumps and wetlands, contaminating surface water and groundwater and posing major health hazards.

The generation rates available from some cities and regions are approximately 0.5 kilograms per

person per day and in some cases as high as 0.8 kilogram per person per day which does not look high when compared with 1-2 kilogram per person per day in developed countries but most of the wastes in developing countries are not collected by municipal collection systems because of poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets. (EGSSAA, 2006) Approximately 70 percent of the waste generated is organic. In theory, this waste could be converted to compost or used to generate biogas, but in situations where rudimentary solid waste management systems barely function it is difficult to promote innovation, even when it is potentially cost-effective to do so. In addition, hazardous and infectious materials are discarded along with general waste in these countries further complicating the waste management problems. (EGSSAA, 2006) Throughout most of Sub-Saharan Africa solid waste generation exceeds collection capacity. This is in part due to rapid urban population growth; while only 35 percent of the Sub-Saharan population lives in urban areas, the population grew by 150 percent between 1970 and 1990. But the problem of growing demand is compounded by broken down collection trucks and poor program management and design. In west African cities, as many as 70 percent of trucks are always out of service most of the times, in 1999 the city of Harare failed to collect refuse from nearly all its residents because only 7 out of 90 trucks were operational.(EGSSAA, 2006) Lack of collection of the waste constitutes health hazards thereby making the challenges and costs of solid waste management in Africa even more daunting. Zurbrugg, 2003; Medina, 1995; EGSSAA, 2006;UNEP, 2007 observed that Municipal solid waste collection schemes of cities in developing countries generally serve a limited part of the urban population and the people without such services are the low-income population living in peri-urban areas. One of the main reasons is lack of financial resources to cope with increasing amount of waste generated by rapid growing cities. The

accumulated uncollected wastes are burned by residents or are disposed of in illegal dumps which blight neighborhoods and harm public health. Municipal employees or shop owners may help reduce the effect in public places; nevertheless, roadside accumulation in many cities has reached levels resembling those that spawned epidemics in European cities over 500 years ago. Unless a more effective urban waste management program and water supply are put in place outbreaks of cholera, typhoid and plagues would constantly be on the increase.

Zurbrugg, 2003 identified the challenges of municipal solid waste management of developing countries as the inadequate service coverage and operational inefficiencies of services; limited utilization of recycling activities; inadequate landfill disposal and inadequate management of hazardous and healthcare waste. Often inadequate fees are charged and insufficient funds from municipal budget cannot finance adequate level of service. Operational inefficiencies was also observed in the solid waste services due to inefficient institutional structure and organizational procedures or deficient management capacity of the institutions involved as well as use of appropriate technologies. Medina, 1995 also saw Current Problems of third world countries as capital expenses since Collecting, transporting and disposing of Municipal Solid Waste (MSW) represent a large expenditure for Third World cities: waste management usually accounts for 30-50 percent of municipal operational budgets. Despite these high expenses, cities collect only 50-80 percent of the refuse generated. In India, for instance, about 50 percent of the refuse generated is collected, 33 percent in Karachi, 40 percent in Yangoon, and 50 percent in Cairo, yet disposal receives less attention: as much as 90 percent of the MSW collected in Asian cities end up in open dumps. In areas that lack refuse collection -usually low-income communities- residents tend to either dump their garbage at the nearest vacant lot, public space, creek, river, or simply burn it in their backyards. Uncollected waste may accumulate on the streets and clog drains when it rains,

which may cause flooding. Wastes can also be carried away by runoff water to rivers, lakes and seas, affecting those ecosystems. Alternatively, wastes may end up in open dumps -legal and illegal-, which is the most common disposal method in the Third World.

Zurbrugg, 2003 also observed that with regard to technical service the often "conventional "collection approach as developed and used by industrialized countries is applied to developing countries. The vehicles were expensive and sophisticated and difficult to operate and maintain, thereby often inadequate for the conditions in developing countries. Little wonder that these vehicles breakdown after a short time of operation.

In the same vein Medina,1995 is also of the opinion that Conventional Waste Management Systems shortcomings is due to the profound differences that exist between industrialized and developing countries in terms of income, standard of living, consumption patterns, institutional capacity, and capital available for urban investments. Conventional solutions usually do not take into account these differences, resulting in less than optimum outcomes. He observed that the solutions that are commonly proposed to the problems in municipal solid waste management (MSWM) in Third World cities often have the following features:

1. Centralized and undiversified - solutions that do not distinguish the different needs and heterogeneity of neighborhoods within each city, and between cities
2. Bureaucratic - top-down solutions, usually reached without or with little community participation
3. Capital-intensive approaches - involving advanced technology and equipment, frequently imported from industrialized countries
4. Formal - conventional solutions only consider the formal sector, neglecting the existence and possible contributions of the informal sector.

Medina, 1995 went ahead to identify the major differences between industrialized and developing countries relevant to the design of MSWM solutions in the latter:

1. Industrialized countries enjoy a relative abundance of capital and have high labor costs, while developing countries have a relative scarcity of capital and an abundance of unskilled and inexpensive labor. It makes sense for the former to devise waste management systems intensive in capital and that save in labor costs, but it often does not make sense for the latter to follow the same approach. Developing countries need low-cost, labor-intensive solutions that reduce poverty, particularly among the most underprivileged segments of society. Socially desirable MSWM solutions in developing countries are those that create income opportunities for unskilled workers, particularly the poor.

2. The physical characteristics of cities in developing and industrialized countries differ

Markedly Third World cities have extensive areas with substandard conditions-slums-with narrow, hilly and unpaved streets. Many immigrants cannot afford to purchase land on which to build their homes. As a result, some migrants occupy vacant land and become squatters. Most of the areas that lack refuse collection service are slum and squatter settlements. Given the conditions of hilly, unpaved or narrow streets common in Third World settlements, it may not be possible for collection trucks to enter those areas. Alternatively, if they do enter those neighborhoods, collection vehicles tend to break down often due to the harsh conditions of streets and roads.

3. An important difference between industrialized and developing countries refers to the dissimilar amount and characteristics of wastes generated. The waste generated tends to go up as income increases. First World cities have higher waste generation rates than Third World cities. In the U.S., cities can have waste generation rates of over 1.2 Kg / person / day, while the residents of some African cities generate less than 200 gr. / person / day. A positive relationship also tends to exist

between income and waste generation rates within each city: in Mexico City, for example, low-income households generate 2.6 Kg. a day, middle-income households produce 2.7 Kg. a day, and upper-income households, 3.7 Kg. a day. Further, in addition to less refuse being generated in low-income communities, waste composition also tends to be different. Waste generated in developing countries contains a large percentage of organic materials, usually three times higher than that or industrialized countries. Waste is also more dense and humid, due to the prevalent consumption of fresh fruits and vegetables, as well as unpackaged food. First World residents consume more processed food and packaged in cans, bottles, jars and plastic containers than in the developing world. As a result, waste generated in the former contains more packaging materials than in that of the latter.

4. Many Third World cities have a dynamic informal sector that has evolved around wastes, which provides income opportunities for recent migrants, unemployed, children, women, elderly and handicapped individuals. The most common occupations are informal refuse collection and scavenging.

A major area that was noted by Medina, 1995 is the role of scavenger or informal refuse collectors in the solid waste management in third world countries. Using their vehicles include the pushcart, tricycles, donkey carts, horse carts and pickup trucks serve the poor and retrieve the recyclables contained in the garbage before disposing of the remainder of the waste. In Santa Cruz, Bolivia the informal refuse collectors serve about 37 percent of the population, And the low-income areas of Ciudad Nezahualcoyotl, Chalco and Iztapaluca near Mexico City, Hundreds of informal collectors with pickup trucks, pushcarts and horse carts provide service in areas not served by municipal authorizes. As against the lack of recycling programs in developing countries informal recycling is common throughout Africa, Asia and Latin America. Scavengers carry out the bulk of the recycling

in municipal wastes as they salvage the recyclable materials on the streets before collection crew arrives. Scavenging provides an income to unemployed individuals, Medina,1995 also observed that migrants who have been able to find employment in the formal sector, women, children and elderly individuals. Many scavengers can be considered a vulnerable segment of the population due to their daily contact with garbage and their often raggedly appearance, they are considered undesirable and sometimes even as criminals. Public policy generally considers scavengers as a nuisance or a problem to be eliminated. Scavengers are not always poor. In fact, scavengers sometimes earn more than factory workers. When scavengers organize themselves in micro-enterprises, scavengers' cooperatives, or form public-private partnerships with municipalities, they can achieve a decent standard of living and improve their working conditions, resulting in grassroots development. Medina, 1995 is also of the opinion that since the structural causes for scavenging such as underdevelopment, poverty, unemployment, and lack of a safety net for the poor it is only humane to make public policy that supports scavenging activities as well as social, economic and environmental sense.

A research embarked by the UNEP in 2003 revealed that the Liberian solid waste management was a key issue to be addressed in the country, the following findings were found after a 10 day review of the solid waste management sector of the country.

Overlapping and imprecise division of responsibilities between various public authorities, The weak nature of the Waste Management Sector became apparent due to the poor institutional capacities and infrastructure , these was due to the shortages of both human and financial resources to operate a viable system. In a bid to improve the sector the Government of Liberia initiated the decentralized process where the municipalities were given authority for raising, and directly accessing waste management-user fee revenues. The process is generally seen as the most

relevant approach for dealing with waste management, however, since it was not properly planned and implemented the risk of additional bureaucracy became obvious. In conclusion a suitable approach to waste management within Liberia is one that must integrate sanitary as well as social objectives, ensure a profitable, reliable service and raise public awareness on health related concerns. Further, there is a need to bring together the public, private and community based actors and to give them a well defined responsibilities in the various fields from preliminary collection to recycling. Also to strengthen institutional capacity for waste management in Liberia the profile and capacity of the public authorities in charge of the sector.

2.3 Waste-Management Practices in Nigeria

Nigerian cities are largely characterized by the public provision of urban infrastructure services. These services, such as water supply, drainage, sewage, access roads and solid waste collection and disposal are usually of poor quality (Onibokun, 1989). Being one of the developing economies with a land area of 928,000 square kilometers harboring a population of 88.5 million people (1991) out of which 64 percent live in the rural areas and 36 percent residing in urban areas (Osuocha, 1999). Nigeria seems to see pollution by domestic and industrial wastes as a necessary outcome of development (Igwe, 2002).

The growing populations, rising incomes, and changing consumption patterns combine to complicate solid-waste problems in Nigeria, the main constitutes of the refuse is about 70 percent putricible content and 30 percent non-putricible content which should be a lot easier to handle .However, owing to inadequate planning heaps of these refuse are commonly found decomposing on streets, open spaces or at designated communal collection points (Osuocha, 1999).

According to Ogu, 2000 in his article "Private sector participation and municipal waste management in Benin City", the problem of solid waste disposal in the country's cities has become one of the most intractable environmental problems. The national profile observed that "...in many Nigerian cities, the volume of solid wastes has overwhelmed urban administrators' capacity to plan for their collection and disposal. Thus, it is not uncommon to find urban streets and roads practically blocked by solid wastes..." (NEST, 1991).

Osuocha, 1999 is of the opinion that institutional framework has been found to be one of the leading causes of the problems of refuse management and this is due to the lack of understanding of the magnitude of the job and the inability to appreciate the dangers posed by refuse mismanagement. He also observes that the efforts of the state Governments to handle refuse particularly in urban areas has not improved significantly, basically because of their inability to appreciate that refuse management requires a separate organization and has failed to appoint an appropriate body to handle refuse. He sees the multiple agencies such as Urban Development Authorities and Environmental Sanitation Task Forces all taking part in handling sanitation as the source of conflict which has hampered the improvement of the refuse management sector. However, in a bid to harmonize sanitation management the states have established the Environmental protection Agency (SEPA) but, its primary responsibility is pollution control.

Public provision of waste services in Nigeria is also characterized by little recovery from service beneficiaries (NEST, 1991) and there is an added problem of the inadequate institutional capacity of the public agencies responsible for environmental waste management (Onibokun, 1989)

Domestic refuse in Lagos alone has been estimated to be 4.5mill.tonnes per year. 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 0.5 kilogram per person, depending on location and economic standing of the individual (Ayeni , 1987). Past Governments in Nigeria have attempted to tackle waste-management issues though "task force" approaches. This approach has been counterproductive in the long run as it created more problems due to lack of coordination and technological know-how in responsible agencies.

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. Waste from the exercise were dumped along roadsides instead of the dumpsites designated by local authorities, it was left to decompose naturally ,eaten by animals, picked by scavengers, or washed away by floods or rains affecting the quality of the surface water.(Nweke , 2000). In Benin the State Government's response to poor waste collection and disposal conditions was the establishment of an ad hoc body, the Edo State Environmental Sanitation task Force. This task force, headed by a military officer to "deal decisively" with sanitation problems, is itself constrained by financial resources and equipment. A study carried out in 1994-95 documented solid waste collection and disposal in Benin City, as well as finance and management issues, based on the results from the randomly selected houses within four zones in the City solid waste services were inadequate as there was no formal arrangement for waste collection and disposal which implies no public or private waste services were available to these residential houses and their neighborhoods. The practice found was disposal of solid waste into storm water drains, burning of waste materials within or outside

compounds and dumping of waste in underdeveloped plots of land.

When these dumpsites are cleaned eventually the waste are transferred to the outskirts of the town where it ends up in abandon 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. However, there is little or no consideration given to the ecological consequences (Igwe, 2002).

The Solid Waste problem was not only restricted to the residential areas as markets and commercial premises were found to have disposal problems. A number of factors were found to be responsible for the poor services condition within Benin City, ranging from poor financing to inadequate institutional arrangements. The Environmental Sanitation Unit lacks personnel, resources and equipment to cover all the parts of the city. As a result, the unit's services are restricted to the core (old city) and some parts of the intermediate zone. About 175 vehicles were required to ensure house-to-house refuse collection in the city in 1994-95 but, at the time of the unit had 26 trucks, all except one had maintenance problems and were subsequently abandoned; and the only pail loader owned by the unit was among the vehicles that had broken down(Ogu;2000) Private sector services were engaged to undertake the collection and disposal of solid wastes in the government reservation area, a high income suburb located in the south-eastern part of the city. At first this process was successful and led to an improvement in waste services. However, by 1994, some private operators engaged in house-to-house collection had withdrawn their services because of a rise in operating costs, including vehicle maintenance. Meanwhile, service charges scarcely kept pace with the cost of service provision because often they were fixed by the city council

Ogu, 2000 argued that the extent to which private participation in municipal waste services can succeed in poor urban localities may depend on recognizing that affordability and problems of cost recovery are important issues and emphasized that the government should encourage community/private operator partnerships as a way of ensuring local residents inputs are considered in service provision, standards and arrangements.

Dauda and Osita (2003) in their article Solid Waste management and re-use in Maiduguri also found the major hindrances faced by the local governments responsible for managing waste within their jurisdictions as: poor funding, poorly trained man power, inadequate equipment and machinery, ineffective collection technique and disposal methods. As a total of 9 vehicles were found in the Borno State Environmental Sanitation Board(BOSEPA) 7 tipper lorries, 1 loader and 1 gully emptier out of which only 4 lorries and 1 loader are functioning. Other issues included inadequate dump sites, inaccessibility to some collection centers due to unpaved or narrow streets, lack of precise guidelines and laws related to solid waste management. They were also of the opinion that in order to handle the growing volume of waste, the proper policies and guidelines must be enacted and implemented. And that it is necessary to educate the public about the consequences of poor waste management and reorganization of the existing facilities to incorporate the activities of the informal waste collectors, community participations like the NGO's and also to encourage the activities of the scavengers. The provision of accessible collection centers, dumping sites and establishment of the integrated waste management facility in Maiduguri would be more beneficial to the society.

Other waste management systems like incineration and composting have their own setbacks, the incinerators in Lagos are out of use due to poor maintenance and the high humidity which requires additional energy to dry the waste to enable burning. Compositing on the other side is

practiced on small scale due to the low demand for compost as an alternative to artificial fertilizers has increased in other to sustain intensive agriculture. Another major drawback for composting is the necessity to separate biodegradable waste materials from other materials.

The problems of domestic waste management in Nigeria are numerous ranging from economic, environmental, and socio-cultural to sociopolitical issues. The level of awareness and environmental education and potential hazards relating to polluted environment is still low and people are more concerned with daily survival than to be bothered with a concept like waste management.

Poor management skills in the handling domestic waste is another major problem most cases open dumps are encouraged based on availability of land without regard to safety, health hazards, and the aesthetic values of the location. In most cases the dumps are ignited and allowed to burn slowly in the open, this practice introduces hazardous combustion products into the atmosphere such as carbon monoxide, sulfur dioxide, oxides of nitrogen, halogenated carbons, poly-aromatic hydrocarbons and particulate matter. The agencies responsible for handling wastes are not adequately financed and the revenue realized from their services are small as only limited fraction of the population is served by house to house collection system, Tenement rates and 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 ever increasing with population growth, high level of industrial development and concentration of major government establishments in cities have resulted in a massive influx of people from rural to urban areas. An acute shortage of accommodation has lead to the construction of indiscriminate shanties and substandard housing without regards to proper planning, which has resulted in problems with

effective solid-waste collection and disposal.

The common practice is where government contract the refuse collection and disposal to waste-disposal companies and in most cases these companies cannot adequately take care of solid-waste management, point source sorting are not addressed and these companies also use shovels and open trucks which leaves droppings from waste along the streets. These efforts could be better structured to ensure wider coverage and to include public participation as it is a concern for everybody.

Despite the limitations facing the solid waste management in Nigeria, significant progress has been made in several areas. Composting and plastic recycling plants have been set up in Ibadan, a slaughter house waste recycling plant in Port Harcourt and an organic waste recycling plant in Kaduna all based on local technology. In a similar manner, the Ondo State Government financed an integrated waste recycling project in which local producers used indigenous technologies to convert organic matter into organic and organo-mineral fertilizers, soft and hard plastics into pellets that serve as raw material for ancillary plastic industries, and metal scrap into ingots and finished products (Olarewaju and Ilemobade, 2009) Recently, a composing facility has been set-up by a private company, Earth Care Nigeria Limited in collaboration with Earth Care Technologies Inc. in Odogunya, Lagos State, with the aim of processing 1500 tons of solid waste per day from which high quality compost can be produced for sale to Nigerian farmers. Also, the Lagos State Government, in a bid to improve solid waste collection and disposal, recently opened a Transfer Loading Station (TLS) which is expected to take delivery of rubbish collected by LAWMA in 10 local council areas and compress it in readiness for transfer to a definitive dump site. Fitted with a static hydraulic compressor, the TLS has a maximum handling capacity of 1000 metric tones (33 truck loads) of waste per day. In addition the Federal Government of

Nigeria has provided incinerators for the National Hospital Abuja, National Orthopedic Hospitals in Dala, Kano, Enugu and Igbobi, Lagos. The Federal Government of Nigeria has also recently concluded feasibility studies with respect to installing integrated waste management facilities in 15 cities Aba and Ibadan are functional at present in Nigeria. The facility will take advantage of local technology in converting waste into resource through material recovery and composting. Campaigns have been carried out in several states to educate citizens on solid waste management and change public attitude towards waste management. Slogans like "clean and green" have been used in states like Calabar and Imo and "Eko'o ni baje" (Lagos shall not deteriorate) in Lagos. (Ugwuh, 2009)

2.4 Classification of Solid Waste.

Solid waste can be classified as follows:

Agricultural wastes: The major waste residues from agriculture are animal manure from farmers' houses, the crop residues as well as residues of agro-chemicals. Manure waste from dogs, cows, pigs and poultry most of which is recycled at site. Crop residues are mainly leaves, tree barks, and yard trimmings.

Municipal Waste: is generated from several sources such as construction, rehabilitation works and demolition debris. Household wastes from living activities, schools, commercial wastes from restaurants and business areas.

Industrial waste: the composition of industrial solid waste is complex depending on the raw material, technological processes and final products of each production centre and its related services.

Hazardous waste: is defined by the Environmental Protection Agency as the waste that pose a potential danger to humans or other living organisms for one or more of the following reasons;

They can be lethal, non-degradable or persistent in nature and may cause detrimental cumulative effect, their effects can be magnified by organisms in the environment. General categories of hazardous wastes include toxic chemicals and flammable, radioactive or biological substances.

Medical waste: The production of hazardous waste from hospitals is estimated to about 50-75 tons in addition the hazardous and toxic waste from hospital activities that is dumped into unhygienic landfills also causes negative impacts to the environmental quality as well as directly impact on the public health. (Huang, 2007)

2.5 Solid Waste Management

Solid Waste management is a polite term for garbage management. It includes all the activities that seek to minimize the health, environmental and aesthetic impacts of solid wastes. Solid waste management is multifaceted hence; it is seen as complex because it involves interactions between diverse components. The business dictionary defines it as the systemic control of generation, collection, storage, source separation, treatment, transport, processing, recycling or disposal of solid wastes. It is much more than a technological issue as it involves managing a large workforce working together closely with the public. (Smith, 2008; Zurbrugg, SANDEC/EAWAG, 2003)

Solid waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial, producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

2.6 Waste Management Concepts

The early concept of waste disposal during the first century of industrial revolution was the dilute and disperse concept, these was because the volume of the waste produced was relatively small and factories were located near rivers as the water provided numerous benefits like: transportation of materials by boat, sufficient water for processing and cooling, and easy disposal of waste into the river. With few factories and a sparse population, dilute and disperse seemed to remove the waste from the environment. With increased industrialization and expansion of urban areas the concept became inadequate and a new concept of concentrate and contain became popular however, the containment was not always achieved as the containers whether landfill or drums, natural or artificial may leak and break and allow waste to escape.

New trends have evolved with time coupled with a bid to have an environmentally sound concept with respect to waste management; wastes are considered as resources out of place. Although we may not immediately reuse and recycle them, it seems apparent that the increasing cost of raw materials, energy, transportation and land will make it financially feasible to reuse and recycle more resources.(Botkin ; Keller ,2005)

The modern concepts of waste management vary in their usage between countries or regions. Some of the most general, widely-used concepts include:

2.6.1 Extended Producer Responsibility - Extended Producer Responsibility (EPR) is a strategy designed to promote the integration of all costs associated with products throughout their life cycle (including end-of-life disposal costs) into the market price of the product. Extended producer responsibility is meant to impose accountability over the entire lifecycle of products and packaging introduced to the market. This means that firms which manufacture, import and/or sell products are required to be responsible for the products after their useful life as

well as during manufacture.

2.6.2 Product Stewardship is a concept whereby environmental protection centers on the product itself, and everyone involved in the lifespan of the product is called upon to take up responsibility to reduce its environmental impact. (US EPA) For manufacturers, this includes planning for, and if necessary, paying for the recycling or disposal of the product at the end of its useful life. This may be achieved, in part, by redesigning products to use fewer harmful substances, to be more durable, re-useable and re-cycle able, and to make products from recycled materials. (National Chemical Emergency Centre) For retailers and consumers, this means taking an active role in ensuring the proper disposal or recycling of an end-of-life product.

Product Stewardship is often used interchangeably with extended producer responsibility, a similar concept. However, there are distinct differences between the two, as suggested by the semantics of the different terms used.

While both concepts bring the onus of waste management for end-of-life products from the government to the manufacturers, Product Stewardship further extends this responsibility to everyone involved in the life-cycle of the product.(Wikipedia.org)

2.6.3 Polluter Pays Principle - the Polluter Pays Principle is a principle where the polluting party pays for the impact caused to the environment. With respect to waste management, this generally refers to the requirement for a waste generator to pay for appropriate disposal of the waste. Polluter Pays is also known as Extended Polluter Responsibility (EPR). This is a concept that was probably first described by the Swedish Government in 1975. EPR seeks to shift the responsibility dealing with waste from governments to the entities producing it. In effect, it internalizes the cost of waste disposal into the cost of the product, theoretically meaning that the producers will improve the waste profile of their products, thus decreasing waste and increasing

possibilities for reuse and recycling, it is a concept where manufacturers and importers of products bear a significant degree of responsibility for the environmental impacts of their products throughout the product life-cycle, including upstream impacts inherent in the selection of materials for the products, impacts from manufacturers' production process itself, and downstream impacts from the use and disposal of the products. Producers accept their responsibility when designing their products to minimize life-cycle environmental impacts, and when accepting legal, physical or socio-economic responsibility for environmental impacts that cannot be eliminated by design.

2.6.4 Pay As You Throw (PAYT) is a usage pricing model for disposing of municipal solid waste. PAYT is sometimes referred to as **unit pricing** or **variable rate pricing**. Users pay a variable rate based on how much waste they present for collection by the local authority or municipality. Where this system is implemented, recyclable waste is usually collected free of charge. PAYT can potentially encourage fly-tipping and other detrimental forms of waste disposal, such as passing it to unlicensed or illegal waste disposal operatives. Europe applies a lifetime duty of care to waste to ensure that it cannot just be palmed off to an operator.

In order for PAYT to be effective at reducing waste, and to discourage illegal dumping, it should be accompanied by effective recycling and alternative disposal programs, such as yard waste collection and curbside recycling. (Wikipedia.org)

2.6.5 Integrated Solid Waste Management

The integrated waste management (IWM) concept is also known as the waste hierarchy it refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum

practical benefits from products and to generate the minimum amount of waste. The ultimate objective of the IWM is to reduce the amount of urban refuse and other waste that must be disposed of in landfills, incinerators, or other waste management facilities. Utilization of the IWM suggests a minimum of 50% reduction by weight of urban waste which could be facilitated by Better design of packaging to reduce waste, an element of source reduction(10% reduction),Establishment of recycling programs (30% reduction),Large-scale composting programs(10% reduction).

Recycling is the major player in reduction of urban waste stream, it is estimated that 80%-90% of U.S. waste stream might be recovered through intensive recycling. A pilot study involving 100 families in east Hampton, New York, achieved a level of 84% more realistic for most communities is partial recycling ,which targets a specified number of Materials, such as glass, aluminum cans, plastics, organic material and newspaper. In 1994 23% recycling rate was achieved in the U.S. and 28% in New England states while Rocky Mountain States reports recycling at 10%. In 1995 New Jersey reported a 52% recycling rate. (Botkin ; Keller ,2005)

2.6.5.1 Reduction Methods

An important method of waste management is the prevention of waste material being created, also known as waste reduction. It is a strategy which any community employs to cut down the amount of waste that is generated. This includes; backyard composting which reduces the amount of waste disposed to landfills, the two-sided copying on paper. Reduction assumes the commitment and involvement of citizens. Source reduction strategies have many favorable environmental impacts, including reducing greenhouse gas production, saving energy, and conserving resources, in addition to reduction in the volume of waste stream. (Heimlich J.E et al)

2.6.5.2 Reuse Methods

Reuse is using a product more than once, either for the same purpose or for an alternate purpose. Reuse does not require reprocessing and therefore, has lower energy requirements than recycling. It is a method of avoidance which includes; reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery), and designing products that use less material to achieve the same purpose (for example, light weighting of beverage cans). It also includes donations to charity, reusing packaging using empty jars for food storage and participating in paint collection and reuse program. (Heimlich J.E et el)

2.6.5.3 Recycling Methods

The process of extracting resources or value from waste is generally referred to as recycling, meaning to recover or reuse the material. In recycling waste materials are processed industrially and then reformed into new or similar products. There are a number of different methods by which waste material is recycled: the raw materials may be extracted and reprocessed, or the calorific content of the waste may be converted to electricity. New methods of recycling are being developed continuously, and are described briefly below.

2.6.5.4 Physical Reprocessing

The popular meaning of 'recycling' in most developed countries refers to the widespread collection and reuse of everyday waste materials such as empty beverage containers. These are collected and sorted into common types so that the raw materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, or sorted directly from mixed waste

streams. The most common consumer products recycled include aluminum beverage cans, steel food and aerosol , glass bottles and jars, paperboard cartons, newspapers, magazines, and cardboard. Other types of plastic (PVC, LDPE) are also recyclable, although these are not as commonly collected. These items are usually composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more difficult, due to the additional dismantling and separation required.

2.6.5.5 Biological Reprocessing

Waste materials that are organic in nature, such as plant material, food scraps, and paper products, can be recycled using biological composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter. There is a large variety of composting and digestion methods and technologies varying in complexity from simple home compost heaps, to industrial-scale enclosed-vessel digestion of mixed domestic waste. Methods of biological decomposition are differentiated as being aerobic or anaerobic methods, though hybrids of the two methods also exist. An example of waste management through composting is the Green Bin Program in Toronto, Canada, where household organic waste (such as kitchen scraps and plant cuttings) are collected in a dedicated container and then composted.

2.6.5.6 Energy Recovery

The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Recycling through thermal treatment ranges from using waste as a fuel source for cooking or heating, to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process typically occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other products. The solid residue (char) can be further refined into products such as activated carbon. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. **(Wikipedia.org)**

2.7. Public Support

The public is generally more responsive in its support as industries and businesses are redesigning their products so that they can easily be disassembled after use and various parts recycled ,the automobile industries are designing automobiles with coded parts so that they may more easily be disassembled and recycled by professional recyclers rather than rusting and becoming eyesores in junkyards, small appliances such as toasters, electric fryers are recycled rather than ending up in landfills, Grocery stores encourage the use of plastic and paper recyclable bags by providing bins for their collection and recycling. Some food stores offer the use of inexpensive shopping bags, Fast food restaurants are using less packaging for their products and providing on-site bins for recycling used paper and plastic.(Botkin ; Keller 2005)

2.8 Markets for Recycled Products.

As with many other environmental solution implementing the IWM concept successfully has brought about its own challenges as recycling in some communities have resulted in glutted markets for the recycled products, which sometimes require temporary stockpiling or suspension of recycling of some items. It is apparent that if recycling is to be successful, markets and processing facilities will have to be developed to ensure that recycling is a sound financial venture as well as an important part of IWM. (Botkin ; Keller 2005)

2.9 Solid Waste Management Methods

Waste management methods vary widely between areas for many reasons, including type of waste material, nearby land uses, and the area available.

2.9.1 Collection and Transportation

Waste collection methods vary widely between different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private industry. Some areas, especially those in less developed countries, do not have a formal waste-collection system. Examples of waste handling systems include: In Australia, most urban domestic households have a 240-litre (63.4 U.S. gallon) bin that is emptied weekly from the curb using side- or rear-loading compactor trucks. In Europe and a few other places around the world, a few communities use a proprietary collection system known as Envac, which conveys refuse via underground conduits using a vacuum system. In Canadian urban centers curbside collection is the most common method of disposal, whereby the city collects waste and/or recyclables and/or organics on a scheduled basis. In rural areas people often dispose of their waste by hauling it to a transfer station. Waste collected is then transported to a regional landfill. In Taipei the city government charges its households and industries for the volume of rubbish they produce. Waste

will only be collected by the City council if waste is disposed in government issued rubbish bags. This policy has successfully reduced the amount of waste the City produces and increased the recycling rate. (Wikipedia.org)

2.9.2 On-Site Disposal this is a common disposal method in urban areas of developed countries, garbage disposal devices are installed in the waste water pipe system of kitchen sinks, and the garbage is ground and flushed into sewer system. This effectively reduces the amount of handling and quickly removes food waste. Final disposal is transferred to sewage treatment plants, where solids remaining as sewage sludge will be disposed of. (Botkin; Keller 2005)

2.9.3 Composting is a biochemical process in which organic materials such as lawn clippings and kitchen scraps decompose to a rich, soil-like material. It is a process of rapid, partial decomposition of moist solid, organic waste by aerobic microorganisms. Although simple backyard compost piles may come to mind, as a waste management option large-scale composting is generally carried out in the controlled environment of mechanical digesters. Refuse is presorted, to remove materials that might have salvage value or cannot be composted, and the ground is up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to humus with a total nitrogen, phosphorus, and potassium content of 1 to 3 percent, depending on the material being composted. After about three weeks, the product is ready for curing, blending with additives, bagging and marketing. This is a popular technique in Europe and Asia, where intense farming creates demand for compost. (Botkin; Keller, 2005)

2.9.4 Incineration is the burning of combustible waste at high temperatures between 900-1000oC or 1650-1830oF which is high enough to consume all the combustible materials, leaving only ash and non combustibles to dispose of in a landfill. Under ideal conditions, incineration

may reduce the volume of waste by 75% to 95% in practice however the actual decrease in volume is closer to 50% because of maintenance problems as well as waste supply problems. Apart from the reduction of the volume of combustible waste incineration has another advantage as the process can be used to supplement other fuels in electric power generation. Incineration however, comes with air pollution and toxic ash and the release of environmental dioxin a carcinogenic toxin, the smokestacks from incinerators may emit oxides of nitrogen and sulfur that lead to acid rain ; heavy metals such as lead, cadmium and mercury and carbon dioxide are also released which is related to global warming. Smokestacks of modern incineration facilities are fitted with special devices to trap pollutants but the process is expensive as the plants themselves are expensive and government subsidies may be needed to aid their establishment, also the economic viability of incinerators depends on revenue from sale of energy produced by burning waste but, as recycling and composting are increased they would compete with incineration for their portion of the waste stream, and sufficient waste to generate a profit from incineration may not be available. Incineration is a disposal method that involves combustion of waste material. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam, and ash. Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in countries such as Japan where land is scarcer, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to

generate heat, steam and/or electricity. Combustion in an incinerator is not always perfect and there have been concerns about micro-pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organics such as Dioxins which may be created within the incinerator and which may have serious environmental consequences in the area immediately around the incinerator. (Botkin; Keller , 2005 ;Cunningham and Cunningham, 2008)

2.9.5 Open Dumps

Open dumps were the traditional way of disposing solid waste, this was done by piling refuse on available land without being covered or otherwise protected. Although thousands of open dumps have been closed and new ones banned in the developed countries many are still being used worldwide especially the giant developing-world megacities which have enormous garbage problems and example is Mexico City, one of the largest cities in the world, generates some 10,000 tons of trash each day. Until recently most of this torrent of waste was left in giant piles, exposed to wind and rain, as well as rats, flies and other vermin. Manila, in the Philippines, generates a similar amount of waste, half of which goes to a giant, constantly smoldering dump called the "Smoky Mountain." Over 20,000 people live and work on this mountain of refuse, scavenging for recyclable items or edible food scraps. In July 2000, torrential rains spawned by the Typhoon "Kai Tak" caused part of the mountain to collapse, burying at least 215 people. The government would like to close these dumps, but how would the residents be housed and fed? Where else will the city put its garbage? (Cunningham and Cunningham, 2008). Dumps are usually located without regards to safety, health hazards and aesthetic degradation. Common sites are abandoned mines and quarries, where gravel and stone have been removed, natural low areas, such as swamps or floodplains: hillside areas above or below towns. In most instances the

refuse is ignited and allowed to burn, in others the refuse is periodically leveled and compacted. In general open dumps create a nuisance by being unsightly, providing breeding ground for pests, creating health hazard, polluting the air, and sometimes polluting ground water and surface water. (Botkin; Keller 2005)

2.9.6 Sanitary Landfills

Sanitary landfills are designed to concentrate and contain waste to the smallest practical area and volume without creating a nuisance or hazard to the public health and safety. This is done by covering the waste at the end of each day of operation or as frequently as possible with compacted layer which restricts the access of insects, rodents and other animals, it also isolates the refuse thereby minimizing the amount of surface water entering into the gas that is escaping from the waste.

Disposing of waste in a landfill involves burying waste to dispose of it, and this remains a common practice in most countries. Landfills were often established in disused quarries, mining voids or borrow pits. A properly-designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly-designed or poorly-managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate. Another common byproduct of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. This gas can create odor problems, kill surface vegetation, and is a greenhouse gas. Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin (such as mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas

is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity. (Botkin; Keller 2005)

2.10 Environmental Impacts and Health Hazards of Solid Waste.

2.10.1 Waste Pollution

Waste pollution is defined as the degradation of the quality of the environment by introduction of pollutants resulting from different types of waste and waste management practices. Typical materials that are found in household waste which have specific environmental impacts with them include biodegradable wastes, batteries, aerosols, oils, acids and fluorescent tubes.

Biodegradable waste such as food waste or sewage is broken down naturally by microorganisms either aerobically or anaerobically. If the disposal of biodegradable waste is not controlled it can cause a number of wider problems including contributing to the release of methane a potent greenhouse gas leading to climate change and can impact upon human health via encouragement of pathogens. Fires periodically break out in open dumps, generating smoke and contributing to air pollution. In the Mexican city of Tampico, on the Gulf of Mexico coast, for instance, a fire burned for over six months at the local open dump. Fires at open dumps often start spontaneously by the methane and heat generated by biological decomposition.

Other forms of pollution associated with waste materials include illegal dumping and leaching. Illegal dumping or fly-tipping often involves unregulated disposal of materials on private or public land. Remote sites with road access coupled with limited surveillance often provides the perfect opportunity for this form of dumping which often goes unpunished and leaves others (such as the community or developer) to properly dispose of the waste. Leaching is the process by which contaminants from solid waste enter soil and often ground water systems contaminating them.

2.10.2 Potential Health Hazards.

Some of the health problems associated with poor water quality arising from inadequate waste disposal and waste management practices include typhoid fever, diarrhea, cholera, hepatitis, hook worm infestation, skin diseases, malaria etc. (Chukwuekezie ,1998;Ekugo ,1998)

Waste dumps are unsanitary and destroy the aesthetic appeal of the environment. The harbor flies, fleas, mosquitoes, rats and other disease vectors. Some diseases carried by rodents and insect vectors include Lassa fever, malaria, filiariasis, yellow fever etc. these areas provide food, water, and habitat and breeding areas for these disease-carrying agent.

Pollution of rivers and lakes results in extensive fish kills and destruction of other forms of aquatic life due to an increased organic load and the concomitant depletion of dissolved oxygen in the water. When fish or other aquatic organisms are not immediately killed they accumulate pollutants, which are eventually transferred to man via the food chain (Ajiwe et al 2000). Airborne pollutants and noxious gases produced from refuse dumps contribute to the increased pulmonary diseases among the populations near dump sites, as well as degradation of the physical environment.

CHAPTER THREE

.0 MATERIALS AND METHODS

.1 Data Collection

n sourcing for information for an in-depth study of the Solid Waste Management in Kubwa, the llowing instruments were adopted; formal and informal interviews, questionnaire dministration, interest group discussions, fieldwork and observations.

questionnaire was designed, for the people living in Kubwa. The questionnaire was structured such a way, that respondents can easily respond by ticking from the alternatives given in the estionnaire. A visual survey of the study was also carried out; this is to observe at first hand lid waste disposal, collection and various points of indiscriminate dumpsites. Photographs ere taken to support the argument in the research.

2 Sources of Data

vo major sources of data were used; the primary and the secondary source.

rimary source: These were the data the author collected directly from the field; while secondary urce: Includes the data collected from already existing work both published and unpublished; aterials gotten from the library, textbooks, journals, newspapers, Magazines, the internet and o, from interactions of the author with other people during the course of the study.

Instruments Used in data collection

following instruments were used during the collation of data.

asuring Tape; Scale and Pan; GPS; Ropes; Waste collection bags

3.4 Sample Size

Stratified random sampling was used as Kubwa was divided into 3 namely the Low, Medium and High density areas, each of these areas were further divided into 3 wards making a total of 9 wards. 30 households were selected from each of the wards, a total of 270 household were studied. Also waste was collected for weighing and sorting from 27 households which represent 1/10 of the sample size.

3.5 Methods of Analysis

The data was represented on frequency tables and analysis was done with the use of simple percentages.

3.6 Procedure for Data Collection

To enable an organized sampling procedure, Kubwa was divided into 3 basic groups putting into consideration the low, medium and high-density areas, For a more detailed and thorough analysis each of these groups were further divided making a total of 9 wards that were considered for the sample collection and data analysis. Phase 4, Phase 3, FCDA owner occupier quarters, P.W, Phase 2 Site 1 and Phase 2 Site 2, Kubwa Village, Byazhin Across, Shelter Farm.

In line with the objectives of the study the following approach was used for data collection.

Objective 1: To determine the quantity and nature of the waste generated within Kubwa; 3 houses were randomly selected from each of the wards mentioned above making a total of 27 houses for the sample collection. These were carried out with the help of a team of scavengers/cart pushers that handle the solid waste collection of these areas and the 100% response was recorded. Waste collection bags were provided for each scavenger/cart pusher and the waste was collected over a period of one week, after which weighing and sorting was done at the scavengers site to determine the nature and quantity of the waste generated.

Objective 2: To identify the location and distribution of the refuse dumps within Kubwa; with the aid of a GPS a total of 19 locations were identified these locations were also photographed and the points were later plotted on a map of Kubwa for better viewing of the distribution. The length, breadth and height of each dumpsite was measured with a tape measure, these were used to estimate the areas and volumes of the solid waste contained in each dumpsite.

Objective 3: To determine the existing waste management practices and facilities within Kubwa; A visit was made to Bwari Area Council and the department of solid waste management, formal and informal interviews were held with the employees of the department and their views about the challenges they face in executing their duties were documented. Also, observations were made by the researcher of the environment and data collection methods and storage system.

A questionnaire was designed to capture basic information required to establish the existing procedure and possible challenges and opinions of the residents for a better solid waste management practice, Copies were distributed to 30 randomly selected houses within the 9 wards making a total of 270 questionnaires. The questionnaires were given to the head of households or their spouse, wherever this does not apply, an adult who has enough knowledge of the topic in the house was given., these were further compared with findings on the best practices that were sourced from published works and unpublished works with relevance to waste management, such materials include but not limited to textbooks, journals, thesis, newspapers, seminars and several websites on the internet. Oral interviews were however conducted for the 5 groups of scavengers that were discovered within Kubwa, their opinions and views were also documented as most of them were not literate.

CHAPTER FOUR

RESULTS

Analysis

his chapter analyses the data extracted from a total of 182 questionnaires which were retrieved t of the 270 questionnaires distributed, it also records the findings from the oral interviews, cussions, observations as well as waste sample collected during the study. The analysis is sed on the objectives of this study which are: to determine the quantity and nature of waste in bwa; the location and distribution of refuse dumps; assessment of existing waste management ctices and facilities within Kubwa. The results are presented in form of frequency and centage tables, maps, photo plates serve as support to the findings of the study.

4.2 Nature and Quantity of Waste

This section determines the average household size per area as well as the nature and quantity of waste generated in these areas. It also relates the quantity of waste generated to the average household size.

Table 4.1: Number of People per Household in the Study Area

AREAS	1 TO 5	6 TO 10	11 AND ABOVE	TOTAL NO OF PEOPLE IN HOUSEHOLDS	AVERAGE PERSON(s) PER HOUSEHOLD
PHASE 3	19	0	0	59	3
PHASE 4	25	0	0	74	3
FCDA	14	0	0	46	3
PHASE 2 SITE 1	7	4	0	61	6
PHASE 2 SITE 2	20	6	0	147	6
P/W	15	5	1	124	6
KUBWA VILLAGE	4	10	0	107	8
BYAZHIN ACROSS	1	7	19	362	13
SHELTER FARM	2	8	15	381	15
TOTAL	**107**	**40**	**35**	**1361**	**63**
PERCENTAGE	**59**	**22**	**19**		

Source: Field work

From table 4.1 above 59% of the responses had between 1-5 people living per house, 22% of the responses had between 6-10 people, while 19% had 11 people and above residing in the houses. A total of 1,361 people were found to live in the houses with an average of 3 person(s) per household in the low density(high income)areas which constitute of Phase 3, Phase 4 and FCDA, 6 person(s) in the medium income areas which are Phase2 Site 1, Phase 2 Site 2 and PW. Variations were however, seen in the average household size of the neighbourhoods in the high density(low income areas) with an average of 8, 13 and 15 person(s) in Kubwa Village, Byazhin

Across and Shelter Farm respectively. These variations were due to the fact that residents have resolved to sublet rooms within their houses to cushion the high cost of accommodation. And each of these rooms houses a whole family.

Table 4.2 : Solid Waste Collected Along Population Density in Kubwa Satellite Town

	Low Density Population			**Medium Density Population**			**High Density Population**		
Areas	**Phase 3**	**Phase 4**	**FCDA**	**PHASE 2 SITE 1**	**PHASE 2 SITE 2**	**P/W**	**KUBWA VILLAGE**	**BYAZHIN ACROSS**	**SHELTER FARM**
NO OF HOUSES	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
WEIGHT OF REFUSE	**12KG**	**13KG**	**34KG**	**64KG**	**40KG**	**18KG**	**87KG**	**21KG**	**16KG**
NATURE OF REFUSE	Polythene Bags, Cans, Fruit peel, hair attachments, Irish potatoes Peels and Vegetables, Food Materials	Old clothing, Cans, Weaveons and attatchments, Plastic, containers, Wires.	Fruit peels, cans, Yam peels, polythene bags. Plastic bottles, beverage cans, cartons	Food Materials, paper, cartons	Food Materials, Old shoes and clothing, Broken Plastics	Rice Chaff, vegetables, milk tins, sugar cane peels, old clothes	Fruit and vegetable , yam peels and food remnant	Plastic bottled, yam peels, old shoes, paper, nails	Paper, old clothes and shoes, metal scarps, polythene bags

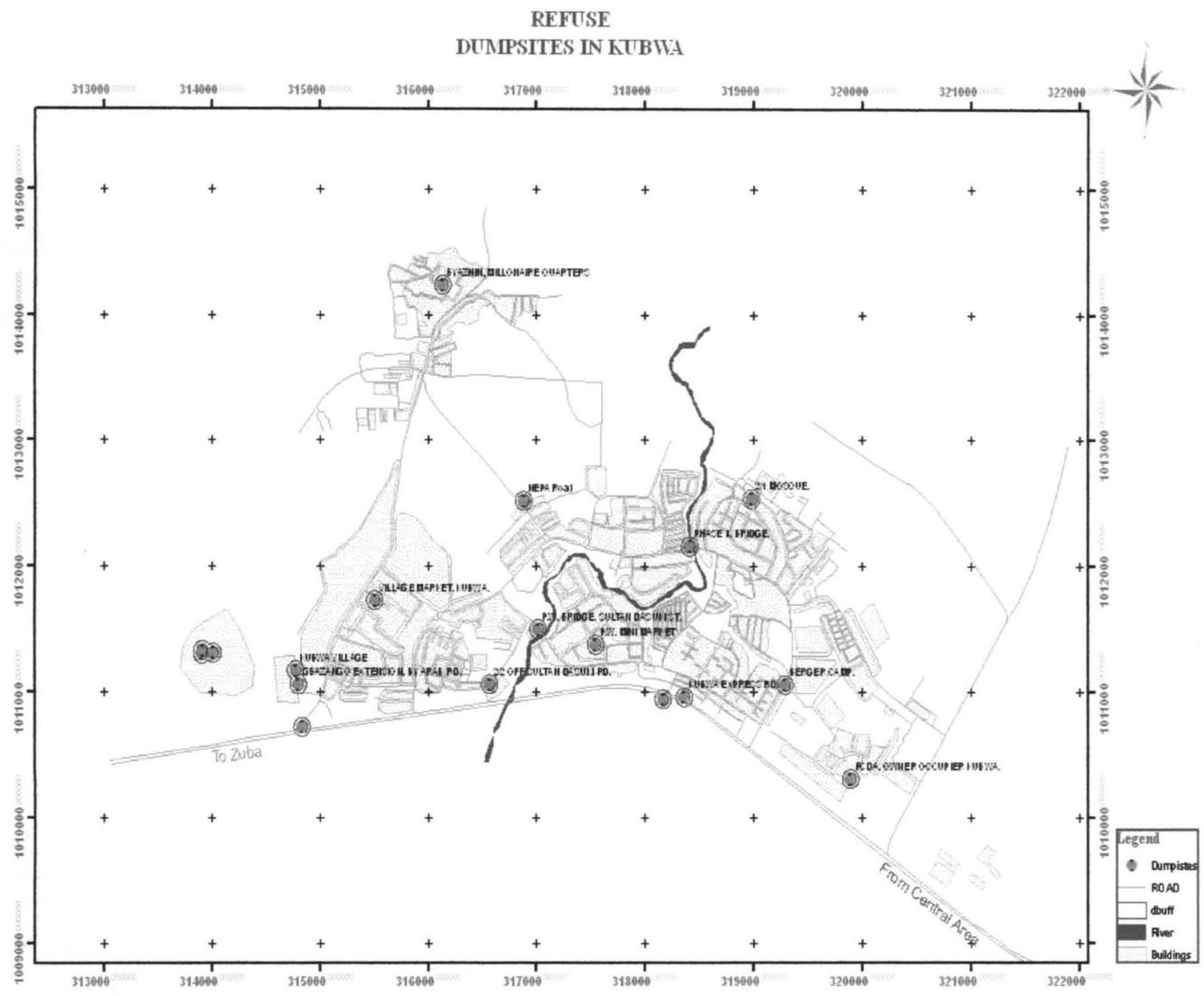
Source: Field work.

Table 4.2 Records the outcome of the random sampling of waste along Low,Medium and High population density of 9 areas within kubwa. This table has the cummulative weight of solid waste collected from 3 houses per area making a total of 27 houses for the 9 wards. The waste was sorted out to determine the nature of the solid waste for each area. Domestic waste was found to be the most predominat nature of waste that characterise the refuse of those living in the high density areas, while the low and medium density areas had a lot of cans, beverage containers and plastic container as well as domestic waste.

the low and medium density areas, rather the result shows that those living in the High density (low income) areas would rather buy the type of food that would have little or no waste such as yams, garri and vegetables. As against those living in the low and medium(high Income) areas who would patronise the fast food joints that serve meals in take away containers, they bought canned food and beverages as revealed in the nature of refuse that were collected from these areas. The residents of the high density areas were found to do a lot of recycling activities to save cost and to generate additional income, They also feed their domestic animals the peels of their food discarding only what they cannot scavenge which is mainly food materials that easily decompose, while those living in the low and medium density areas simply throw out all their waste as evidenced in the high quantity of cans, plastics, toys and polythene bags that dominate their waste baskets.

4.3 Location and Distribution of Refuse Dumps within Kubwa

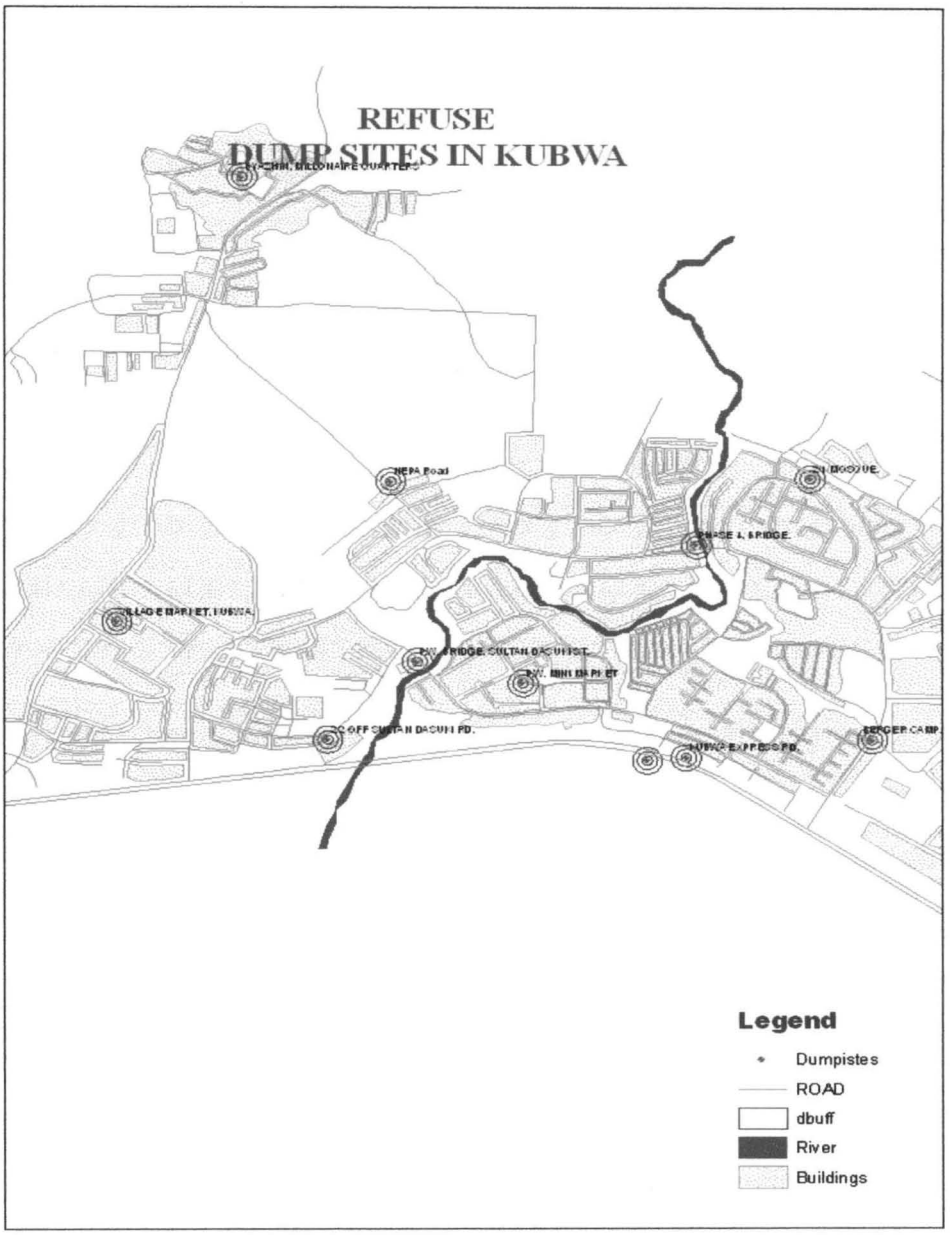
With the aid of a GPS the coordinates of 19 refuse dumps within kubwa were identified (table 4.4.) The 19 coordinates were plotted on a map of kubwa for better viewing of the distribution. (Figure 4.1 and Figure 4.2)



Scale: 1:30000

Figure 4.1: The distribution of refuse dumps within Kubwa (using coordinates from Table 4.5 above)

Source: Goggle Earth and Field work.



Scale: 1:30000

Figure 4.2: The Buffed Refuse Dumps within Kubwa (using coordinates from Table 4.5 above)

Source: Goggle Earth and Field work.

4.4 Existing Waste Management Practice and Facilities:

This section assesses the waste disposal practices and facilities available within Kubwa.

Table 4.5: Refuse Disposal Methods

AREAS	OPEN AIR BURNING(A)	OPEN DUMPING(B)	INCINERATION(C)	DRAINAGE(D)	OTHERS	TOTAL
PHASE 3	5	10	0	4	0	**19**
PHASE4	1	13	0	11	0	**25**
FCDA	2	8	0	3	1	**14**
PHASE 2 SITE 1	3	6	0	2	0	**11**
PHASE 2 SITE 2	2	20	0	3	1	**26**
P/W	0	11	0	10	0	**21**
KUBWA VILLAGE	0	9	0	5	0	**14**
BYAZHIN ACROSS	0	19	0	8	0	**27**
SHELTER FARM	0	17	0	8	0	**25**
TOTAL	**13**	**113**	**0**	**54**	**2**	**182**
PERCENTAGE	**7**	**62**	**0**	**30**	**1**	**100**

Source: Field work

In table 4.5 the major method of waste disposal was found to be open dumping which accounts for 62% of the total response,this represents the most common practice among the low and medium density areas , 30% of the respondents dump their refuse in the drainage while, 7% practice open air burning and 1% use other methods. From the study it was also found that the most predominant method of waste disposal was open dumping (plate I – XIV), dumping in drainages and open burning were also practiced. These practices were found to be due to the fact that there was no sanitary facility provided within the areas.

Table 4.6: Promptness of Waste Disposal

AREAS	YES	NO	TOTAL
PHASE 3	15	4	**19**
PHASE4	10	15	**25**
FCDA	3	11	**14**
PHASE 2 SITE 1	3	8	**11**
PHASE 2 SITE 2	2	24	**26**
P/W	19	2	**21**
KUBWA VILLAGE	10	4	**14**
BYAZHIN ACROSS	9	18	**27**
SHELTER FARM	5	20	**25**
TOTAL	**76**	**106**	**182**
PERCENTAGE	**42**	**58**	**100**

Source: Field work

Table 4.6 shows that 42% of respondent dispose their waste immediately these represents people living in the low and medium density areas such as Phase 3 and PW, while the 58 % that do not dispose their waste immediately are mainly from the high density areas such as Shelter Farm and Byazhin Across .

Table 4.7: Methods of Waste Storage

AREAS	WASTE BASKETS	POLYTHENE BAGS	SACKS	DRUMS	NON-SPECIFIC	TOTAL
PHASE 3	10	9	0	0	0	**19**
PHASE4	15	7	2	1	0	**25**
FCDA	7	5	1	1	0	**14**
PHASE 2 SITE 1	5	3	3	0	0	**11**
PHASE 2 SITE 2	8	9	6	3	0	**26**
P/W	8	5	6	2	0	**21**
KUBWA VILLAGE	1	2	7	4	0	**14**
BYAZHIN ACROSS	5	2	20	0	0	**27**
SHELTER FARM	0	13	12	0	0	**25**
TOTAL	**59**	**55**	**57**	**11**	**0**	**182**
PERCENTAGE	**32**	**30**	**31**	**6**	**0**	**100**

Source: Field work

From the table above, 32% of the respondents store their waste in baskets, 30% use polythene bags, 31% in sacks while 6% use drums. The low and medium density areas store most of their waste in baskets and polythene bags which can be related to their living standard which they find convinient when disposing their refuse while, the high density areas store mainly in sacks as they would rather recycle their polythene bags.

Table 4.8: Frequency of Waste Disposal

AREAS	DAILY	EVERY OTHER DAY	WEEKLY	MONTHLY	TOTAL
PHASE 3	4	5	10	0	**19**
PHASE4	6	10	9	0	**25**
FCDA	1	7	6		**14**
PHASE 2 SITE 1	1	3	7	0	**11**
PHASE 2 SITE 2	3	8	15	0	**26**
P/W	3	10	8	0	**21**
KUBWA VILLAGE	1	7	5	1	**14**
BYAZHIN ACROSS	0	15	10	2	**27**
SHELTER FARM	1	10	11	3	**25**
TOTAL	**20**	**75**	**81**	**6**	**182**
PERCENTAGE	**11**	**41**	**45**	**3**	**100**

Source: Field work

Table 4.8 Records that 45% of the respondents dispose their waste weekly these percentage cuts across people living in all areas, 41% every other day , 11% daily and 3% monthly. This results reveals how long the residents stored their waste within their houses before disposing it outside. Majority of the people living in the low and Medium density areas dispose their waste weekly while the high density areas dispose every other day.

4.5 Stakeholders to Manage Waste

This section identifies those responsible for waste collection and disposal in Kubwa, also it determines the willingness of the residents to pay for services rendered.

Table 4.9: Stakeholders in Charge of Refuse Collection

AREAS	AREA COUNCIL	SCAVENGERS	COMMUNITY	OTHERS	NONE	TOTAL
PHASE 3	5	10	4	0	0	**19**
PHASE4	8	14	3	0	0	**25**
FCDA	5	6	2	0	1	**14**
PHASE 2 SITE 1	4	5	2	0	0	**11**
PHASE 2 SITE 2	10	12	3	0	1	**26**
P/W	6	11	4	0	0	**21**
KUBWA VILLAGE	5	9	0	0	0	**14**
BYAZHIN ACROSS	2	17	3	5	0	**27**
SHELTER FARM	5	17		3	0	**25**
TOTAL	**50**	**101**	**21**	**8**	**2**	**182**
PERCENTAGE	**27**	**55**	**12**	**4**	**1**	**100**

Source: Field work

Based on the results above 55% of waste is collected by the Scavengers, 27% by the Area council,12% by community efforts, 4% others and 1% none. Majority of the households patronise the scavengers who double as cart pushers for their refuse collection (plate II - III). While, the area council which is solely responsible for waste disposal within Kubwa handles just about 27%.This could be due to the fact that the Area Council is understaffed, overwhelmed, lack waste collection equipment, and is inadequately funded while, the services of the cart pushers/scavengers are readily available and affordable.

The Waste Management Department of the Bwari Area council is solely responsible for managing the solid waste in Kubwa, and discussions with the staff of these department revealed

the following: The previous FCT administrator Mallam Nasir El-Rufai had tried a Public Private Partnership (PPP) with four waste companies, which were paid for four months, to test run the collection and transportation of waste from the residents of Kubwa. It was a success, while the council paid for their services, but the companies left as they failed to generate enough money from the services they rendered to the residents. The department lacked equipment, manpower and funding. They have only one pail loader and whenever they needed to clear out any of the area that was clogged with refuse, they often had to hire an open truck and labourers for that days' work. They also expressed their concern that the department was not given the attention it required, as the Nigerian mentality that Waste is not a challenge.

During the course of the research five scavenging groups (Gidan Bola) were discovered within and around Kubwa. Discussions with the scavengers revealed the following concerns: These scavengers have only push carts and sacks as the tools that they use, and they access most of the areas on foot, these limits the amount of waste they can convey to the dumpsites and clearly shows their lack of capacity as they only collect the waste they think can generate substantial income for them, while a greater amount of the waste remains uncollected. A lot of recycling activity was found within the scavengers dens and they said that they had high patronage from companies coming from as far as Kaduna for their products. Tools such as weighing scale were seen to be hanging from trees where the weight of the recycled products was taken to determine price. It was also observed that they did not have any protective clothing, and they live within the dumpsite, which exposes them to a greater health hazard. The scavengers were of the opinion that the government was not giving them the necessary attention they deserve despite the vital role they played in the economy of the country, as was done in other countries where protective clothing, booths, gloves and nose masks where given to the refuse collectors.

Table 4.10: Payment for Waste Collection

AREAS	YES	NO	TOTAL
PHASE 3	11	8	**19**
PHASE4	16	9	**25**
FCDA	9	5	**14**
PHASE 2 SITE 1	3	8	**11**
PHASE 2 SITE 2	14	12	**26**
P/W	12	9	**21**
KUBWA VILLAGE	4	10	**14**
BYAZHIN ACROSS	4	23	**27**
SHELTER FARM	5	20	**25**
TOTAL	**78**	**104**	**182**
PERCENTAGE	**43**	**57**	**100**

Source: Field work

From the table above 57% of the respondents do not pay for refuse collection which represents mainly people living in High density areas and some people living in medium density areas ,while 43% of the respondents that pay for refuse collection are mostly from the low density areas. This further explains the prevelance of illegal dumpsites, being that it cost nothing to throw your waste at any available place.

Table 4.11: Amount Paid for Service Charge

AREAS	N20-N250	N250-N500	N500-N1500	DEPENDANT ON QUANTITY	NO RESPONSE	TOTAL
PHASE 3	7	2	1	1	0	**11**
PHASE4	8	5	1	2	0	**16**
FCDA	6	2	0	0	1	**9**
PHASE 2 SITE 1	3	0	0	0	0	**3**
PHASE 2 SITE 2	12	1	0	0	1	**14**
P/W	9	1	0	2	0	**12**
KUBWA VILLAGE	1	0	0	1	2	**4**
BYAZHIN ACROSS	1	0	0	0	3	**4**
SHELTER FARM	0	0	0	3	2	**5**
TOTAL	**47**	**11**	**2**	**9**	**9**	**78**
PERCENTAGE	**60**	**14**	**3**	**12**	**12**	**100**

Source: Field work

Table 4.11 reveals that 60% of the respondents pay between N20-N250, 14% pay between N250-N500, 12% pay depending on quantity of waste, another 12% did not respond, while 3% pay between N500-N1500. The people living in the low density and medium density areas are the majority of the people who pay for waste collection while those living in the high density areas do not pay for waste collection even thou they could pay as low as N20. The amount that the people pay further gives an idea about the quality of waste management services rendered as the amount is so small which explains why no private firm was found rendering such services and further confirms the findings from the area council about the inability of the private firms to sustain the rendering of these services after the government stopped funding them.

Table 4.12: Willingness to Pay for Service Charge

AREAS	YES	NO	TOTAL
PHASE 3	11	8	**19**
PHASE4	16	9	**25**
FCDA	9	5	**14**
PHASE 2 SITE 1	3	8	**11**
PHASE 2 SITE 2	14	12	**26**
P/W	12	9	**21**
KUBWA VILLAGE	4	10	**14**
BYAZHIN ACROSS	4	23	**27**
SHELTER FARM	5	20	**25**
TOTAL	**78**	**104**	**182**
PERCENTAGE	**43**	**57**	**100**

Source: Field work

Out of the 104 respondents that do not pay for waste collection, Table 4.12 captures the willingness of these respondents to pay for such services. 54% of the respondents were willing to pay for waste collection, while 46% are not. The wilingness to pay for waste collection was found to be high for all areas as the seen by the percentages. However, the majority of those that were not willing to pay were from the high density areas and the reason for that was largely because they earned very little and would rather channel such resources to other needs they considered pressing.

4.6 Community Participation in Solid Waste Management in Kubwa

This section determines the degree of community participation in solid waste management.

Table 4.13: Area Meetings for General Well Being

AREAS	YES	NO	NO RESPONSE	TOTAL
PHASE 3	6	11	2	**19**
PHASE4	3	13	9	**25**
FCDA	3	11	0	**14**
PHASE 2 SITE 1	1	10	0	**11**
PHASE 2 SITE 2	6	20	0	**26**
P/W	9	12	0	**21**
KUBWA VILLAGE	2	12	0	**14**
BYAZHIN ACROSS	3	24	0	**27**
SHELTER FARM	5	20	0	**25**
TOTAL	**38**	**133**	**11**	**182**
PERCENTAGE	**21**	**73**	**6**	**100**

Source: Field work

Table 4.13 determines the level of cooperation that exist between the residents by looking out for organised avenues were issues discussed regarding their general well being, based on their responses only 21% had such meetings while, 73% of the respondent did not have an avenue for such discussions , 6 % did not respond to the question. From the results above, the community based organisations do not exist in most areas. Hence Community participation was found to be very low as no avenues where designed to meet, discuss and resolve issues that bother on the general well being of the residents.

Table 4.14: Sanitation Exercise Arrangement

AREAS	YES	NO	TOTAL
PHASE 3	6	13	**19**
PHASE4	3	22	**25**
FCDA	3	11	**14**
PHASE 2 SITE 1	1	10	**11**
PHASE 2 SITE 2	6	20	**26**
P/W	2	19	**21**
KUBWA VILLAGE	5	9	**14**
BYAZHIN ACROSS	2	25	**27**
SHELTER FARM	3	22	**25**
TOTAL	**31**	**151**	**182**
PERCENTAGE	**17**	**83**	**100**

Source: Field work

From the table above 83% of the respondent do not have an arrangement for sanitation exercise ,while 17% do. Most areas do not organise sanitation excercises. This is due to the general believe that the sanitation of the environment should be solely the responsibility of the government which explains prevalence of illegal refuse dumps that litters the town (plates I-XIV). They however, believe that provision of more waste containers is the best way, to alleviate the problem of waste disposal. Some however, recommended the provision of incinerators to solve the problem.

Table 4.15: Frequency of Sanitation Exercise

AREAS	WEEKLY	MONTHLY	OTHERS	NO RESPONSE	TOTAL
PHASE 3	2	3	0	1	**6**
PHASE4	1	2	0	0	**3**
FCDA	0	3	0	0	**3**
PHASE 2 SITE 1	0	1	0	0	**1**
PHASE 2 SITE 2	2	1	1	2	**6**
P/W	0	2	0	0	**2**
KUBWA VILLAGE	0	5	0	0	**5**
BYAZHIN ACROSS	0	2	0	0	**2**
SHELTER FARM	1	2	0	0	**3**
TOTAL	**6**	**21**	**1**	**3**	**31**
PERCENTAGE	**19**	**68**	**3**	**10**	**100**

Source: Field work

The table above shows that out of the 31 respondents that organise sanitation excersices 68% of the respondent do a monthly sanitation exercise,19% weekly,3% others while 10% did not respond to the question. The majority of the people that participate in sanitation excercises are from the low density areas.This revealed that the monthly sanitation excersices were actually those mandated by the government on the last Saturday of every month.

Table 4.16: Willingness to Participate in Sanitation Exercise

AREAS	YES	NO	TOTAL
PHASE 3	11	2	**13**
PHASE4	19	3	**22**
FCDA	9	2	**11**
PHASE 2 SITE 1	8	2	**10**
PHASE 2 SITE 2	18	2	**20**
P/W	18	1	**19**
KUBWA VILLAGE	7	2	**9**
BYAZHIN ACROSS	22	3	**25**
SHELTER FARM	22	0	**22**
TOTAL	**134**	**17**	**151**
PERCENTAGE	**89**	**11**	**100**

Source: Field work

Table 4.16 shows that out of the 151 respondents that do not have an organised sanitation exercises, 89% of the respondent are willing to participate in the sanitation exercise. This percentage cuts across people from all areas under considerations. While, 11% are not willing to participate. The high percantage in the willingness of the people to participate in sanitation exercises indicates that an awareness campaign to educate people on the effects of solid waste on the residents would be welcomed and possibly the establishment of community based organisations.

Plate I : Bags of refuse dumped along the Kubwa expressway.

Plate II : A scavenger dumping waste on the illegal refuse dump along Kubwa expressway.

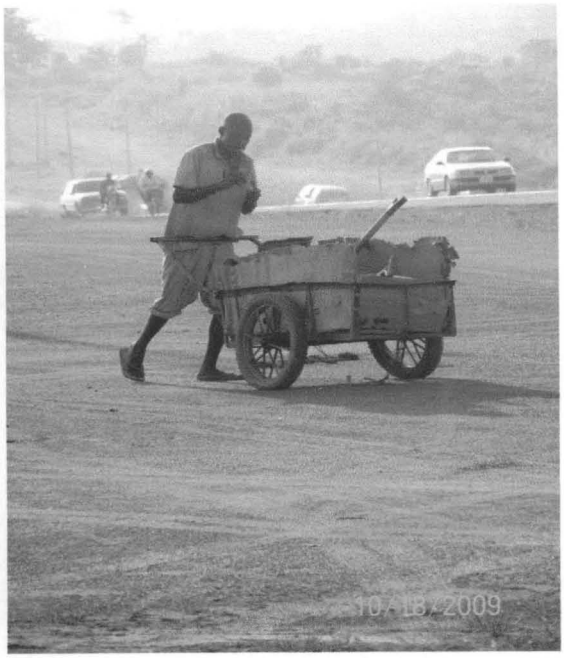


Plate III : A scavenger at work

Plate IV: Area Council Refuse Bin in Kubwa Phase 4.

Plate V: An illegal dumpsite in Kubwa

Plate VI : A drainange turned into a dumpsite along Federal Housing Junction.

Plate VII: A dumpsite near residential area in Kubwa Village.

Plate VIII: Waste sorted into glass bottles and plastic bottles

Plate IX : A scavenger sorting solid waste colected.

Plate X: Metals separated from waste collected.

Plate XI:Shoes sorted from solid waste collected by scavengers.

Plate XII: A dumpsite with various kinds of sorted solid waste

Plate XIII: Dumpsite within Kubwa village Slum.

Plate XIV:The Researcher with a team of Scavengers around Nepa Road Kubwa

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In this chapter, the summary of findings, conclusion and recommendation are presented.

5.1 Discussion

The study set to achieve the following objectives: to determine the quantity and nature of waste generated within Kubwa, to examine locations and distribution of refuse dumps within Kubwa, to assess the existing waste management practices and facilities within Kubwa and to recommend possible solutions.

During the study the average quantity of waste generated per person for the low density (high income) areas was found to be 2.07kg and the average household size was found to be 3, the medium density areas generated 2.41kg as the average waste per person and the average household size for these areas was found to be 6 while, the high density (low income) areas were found to generate an average of 1.56kg with household sizes varying from 8, 13 and 15. The reason for these variations is the sublet/squatting practices found in the high density areas to cushion the high cost of accommodation within the Federal Capital Territory.

Based on these a relationship was found to exist between the average household size and the quantity of waste generated per person. As the people in the low density areas tend to generate more waste than those living in the high density areas.

The nature of waste that were found in the refuse collected from the people living in the low and medium density areas was characterised with a lot of plastics, cans, toys, old shoes and clothes, bottles and food remnants, while, the refuse from the high density areas was mainly characterised

with more of yam peels ,vegetables a few plastics. These reveals the habits of the residents as those living in the low and medium density areas were found to earn higher incomes and could afford certain luxuries such as patronising fast food joints and carrying their food in takeaways containers, juice packs, soft drinks cans and bottles, bottled water and lots of wigs and Hair attachments all of which they discard into their waste bins and could be seen as being wasteful. While, those living in the high density (low income) areas were found to do a lot of recycling of their plastic containers, reuse of their hair attachments, selling any container they don't need at home to get additional income, and what eventually gets to their waste baskets are the things that cannot fetch any additional value to them.

The location and distribution of refuse dumps within Kubwa was found to be sporadic as about 19 locations were identified with 10 located in areas classified as low density (high income) areas and 4 locations identified in the medium density areas while, 5 locations were identified in the high density(low income) areas. Though more refuse dumps were identified in the low density areas their cumulative volumes was a lot smaller than those of the high density (low income) areas. This could be due to the fact that most dumpsites are located within the neighbourhoods of the urban poor, an argument that Bernstein (2004) raised were he said that waste dumpsites are located near vulnerable communities, also those from the low density (high income) areas could afford to pay for their waste to be collected and disposed off at the dumpsites located in the high density(low income) areas confirming the point raised by Chris Zurbrugg that as income of the residents increases, part of the wealth is used to avoid exposure to environmental problems at the household or neighbourhood levels. So those from the high density (low income) areas are stock with these conditions. This should be of great concern as this condition of living exposes the residents to life-threatening conditions that bother on their

health a point also raised by chris zurbrugg, being that these dumpsites serve as breeding ground for rodents and insects that spread disease . Kubwa is transversed from the north east to the south west by Usuma River which is dammed and provides water to the federal capital territory, Great attention should be given to the problem of indiscriminate dumping , because as these practices of uncontrolled dumpsites persists pollution of water and air resources abound, also flooding due to blocked drainages and diseases outbreaks that are similar to the Bubonic plaque, cholera and typhoid fever that altered the populations of Europe as recorded by Barbalace (2003) could occur not forgetting the devaluation of the aesthetic values of the environment.

In assessing the existing waste management practices and facilities within Kubwa, it was found that sanitary facilities do not exist; this is a major setback from the initial planning of the satellite town. The Area council was found to handle just about 27% of the waste collection within Kubwa most of which was done by placing bins within the Low and medium density areas, and often times these bins were left overflowing with garbage as the waste management department lacked the basic facilities and manpower to collect and dispose these wastes. Based on the discussion the author had with the employees of the department, waste management methods of collection and transportation is still a major challenge due to funding, so other waste management methods such as composting, incineration sanitary landfills would be too expensive for them to practice except the government came to the aid of the department, hence they resolved to open dumping whenever they were able to organise these exercises.

Open dumping was found to be the most prominent waste disposal method that the residents adopted as they are left to fend for themselves, they patronise the scavengers and cart-pushers that control 55% of the waste collection at a low fee. These scavengers sort out the wastes to

identify items that could earn them money, and then they discard the rest at any available place. This makes Kubwa prone to flooding, air, water and land pollution as well as the outbreak of epidemics. Also, public awareness was found to be absent, as the waste management department do not organise any public campaigns to enlighten the people. The scavenger's place in the solid waste management of Kubwa ranks top, as this means of livelihood provides income for the unemployed based on this the Author agrees with Medina (1995) that organising them into micro-enterprises or cooperatives or the formation of public-private partnership with the area council would help them achieve a decent income and improve their working conditions, resulting in grassroots development.

In all this one wonders the role of government and its policies and the implementation of such policies. According to the then Honourable Minister of State for Environment, Federal Ministry of Environment Abuja, Nigeria Dr. Otukong Imeh T. Okopido in his article titled Environmental Pollution An Emerging Health Hazard in The Nigerian Journal of General Practice volume 7 No. 1, 2002. The Federal Government is very conscious of the environmental problems that are inimical to the health of her citizens as this consciousness informed the creation of the Federal Ministry of Environment in 2002. He also said it lead to the development of the National Environmental Health Action Plan (NEHAP) which shows the nations commitment to ensuring a safe and healthy environment. And was expected to bring together the many faces of environmental health policies and provide an overview of plans for the future. It was also to light the way for environmental health delivery by providing the framework for actions by national, state and local governments industry and NGO's to improve the environment to the benefit of the health and quality of life of the populace. All these were poised to meet the environmental challenges of the 21st Century effectively.

National policies such as the Nigeria's National Policy on Environment (1989) which had the aim of: securing the quality of the environment for the health and wellbeing, conserving and using the environment and natural resources for the benefit of the present and future generations and to promote public awareness on the link between development and the environment.

The Nigerian Legislation is not left behind as recorded by Ifeanyi Anago (2002) he states that the 1999 constitution captures the following; Section 20: "The State shall protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria".

Article 24: "All peoples shall have the right to a general satisfactory environment favourable to their development."

Harmful wastes (Special Criminal Provisions) Act Cap 165. This law was the immediate reaction of the dumping of toxic waste product in Nigeria in 1988, otherwise known as the Koko incident subsequently the Federal Military Government promulgated the Federal Environmental Protection Agency (FEPA) Decree No. 58 of 1988 (now Cap 131) for the first time an agency was set to oversee the environment with specific powers to establish such environmental criteria, guidelines, specifications or standards for the protection of the nation's air, inter-state water as may be necessary to protect the health and welfare of the population from environmental degradation (6) FEPA also has the responsibility for setting standards for water quality, noise control, effluent limitation, ozone layer protection and control of hazardous substances. Also according to Osuocha (1999) the Federal Government fully adopted the United Nation's proposal for the establishment of country level collaboration on water supply and sanitation as a result of which a workshop was held in December 1998 at Abuja, Nigeria to begin the process of developing a National Sanitation Policy which would address issues concerning institutional

arrangements, implementation approaches, guidelines for collection, transportation and final disposal as well as specification for preparing landfill sites among other things. It was hoped that when all was set refuse management would become the responsibility of a separate agency such as the municipal authority with the involvement of private participation especially in the area of land filling. It believed the concentration of all sanitation activities to one agency ignores the magnitude of the work required in refuse management. The municipal authorities should be empowered to handle refuse as part of their responsibility. This obviously informed the decision that made Bwari Area Council in charge of solid waste management in Kubwa. However, the empowerment of the Council to tackle waste was left out as they still battling with funding.

Generally the implementation of policies is an area that was found wanting as enough policies abound to cater for the needs of the people as regards the safety of their environment.

5.2 Conclusion

Solid waste management within Kubwa was found to be very poor, the inadequacy of waste management facilities in the area has contributed in no small way to; the indiscriminate dumping of refuse by the residents, illegal dumping of waste on the streets, even to the extent of dumping refuse close to residential quarters and some in drainages, (Plate VI, VII and plate XIII). The absence of regulated waste collector scheme is also a major factor in waste management within the area. This has led to the prevalence of scavengers, who collect refuse from households in the area, either at a fee or free. These scavengers are not under the area council, they often contribute to the dumping of waste in unauthorized sites. Most of the scavengers depend on money made from selling solid waste such as metals, plastics, rubber to sustain their livelihood. In their efforts to get these wastes, they sort the solid waste into various types, and often empty waste bins

legalized by the area council. The Area council was found to be understaffed, not adequately funded and was overwhelmed with the challenges of managing waste in Kubwa. They lacked the basic equipment needed to handle waste collection and disposal and no sanitary facility was found within the area. Community participation and general awareness of the effects of solid waste on the health and aesthetics of Kubwa was found to be very low, as waste management was relegated to the background and not given the attention received by other basic amenities such as electricity or water supply where communal efforts were made to resolve issues.

5.3 Recommendation

The following are the recommended solutions for the problems of Solid Waste Management in Kubwa Satellite Town.

- The provision of solid waste facilities, which will be accessible to the residents of Kubwa such as; Placement of more disposal bins within the areas and engaging the services of bodies that would be involved in collection and transportation to the recommended disposal sites.
- The Area Council should collaborate with Non-Governmental Organisations to get the Scavengers organized, since they already have a structure on ground, and close monitoring and evaluation of their activities could be done. While, Provision of basic protective clothing should be done by the area council.
- Sorting and recycling activities that are done on a low scale by scavengers can be encouraged; these activities should be carried out at the recommended disposal sites to generate huge revenues for the community.
- Community based Organizations (CBO's) and Non- Governmental Organizations

(NGO's) activities should be encouraged to increase the awareness of the effect of Solid waste on the health and livelihood of the residents and waste collectors.

- The Waste management Department of Bwari Area Council needs funding, staffing and equipment to boost the activities of the department. Also training should be organized for the staff to get them conversant with current practices.

REFERENCES

Adedibu, A.A. (1986) Solid Waste Management and a New Environmental edict: A case Study from Ilorin, Kwara State, Nigeria, *The Environmentalist, Vol. 6 pp 63-68*

Ajiwe, V.I.E., Nnabuike B.O., Onochie C.C.' and Ajobola V.O (2000) Surface water pollution by effluents from some industries in Nnewi area, Nigeria.*Appl.Sci.* Vol.3, pp 1265-1280

Anago I. (2002) Environmental Impact Assessment as a tool for sustainable development the Nigerian experience. International Congress FIG XXII. Washington, D.C. USA, April 19-26

Ayeni, M.A.O (1987) Patterns, processes and problems of urban development. In A Geography of Nigerian Development. Oguntoyibo,J.S, Filani M.O. and Aneola D.O Ibadan Heinman Educational Books Nigeria Ltd. pp 5-74

Barbalace, R. C. (2000) The History of Waste, http://environmentalchemistry.com/yogi/environmental/wastehistory.html(06/12/2009)

Botkin D. B and Keller E.A (2005) Environmental Science Earth as a Living Planet. John Wiley & Sons pp 572- 576

Chukwuekezie, C.I (1998) Microbiology of Refuse Dumps in Port Harcourt. (Unpublished B.Sc Thesis). University of Port Harcourt, Nigeria. Pp

Cunningham, W.P and Cunningham, M.A. (2008) Environmental Science A Global Concern. Mc Graw Hill pp 476

Ekugo, E.I. (1998): Public Health and Urban sanitation .Environ. News Vol.5, pp 7.

Heimlich, J.E., Hughes L.K. and Christy.A.D The Ohio State extension Factsheet: Integrated Solid Waste Management CDFS-106-05

Huang, Y.C.J. "Solid Waste Disposal": Microsoft Student Encarta 2007(DVD) Redmond, WA: Microsoft Corporation, 2006 (August, 20 2008)

Medina, M. (1995): Globalization, Development and Municipal Solid Waste Management in Third World Cities

Mohammed, D and Osita, O. Solid Waste Management in Maiduguri, Nigeria. "Paper presented at the 29th WEDC International Conference: 2003

Nigerian Environment and Study/Action Team (NEST) (1991), Nigerian's threatened Environmental: A National profile, NEST Ibadan, pp229

Nwankwo, C.K. (1994): Solid Waste management, General Reviews and a glance at the Nigerian Situation. *Mining Geol.* Vol.27, pp 20-25

Nweke ,A.A (2000): Impact of Organic Waste Pollution on the Macro-benthos and Fish Fauna of Elechi Creek.(Unpublished PhD Thesis) Rivers State University of Science and Technology, Port Harcourt, Nigeria. pp 287

Ogbonna, D.N, Ekweozor.K.E. and Igwe, F.U. (2002): Waste Management: A Toolkit for Environmental Protection in Nigeria. *AMBIO A Journal of the Human Environment*. Vol. 31, Iss. 1, pp 55-57

Ogu, I.V. (2000): Environment and Urbanisation "Private Sector Participation and Municipal Waste Management in Benin City, Nigeria."Vol 12; pp103

Okopido, I.O (2002): Environmental Pollution an Emerging Health Hazard-The Nigerian Scenario. The Nigerian Journal of General Practice. Vol.7, No. 1.

Olanrewaju, O.O. and Ilemobade, A. A. (2009): waste to wealth: A case study of Ondo State Integrated Waste Recycling and Treatment Project, Nigeria J. *European Journal of Social Sciences* Vol. 8 No.1, pp 1-2

Olorunfemi, J. F. and Odita, C.O. (1998): Land Use and Solid Waste Generation in Illorin, Kwara State, Nigeria. *The Environmentalist* Vol.18, pp 67-75

Onibokun, A (1989): "Urban growth and urban Management in Nigeria" in Ogu I. V. Private

Sector Participation and Municipal Waste Management in Benin City, Nigeria. Pp

Osuocha, P.C. (1999) Improving Refuse Management in Urban Nigeria. "A Paper presented at the 25th WEDC Conference Integrated Development for Water Supply and Sanitation

Smith, S.T.(2003): What is Solid Waste Management http://www.wisegeek.com/what-is-solid-waste.htm (December, 12 2009)

Sule, R.A. (1982): Environmental Pollution in an urban centre. Waste Disposal in Calabar. Third World Plan. Vol. 3, pp 4-7

The Guardian Newspaper: Waste Management: A Solution. August, 18 1999.

UNEP (2007): Assessment of Solid Waste Management in Liberia. http://www.unep.org (August, 11 2008)

History of Memphis Solid Waste Management www.cityofmemphis.org (December, 12 2009)

Waste management "http://en.wikipedia.org/wiki/Waste_management"(August, 11 2008)

Zurbrugg.C., SANDEC/EAWAG 2003 Solid Waste Management in Developing Countries.

http://www.eawag.ch/forschung/sandec/publikattionen/swm/dl/basics_of_swm.pdf (August, 11 2008)

APPENDIX I

SCHOOL OF POST GRADUATE STUDIES
DEPARTMENT OF GEORGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

Questionnaire for the Public

TOPIC: AS ASSESSMENT OF SOLID WASTE MANAGEMENT IN FEDERAL CAPITAL TERRITORY. A CASE STUDY OF KUBWA SATELITE TOWN.

The research work is proposed to be done on the above topic in pursuit of a Master Degree in Environmental Management.

The purpose of this survey is to obtain basic data required for a proper assessment of the solid waste management of Kubwa in a bid to recommend possible solutions.

Therefore, your honest responses and cooperation is required for an effective study.

All information obtained would be treated with utmost confidentiality and only for the purpose of the research work.

INSTRUCTION:
Kindly Tick ( ) or fill the space as appropriate.

1. How many people live in your house?
   (a) 1-5 ( ) (b) 6-10 ( ) (c)11 and above ( )

2 What are the sources of your refuse? (a) Domestic Waste ( ) (b) Commercial activities ( ) (c) Industrial activities ( )

3. Types of Solid Waste Generated
   (a) Food Materials ( )
   (b) Metal Scraps and can ( )
   (c) Ashes and dust ( )
   (d) Polythene and paper ( )
   (e) Plastic and Ceramic ( )
   Others (Specify) _____

4. How do you dispose your refuse?
   (a) Open air burning ( ) (b) Open dumping ( ) (c) Incineration ( )
   (d) Drainage ( ) (e) Others (Specify) _____

5. Do you dispose your waste immediately?
   Yes ( ) No ( )

6. If no, how do you store your waste before disposal?
(a) Waste Basket ( ) (b) Polythene Bags ( ) (c) Sacks ( ) (d) Drums ( )

7. How many times do you empty your bins?
(a) Daily ( ) (b)Every other day ( ) (c)Weekly ( ) (d) Monthly.

8. Which agency is responsible for your refuse collection?
(a) Area council ( ) (b) Private firms ( ) (c) Community ( ) Others Specify _____

9. If the disposal method use is open dumping, are you satisfy with the location?
Yes ( ) No ( ).

10. If no, which one do you feel is the best alternative?
(a) Provide incinerators ( ) (b)Provide more waste containers ( )
(c) Others Specify ( ) _____

11. Do you pay any fee for the collection of your waste?
Yes ( ) No ( )

12. (a) If yes how much _____
(b) If no are you willing to pay? Yes ( ) No ( )

13. What is the major problems you encounter with the firm that handles waste disposal in your area? _____

14. Do you have any waste management facilities close to your home?
Yes ( ) No ( )

15. If yes, is it close to your house? (a) Yes ( ) (b) No ( )

16 Do you have an avenue where you meet and discuss issues regarding your general well being?
Yes ( ) No ( )

17. Do you have an arrangement for a sanitation exercise to clean the area?
Yes ( ) No ( )

18. If yes, how often do you do it?
(a) Weekly ( ) (b) Monthly ( ) (c) Others Specify _____

19. If no, are you ready to participate in any one?
(a) Yes ( ) (b) No