



**DETERMINANTS OF EFFECTIVE SOLID WASTE MANAGEMENT IN KAKAMEGA COUNTY**

**KELVIN MURUMBUTSA MALENYA**

## DETERMINANTS OF EFFECTIVE SOLID WASTE MANAGEMENT IN KAKAMEGA COUNTY

<sup>1</sup> Kelvin Murumbutsa Malenya and <sup>2</sup> Dr. Jane Omwenga

<sup>1</sup> Student, Jomo Kenyatta University of Agriculture & Technology (JKUAT), Kenya

<sup>2</sup> Lecturer, Jomo Kenyatta University of Agriculture & Technology (JKUAT), Kenya

Accepted: November 10, 2015

### ABSTRACT

*Solid waste has become a major challenge in many countries all around the world. Municipal councils are spending significant resources in addressing this problem but due to an increase in population in urban centers resulting from rural urban migration has put a strain on the cities resources which cannot adequately cater for the ever increasing numbers. In developing countries it has been estimated that solid waste contains 50 percent organic matter 30 percent recyclable materials which essential means that 80 percent of waste can be recycled. The purpose of this study was to assess the Determinants of Effective Solid Waste Management in Kakamega County. This is because of the increasing sites of unattended waste disposal in public spaces in the county. The objective of the study were; to establish the extent to which technical factor influence effective solid waste management in Kakamega County; to establish how financial factor influence solid waste management in Kakamega County; To determine how institutional factor influence effective Solid Waste Management of Kakamega County. The target population will consist of 62 employees of Kakamega County, 40 employs from the ministry of Health and Sanitation, 16 employs from ministry of housing and 4 officials from National Environmental Management Authority. The researcher used stratified sampling method because it was the most convenient. Data collection instruments for this research were questionnaires and interviews. Validity of research instruments was established by consulting the supervisor. The researcher employed the test and retest method to establish reliability of the research instruments. The researcher used Statistical Packages for Social Science (SPSS) to analyze data. The study found out that financial factors played a factor in effective solid waste management in Kakamega County. Technical factors such as lack of professional personnel and equipment had an association to effective solid waste management. Institutional factors such as county lack of public awareness and policy on waste reduction, lack of clear authority and sanitation rules significantly influenced effective solid waste management. The recommendations in this research centered on determinants of effective solid waste management in Kakamega County were, strict enforcement of by-laws and policy, more budget allocation and proper waste allocation systems*

**Key Words:** Offensive Waste Management

## **INTRODUCTION**

Solid waste is described as any refuse, garbage, sludge from a water plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or those that contained gaseous material, resulting from commercial, industrial, mining and agricultural operations, and from community activities.

Urban solid waste management is a global problem. This has been caused by continuous increase of rural urban migration which has resulted to increasing urban poverty and rapid urbanization. United Nations Humanitarian Settlement, Habitat projects that the world's urban population will increase by about 70 million people annually by 2020. The greatest impact of this increase will be felt in developing countries, mainly in Asia and Africa. This in turn will increase the growth of slum settlements. The United Nation currently estimates that there are approximately 863 million urban slum dwellers worldwide (UN-Habitat, 2013). If current trends and policies are not reversed, the total number of people living in urban slum settlements could be close to 1.5 billion by 2020. One of the targets of United Nation, Millennium Development Goals is to have cities without slums and to achieve significant improvement in lives of at least 100 million slum dwellers by 2020 according to (MDGs) Target 11 (UNEP & UN-Habitat, 2013).

Local Authorities and Cities all around the world have had challenges in solid waste management due to the increase of waste generation, high cost of management, lack of understanding over diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning

An expanding economy, increase in population, rapid urbanization and rise in community levels of living standards has accelerated the solid waste generation rate in many developing countries (Minghua, 2009). Municipalities have a

responsibility of ensuring that waste is managed efficiently and effectively in cities and urban areas. However, the municipal authorities tend to face more problems beyond their ability to tackle (Sujauddin, 2008) this is mainly due to lack of finances, poor organization, complex nature and system multi-dimensionality (Burntley, 2007).

United Nations Environmental Program (UNEP, 2012) combined solid waste management plan estimated that the total amount of waste generated globally in the 2006 was 2.02 billion tonnes which showed a 7 percent increase compared to the 2003. They also projected that there will be an increase in the solid waste generated globally by 37.7 percent this is approximately 8 percent per year between the year 2007 and 2011.

### **Statement of the Problem**

Solid waste management is one of the major urban development challenges in Kakamega County. In many parts of the world, open dumpsites are still the primary means of managing solid waste (Dulo, 2010). Poor infrastructure, has made many areas inaccessible, lack of well-designed collection systems, collection days and time schedule has resulted to inadequate and malfunctioning of equipment, open burning of garbage, illegal dumping are the main technical problems facing many counties

Limited capacity has led to inefficiency of the urban management authorities, limited involvement of stakeholders including the local community, community based organizations, non-governmental organizations, churches and low-income levels especially in the slum areas (JICA, 2010). The informal settlements are characterized by huge open dumpsites and blocked sewers which are a health hazard to the residents. Un-attended municipal solid waste poses health risks to the area residents such as water borne diseases that result to high mortality rates among children (APHRC, 2012).

With the growing and increased human population and industrialization in the county input in the dumpsite has exceeded the environment capacity to accumulate and degrade them. This means that there are limits to the total amount of waste that can be decomposed in a given area and in a limited period of time. However every society desire to grow in numbers, technologically and in value but the maximum is always reached in this growth. The problem is that unmanaged dumpsite and improper methods of solid waste disposal results into scenic blights, create serious hazards to public health, pollution of air and water resource, accident hazards, increase in rodent and insect vectors and a source of greenhouse gases that lead to global warming (Ekere, 2009)

Kakamega County Government has not allocated sufficient funds nor has the county assembly passed legislations that would ensure proper implementation and sustainability of proper solid waste management. Inadequate garbage dumping sites and negative attitudes from the community have led to unsatisfactory effective solid waste management (Seng, 2010). This study seeks to find out what are the determinants of effective solid waste management in Kakamega County

### **The objectives of the Study**

The overall objective of the study was to find out the determinants of effective solid waste management in Kakamega County. The specific objectives were; To establish the extent to which technical factors; financial factors and institutional factors influence effective Solid Waste Management Kakamega County

### **Research Questions**

1. How does the technical factor influence effective solid waste management in Kakamega County?
2. How does the financial factor influence solid waste management in Kakamega County?

3. How does the institutional factor influence effective Solid Waste Management Kakamega County?

### **Scope of the Study**

The study was delimited to Kakamega Town. Kakamega is a town in western Kenya lying about 30 km north of the Equator. It is the headquarters of Kakamega County. The town has a population of 99,987 (2009, Census). The study will focus on the determinants of effective Solid waste management in Kakamega town considering the high population. It focused on solid waste as opposed to sludge that was produced by households, markets and business. The study will cover a target population of 122 individuals who are major stakeholders in solid waste management. These shall compromise of 62 employees from the County Council, 4 from National Environmental Management Authority, 16 from the Ministry of Housing and 40 from the public Health and Sanitation

### **LITERATURE REVIEW**

#### **Theoretical Framework**

In the early stages of urbanization there was no need for an organized system of a domestic waste collection and disposal. This is because in the 1900s garbage was mostly organic and could be easily disposed by burning or biodegradation in pits, backyards or small dump sites. In the twentieth century a higher percentage of garbage consisted of metals, glass, and plastic. The amount of paper and plastic packaging has grown as organic waste reduced. However, collection and removal of waste has become a duty of municipal councils and privately owned solid waste disposal companies contracted (Crook, 2010)

Effective solid waste management typically includes, waste generation, storage, processing and treatment and final disposal (Jindal, 2008). In developing countries municipal solid waste contains around 50 percent organic matter and 30 percent recyclable materials, meaning a potential

80 percent of waste could be recycled (Habitat, 2013)

This study has exposed one theory namely the ecological modernization theory which is a theory of environmental sociology that provides a sociological interpretation of environmental reforms. The theory suggests the need for a national policy of solid waste management and effective system for the sustainability of solid waste management.

#### **a) Ecological Modernization Theory**

Ecological Modernization (EM) refers to a series of institutional, operational, economic, governance, social and political shifts that are set in motion by environmental drivers. These drivers push new social arrangements, new discourses, new scientific and technical developments, and a shift in responsibilities and interests between public and private sectors, between governments and their citizens, between civil society and other economic actors, and between the formal and informal sectors and arrangements within a wide range of disciplines. Although political institutions have contributed to poor environmental outcomes in the past, Ecological Modernization Theory (EMT) argue that they can be readily reformed to better address ecological issues (Mol & Sonnenfeld, 2009). Proponents hope that, through marginal shifts in focus, political actors could be responsible for building new and different coalitions to make environmental protection politically feasible. Thus, EM research has examined the institutional changes that accompany a shift from government to environment governance. For example, EM argues for a more substantial transformation towards decentralized, consensual forms of governance, and a focus on new forms of political intervention. Advocates consider the role of the nation-state to be central to achieving more sustainable societies. There is a focus on “open, democratic decision-making, maximizing participatory opportunities for broader social

interests” (Berger, 2001). These opportunities will only occur alongside increasing activism by non-governmental organizations, economic agents and changes to the institutional structure of society

Ecological Modernization has a good chance of influencing decision makers since it frames the debate in non-threatening terms by supporting industrial development, the market and liberal-democracy. EM argues that economic growth can be decoupled from environmental harm through institutional transformations. In essence EM supports the existing institutional of power and modest initial reforms and also prepares the groundwork for substantial transformations

Ecological Modernization advocates technological innovation that decouples economic growth and industrial development from environmental damage to a cleaner industrial revolution. The theory aims to encourage industry to research, develop and deploy more eco-efficient technology. This new technology should reduce raw material and energy use, cut emissions, eliminate the use of hazardous material, wean production off the depletion of non-renewable resources, sustainability of harvest renewable resources conserve biodiversity and protect essential environmental materials, energy use and waste disposal (Cohen, 2006).

Ultimately Ecological Modernization treats all environmental issues, solid waste included, as a challenge to eliminate inefficiency via better design. It promotes the use of more eco-efficient technology as well as the redesign of economic and political institutions to create incentives that will effectively decouple economic growth from raw material use, waste and environmental damage (Dryzek & Howes, 2012). Waste is seen as an indicator of inefficiency.

Ecological Modernization is a theory of environmental sociology, which provides a sociological interpretation of environmental

reforms. The theory suggests that the need of a national policy of solid waste management (SWM) and effective system for sustainability of SWM. However national system of SWM seems to be not working effectively to deliver sustainability due to lack of responsiveness of governmental officials, policy and institutional gaps, privatization process failures and managerial aspect problems. The study argues that EMT provides a new framework for understanding and analyzing sustainability of SWM

### **Conceptual Framework**

There are a number of factors that influence waste generation in many urban areas and cities such as technology, facilities for separation, management policies and enforcement, legislation, individual level of income education, geographical location, political stability, gender roles, cultural practices (Abel, 2009). The quantity of solid waste generation also varies with socio-economic groups in which the middle class are most responsible (Sridhar, 2013). Waste management is also affected by these aspects or enabling factors that facilitate the performance of the system. They are: Technical, Financial, and Institutional.

#### **a) Technical Factors**

Literature suggests that technical factors influencing the system are related to lack of technical skills (The knowledge and abilities needed to accomplish related duties, as well as other specific tasks ) among personnel within municipalities and government authorities (Hazra and Goel, 2009), poor roads and vehicles (Henry, 2010) deficient infrastructure (Moghadam, 2009), insufficient technologies and reliable data (Mrayyan & Hamdi, 2010)

Poor waste disposal situation in developing countries has also been attributed to the general dearth of unqualified personnel in the waste sector (Ogawa, 2012). According to (Onibokun, 2009) most municipal authorities are unable to attract suitably qualified personnel for the various aspects of waste management such as planning, operations

and monitoring. (Ogawa 2012) corroborates this observation when he notes that developing countries characteristically lack the technical expertise required for solid waste management planning and operation and this is usually the case at both national and local levels. He argues that many officers in charge of solid waste management have little or no technical background training in engineering or management. Without sufficiently trained personnel, however, solid waste management projects cannot be effective and sustainable. (Ogawa, 2012) has observed that in many cases, solid waste management programmes initiated by external consultants have collapsed in the hands of local management due to the lack of expertise and loss of funding. (Lohse, 2003) has also observed that local governments in developing countries generally lack the required capacity and technical expertise to accomplish effective and sustainable waste management programmes. Several studies in Africa and elsewhere in the developing world confirm the dearth of qualified waste management personnel and how this results in failure to undertake effective and sustainable waste management in the cities.

A study carried out by researchers at the Namilyango College in Kampala, Uganda found that the failure of waste management programmes in Kampala and other Ugandan cities was largely the result of a lack of trained manpower/personnel to execute waste management programmes. (Kironde, 2011) also found that human resources for waste management in Dar es Salaam were very inadequate in terms of managerial and technical staff and even labourers. The lack of qualified waste management personnel has been blamed on the lack of training and poor conditions of service in the sector. Generally, employees in the waste sector are poorly paid and have very poor conditions of service which makes many people shun jobs in the sector, including labourers (Kironde, 2011). Thus, besides the difficulty of attracting professional waste management staff, it

is also difficult to attract labourers to the waste sector in spite of the high levels of unemployment in poor country cities (Onibokun, 2009 & Kironde, 2011).

#### **b) Financial Factors**

Municipalities have failed to manage solid waste due to financial factors. The huge expenditure needed to provide the service (Sharholy, 2007), the absence of financial support, limited resources, the unwillingness of the users to pay for the service (Sujauddin, 2008) and lack of proper use of economic instruments have hampered the delivery of proper waste management services. (Sharholy, 2008) indicated that the involvement of the private sector is a factor that could improve the efficiency of the system.

Solid waste management often takes a big amount of the total recurrent municipal budget. Despite the high financial burden, the local authorities often struggle to provide adequate and reliable services. According to USAID it is common for municipalities in developing countries to spend 20–50 percent of their available budget on solid waste management, which often can only stretch to serve less than 50 percent of the population (Memon, 2010). Public sector inefficiencies and continuously increasing cost has led local authorities to analyze if this service can better be provided by the private sector ( El Fadel & Massoud 2012). Increasingly public–private partnerships (PPP) have emerged as an alternative to improve municipal solid waste service performance at lower costs (Zhu, 2007 & Abdrabo, 2008). But even with a new partnership approach the financial aspects of municipal solid waste management remain critical for ensuring sustainability of the system. This concerns budgeting, cost accounting, financial monitoring and evaluation aiming at recovering sufficient money to cover recurrent operational expenditures of the collection service as well as to stock up capital for new investments or large maintenance. These methods are too seldom

employed and the municipality rarely knows the actual cost of providing the service (Wilson, 2012). While external capital may often be needed for major investments, the recurrent costs should by preference be covered by a combination of user fees, and local taxes, but some degree of cross-subsidization and/or financing out of governmental sources may be needed to ensure equitable access to service (Wilson, 2013)

#### **c) Institutional Factors**

Inefficient institutional arrangements adversely affect urban management in poor countries generally and environmental service delivery in particular (UN-Habitat, 2014). According to UN-Habitat (2014), it is characteristic of developing countries to have several agencies involved in the delivery of solid waste and other municipal services. Furthermore, (Ogawa, 2009) has observed that there are often no clear roles or functions of the various agencies involved in urban environmental management. At the same time, no single agency is usually designated to coordinate the activities of waste sector agencies (Armah & Attahi, 2009). (Ogawa, 2009) has, therefore, observed that the lack of coordination among the relevant urban sector agencies often results in different agencies duplicating one function. In the case of externally supported solid waste management projects, it is common for different agencies within the same country or city to act as counterparts of external support agencies for different waste management projects without any collaboration of efforts (Ogawa, 2009). Institutional inefficiencies of this nature can lead to duplication of functions, gaps in service delivery and waste of already scarce resources, or even the collapse of solid waste management programmes (UN-Habitat, 2013). (Zurbrugg, 2009) has also noted deficient management capacities of institutions involved in urban environmental management in poor country cities.

Solving the waste problem in poor cities will, therefore, require improvements in the institutional arrangements and capacity building for waste management and other aspects of the urban environment

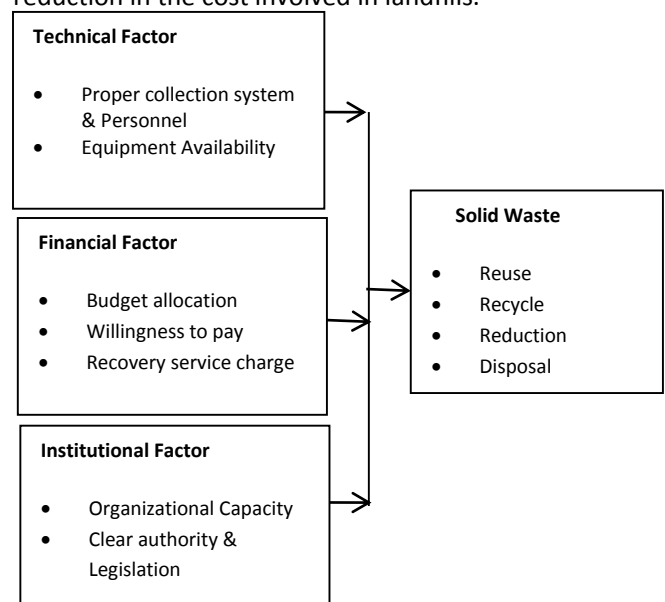
Institutional systems provide a framework for better social order in a community as well as public policy formulation and implementation process. They are also requisite for legitimizing policies, social values and actors embodied in resource development and utilization, economic programmes, governance practices and promoting specific cultural heritage (URCRD Kenya, 2010).

Management deficiencies are often observed in the municipalities. Some researchers that have investigated the institutional factors that affect the system have come to the conclusion that local waste management authorities have a lack of organizational capacities (leadership) and professional knowledge. Besides they concluded that the information available is very scanty from the public domain (Chung & Lo, 2008). The extremely limited information is not complete or is scattered around various agencies concerned, therefore, it is extremely difficult to gain an insight into the complex problem of municipal solid waste management (Seng, 2010).

Researchers have documented how an adequate legal framework contributes positively to the development of the integrated waste management system (Asase, 2009) while the absence of satisfactory policies and weak regulations (Seng, 2010) are detrimental to it. The conceptual framework in this study shows how effective solid waste management is a complex task which goes beyond technical, financial and institutional aspects which are seen as independent variables and effective solid waste management as a dependent variable.

#### d) Solid Waste Management

Solid waste management, waste reduction and pollution prevention are all terms which are often used interchangeably. Solid waste minimization is designed to reduce the toxicity, volume or weight of waste before disposal. Solid waste management has become an issue of main concern for national government, local authorities, researcher, and policymakers. Despite this straightforward definition, it has been difficult for the public to participate in solid waste management. Therefore, waste management campaigns should focus on waste minimization or reduction in order to preserve the environment and maintain good living conditions for citizens (Tonglet, 2009). An important concept of waste minimization is through 3'R (reduce, reuse and recycling) (Franchetti, 2009) and treatment (composting and incineration) (Schall, 2012). There is a great need to develop a regional strategy for waste minimization at the local level. However, Read et al. (2008) adopted a broader definition of waste management as “prevention and/or reducing the generation of waste, improving the quality of waste generated, including reduction of hazard and encouraging re-use, recycling and recovery”. Looking at these various definitions, it is obvious, that the main aim of waste management is to have a sustainable solid waste management via the reduction of solid waste, pollutants and the reduction in the cost involved in landfills.





### Figure 1: A conceptual Frame work

#### Empirical review

Several studies have been made on solid waste management in across the Globe. Most of them have been carried out in big cities like Sweden, Niger delta, Dar es Salaam and Kampala. Common for the cities is that the solid waste is a big problem and the local authorities have failed to handle the solid waste problem. Increased urbanization and a change in the composition of waste have made the situation even worse.

The waste sector in Sweden is regulated by an extensive legal framework. It's the European Union who set the frames for the European waste management and forms the agenda for waste politics. It is with consideration of these frames that Swedish government can form how the waste management in Sweden will look. As a base is the Waste directive (2008/98/EG) which primary goal is to minimize negative effects on human health and the environment connected to production and management of waste. A central part of the waste directive is the waste hierarchy that describes an order of prioritization for how waste within the EU should be treated (Naturvardsverket, 2012). Beyond including regulations heading for the waste hierarchy the waste directive includes rules for how waste shall be managed including licensing, planning for waste management in practice and demands regarding reports, inspection and review (Naturvardsverket, 2012).

The Swedish legal framework for waste and waste management is found in the Swedish Environmental Code, in the fifth tenth chapter, the portal paragraph and the five rules of consideration plus the waste prescript (Naturvardsverket 2012). More than the national rules regarding waste and waste management is the 16 national

environmental quality objectives adopted in 1999 by the Swedish government and three of them regard waste. These 16 objectives together with the generation goal set the environmental aspect of the waste management. The generation goal is "to the next generation hand over a society where the large environmental problems are solved, without causing increased negative environmental and health impact outside of Swedish boundaries" (Naturvardsverket 2012). Goals' concerning waste and waste management is mainly found in the objectives; a good built environment, a non-toxic environment and reduced climate impact (Miljomal 2013).

The municipalities are free to choose how to organize their waste management, this opportunity of municipal autonomy is written in the Swedish constitutional law, and there are several different forms of organization. They can choose between; own management, municipal corporation, own or together with other municipalities, corporate board or a municipal coalition. Though the Swedish waste management is based on the waste hierarchy's five steps explained earlier (Avfall Sverige 2012).

In Niger Delta cities indiscriminate solid waste disposal is a menace and embarrassment. About 70 to 80 percent of solid wastes generated in Niger Delta cities are either deposited on road sides, illegal dumpsites, in water ways, or in open dumpsites which adversely affect the environment (Isu, 2011). Solid Waste (SW) also poses risks to public health and adversely affects flora and fauna, especially when it is not appropriately collected and disposed (Geraldu, 2010). The poor state of Solid Waste Management (SWM) in Niger Delta cities is caused by inadequate facilities, poor funding, and poor implementation of policies as well as unsustainable lifestyle such as consumption pattern. According to (Egunjobi, 2009), the problem of ineffective SWM in the Niger Delta is closely linked with poor social services delivery efforts which cause unnecessary

delays in solid waste clearance. Broken down machinery, poor maintenance of dumpsites, poorly maintained urban streets and roads and irregularities in the designation of sanitary landfill sites are all problems. Studies have revealed that households account for about half of the solid wastes generated, by weight in the Niger Delta cities (Geraldu, 2010).

Solid waste management he states received considerable attention in the Niger Delta and Nigeria generally in recent years. Despite this laudable attention, collection, disposal, processing, treatment, recycling and utilization have defied solution as a result of the attitude of the people. The waste disposal habit of the people, corruption, work attitude, inadequate plants and equipment among others are the major factors militating against effective SWM in the Niger Delta. The major effects of poor SWM in Niger Delta cities include: blocked drains, flooding, traffic congestion, soil pollution, air pollution, surface water pollution, health problems, un-aesthetic dumpsites and loss of community pride

Kampala, Uganda, has a problem with increased generation of waste, but the increase has not been accompanied by an equivalent increase in the capacity for managing the waste (Mugagga, 2011). Uganda, solid waste management has been regarded as an important component of the environmental structure in human settlements (NEMA, 2010).

However, solid waste management in Uganda has led to effects on the environment. Burning and burying of solid waste has led to air, water and soil pollution, while landfills, if not properly managed can also cause environmental problems among others, the pollution of ground water and surface water, land degradation and poor general aesthetic quality of the surrounding environment (NEMA, 2010). There are many contributing factors to the escalation of the solid waste problem in the

country such as lack of equipment, no adequate finance and lack of skilled labor.

The fact that urbanization in Uganda started not long ago, the issue of solid waste management had not received the deserved attention (Mbabazi, 2011). Up to now, the authorities are grappling with ways to deal with the emergent problem of waste disposal.

### **Critique of Existing Literature**

Many researchers have identified solid waste as a major problem that has reached proportions requiring drastic measures. Three key trends have been observed with respect to solid waste, change in the quality or make-up of waste generated, disposal method of waste collected, increase in sheer volume of waste generated by urban residents by land-fill and incineration (Srinivas, 2012)

Considering the challenges of effective solid waste management by countries there has been an urgent need for local municipalities to learn and adopt innovative measures that would ensure effective and sustainable solid waste management. There has been an emergence of biodegradable solid waste in production of fertilizers and biogas. This can be seen in the adopted in countries such as Nigeria which as a result produce enormous amounts of Methane (Yusuf & Oyewumi, 2012). A mixture of manure and ash has been used for soil amelioration to boost agriculture productions in Jos (Pasquini & Alexander, 2013)

Researchers have highlighted the involvement of all stakeholders, to develop waste management strategy among central business organizations and industries, to develop a sound waste management strategy for collection, treatment and transportation and to further promote resource recovery and environmental protection (Madebwe & Madebwe, 2009)

Although researchers have undertaken rigorous efforts for waste generation modeling, the geographic scope of the studies has been limited. The region-specific studies have yielded mixed results. On the one hand, they may confirm the need for region-specific policy design. On the other hand, the existing studies do not provide external validity for regions without waste generation studies. Notably, many more studies have been conducted in the western world than in Africa. This could suggest that the western countries pay more attention to waste management issues, and accordingly, have undertaken more efforts in waste volume tracking and recording. In addition, most studies are conducted on the basis of single period data. Panel data analyses are limited, thus the findings from previous analysis in certain regions may not be valid to the other regions.

#### **Research Gap**

Many experiences, problems, solutions and their effects in developing countries on solid waste services are not written down. There has been a lack of research in this field until recently. The focus of most literature and research is either on privatization of municipal services through micro-enterprises or on the activities, problems and living conditions of the informal solid waste sector (Asia). In Africa research and project intervention in the field of solid waste management received attention rather recently. There is a lack of comparative studies on solid waste management projects in different countries. The emphasis usually is on all kinds of environmental action or on urban services. The experiences that are described often lack details, especially on aspects like the strategy or working method used incentives, approach used in education, effects of solutions tried, the role of women, contents of preparatory research, etc.

## **RESEARCH METHODOLOGY**

### **Research Design**

This study adopted a descriptive design. A cross-sectional survey on four institutions from which data was collected, was performed in this study.

### **Target Population**

The study population comprised of 455 individuals in different institutions According to (Mugenda & Mugenda, 2003), a target population is that population which the researcher wants to generalize results. The target population for this study identified all employees

### **Sample Size and Sampling Technique**

A sample of 130 respondents was selected from the target population. The four categories were chosen because they represented played different roles in solid waste management and thus will give different views which would be useful to the study

The researcher chose to use stratified and simple random sampling because of the following reason namely; the ease of assembling the sample.

### **Data Collection Instruments**

Primary data was collected using pre-determined questionnaires. The study used questionnaires containing closed ended, open ended and dichotomous questions. According to Creswell (1994), data collection methods for primary data include; structured and semi-structured questionnaires, mailed questionnaires, structured and semi-structured interviews (personal and telephone interviews), observation and focus groups. Likert scale questions were also used since the responses are easily quantifiable and subjective to computation. Secondary data was sourced from organizational process assets and published materials

### **Data Presentation and Analysis**

Common data collection methods used in qualitative research are focus groups, in-depth

interviews, uninterrupted observations, interviews with managers regarding strategic decision making, how they perceive it and what they use as a guide to making these decisions. A statistical application, Statistical Package for the Social Sciences (SPSS) was used as a platform for data analysis, data cleaning was done using Microsoft excel whereby the data file was checked for accuracy and completeness. Data analysis was done to generate a view of how the objectives were to be achieved. This was done using descriptive statistics, which saw the use of frequency tables, percentage charts/ pie charts, distribution tables and bar graphs.

According to Miller (1991), descriptive statistics is used to describe data collected from a sample. The mean, median, percentage, mode and standard deviation are the most commonly used descriptive statistics. Frequency distribution tables were used in this study to give a description of the data. Graphs bar and pie charts was used for further representation

## **REASERCH FINDINGS AND DISCUSSIONS**

### **Response Rate**

Out of 130 questionnaires that were issued 122 were filled and returned. This gave 93.8% response rate of the study.

### **Socio-Demographic Characteristics of Respondents**

The study sought to find out the Age brackets of the respondents from the Ministry of public health and sanitation, Ministry of housing, National Environmental Management Authority and the County Council all from located in Kakamega County. Results showed that most respondents were in age brackets of 21-50 years 86% and those above 50 years had 14%. From the statistics it is clear that the majority of the respondents were in age bracket of 21-50 years. This means that majority of respondents were of a mature age

The findings on gender indicated that majority of the respondents were male 63.1% while the 36.9 were female. This is an indication that we had more male participating in the study.

The study sought to find ought the working experience of the respondents, how many years they were involved in solid waste management. The results revealed that 35.2% have been working for less than 5years, 16.4% have been working for a period of 5-10 years and 13.1% for more than 20 years. This indicates that most respondents had enough experience knowledge and skills in effective solid waste management in Kakamega County. The results also show that the competence and skill increases with increase in years of performing the Job

The findings on the level of education of the respondents pointed out that 25.4% of the respondents had certificates, 37.7% had a diploma educational level. 21.3% had degree education level, 14% had Master's Degree while 16% of respondents had a PhD education levels. This showed that majority of the respondents in Kakamega County 63.1% have attained certificate and diplomas.

The results show that 2(1.6%) Phd, 17(14.1%) Masters, 26(21.3%) Bachelors, 46(37.7%) Diploma, 31(25.4) Certificates have had an education. This means the respondent's understood and responded to the questionnaires administered to them.

### **Study Variables**

#### **a) Financial Factors and Effective Solid Waste Management**

This section focuses on how financial factors like budget, capacity to pay for services and sufficient allocation of funds influence effective solid waste management in Kakamega County

**Table 1: Financial Factors and Effective Solid Waste Management**

Financial Factors	Effective Solid Waste Management					Total
	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	
Strongly Disagree	11	1	2	5	8	27
Disagree	6	1	3	11	30	51
Undecided	0	3	2	0	4	9
Agree	3	2	1	5	14	25
Strongly Agree	2	2	1	4	1	10
<b>Total</b>	<b>22(18%)</b>	<b>9(7.4%)</b>	<b>9(7.4%)</b>	<b>25(20.5%)</b>	<b>57(46.7%)</b>	<b>122(100%)</b>
Variable	SA	A	U	D	SD	
There is enough budget allocation for provision of SWM services in the county	17(13.9%)	28(23%)	12(9.8%)	41(33.6%)	24(19.7%)	
County has capacity to pay for those involved in collection of waste	10(8.2%)	28(23%)	7(5.7%)	45(36.9%)	32(26.2%)	
Limited funds are allocated for waste management by County Government	24(19.7%)	39(32%)	12(9.8%)	40(32.8%)	7(5.7%)	
There is sufficient funds allocated for promoting waste reduction, recycling and recovery	10(8.2%)	20(20.5%)	9(7.4%)	51(41.8%)	27(22.1%)	

**N=122**

**Key: SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree**

The results showed that there is enough budget allocation for provision of SWM services in the County Strongly Agree (13.9%), Agree (23%), Undecided (9.8%), Disagree (33.6%), Strongly Disagree (19.7%); County has capacity to pay for those involved in collection of waste Strongly Agree (8.2%), Agree (23%), Undecided (5.7%), Disagree (36.9%), Strongly Disagree (26.2%); Limited funds are allocated for waste management by County Government Strongly Agree (19.7%), Agree (32%), Undecided (9.8%), Disagree (32.8%), Strongly Disagree (5.7%); There is sufficient funds allocated for waste reduction, recycling and recovery Strongly Agree (8.2%), Agree (20.5%), Undecided (7.4%), Disagree (41.8%), Strongly Disagree (22.1%)

**Table 2 Financial Factors and Effective Solid Waste Management**

The result from table 2 was to show whether finances played a role in effective solid waste management. The results illustrated that 67.2% of respondents agreed that financial factors influence effective solid waste management, 25.4% disagreed while 7.4% of respondents were

undecided. The study findings disclosed that financial factors in terms of recovery service charge, budget allocation and willingness to pay influence effective solid waste management were inadequate to promote effective solid waste management in Kakamega County. A research by

(Kim & Kamata, 2011) revealed that one principal reasons for inefficient solid waste management system in developing countries in financial constraints. Solid waste management is given low priority in developing countries except in capitals and large cities very limited funds are allocated for solid waste management.

### b) Technical Factors and effective Solid Waste Management

This section focuses on analysis of how technical factors like proper collection systems, proper qualifications of personnel, proper designed and operating sanitary land-fills and equipment availability influence effective solid waste management in Kakamega County

**Table 3: Technical factors and Effective Solid Waste Management**

Variable	SA	A	U	D	SD
County is not efficient in waste generation, storage, collection and disposal of waste	30(24.6%)	45(36.9%)	11(9%)	25(20.5%)	11(9%)
County has enough equipment and personnel involved in waste management	9(7.4%)	25(20.5%)	9(2.4%)	57(46.7%)	22(18%)
County has weak waste collection, transportation and handling infrastructure	36(29.5%)	40(32.8%)	10(8.2%)	28(23%)	8(6.6%)
There is a number of active players involved in collection, transportation and disposal of wastes	15(12.3%)	33(27%)	7(5.7%)	36(29.5%)	31(25.4%)
There is very high waste generation within the county which cannot be handled by available equipment and vehicles	30(40.2%)	43(35.2%)	7(5.7%)	38(31.1%)	4(3.3%)
Personnel in solid waste management have adequate qualifications an skills	7(5.7%)	12(18%)	8(6.6%)	44(24.6%)	41(33.6%)
Waste workers have poor working conditions	41(33.6%)	57(46.7%)	6(4.9%)	16(13.1%)	2(1.6%)

**N=122**

**Key: SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree**

The results point out that the County is not efficient in waste generation, storage, collection and safe disposal of waste; strongly agree (24.6%), agree (36.9%), undecided (9%), County did not have enough equipment and personnel involved in solid waste management; strongly agree (7.4%) agree (20.5%), disagree (46.7%), disagree (18%); County had weak waste collection, transportation and handling infrastructure; strongly agree, (29.5%), agree (32.8%), undecided (8.2%), disagree (23%)and strongly disagree (6.6%) there was a number of active players involved in waste collection, transportation and disposal. Strongly agree (12.3%), agree (27%), undecided (5.7%), disagree (31.1%) and strongly disagree (3.3%); personnel involved in waste management do not adequate qualification skills. Strongly agree (5.7%), agree (18%), undecided (6.6%), disagree (24.6%), strongly disagree (33.6%). Results also showed that workers had poor working conditions, strongly agree (33.6%), agree (46.7%), undecided (4.9%), disagree (13.1%) and strongly disagree (1.6%)

**Table 4 Technical Factors and Effective Solid Waste Management**

The result from table 4 was to show whether technical factors played a role in effective solid waste management. The results illustrated that 68.8% of respondents agreed that financial factors influence effective solid waste management, 23.7% disagreed while 7.4% of respondents were undecided

Technical Factors	Effective Solid Waste Management					Total
	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	
Strongly Disagree	6	1	3	11	30	51
Disagree	9	1	2	5	10	27
Undecided	0	3	2	0	4	9
Agree	3	2	1	5	14	25
Strongly Agree	2	2	1	4	1	10
<b>Total</b>	<b>20(16.3%)</b>	<b>9(7.4%)</b>	<b>9(7.4%)</b>	<b>25(20.5%)</b>	<b>59(48.3%)</b>	<b>122(100%)</b>

**c) Institutional Factors and Effective Solid Waste Management**

organization capacity influence effective solid waste management in Kakamega County.

This section focuses on Institution factors like authority and environmental rules and

**Table 1 Institutional Factors and Effective Solid Waste Management**

Variable	SA	A	U	D	SD
County lacks public awareness on solid waste management	37(30.3%)	46(37.7%)	14(11.5%)	17(39%)	8(6.6%)
There is lack of information about local initiatives concerning solid waste management	31(25.4%)	56(49.5%)	14(11.5%)	18(14.8%)	3(2.5%)
The County council lacks a policy on waste reduction at the source and on involving community groups	32(26.2%)	54(44.3%)	10(8.2%)	19(15.6%)	7(5.7%)
County lacks clear authority and sanitation rules	33(27%)	44(36.1%)	10(8.2%)	24(19.7%)	11(9%)

**N=122**

**Key: SA=Strongly Agree, A=Agree, U=Undecided, D=Disagree, SD=Strongly Disagree**

The results on the influence of institutions factors in effective solid waste management in table 5 points out that county lacked public awareness on Solid waste management: strongly agree (30.3%) agree (37.7), undecided (11.5%), agree (13.9%) and strongly agree (6.6%); there was lack of information about local initiatives concerning solid waste management; strongly agree (25.4%), agree (45.9%), undecided (11.5%), disagree (14.8%) and strongly disagree (2.5%), the county council lacked public policy on waste reduction at the source. Involvement of community groups result showed, strongly agree (26.2%), agree (44.3%),

undecided (8.2%), disagree (19.7%), and strongly disagree (9%). The finding from the interview schedule indicated that the county council was inadequate in creation of awareness to the community on effective solid waste management

Effective Solid Waste Management						
Institutional Factors	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Total
Strongly Disagree	9	1	2	5	8	27
Disagree	6	1	3	11	30	51
Undecided	0	3	2	0	4	9
Agree	3	2	1	5	14	25
Strongly Agree	2	2	1	4	1	10
<b>Total</b>	<b>20(24.4%)</b>	<b>8(9.8%)</b>	<b>11(13.4%)</b>	<b>26(31.7%)</b>	<b>57(46.7%)</b>	<b>122(100%)</b>

**Table 6: Institutional Factors and Effective Solid Waste Management**

Table 11 shows that 78.4% of respondents agree that Institutions organization have hindered effective solid waste management. 13.4% are undecided and 34.2% disagree that institution organizations actually play a role in solid waste management.

**SUMMARY OF THE FINDINGS**

The study had the following objectives: To establish the extent to which technical factor influence effective solid waste management in Kakamega County; to establish how financial factor influence solid waste management in Kakamega County; to determine how institutional factors influence effective Solid Waste Management of Kakamega County.

Majority of the respondents were in the age bracket of 21-50 years. This meant that majority of the respondents were mature middle age people and understood the determinants of effective solid waste management in Kakamega County, Kenya. There was an indication that more males than females participated in effective solid waste management in Kakamega County. The results illustrated that 35.2% of the respondents had been working for less than 5years, 16.4% had been



working for a period of 5-10 years and 21.3% had been working for 10-15years, 14% of 15-20years and 13.1% more than 20 years. The results further showed that 25.4% of respondents had certificates, 37.7% had diploma education level and 14% had master degrees while 16% of respondents had PhD education levels. There was further proof that education level played a vital role on effective solid waste management in Kakamega County.

#### **a) Financial Factors**

The study findings influence the financial factors on effective solid waste management in Kakamega County disclosed that finances in reference to recovery charges, budget allocation, and County capacity to pay for those involved in collection of litter and recovery led to inefficient effective solid waste management

#### **b) Technical Factors**

Technical factor like proper collection system, professional qualification of personnel, proper designed operating sanitary landfills and equipment availability were not efficient in effective solid waste management in Kakamega County.

#### **c) Institutional Factors**

Results from the Institutional factors revealed that the county lacks public awareness on solid waste management, the county lacks proper legislation policy on waste reduction at the source and on involving group, lack of clear authority and sanitation rules negatively and significantly influenced the effectiveness of effective solid waste management

#### **Conclusions**

The study made the following conclusions. Financial factors like service recovery charge, budget allocation and the county capacity to pay those involved in waste and sufficiency of funds for promoting waste reduction, recycling and recovery were very low and this thus has led to inefficient

effective solid waste management in Kakamega County.

Technical factors like proper collection systems, professional qualification of personnel, proper designed and operation of land-fills and equipment availability were not efficient in addressing effective solid waste management Kakamega County. Financial factors had marginal associations on effective solid waste management. Institutional factors such as county lack of public awareness on solid waste management, the lack of policy for waste reduction at the source and on involving community groups, lack of clear authority and sanitation rules and negatively and significantly influenced effective solid waste management

#### **Recommendations**

The following recommendations were made in conclusion of the study;

The County government should allocate enough money for provision of solid waste management within the county which should be reviewed periodically to ascertain if the monies are put to correct use and are efficient to ensure that waste is effectively managed. The county government should ensure better waste management through waste reduction, reuse and recycling of compost waste. As the facilitator for waste management program development the county government should support business communities through pilot projects, funding training and technical assistance information exchange follow up support and monitoring

For waste management to be effective there should be proper waste collection systems. Professional qualification of personnel, proper designed and operating sanitary land-fills and equipment availability so as to reduce environmental pollution and prevent health hazards. To increase the county capacity to manage waste from larger number of hotels, more

employees need to be hired for collection, sorting, composting and management.

The research found out that there is no strict enforcement of the county by-laws by public health officers such that open pits and drainages are common. This research recommends that existing by laws should be strictly enforced in all areas of the county and new ones formulated to cope with changing times, for example formulation of county solid waste management policy.

#### **Further Areas for Research**

As per the analysis and findings of this research, further research should be done on determinants of effective solid waste management in Kakamega County; study/research should be conducted on other types of solid waste in the county and other solid waste management in other counties. A study should be done on the influence of government policies on effective solid waste management, role of stakeholders like NGO`S and NEMA as well as the public awareness on solid waste management in Kenya and beyond. This will show if this research has universal application.

## REFERENCES

- Adegboye K., (2006). Scavenging 2006: Making a “Lucrative” Living from a Hazardous Dump Sites. *Vanguard*, 28, 36.
- Afroz, R. & Masud, M.M. (2011). *Using a contingent valuation approach for improved solid waste management facility: Evidence from Kuala Lumpur, Malaysia*. *Waste Management* 31, 800-808.
- Agunwamba, J. C. (1998). Solid waste management in Nigeria: Problems and issues. *Environmental Management*, 25(2), 849-856.
- Anaman, K. A., & Jair, R.M. (2000). Contingent valuation of solid waste collection services for rural households in Brunei Darussalam. *The Singapore Economic Review*, 45 (2), 223-240.
- Babalola, A., Ishaku, H.T., Busu I & Majid, M. R. (2010). The Practice and Challenges of Solid Waste Management in Damaturu, Yobe State, Nigeria. *Journal of Environmental Protection*, 1, 384-388.
- Banga, M. (2011). Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala. *Zambia Social Science Journal*, 2(1), 27-39.
- Baud, Isa, Post, Johan & Furedy, Christine (2004). *Solid Waste Management and Recycling: Actors, Partnerships and Policies in Hyderabad India*. USA. Kluwer Academic Publisher.
- Carson, R., Nicholas, F., & Meade, N. F. (2001). Contingent valuation: controversies and evidence. *Environmental and Resource Economics*, 19 (2), 173-210.
- Chifamba, P. (2007). Trace metal contamination of water at a solid waste disposal site at Kariba, Zimbabwe. *African Journal of Aquatic Science*, 32(1), 71-78.
- Division of Technology, Industry and Economics International Environmental Technology Centre Osaka/Shiga, Japan.
- EEA (2001). *Environmental Signals 2001*. Environmental Assessment Report No 6. Copenhagen, European Environment Agency.
- Environmental News Service. (2007). *Giant waste poisoning Nairobi children, environment*. Environmental News Service. Available at: [www.ens-newswire.com/ens/oct2007/200710-09-01.html](http://www.ens-newswire.com/ens/oct2007/200710-09-01.html) (accessed on 12 March, 2014).
- Hall, J. & Dalimier, F. (2000). *Waste Management–Sewage Sludge*. DGXI Study Contract B4-3040/014156/92. Brussels, European Commission.
- Ikem, A., Osibanjo, O., Sridhar, M. K. C., & Sobande, A. (2002). Evaluation of ground water quality characteristics near two waste sites in Ibadan and Lagos. *Water, Air and Soil Pollution*, 140 (1-4), 307-333.
- Ikiara, M.M, Karanja A.M & Davies, T.C (2004) *Collection, Transportation and Disposal of Urban Solid Waste in Nairobi*.
- Imam, A., Mohammed, B., Wilson D. C., & Cheeseman, C. R. (2008). Solid waste management in Abuja, Nigeria. *Waste Management*, 28, 468–472.
- Jin, J., Wang, Z., & Ran, S. (2006). Comparison of contingent valuation and choice experiment in solid waste management programs in Macao. *Ecological Economics*, 57, 430-441.
- Komilis, D. P., Ham, R. K., & Stegmann, R. (1999). The effect of municipal solid waste pre-treatment on

- landfill behaviour: A literature review. *Waste Management and Research*, 17, 10-19.
- Kothari, C.R. (1990). *Research Methodology: Methods and Techniques*. New Delhi: New Age International publishers limited.
- Leedy, P.D. & Ormrod, J. E. (2010). *Practical Research: Planning and Design*, Ninth Edition. NYC: Merrill.
- Love, D., Zingoni, E., Ravengai, S., Owen, R., Moyce, W., Mangeya, P., Meck, M., Musiwa, K., Amos, A., Hoko, Z., Hranova, R., Gandidzanwa, P., Magadzire, F., Magadza, C., Tekere, M., Nyama, Z., Wuta, M. & Love, I. (2006). *Characterization of diffuse pollution of shallow groundwater in the Harare urban area, Zimbabwe, in Groundwater pollution in Africa* by Xu, Y. and Usher, B.H. UNEP, Gt. Britain.
- Mangizvo, R. V. (2008). "Management practices at the Mucheke municipal solid waste disposal site in Masvingo City, in Zimbabwe." *Journal of Sustainable Development in Africa*, 10, (2), 147-164.
- Mato, R. R. A. M., & Kaseva, M. E. (1999). *Critical review of medical waste practices in Dar-es-Salaam City. Resource Conservation and Recycling*, 25(3- 4), 271-287.
- McDougall, Forbes R. White, Peter R. Franke, Marina, Hindle,P., (2008). *Integrate Solid Waste Management: A life cycle inventory*. Chichester: Wiley.
- Ministry of Information and Culture Printing Department, Lagos Nigeria, (1992). *The Nigerian Urban Regional Planning Law Decree 88*. Nigerian Institute of Town Planners.
- Mitchell, R., & Carson, R. (1989). *Using surveys to value public goods: The contingent valuation method*. Resources for the future, Washington, D.C.
- Mugenda, O. M. & Mugenda, A. G. (2003). *Research Methods: Quantitative and Qualitative Approaches*, (2<sup>nd</sup> Ed.). Nairobi: Acts Press.
- Napoleon, S., Momodu, K., O. D., & Joan E. D., (2011). *Mitigating the Impact of Solid Wastes in Urban Centres in Nigeria*. Kamla-Raj.
- Ngoc, N. U., Schnitzer, H. (2009). *Sustainable Solutions for Solid Waste Management in South East Asian Countries*.
- Okalebo, S.E., Opata, G.P., & Mwasi, B.N. (2014). An analysis of the household solid waste generation patterns and prevailing management practices in Eldoret town, Kenya. *International Journal of Agricultural Policy and Research*, 2 (2), 076-089.
- Okonkwo, J. O. & Mothiba, M. (2004). Physico-chemical characteristics and pollution levels of heavy metals in the rivers in Thohoyandou, South Africa. *Journal of Hydrology*, 308, 122-127.
- Orodho J, O & Kombo, M. M. (2002). *Guidelines on Special Study Paper (SSP)*. Nairobi: Kenya Institute of Special Education.
- Oyaro, K. (2003). *Month after dump scare, problems persist*. *Inter-Press Service News Agency*.  
(Johannesburg). 13 May 2008.  
[www.unep.org/cpi/briefs/2008March122014](http://www.unep.org/cpi/briefs/2008March122014)

- Phelan, C. & Wren, J. (2005-06). Graduate Assistants. *Exploring reliability in academic assessment*. UNI office of academic assessment.
- Role, M. E. (2013). *Handbook of social and Educational Research methods for graduate studies*. Unpublished manuscript, Department of Educational Administration Curriculum and Teaching. University of Eastern Africa Baraton, Kenya.
- Rotich, K. H., Zhao Y., Dong J., (2005). *Municipal solid waste management challenges in developing countries–Kenyan case study*. College of Environment and Resources, Jilin University, Changchun 130026, China.
- Rotich, K. H., Zhao, Y., & Dong, J. (2006). Municipal solid waste management challenges in developing countries–Kenyan case study. *Waste Management*,
- Sandec (2004). cited in Zhu et al 2007: 126, *Improving Municipal Solid Waste Management in India: A source book for policy makers and practitioners*.
- Sierra Leone. Final Results (2006) Population and Housing Census, Statistics, Sierra Leone. Waste Management- *From Wikipedia the free encyclopaedia (2009)*. From [http://en.wikipedia.org/wiki/Waste\\_management](http://en.wikipedia.org/wiki/Waste_management) (Retrieved on 16/03/2014).
- Simon, M.K (2011). *Dissertation and Scholarly Research: Recipes for success* (2<sup>nd</sup> Ed.). Seattle, WA, Dissertation Success LLC.
- UNEP (2002). *Industry as a partner for sustainable development: Waste Management*. New York: UNEP.
- United Nations Environment Programme, UNEP. (2009). Developing Integrated Solid Waste Management Plan Training Manual. *Volume 2: Assessment of Current Waste Management System and Gaps therein*. United Nations Environmental Programme.
- United Nations Population Division (2001). *World Urbanization Prospects: The 1999 Revision. Key Findings*. United Nations Population Division.
- Wilson, D.C., Araba, A.O., Chinwah, K., & Cheeseman, C.R. (2009). Building recycling rates through the informal sector. *Waste management*, 29(2), 629- 635.
- Yobe State Environmental Protection Agency YOSEPA, (2009). "Liquid and Solid Waste Management in Damaturu Metropolis in the Capital of Yobe State," *Yobe Printing, Damaturu*, 6, 1-14.
- Zhu, Da, Asnani, P. U. & Zurbrugg, C. (2007). *Improving municipal solid waste management in India: A source book for policy makers and practitioners*. Herndon: World Bank Publication.