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**SOLID WASTE MANAGEMENT AND EFFECTIVENESS IN THE  
CONTEXT OF DEVOLVED SYSTEM OF GOVERNANCE IN KENYA:  
THE CASE STUDY OF KIAMBU COUNTY MUNICIPAL AREAS**

**BY**

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## DECLARATION

This research project is my original work and has not been submitted for a degree in any other University or Institution.

Signature.....

Date.....

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The research project has been submitted for examination with my approval as University Supervisor.

Signature.....

Date.....

**PROF. EDWARD MBURUGU**

## **DEDICATION**

I dedicate this Research project to my children (Jason and Juliet), my Mum (Mercy Kaiya), Dad (Joshua Wanjohi) as well as my brothers (Douglas and Erick) for their unending support and encouragement.

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## TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>ii</b>
<b>DEDICATION.....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>iv</b>
<b>TABLE OF CONTENTS .....</b>	<b>v</b>
<b>LIST OF TABLES .....</b>	<b>viii</b>
<b>LIST OF FIGURES .....</b>	<b>ix</b>
<b>ABSTRACT.....</b>	<b>xi</b>
<b>CHAPTER ONE: INTRODUCTION .....</b>	<b>1</b>
1.1 Introduction.....	1
1.2 Background of the Study .....	1
1.3 Statement of the Problem.....	3
1.4 Research Questions .....	4
1.5 Objectives of the Study.....	4
1.5.1 The Overall Objective.....	4
1.5.2 Specific Objectives .....	4
1.6 Justification of the Study .....	5
1.7 Scope and Limitations of this Study .....	5
1.7.1 Scope of this Study .....	5
1.7.2 Limitations of this Study.....	5
<b>CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK.....</b>	<b>7</b>
2.0 Introduction.....	7
2.1 The Literature Review .....	7
2.1.1 Global perspective .....	7
2.1.2 Waste in Africa Urban Areas.....	10
2.1.3 Waste Management in Kenya .....	11
2.1.4 Solid Waste Regulations.....	15
2.2 Theoretical Framework.....	16
2.2.1 Systems Theory.....	16
2.2.2 Symbolic Interactionism Theory .....	19
2.3 Conceptual Framework.....	22

<b>CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY .....</b>	<b>24</b>
3.1 Introduction.....	24
3.2 Site Description/Area of Study .....	24
3.2.1 Position and Size.....	24
3.2.2 Population Size .....	24
3.2.3 Urban Population .....	24
3.3 Research Design.....	25
3.4 Unit of Analysis and Units of Observation.....	25
3.5 Target Population.....	25
3.6 Sample Size and Sampling Procedure .....	25
3.7 Methods of Data Collection .....	26
3.8 Ethical Considerations .....	26
3.9 Data Analysis .....	26
<b>CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION ...</b>	<b>27</b>
4.1 Introduction.....	27
4.2 Demographic Characteristics .....	27
4.2.1 Age of the Respondents .....	27
4.2.2 Gender of the Respondents .....	27
4.2.3 Highest Level of Education .....	28
4.2.4 Number of Years Lived in Kiambu .....	29
4.3 Nature of Waste Generated Within Municipal Areas of Kiambu County.....	30
4.4 Stakeholders in Solid Waste Management .....	31
4.5 Effectiveness of the Current Solid Waste Management Methods .....	33
4.5.1 Frequency of Waste Collection.....	33
4.5.2 Ranking of Services Provided by Waste Collectors .....	33
4.5.3 Problems Encountered in Waste Collection .....	34
4.5.4 Effectiveness of Solid Waste Management Methods .....	35
4.6 Conclusion .....	38
<b>CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>39</b>
5.1 Introduction.....	39
5.2 Summary .....	39
5.2.1 Sources and nature of wastes generated within municipal areas of Kiambu County ...	39

5.2.2 Extent of awareness of the solid waste management problem in Kiambu County municipal areas.....	39
5.2.3 Major stakeholders in solid waste management within Kiambu .....	39
5.2.4 Effectiveness of the current solid waste management methods used by the Kiambu County Government .....	40
5.3 Policy Recommendations.....	40
5.4 Recommendations for Further Studies.....	41
<b>REFERENCES.....</b>	<b>42</b>
<b>APPENDICES .....</b>	<b>46</b>
Appendix I: Letter of Introduction.....	46
Appendix II: Questionnaire.....	47
Appendix III: Key Informant Interview Guide.....	54

## LIST OF TABLES

	<b>Page</b>
Table 3.1: Target Population and Sample Size .....	26
Table 4.1: Age of Respondents .....	27
Table 4.2: Gender of Respondents .....	28
Table 4.3: Respondents Level of Education .....	28
Table 4.4 Number of Years Lived in Kiambu .....	29
Table 4.5: Problems Encountered in Waste Collection .....	35
Table 4.6: Effectiveness of Solid Waste Management Methods .....	36



## LIST OF FIGURES

	<b>Page</b>
Figure 4.1: Nature of Waste Generated .....	30
Figure 4.2: Waste Disposal in Designated Areas.....	31
Figure 4.3: Stakeholders in Solid Waste Management.....	32
Figure 4.4: Stakeholders in Solid Waste Management.....	32
Figure 4.5: Waste Collection Frequency .....	33
Figure 4.6: Ranking of Services Provided by Waste Collectors.....	34

## **ACRONYMS AND ABBREVIATIONS**

EA	Environmental Audit
EIA	Environmental Impact Assessment
EMCA	Environmental management and Coordination Act
E.U	European Union
NEMA	National Environment Management Authority
NGO	Non-governmental Organization
NWMS	National Waste Management Strategy
SBC	Secretariat of Basel Convention
SWM	Solid waste management
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development

## ABSTRACT

In Kenya, solid waste management is a key area of worry in countless urban centers as well as other developing countries. It poses a significant threat to public health as well as environmental degradation. In major urban centers within the country (Kenya), there is evidence of rampant pollution from haphazard dumping, inadequate infrastructure for solid waste collection. Waste collection by the private sector is unregulated adding to the growing challenge.

This study, therefore, aimed at generating data on the current solid waste management state within Kiambu County as well as identifying challenges and opportunities to advance the present-day solid waste management practices within Kiambu.

The study focused on Kiambu County municipal areas. A survey was carried to obtain information about how the devolved system of governance handles waste, and the levels of compliance to set rules and policies of Kiambu County in the management of solid waste. Information was collected using descriptive study because it provided respondents with an opportunity to describe the phenomenon under study.

The unit of analysis in this study was solid waste management in relation to the devolved system of government. The units of observation were the respondents who were stakeholders in waste management within Kiambu County. The respondents included the Chief Officer Environment, NEMA officers within the County, Sub-County Administrators, private garbage collectors as well as Sub-County Environment Officers.

Quantitative data was obtained from 12 Sub-County administrators from 12 sub counties in Kiambu County, 1 chief officer as well as 12 sub-county environment officer, 100 private garbage collectors as well as 5 NEMA officers within Kiambu County. Qualitative data was collected from key informants who included residents who had lived within the municipal areas for over 15 years, members of county assembly, some head teachers as well as church leaders. Sample size from the various strata was selected using simple random sampling. In the case of some respondents, the whole target population was interviewed without sampling.

The results showed that over 94% of people interviewed had undergone undergraduate studies. The relationship between level of education and solid waste management cannot be underestimated. This is because education helps shape people's attitudes. During the study period, the researcher also found out that many of the respondents were understood the basics of solid waste management concerns. They also understood the risks of improper waste management to both the environment as well as human health. However, many projected frustrations on lack of proper structures by the county government to handle solid waste.

The results of the study showed that various stakeholders are involved in management of solid waste in Kiambu County who include the local authority; community based organizations, churches, NGOs, and self-help groups as well as private firms. However, the Local Authority/County Government was the major stakeholder in management of solid waste within the County.

The study results also established that majority of the respondents would prefer waste to be collected once in a week, on the other hand 25% wanted it collected twice a week, 6% once in two weeks 4% twice a month and finally 3% once in a month. The study also established ranking of waste collectors by the target population with many of the respondents ranking the services of domestic garbage collectors to be good (51%), very good (31%), poor (12%) and very poor (6%).

The study also showed some problems encountered in solid waste management which included bulkiness of waste, storage method and device, foul smell, distance from the disposal site from some residences, poor transportation, poor collection and management of disposal sites. The findings of the study brought out the need for an integrated approach towards SWM, implementing waste-to-energy projects within the county, harmonizing reporting systems to minimize duplication of efforts, incorporating SWM into fundamental County planning and finally, coming up with a SWM law for Kiambu County.

## **CHAPTER ONE: INTRODUCTION**

### **1.1 Introduction**

This chapter presents the research project, laying out the study background, problem statement, investigative questions, research objective(s), justification along with the scope and the research limitations.

### **1.2 Background of the Study**

Solid waste is a term that is used to refer to unwanted or useless garbage resulting from activities from human beings and animals. Solid waste comes from mostly industrial, residential and commercial activities; it can be dealt with using a number of approaches. Solid waste management (SWM), therefore, is a field which deals with waste control from the point source (generation), storing, gathering, transfer, processing and eventual disposal in a method that takes into context the range of conservation, engineering, public health, aesthetics, economics and other environmental concerns. SWM, in its scope embraces financial, administrative, planning, legal and engineering elements (LeBlanc, 2017).

Solid waste can be classified into six groups: residential (domestic waste), institutional, commercial, demolition, street sweeping, and construction waste, as well as sanitation waste (Rushbrook, 1987). Other terms that are used to refer to solid waste include: garbage, trash, rubbish and refuse. According to (Zurbugg, 2007), urban dwellers generate more waste than their rural counterparts mainly because of the high population density and also availability of resources. It is, however, sad to note that the rate of disposal does not correspond to the rate of generation thus causing a huge problem. Zurbugg (2007) notes that human exercises create waste, and the manner in which these waste are taken care of, stored, collected and discarded can posture dangers to nature and to public wellbeing. In urban territories, particularly in the fast urbanizing urban communities of the creating scene, issues and concerns of solid waste administration are of quick significance. This has been recognized by most administrations; however it may, fast general population development overpowers the limit of most city authorities to give even the fundamental administrations. He further notes that in majority of the developing countries, characteristically almost two thirds of the solid waste generated are not collected (United Nations Populations Division, 1997).

Consequently, the uncollected waste that sometimes has significant amounts of animal and human excreta is discarded indiscriminately in drains and on the streets contributing to insect breeding, flooding, and increase of rodent vectors. It also contributes to the spread of diseases

like cholera. The core objective of SWM is to decrease and eradicate the adversarial effects of waste on human health as well as the environment while increasing the quality of life and supporting economic development (Zurbugg, 2007).

SWM has six functional components which include

- Generation of waste,
- Waste handling, storing and waste processing,
- Collecting of waste
- Transport and Transfer
- Recovery and Processing
- Waste disposal

In Kenya management of solid waste is a key challenge in countless urban centers as well as other developing countries. It poses a weighty peril to both environment and public health. In major urban centers within the country (Kenya), there is evidence of rampant pollution from haphazard dumping, inadequate infrastructure for solid waste collection, unregulated solid waste collection by the private garbage collectors. SWM is therefore a mounting challenge. Most of the waste in the rural regions is biodegradable, the state of affairs is dissimilar in urban regions as the emergent industrialization and consumerism generate garbage at a speed that the country may not be able to sustainably dispose off. Piles of solid wastes are now a common scenario in most of the urban centres in Kenya as the government is yet to come up with an inclusive strategy to confront the nuisance.

Kenya's rate at which solid waste is being generated is higher than the current rate of urbanization globally. Kenya's urban population is progressively increasing at a higher rate. According to the 2009 census, 13.9 million Kenyans were living in urban centers compared to 5.6 million in the 1999 census. As a result of this, (Hoornweg, 2012) predicted that the rate of solid waste generation in Kenya may grow from the current estimate of 2000 tons per day to 10,171 tonnes per day by the year 2025.

In Kiambu County, the key role of management of solid waste is upon the county government. However, there are licensed private waste collectors as well as community based organizations who take up the role too. These private collectors are not well coordinated and monitored. As a result of devolution, many developments are rapidly coming up within the counties. This had translated to increased rural-urban migration and

consequently increased industrial and domestic wastes within the urban centers. Solid wastes in Kiambu County come from a number of sources. The primary generators of solid waste in high volumes include industries and residential areas. Other low volume solid waste generators include construction wastes and wastes from the transportation industry.

### **1.3 Statement of the Problem**

A report by James (2012) outlines municipal solid waste as a major by-product of urbanization grows as fast as the rate of urbanization. Presently world metropolises produce roughly 1.3 billion tonnes of waste annually. This load is projected to surge to roughly 2.2 billion tonnes by 2025. This will be more than double in countries with lower incomes. It is important to take note that in Kenya, solid waste is principally collected and subsequently taken to open dumpsites for disposal. It is imperative to appreciate that the mandate of solid waste management in Kenya now lays county governments under the new devolved system. With swelling urban sprawls, more waste is generated straining present capability of county governments to handle. For the poor urban dwellers, the issue of solid waste management may not be a key area of concern considering that they have other pressing challenges like poverty. Additionally, (Habitat, 1994) notes that in developing countries handling of solid waste is considered “below acceptable level of dignity”. Lack of waste collection adequate equipment and minimal workforce within the county also hampers waste management systems that are effective. Moreover, inadequate resources to fund education and information promotion campaigns to educate the general public on waste management from source also hinder the efficiency of the county governments to manage waste. Inadequate coordination between the county governments and private waste handlers also acts as an obstacle towards effective solid waste management in the county.

Essentially, waste management relates with city planning essentially from the generation point of waste (source) i.e. the built environment as well as the people. In the past City planners have not been adequately involved in waste management. This function has been left to the environmental field (Farhan, 2006). This means that many waste generation programs within the previous municipalities have focused only on the disposal of the waste with disregard to the entire life cycle of waste; from source to disposal. Considering that city/town planning is a function that falls under the county government, it would be imperative to ensure that issues of solid waste management beginning the source of waste to dumping are factored in during planning.

The impacts of solid waste to the environment (land, air, ecosystems) are not only devastating but also alarming. There have been efforts by the private sector in solid waste management including in the collection, disposal as well as recycling. The challenge, however, is that the rate of urbanization means that the burden of solid waste management puffs up proportionately as the increasing urban population. Even though several researches have been done on solid waste management, none has been carried out with specific focus on Kiambu County under the devolved system of governance. The researcher considered Kiambu County for the research mainly because Kiambu exhibits a dual character of being both a rural as well as an urban place. Kiambu is also experiencing rapid population growth especially in the urban centres as a result of devolution. This has therefore led to upsurge in the amounts of wastes being produced in its urban centres. This study, therefore, looked at the challenges facing solid waste management in Kiambu County under the devolved system of governance and the opportunities that could be utilized to address the situation.

#### **1.4 Research Questions**

- i. What is the nature and type of wastes generated within Kiambu County?
- ii. What is the extent of awareness of the problem of solid waste management within Kiambu County?
- iii. Who are the stakeholders in solid waste management within Kiambu?
- iv. How effective are the current solid waste management methods and approaches in Kiambu County?

#### **1.5 Objectives of the Study**

##### **1.5.1 The Overall Objective**

The overall objective of the study was to generate information on present state of the solid waste management within Kiambu County and subsequently identify challenges and opportunities to improve the current solid waste management systems within the County.

##### **1.5.2 Specific Objectives**

- i. To establish nature and types of wastes generated within municipal areas of Kiambu County
- ii. To establish the extent of awareness of the solid waste management problem in Kiambu County municipal areas
- iii. To identify the major stakeholders in solid waste management within Kiambu



- iv. To examine the effectiveness of the current solid waste management methods used by the Kiambu County Government

## **1.6 Justification of the Study**

The researcher wished that based on their findings of the study, opportunities that are not utilized in improving the current solid waste management system will be identified. Consequently, this will lead to more consultations and initiatives so as to improve on the current state of solid waste management within Kiambu County.

This research also aimed at drawing attention to a couple of stakeholders in matters of solid waste management including the level at which they have been involved on this issue. The stakeholders could use this information to improve on strategies and policies that could be put in place to handle issues of solid waste management within Kiambu County.

## **1.7 Scope and Limitations of this Study**

### **1.7.1 Scope of this Study**

Solid Waste Management is an intricate problem worldwide. However, the major emphasis of the study was investigating the current solid waste management practices in Kiambu County by both the county government as well as private stakeholders. The study also aimed at identifying the challenges facing solid waste management, and subsequently identifying opportunities to improve the situation within the County. The study narrowed down on municipal waste which is waste from households, commercial areas as well as from the markets.

### **1.7.2 Limitations of this Study**

The major limitation to this study was time constraints given such that the researcher works from 8.00 am to 5.00 pm. Another limitation was the validity of the information given by respondents. Even though a lot of data was generated from reports, some of the data was sourced from individual respondents who may either have limited the information they gave for various reasons or given inaccurate information. This is because the main respondents were those charged with the mandate to manage solid waste disposal and collection in the County of Kiambu Government. Some additional data was also be sourced from private garbage collectors. Also, the generalizability of the study findings to the rest of the country

would be a limitation; since each county has its own unique challenges in addressing issues of solid waste management.

Some limitations were reduced by the researcher asking for some days off from work in order to make time for the research. The researcher also ensured that she chose key informants who were had lived in Kiambu County for more than 15 years and had thus experienced solid waste management evolution within Kiambu County from both the administration level as well as other stakeholders in management of solid waste within the county.

## **CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

### **2.0 Introduction**

#### **2.1 The Literature Review**

##### **2.1.1 Global perspective**

For a very long time, implementation and formation of the solid waste management programmes and some policies in Africa was carried out by the government institutions without considerable public engagement. This went on until the late 1980s when social and political changes began. The changes brought about rise of civil society, CBOS, community based groups towards enhanced creating awareness on environmental issues in the general public. This has led to increased campaigns towards waste reduction at source, recycling as well as sound disposal of the waste. Many proposals have also been conducted to address waste management from the point source. In essence, however, waste management is more than just an environmental problem. Waste material flows are associated with not only a transformation from raw materials to waste materials, but also a redistribution of wealth and socioeconomic impacts as well as environmental consequences.

Brown (2001) observes postmodern societies have significantly increased and indulged in excessive consumption of materials for comfort, luxury and even convenience. This era has been characterized as the “throw-away economy” and the “material age”. Practically, the waste management process interacts with the city planning critically from first the source of the waste generation: built environment and people. City planners’ contribution in the solid waste management has largely been restricted to mostly environmental field, focusing mostly on facility siting in particular (Farhan, 2006). In addition, waste management is ordinarily supposed as the “end-of pipe” of socio-economic activities. Thus, the current waste management existing programs have mainly concentrated on disposal of waste produced, rather than probing the key points of waste generation and the complete life-cycle of the waste products and materials.

According to Farhan (2006), planners in nature have the unique knowledge and skills to contribute to practical and efficient waste management. They understand regional and local demographic and employment characteristics as well as its economic structure of an area. They are skillful at utilizing the local records mainly for the dynamic for estimations of community planning and, infrastructure and the waste management main programs should be incorporated to fit in the long-term plan. Additionally, planners put distinctive emphasis on the spatial inferences during formulation of policies also they are ready to integrate some

local characteristics to formulate waste management policies that are community-specific. Furthermore, the planners may grasp an all-inclusive view of the area and may control the interdisciplinary cases of the waste management. A better conceptualization for the intricacies in the waste management may help in minimizing conflicts between the planning objectives and the stakeholders. This will consequently, promote environmental effectiveness, economic efficiency and social equity in waste management planning.

According to Bank (1999), the subject of solid waste management is continually becoming both a health as well as an environmental concern in the municipal parts of most developing countries. Mostly in Africa, this problem is severe within the capital cities. The public sector in these cities has been unable to effectively deliver services. This has led to increased illegal dumping of both industrial and domestic waste. Solid waste management in most cities around Africa is given very low priority. Consequently, the funds provided are limited for the solid waste by governments. This means that levels of the services that are needed for the safeguard of public health and environment are not even accomplished. The lack of effective solid waste management translates to significant negative effects on the environment like: soil, water, land, as well as air pollution. These impacts, consequently pose both healthy and safety problems on the population.

World Bank, 1999 sites that cities in the developing and the developed countries may spend below 0.5 % of per capita GNP on management of solid waste, which takes up about the a third of all the total cost; this therefore means that the capacity of municipal governments to collect and dispose waste is overwhelmed. Consequently, a swelling number of city dwellers, especially those in low – income areas, will have limited access to waste management services from municipalities. According to (EPA., 2010), the per capita municipal solid waste generation speed in America has grown with over 70%. With associated waste generation and, timely anticipated population increase and operational waste management is among the challenges of the sustainable development that needs to meet current needs without compromising the capability of forthcoming generations to satisfy their needs (WCED, 1987).

Importantly we have to note that waste management in towns plays a predominantly significant role since the municipal waste from cities and towns often ends up being disposed in low-income areas and rural areas. This means that the full impacts of these waste disposal activities might pass on to several years later. According to Wolman (1969), the significance

of effective management of solid waste in the book “city metabolism” model cannot be undermined. According Wolman, the commodities as well as materials that are needed to sustain, build, and in rebuilding a city are the constituents in the city metabolism process. Wolman indicate that the metabolic cycle is not complete till waste and residue have been removed and disposed of with a minimum nuisance and hazard. It is unfortunate that half a century later, the “nuisance and hazard” that he was alarmed about, the existence of waste management activities to date all around the world.

According to the EPA (2014) the Clean Air Act in the United State regulates about 188 toxic air pollutants. 30 of these pollutants may be released during the process of waste decomposition in landfills/dumpsites. Landfills comprise of some of the largest anthropogenic sources of methane emissions. Apart from air emissions, leachate from landfills can cause contaminate not only on-site but off-site as well. This leads to potentially significant threats to human health as according to the Groundwater Foundation (2005), over 99% of the rural population in the U.S depend on ground water for their drinking needs. Additionally, the activities of waste collection and transportation generate air pollution as well as prejudice the aesthetic value of the natural environment. Pragmatic studies have shown property value depreciation in the areas bordering landfills (Eshet, 2005).

According to Parker (2003), a former official of the Illinois EPA stated that landfills and communities can work together and accept each other and actually benefit from each other. Several cities have supported this statement claiming “garbage is good” for them. The “benefit” here refers to the host community fees, tax revenues, free or low-cost waste disposal quotas, portion of energy recovery, and infrastructure improvement. For example, several states in the U.S. (such as Georgia, Massachusetts, Maine, Minnesota, New Jersey, Pennsylvania, Tennessee, and Wisconsin) require private landfills to compensate hosting communities with at least \$1 per ton of waste received (Morgan, 2004). These compensation mechanisms have made waste disposal facilities welcomed in some communities, especially those facing economic difficulties.

In Nepal, the challenge of solid waste management is also immense in many towns. Many municipalities focus mainly only on the collection and dumping of waste. Focus is not given towards reduction, re-use as well as recycling of waste for sustainable waste management. Municipalities in Nepal have also failed to recognize role of the other stakeholders in the

waste management process including both formal and the informal sectors as well as community organizations in planning for effective waste management (Action, 2008).

### **2.1.2 Waste in Africa Urban Areas**

The process of waste management in city centers of Africa has been majorly devolved/centralized (Liyala 2011). The process involves the utilization of imported garbage collection trucks (Rotich, 2006). The trucks transport wastes collected from receptacles or transfer points to the designated dumpsites. The design of municipal solid waste management (MSWM), E.A. has significantly transformed from colonial times when it was well-organized because of lesser population in the urban areas and more sufficient resources to the present-day which has significant inadequacies (Okot-okumu & Nyenje, 2011). Since then centralized waste management system greatly evolved into a multi-disciplinary approach in management.

USAID (2004) notes that Rwanda has achieved a lot in waste management through the fiscal decentralization policies. Some of the milestones achieved include routine collection of household waste from three pilot districts in Kigali, imposing higher tariffs for waste collection within the city of Kigali, preparation and sale of fuel briquettes using recycled materials; and anticipated reduction in deforestation as a result of the sale of cheaper briquettes as compared to charcoal, preparation and sale of compost and lastly a significant reduction of waste that is disposed off in the landfill. Thompson (2010) indicates that in Accra shows that the annual growth rate of the city is 4%. This makes it the fastest growing cities in Africa. It has led to consequent growth of the municipal waste in the urban areas. The increased waste has surpassed the city's capacity for processing as well as containment leading to challenges in waste management. This has led to the Accra Management Authority delegating waste collection and disposal to private companies. Waste collection within Accra is done either from a central collection container or from house to house. The Authority pays the private companies with internally generated funds as well as national budgetary allocations from the state government.

Waste collection depends on the neighborhoods. High income neighborhoods have better waste collection arrangements with their waste being collected from door to door. Residents are, however, required to pay for the collection. Subsequently, low income neighborhoods get the service for free. Residents from these neighborhoods shun away from dropping the waste at the central collection points since they are unable to afford these fee. Thompson (2010)

indicates that low income neighborhoods constitute over 80% of the population. The collection, storing, conveyance and the final disposal/treatment of the wastes are stated to maybe have become serious problems in the urban centers (Okot- Okumu & Nyenje, 2011). The types of wastes produced by urban areas within East African are primarily the organic materials which are decomposable. Consumption the urban community generates the most compound wastes, kitchen wastes and the sweepings (Simon, 2008). This may demand for an effective system of collection so as to mitigate the environmental degradation as well as health risks not to mention loss of aesthetics. E-waste has become a substantial threat to the human health and environment in urban centers within East Africa due to the current global trend of the increased usage of electronic goods and electrical (Wasswa & Schluep, 2008).

### **2.1.3 Waste Management in Kenya**

Solid wastes in the Kenyan urban centers are the results of the extensive variety of industrial, service processes, and manufacturing. Major large-volume generators for the industrial solid wastes including chemicals, petroleum, transportation, paper, textile, and wood, leather and wood industries. The Secondary generators also include construction waste, equipment repair and auto, dry cleaners electroplaters, and pesticide applicators (UNEP, 2005).

In Kenya, waste management has been customarily by legislation bequeathed to the local Authorities. This role has however, grown to be very challenging due to increased urbanization as well as rapid growth in population. Many local governments do not give considerable attention as well as resources to waste management services. The population growth in the country is characterized by the rapid development of the middle class who are increasingly after material comfort. This consequently leads to increased waste quantities as well as intricate waste flows. The waste flow is further complicated by increased industrialization within the country. If effective and adequate waste management practices and policies are not even implemented, the cities with time would be overwhelmed by their waste leading to health and environmental problems for the populations (NEMA, 2008).

The challenges of waste management in Kenya aren't different from the other countries and towns around Africa. According to a study carried out by (Karanja, 2005) in Nakuru Town, the most ever increasing population within the town has accordingly led to increased disposing of waste. This has led to the cities losing its former reputation and glory as the "cleanest town in East Africa".

The study also notes that rising urban population and increased informal settlements has led to a rise in the demand of provision of the basic services like garbage collection, the water supply as well as sanitation. This demand surpasses the available supply by the municipal governments which are currently the county governments. Consequently, this has led to increased challenges in waste management.

Karanja et al, (2005) also observes that picking of waste in Nairobi has been divided into the street picking- majorly in small dustbins; streets and open city waste dump pickers and waste sites. Waste pickers are present at the designated as well as informal dumpsites like the Dandora dumpsite. Twenty percent (20%) of the waste pickers within the Dandora dumpsite live within the dumpsite. A significant number of waste pickers are live in the streets and they use garbage as their source of income. The pickers and waste dealers who earn from the recovery and the sale of recyclable materials from the Dandora dumpsite number to over 2000 in number. A report by Habitat (2010) indicates that some of challenges facing waste management in the city of Nairobi comprise the lack of physical capability in managing waste and the financial constraints. In Kisumu, for example, the situation is almost similar to other urban centers and cities in Kenya. The report indicates that about 500 tons of the waste is generated in a day and only about twenty percent of it is taken to the dumpsite. Kisumu lacks a strong response to the solid waste management. The problem is escalated by a poor attitude towards the waste management as well as small capacity offering waste management services by the local Authority.

Mwangi (2003) observes that the introduction of economic structural adjustments since the mid 1980's by the Kenyan government has led to reduce of the public expenditure. This has an adversarial effect on the urban residents. This means that delivery of urban services including waste management will have to be done through a different approach. This is currently being reflected in Kiambu County as the county government has started a campaign that owners of residential flats should engage the services of private waste collectors to collect their waste. The county governments who are now charged with the responsibilities of providing municipal solid waste management services are facing major challenges in this role. The difficulty is aggravated by lack of legislation and even where the legislation is available, there lacks effective enforcement strategies. Other problems facing the county governments are lack of funds, changing lifestyles such as the use of disposable diapers; canned and bottled drinks also contribute towards the problems of solid waste management by the country government and municipalities.



NEMA (2008) argues that it is of utmost importance that the National Waste Management Strategy (NWMS) is implemented due to its considerable socio-economic benefits. The strategy needs to address the volumes of wastes generated while ensuring that the complex waste flows are all environmentally sustainable for projection of the populations. The NWMS is seeking to incorporate objectives of the environmental sustainability and the achievements of waste hierarchy and the broader development and transformation objectives of improved economic development public health outcomes, improved access for all and poverty alleviation. Report (2005) shows the need for waste minimization towards enhancement of competitiveness and resource efficiency. These include reuse, reduce and recycle approach, China's Circular Economy Approach, E.U's waste prevention and recycling strategy among others. Recycling can effectively minimize solid waste at the point source, during transit as well as disposal. This will ultimately reduce the disposal costs for the waste. According to Girling, (2005) recycling of solid inorganic waste can contribute significantly towards informal employment creation as well as solving solid waste management problems. Without a doubt the overall problem of Solid waste management is multi-dimensional: several groups, the United Nations (UN) included. A number of non-governmental organizations (NGOs) also promote an integrated approach system for Solid waste management mostly by pinpointing the important stakeholders, also recognizing explicit issues that make up the important "stumbling blocks", also by making suggestions for action that are based on the local information, suitable technologies, and some persistent environmental and human health fears (Senkoro, 2003).

The Solid Waste Management challenge is very pertinent in Kenya (Gakungu, 2011). The collection mechanisms are so ineffective and the disposal arrangements are also not so environmentally sustainable. Basically, thirty to about forty per cent of the solid waste in the municipal areas is goes uncollected. Below fifty per cent of people in urban centres is also provided with services (Otieno, 2010). Otieno states that approximately eighty per cent of the transport vehicles used for collection is likely non-functioning or is in need of repairs. He also says that if by coincidence sustainable solid waste management is not taken up as a dire need in Kenya, almost all municipal areas in the country will be covered in waste. Ali (2009) observes that in several countries and regions, international and national have fixed objectives for recycling of municipal solid waste, diversion and recovery from landfills.

In order to implement and develop optimal approaches that will reach the objectives of SWM, information which is accurate is required addressing the configuration of all elements of the household waste stream. It thus becomes imperative to scrutinize the type and quality of the waste produced. This will lead to the enhancement of actions at the source. As a response to the above outlined environmental challenges, Kenya reviewed its related laws policies and laws. This led to the enactment of the Environmental Management and Coordination Act (EMCA) of 1999. EMCA confers duties and confers rights to individuals on the enhancement and safeguarding the environment. It provides an assurance to every Kenyan a healthy and clean environment. The provisions also envision protection of the environment to ensure sustainability for the present and the future generations. The Vision 2030 also premeditates the same rights. Present generations' needs need to be met so as to ensure development. However, this should not compromise the capability of the generations in future to meet their needs. This ensures sustainable development (UNEP, 2010).

Sustainability can only be achieved by putting in place a system for the integration of environmental considerations in planning and management in social and economic aspects. The growing environmental fears and concentration on energy and material recovery are gradually shifting the route of solid waste planning and management. Emphasis to date is moving towards development of sustainable and low cost structures for management of solid waste, while putting into thought various management practices. Such a structure should come in as a solid waste system support for decision making that puts into consideration environmental and socio- economic concerns. The structure outlines solid waste composition, rate of generation, treatment, collection and disposal including the potential positive and negative environmental impacts of various techniques and methods of solid waste management.

The Environmental Coordination and Management Act (EMCA, 1999) as well as Waste Management regulations outline that it is the mandate of local authorities to ensure a clean and healthy environment ensuring proper waste management within their areas of jurisdiction. Pursuant to these legislations, the City Council of Nairobi revised its bylaws on waste management in 2007 to be able to better manage waste. Strategies for providing DSWM services for people in slum areas of cities should be drawn and planned in a different way from those in other formal areas. This is because the conventional methods for delivering public services in these areas repeatedly do flop and also subsidizing the services makes it hard to generate a big sense of community responsibility.

#### **2.1.4 Solid Waste Regulations**

##### **Basel Convention**

The Basel Convention that was on the issue of the Control of the Transboundary Movements of the Hazardous Wastes including disposal. This was effected on 22<sup>nd</sup> March, 1989 through Plenipotentiaries Conference in Basel, Switzerland. This was in the response to the public outcry caused by deposits of toxic waste from abroad to Africa (SBC /UNEP 1989). The major objective of this Basel convention was to protect the environment and human health against hazardous waste. It has defines a large wide range of the wastes that can be classified as “hazardous” according to their, characteristics, composition and/or origin. The Article 14 of this convention provides for the establishment of the regional as well as the sub-regional points for training and technology transfers with regard to hazardous waste management. The article also provides for the minimization of waste generation that cater for the different sub-regions and regions. Up to date, fourteen (14) such centers have been already established.

##### **Bamako Convention**

This convention involved a treaty amongst Africa countries ban of importation of hazardous materials. The convention was shared by twelve nations of OAU (Organization of African Unity) in January 1991 at Bamako in Mali. It came into act into 1998. Impulsion of this convention followed failure of Basel convention to prohibiting trade of the hazardous waste in most of less developed countries. It was also greatly driven by the realization that there was a lot of import of toxic wastes to Africa. For example, in 1987 eighteen thousand barrels of hazardous waste were imported into Nigeria by an Italian Company. The company has agreed to pay a local farmer 100 dollars per month to store the waste (Langlet, 2009). This Bamako Convention used a format and language similar to the format of Basel Convention, but it is much solider in prohibiting all the importation of the hazardous waste. Unlike the Basel Convention that had made exemptions on certain hazardous waste like radioactive material, The Bamako convention does not make any exemptions on certain hazardous wastes.

##### **The Constitution of Kenya, 2010**

Article 70 of the Kenyan constitution stipulates that every person in Kenya has a right to a clean environment. The right to life which is protected by the constitution may largely depend on the environment. This therefore means that if the health and state of the environment is compromised, the right to life is also compromised. The fourth schedule of the Constitution also outlines the functions of county governments under the devolved

system. One of the functions defined includes removal of refuse, refuse dumps and disposal of solid waste.

### **Environment Management and Coordination Act, EMCA (1999)**

Part 12 (a), 2<sup>nd</sup> schedule of EMCA, 1999 explains that Environmental Impact Assessment (EIA) and Environmental Audits (EA) need to be conducted for purposes of waste disposal as well as the site for solid waste disposal. Part VIII Section 87(1) explains that no individual shall dispose any waste whether that waste is generated within or out of Kenya, in a manner that pollutes the environment or brings about ill health to any human being.

Section 89, highlights that any individual, whom at the start of an Act, owns or operates waste disposal site or generate hazardous waste, will apply to relevant authorities to acquire license within a period of six months following the implementation of this Act.

Section 87 (2), in paragraphs (a) and (b) of EMCA stipulates that no individual should transport any waste unless it is accordance to the authority through issuance of a valid license. Any waste should be deposited to a waste disposal site that is established by the issuance authority. Section 90 forces an individual to stop the generating, handling, transporting, storing or disposal of any waste whereby such generation, handling, transportation, storage and disposal might present high risks or danger to public health, environment or natural resources. Section 87(1) stipulates that no individual should discharge or dispose any waste material, whether generated within or outside Kenya, in a manner that causes pollution to the surrounding or ill health to an individual.

## **2.2 Theoretical Framework**

### **2.2.1 Systems Theory**

Systems theory entails a trans-disciplinary study about an abstract arrangement of an occurrence that is independent of all the elements, type or temporal scale or spatial existence. It evaluates both the principles of usual complex beings as well as unusual mathematical models that can be utilized to describe them (Bertalanffy, 1951). System theory was advanced by a biologist known as Ludwig (1928). Ever since Descartes put forward two fundamental assumptions. A system may be separated into some discrete constituents so that every constituent may be evaluated as an independent entity. The individual constituent/component may possibly be filled in a linear fashion in to unfolding the entirety of this organization. Bertalanffy Von projected that the assumptions were incorrect. Quite the

opposite, a system is defined by the nonlinearity of the connections and the interactions of its components. In 1951, Bertalanffy von stretched systems theory to embrace the biological systems. Zadeh Lotfi, an electrical engineer at Columbia University promoted this three years (Kuhn, 1974).

Kuhn outlines one mutual component of these systems: having an understanding of some components in a system gives people an understanding about other parts. This information range from a piece of information that is proportionate to the amount which is deduced from such information (Kuhn, 1974). These systems can either be controlled (cybernetic) or uncontrolled. Information in the controlled systems is detected and the variations are enhanced in the reply to that information. Kuhn discusses this as selector, detector, and the effector roles of the systems. The detector relates with communications of information amid systems. The selectors are determined by the rules which the systems utilize in decision making. The effector is the avenue which the transactions/relations are established amongst the systems. Transaction and Communication are only the interfaces between systems. Transactions involve communication, while Communication is the exchange of information.

The essence of the decision is moving systems in the direction of equilibrium, according to Kuhn's model. Transaction and Communication provide an avenue for the system to reach equilibrium point. Culture entails learned patterns that are communicated, and the society involves a collection of people with similar body and culture (Kuhn, 1974). A subculture is defined as a relative as the existing focus of attention. Culture is perceived as a pattern within the system; when the society is regarded as a system. Systems theory gives an internally stable structure for categorization and assessment of the world. Legibly, there are many valuable concepts and definitions in the systems theory. Mainly, it provides a scholarly method of evaluating any state of affairs. The systems theory provides a universal approach to all the sciences. There are several occasions where matching principles are revealed frequent times due to players in one of the field being ignorant that the theoretical structure needed had already been well established in another field (Bertalanffy, 1968). Such pointless duplication of this effort may be avoided by the general systems theory. General systems theory is extensively used in organizational development. Initially organization theory pin pointed the technical necessities of the activities of in organisations. Following the rise of systems theory in 1970, scientists were inclined to examine whether organisations as open systems related with the environment. Interestingly, there lacks an agreement on the

importance of the environment, however, there are differences regarding the parts of the environment that are most important.

Scott and Meyer (1983) acknowledged the three dominant models used for investigating the interaction of the organization and the environment. The first one is the organization-set model which is also referred to as the resource-dependency theory. This model gives emphasis to the resource needs and the reliance of an organization that makes same demands from our environment and that pressures the competition formed by the insufficient environmental resources. This inter-organizational field model also analyzes the interactions of the organizations to other organizations; it is commonly within a localized geographical area.

Social and Organizational systems should alter and change so as to remain healthy. Both are sensitive, and are open systems to variations within the environment. An environmental variation can have an intense effect on an open system. Health of an organisation is interlinked with the capacity to anticipate and adopt environmental changes. Surrounding health is related to the energy-matter connections when considering location in the organisation and social structures. A two-sided affiliation exists amidst the environs and components of all subsystems that work in the environment. Social change tries to deal with a problem or act as a catalyst towards a vision. Change is introduced in the organisation with the objective of upsetting other components in the organisation. Knowledge regarding the nonlinear interactions amid variables gives planners' ability to effect modifications in a preferred variable with remarkably small adjustments in another. System theory allows planners to predetermine their perceptions and forecast whether their decisions impact on other elements in the environment and the device. The interpretation of all systems is outlined by our experience and our way of life. The fact that the systems principle identifies the relativity of notion may assist to increase our information of our roles inside the universe. It proposes a structure for us to recognize and re-examine our environment.

A system approach offers a shared process for the study of organizational and societal arrangements. It gives a nicely-described terminology to capitalize on interactions across disciplines. Instead of being a lead to it, systems theory is a way of searching at matters. It is an internally regular technique of scholarly analysis that can be carried out in all regions of social science.

### **Application of theory on solid waste management**

The need for a system method in waste management is a multifaceted task that calls for suitable technical solution, sufficient organizational potential and cooperation among diverse participants (Zarate et al., 2008). The multi sectoral and interdisciplinary matters needed for the right management of solid waste highlights the interface and intricacy among the physical additives of the gadget and the theoretical additives that comprise the social environmental sphere. When waste is considered to be perceptible being a portion of a system, connecting waste into different parts of a system is determined and because of that reason the capability for responsibility of the operation will arise.

Theoretically, this view intensifies the need for waste management approach that deals with complexity (Seadon, 2010). Equally, SWM approach is reductionist, and not designed to handle complexity of interactions in between systems, and its components that are divided into smaller elements. System processes such as generation of waste, collection and disposal processes are anticipated to be autonomous and each component is interlinked and influenced by others. The reductionist method is basically divided into many more secondary categories, and waste streams from various segments along with residential and commercial waste streams are commonly considered one at a time (Seadon, 2010). Techniques therefore have a propensity to cognizance on management of one category of waste at a time amounting to contemplation on a particular technology in inclination to waste control structures. Subsequently, the limitation for waste challenge is dealt with through other waste concerns that emanate from each compartment solution (Djukema et al., 2000). Tendencies to scrutinize issues in a myopic and comprehensible way are seen as a route towards increasing complexity in issues (Funtowicz & Ravetz, 1993; Meadows, 2008). This is established inside the SWM sector by way of the mounting call for SWM practices that distinguish the social, political, cultural and environmental scope that interrelate with diverse stakeholders; in addition to accounting for the large devise through all-inclusive, integrating approaches.

#### **2.2.2 Symbolic Interactionism Theory**

The symbolic interaction perspective additionally referred to as symbolic interactionism, is a main framework of sociological idea. This viewpoint is supported by the symbol that people broaden and depend on the process of social interaction. Symbolic interaction is a statement that insinuates that people act according to how they interpret the meaning of their world (Max Weber, 1930). Symbolic interaction concept or symbolic interactionism is a key

perspective inside the topic of sociology. It presents a key theoretical foundation for a significant number of the studies performed through sociologists. The critical principle of this perception is that the means we derive from and characteristic to the world around us is a social construction shaped by way of daily social interplay. This concept fundamentally centered on our usage and how we infer matters as symbols to talk to one another differently, how we will form and keep an identity that we show to the world and an experience of self within us, including the way we can form and hold the reality that we accept as real with to be true (Meads, 1934). Blumer came up with the time period “symbolic interaction” in (Meads, 1937). He later quite literally published the book in this theoretical angle, titled “Symbolic Interactionism.”

In this work he outlined three fundamental principles of this theory.

- We act towards things or people with regard to the meaning that we interpret from them.
- These meanings are as a result of social interaction amidst individuals (they are part of social and cultural limits)
- Meaning and conceptualization of a continuous interpretive process that ensures that the original meaning may be the same change a little bit or evolve radically.

Based on those fundamental views, symbolic interactionist perspectives explain these facts as they are, it is part of a social construct that is produced through continuous social interplay, it exists in a given social context (Blumer, 1969).

It should be stated that the symbolic interactionists support a selected technique due to the fact they see it as the fundamental thing of interaction in the human society. Symbolic interaction tends to take two great, but related methodological paths. Processual Symbolic Interaction pursues to ascertain the elaboration and reveal in of meanings in natural sets of social interplay via commonly qualitative techniques (e.g. Examining the technique wherein humans come to be and represent selves) whilst Structural Symbolic Interaction pursues to map the contours of the self through predominantly quantitative strategies (e.g. Analyzing the structure of the self by asking who people trust - themselves or others).

### **Limitations of the Theory**

The most important drawback of symbolic interactionism identifies with its essential commitment: it centers on the continuing contestation and construction of implications within society (e.g. rules, norms, interpersonal experiences or cultures), which can only be seized

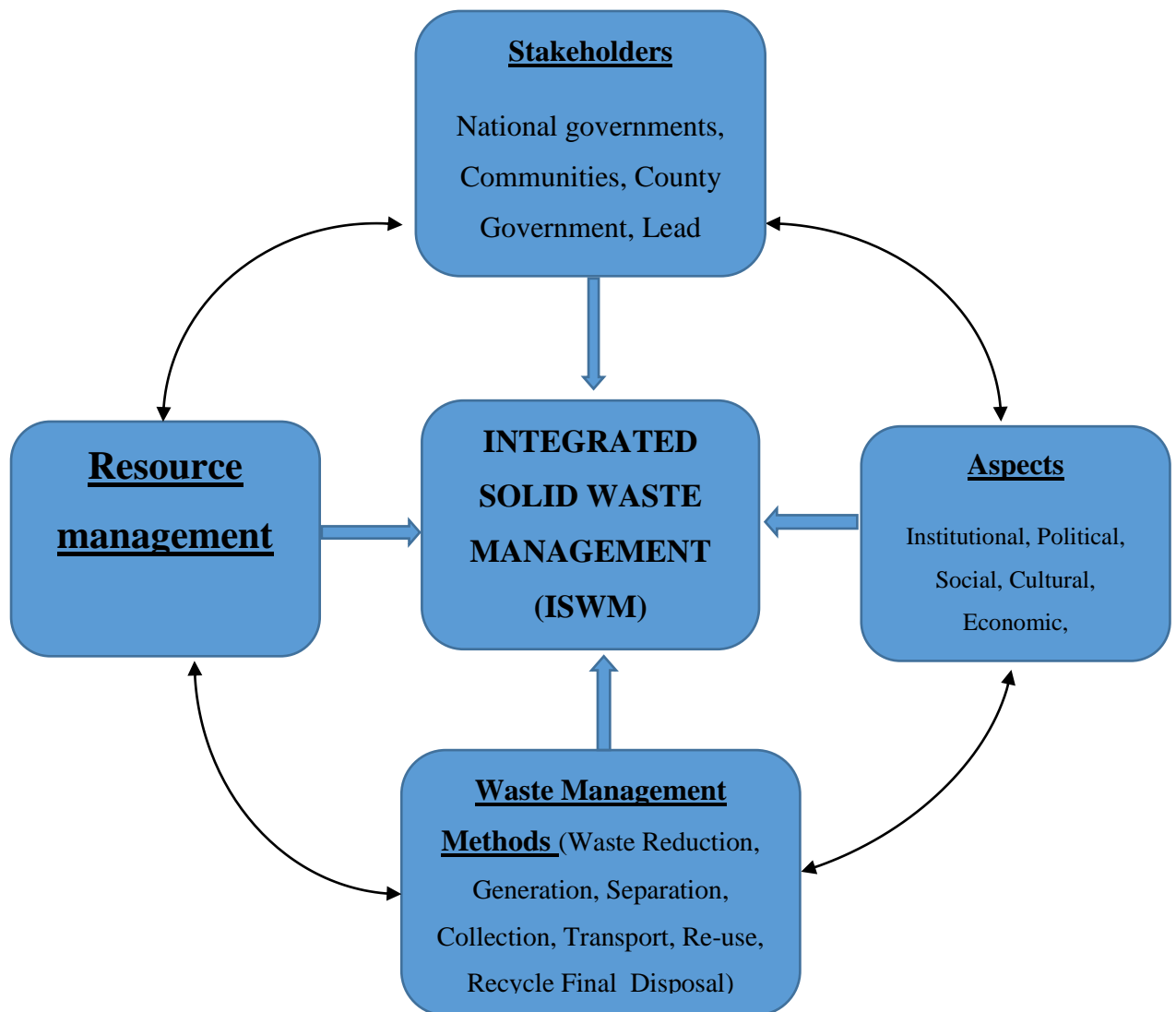


through scrutiny of individual beings or small groups. Consequently, Symbolic Interactionism characteristically focuses on “how” things are done (e.g. how people achieve things that can be witnessed in the natural world and in real time) instead of “why” things are. Hence, Symbolic Interactions is all the sufficiently appropriate in expounding how the world is but can't exhibit and document expectations about how the world may be in specific situations.

### **Application of the theory to the Study**

The researcher used this theory to determine the cultures that the people of Kiambu municipality have formed on matters of solid waste management. The theory states that individuals act from interpretation of meanings. This will help the researcher know how a concern is the solid waste is to the members of that community and what meaning do they attach to the solid waste its handling and disposal. The theory also states that the meanings are products of social interactions between the people and may add the social structures in place. This will help the researcher draw conclusion on what might be the driving forces status of the solid waste management in the study area. If the status is bad or worse the conclusion therefore is that the relevant bodies mandated to sensitize the public on solid waste has failed, as well as the relevant bodies to collect and keep the municipal clean and free from irresponsible dumping of solid waste. The theory also put it across that making meanings and the understanding is a continuous interpretive simple process, in the course of which the first meaning may change slightly, remain the same, or may develop radically. This means that if and when certain meanings and understanding of solid waste management will be altered to suit a sustainable solid waste management then municipality and the whole County will have sound solid waste management systems in place.

### 2.3 Conceptual Framework



ISWM is a multi-dimensional issue. For the system to be effective, there are four main factors affecting it. The first one is stakeholder involvement. Stakeholders include local and national governments, citizens, NGOs, waste managers, as well as the informal and formal sectors. Collective action by all stakeholders is needed for the strategy to work. This may include public education and awareness campaigns as well as collective decision making by all stakeholders concerned. Social acceptability of the strategy is important as well a strong political will (Asase et al., 2009).

The second factor affecting an effective ISWM strategy is the various Institutional, Political, Socio-cultural, economic, financial, technical, institutional and environmental aspects of the strategy. ISWM Strategy (ISWMS) involves the choosing and use of appropriate technologies, techniques and management programs to achieve specific goals and objectives like social acceptability, health and environmental, regulations as well as economic reliability, (Oteng-Ababio, 2012). It considers local conditions and the choice of a proper combination of technologies and alternatives to address local challenges without compromising on legislative requirements. The process of decision making is determined by including institutional, economic, environmental, and socio-cultural concerns. ISWM requires multidimensional methods of handling and disposal, designed to suit specific community needs.

Thirdly, waste management methods affect the overall effectiveness of ISWMS. Selection of an appropriate waste management method should be based on the unique community needs while considering government and institutional policies, economic situation and socio-cultural considerations (Zhu, 2007). Waste management methods consist of but are not limited to: Waste prevention, waste reduction, open dumping, incineration, composting, reuse, recycling, chemical treatment, compaction and even disposing in sanitary landfills. It is imperative to note that no single method can address all the needs of a community in management of waste. Thus different methods must be given consideration and integrated. Various communities also have varied needs in waste management. An ISWMS approach seems to be the most sustainable and effective alternative in handling the increasing solid waste concerns. However, this approach takes great planning and resource allocation so as to realize its goals. Countries require an understanding of all the aspects related with waste management for the strategy to work.

## **CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY**

### **3.1 Introduction**

This chapter highlights all the activities, procedures and the shape of the entire study. Here a brief description of the study area will be given, who and how the questions were asked as well as the tools for data collection.

### **3.2 Site Description/Area of Study**

#### **3.2.1 Position and Size**

The research was carried out in Kiambu County which is one of the 47 counties in the Republic of Kenya. It is located in the central region. The County covers a total area 2,543.5 Km<sup>2</sup> of this area, 476.3 Km<sup>2</sup> is under forest cover (National census, 2009). Kiambu County is next to (borders) Murang'a County towards the North, Machakos towards the East, Nyandarua County towards North West and Nakuru to the West. It also borders Kajiado and Nairobi Counties to the South. The County lies between latitudes 00 25 degrees and 10 20 degrees South of the equator and Longitude 36 31 degrees and 37 15 East.

#### **3.2.2 Population Size**

Based on the 2009 Population and Housing Census, population within Kiambu County for the year 2012 was projected to be 1,766,058 (892,857 females and 873,200 males). The population is projected to increase to 2,032,464 people by the end of 2017. The population growth rate of Kiambu stands at 2.81%. The County is also experiencing an influx of rural-urban migration because of its proximity to the City of Nairobi. People prefer to live in some of the major towns like Kiambu, Ruiru and Juja because of this proximity. Male and female sex ratio is estimated at 1:1.012 in the County.

#### **3.2.3 Urban Population**

The 2009 Population and Housing Census points out that Kiambu had a town population of 936,411 in 2009. In 2012 the population was projected to be 1,018,773. By the end of 2017 the urban population in Kiambu is expected to reach 1,172,453 up from 1,108,380 in 2015. According to the County urban population distribution per urban centers, Kikuyu and Ruiru towns record the highest population of people that live in urban places that include Karuri and Thika town. High population in urban centres is accredited to the vicinity to Nairobi thus offering areas where people who work in Nairobi can reside. Additionally, industrial growth in some sub counties like Thika and Ruiru entice more labour force.

### **3.3 Research Design**

A survey was carried to find information about how the devolved system of governance handle waste, and the levels of compliance to set rules and policies of Kiambu County in the management of solid waste in the region. Descriptive survey was also be used as a method of collecting information as it was the most reliable and valid in information gathering on people's opinion, beliefs, attitudes and behaviour in relation to assessment of public participation. Descriptive research design was applied because it gave respondents an opportunity to describe the phenomenon under study. Information collected through descriptive survey can also be statistically inferred on a population and allowed for grouping of responses.

### **3.4 Unit of Analysis and Units of Observation**

In this study the subject of analysis was solid waste management in relation to the devolved system of government. The units of observation were the respondents who were stakeholders in waste management within Kiambu County. The respondents included the Chief Officer Environment, NEMA officers within the County, Sub-County Administrators, private garbage collectors as well as Sub-County Environment Officers.

### **3.5 Target Population**

Target population constitutes units or objects that share similar traits under investigation (Bryman & Bell, 2003). Target population of this study comprised of 12 Sub-County administrators from 12 sub counties in Kiambu County, 1 chief officer as well as 12 sub-county environment officer, 100 private garbage collectors as well as 5 NEMA officers within Kiambu County. Qualitative data was also sourced from key informants who included residents who had lived within the municipal areas for over 15 years. Other key informants included members of county assembly, some head teachers as well as church leaders.

### **3.6 Sample Size and Sampling Procedure**

Sampling method is a method used to select the sample from a population. Kombo and Tromp (2006), define a sample as a unit that represents a whole population whose traits are assessed so as to get information regarding a sample. The respondents were categorized into various strata and thereafter simple random sampling was applied to arrive at the sample from the various strata. In the case of some respondents, the whole target population was interviewed without sampling. The population data and sample size is as outlined in table 3.1.

**Table 3.1: Target Population and Sample Size**

<b>Department</b>	<b>Population</b>	<b>Sample size</b>
Chief Officer	1	1
Sub-County Administrators	12	12
Environment Officers	12	12
NEMA officials	5	5
Private Garbage collectors	100	30
<b>Total</b>	<b>130</b>	<b>60</b>

### **3.7 Methods of Data Collection**

Questionnaire was the data collection tool; questionnaires were self-administered by dropping and picking them later from the respondents. The questionnaires comprised of closed-ended questions thus the respondents were restricted to direct answers without further explanation. The questionnaires were collected upon completion. For additional qualitative data, the researcher used a key informant guide to complement the questionnaires. Data collected was both primary and secondary data. Creswell (2012) describes primary data as information which is gathered for the first time; it is original in character. Secondary data, on the other hand is data that has previously been collected and statistically processed.

### **3.8 Ethical Considerations**

Permissions letters were sought from all relevant authorities before commencing the study. This included a letter from University of Nairobi that would authenticate the research. Information was gathered on voluntary basis and grounds of the respondents. The information given by the respondents was treated with the highest degree of confidentiality and privacy.

### **3.9 Data Analysis**

So as to analyze collected data Mugenda, (2008) inferred that, it is imperative for a researcher to have information on statistical data analysis tools which include descriptive, inferential and test statistics. Prior to processing the response the researcher went through the filled questionnaires to ensure completeness and consistency. Thereafter the data was coded to allow the responses to be clustered into several classifications. Both qualitative and quantitative data was collected and analyzed by descriptive analysis including SPSS (V. 21.0) and MS Excel. Data was finally presented by the use of frequency distribution and percentage tables in order to describe and present the data more easily.

## **CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION**

### **4.1 Introduction**

The chapter describes processes, procedures and techniques used to analysis presentation and interpretation of data collected using the questionnaires. The chapter expounds the quantitative data analysis. In total, 60 questionnaires were distributed. Out of these, 50 were filled and given back putting the response rate at 83%.

### **4.2 Demographic Characteristics**

#### **4.2.1 Age of the Respondents**

Table 4.1 outlines that 12% of the respondents were aged 18-25 years. Respondents between ages 26-35 accounted for 34% while ages 36-45 accounted for 32%. 14% were between 46-55 years and the final 8% were 55 years and above

**Table 4.1: Age of Respondents**

<b>Age of the Respondents (Years)</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>18-25</b>	6	12.0
<b>26-35</b>	17	34.0
<b>36-45</b>	16	32.0
<b>46-55</b>	7	14.0
<b>Above 55</b>	4	8.0
<b>Total</b>	<b>50</b>	<b>100</b>

Different age groups exhibit different lifestyles and consequently, waste generation tends to differ between the age groups (Zurbugg, 2007) Based on the above 78% of the population was between 18 and 45 years old. Considering that the data was collected in the urban areas of the county, this population group is made up of the working class. When it comes to waste management, different age groups will exhibit different perceptions towards waste management.

#### **4.2.2 Gender of the Respondents**

As outlined in Table 4.2 the male respondents accounted for 72% of the respondents while the females constituted 28%. Thus, majority of the respondents were male.

**Table 4.2: Gender of Respondents**

<b>Gender</b>	<b>Frequency</b>	<b>Percent (%)</b>
Female	14	28.0
Male	36	72.0
<b>Total</b>	<b>50</b>	<b>100.0</b>

Based on the study carried out by the researcher, society perceived solid waste management to be the responsibility of women. This was the case in most low and middle income areas. However, in high income neighborhoods, the task was seen to be a collective responsibility.

According to Müller, 2002 women and men, girls and boys have different roles when it comes to waste management activities. This is to a degree influenced by cultural traditions and in some cases influenced by practical interests, like earning a living, and maintenance of a healthy living environment. It may also be influenced by the desire to achieve recognition a worthy member of the community. Waste management activities range from collection and disposal recycling, and re-use. The activities also involve decision making and management all the way to the negotiation and representation of their interests with the public and private sectors.

#### **4.2.3 Highest Level of Education**

Table 4.3 displays that of the respondents 54% have undergraduate qualifications. Those who had masters level as their highest level of qualification were 28% while 12% had doctorate qualifications. 6% of the respondents had attained a diploma and other qualifications.

**Table 4.3: Respondents Level of Education**

<b>Highest Level of Education</b>	<b>Frequency</b>	<b>Percent (%)</b>
Doctorate	6	12.0
Masters	14	28.0
Bachelors	27	54.0
Diploma	2	4.0
Others	1	2.0
<b>Total</b>	<b>50</b>	<b>100.0</b>



According to the above information, over 94% of people interviewed had undergone undergraduate studies. The relationship between level of education and solid waste management cannot be underestimated. This is because education helps shape people’s attitudes. During the study period, the researcher also found out that majority of the respondents understood the basics of solid waste management. They also understood the risks of improper waste management to both the environment as well as human health. However, many projected frustrations on lack of proper structures by the county government to handle solid waste.

Strong (1998) observes that among the measures to help develop solid waste management systems within administrative areas were to carry out environmental awareness campaigns among their citizens. Environmental health behaviors like proper disposal of waste are perceived to be enhanced when policies and environments support choices that are healthy and when the individuals are educated and motivated to make those choices (WHO, 1986). Oteng-Ababio, (2012) additionally observed that respondents who had achieved secondary, post-secondary and graduate level education were more eager to participate in activities aimed at improved solid waste management.

#### **4.2.4 Number of Years Lived in Kiambu**

Table 4.4 outlines that of the respondents, 45 percent had lived for 2-4 years at the County. 17.5 percent had worked within the county for a period of between 5-7 years. Those who had worked for 8-10 years accounted for 30 percent while the rest (7.5 percent) had worked for over 10 years.

**Table 4.4 Number of Years Lived in Kiambu**

<b>Number of Years Lived in Kiambu</b>	<b>Frequency</b>	<b>Percent (%)</b>
2-4	21	45.0
5-7	9	17.5
8-10	14	30.0
Over 10	6	7.5
<b>Total</b>	<b>50</b>	<b>100.0</b>

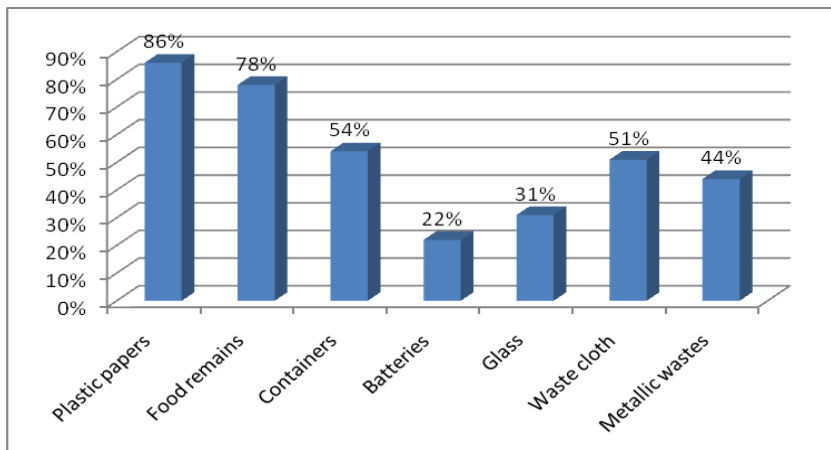
During the period of study, the researcher found out that Kiambu has experienced immense growth. This was especially after devolution. Some of the key informants of the study indicated that with the growing population, many people who work in Nairobi prefer to live

in Kiambu because of its close proximity to Nairobi. The construction of the Eastern Bypass has also contributed to opening up of various towns within Kiambu County. This has consequently led to population influx. Based on the data in the above table, majority of the population has lived in Kiambu for less than 10 years. Also, 62.5% of the population has lived in the county for less than seven years.

This data resonates well with the many of the observations of the key informants. The informants also insinuated that solid waste management problems have increased with the increasing population. According to some respondents, the rate at which population has increased in the urban/municipal areas has overwhelmed the county government’s capacity to handle the solid waste menace. Majority felt that the administration needed to change tact to cater for the rising populations as well as the changing lifestyles among the urban dwellers.

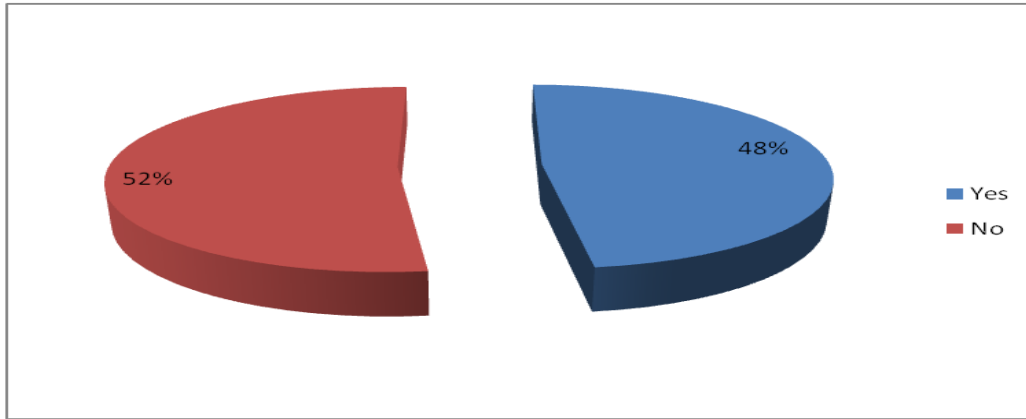
#### 4.3 Nature of Waste Generated Within Municipal Areas of Kiambu County

Figure 4.1 demonstrates that a large number of respondents agreed that plastic papers were the main sources of waste generated in Kiambu County. This was followed by food remains (78%), containers (54%), waste cloth (51%), metallic wastes (44%), glass (31%) and finally batteries (22%).



**Figure 4.1: Nature of Waste Generated**

Observations from some of the respondents indicated that the increased use of plastic wrappings even for small things was the main reason why they were the main sources of waste. Figure 4.2 below further indicates that most of the respondents (52%) do not dispose their waste in designated areas.

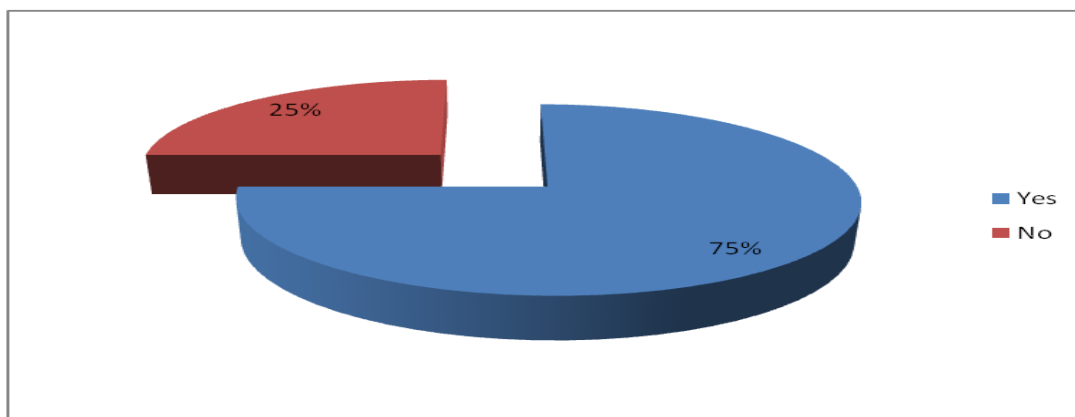


**Figure 4.2: Waste Disposal in Designated Areas**

According to qualitative data collected by the researcher, many people claim they do not have access to designated areas of solid waste disposal. According to one of the Member of County Assembly interviewed in one of the urban centres, while acknowledging the effort put in place by the County Government, solid waste receptacles installed by the County Government are inadequate. He noted that huge improvements had been made to collect waste within the markets and this had significantly improved the solid waste management within the market area. However, a lot needed to be done to improve on waste collection from residential flats because they are among the highest waste generators. He also observed that most landlords have not put in place receptacles within their premises and this exacerbates the problem of solid waste management within the County.

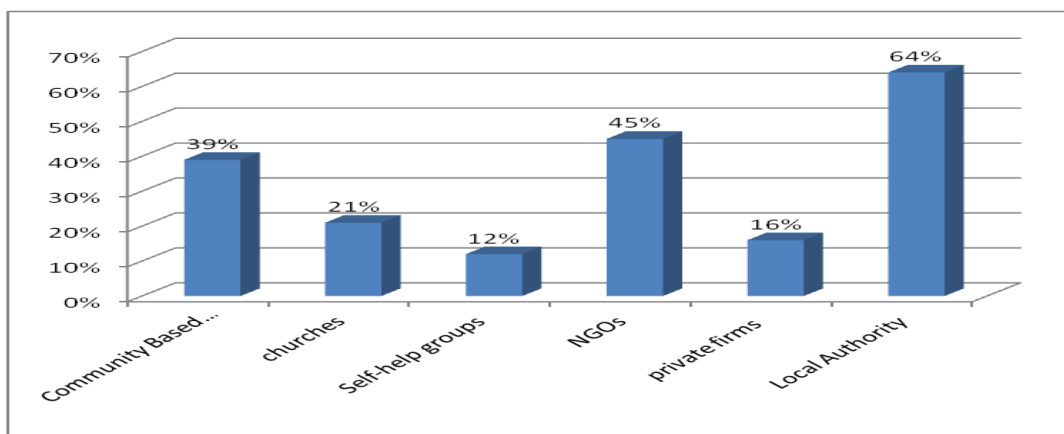
#### **4.4 Stakeholders in Solid Waste Management**

Figure 4.3 shows that there are various stakeholders involved in the management of solid waste in Kiambu County. Majority of the respondents (75%) agreed that there were various stakeholders involved in the management of solid waste in Kiambu County while 25% negated.



**Figure 4.3: Stakeholders in Solid Waste Management**

Figure 4.4 shows that stakeholders in the management of solid waste in Kiambu County include the local authority; community based organizations, churches, NGOs, and self-help groups as well as private firms.



**Figure 4.4 Stakeholders in Solid Waste Management**

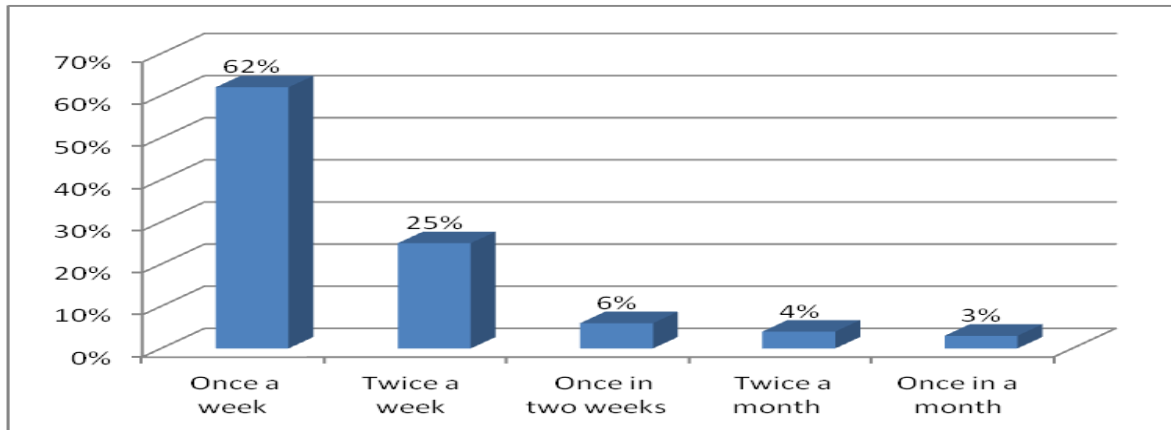
According to the data collected, all the stakeholders played different roles in management of solid waste within the county. Evidently, the local authority was the major stakeholder in solid waste management. NGOs as well as community based organizations followed while churches, self-help groups and private firms came among the last.

One of the key informants of this research noted that churches and schools needed to take a bigger role in solid waste management. He felt that if people were educated and enlightened on proper solid waste management, management of the same would be more efficient. The local authority/County Government is the main stakeholder and is also mandated by the legislation to oversee matters regarding solid waste management.

## 4.5 Effectiveness of the Current Solid Waste Management Methods

### 4.5.1 Frequency of Waste Collection

Figure 4.5 illustrates that majority of respondents would prefer collection of waste to be once in a week (62%), on the other hand 25% wanted it collected twice a week, 6% once in two weeks 4% twice a month and finally 3% once in a month.

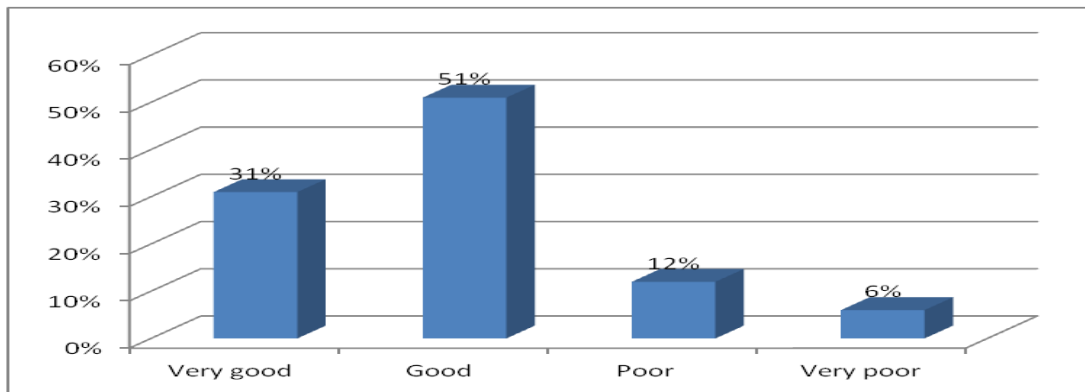


**Figure 4.5: Waste Collection Frequency**

According to the Kiambu County Government Chief Officer for Water Environment and Natural Resources, waste collection before devolution was below 25%. This has improved since County Government came in place as waste collection currently stands at 75%. A semi aerobic landfill is underway which is in partnership with UN-HABITAT and has been modeled by Japanese Fukuoka University. According to him, the County Government has significantly improved solid waste management in the counties. Some respondents, however, felt that waste collection by the county government had not been consistent over time and they thus had to engage the services of private garbage collectors.

### 4.5.2 Ranking of Services Provided by Waste Collectors

As illustrated in figure 4.6 most of the respondents ranked the services of domestic waste collectors to be good (51%), very good (31%), poor (12%) and very poor (6%). This implies that the services are good.



**Figure 4.6: Ranking of Services Provided by Waste Collectors**

Services of waste providers varied based on neighborhoods. Most of the neighborhoods which ranked waste collection poorly were low income areas. These areas are highly populated and also accessibility is a major issue. Also, some of these neighborhoods could not afford to hire private firms to collect the garbage and thus heavily rely on the County Government. 82% of the respondents felt that waste collection in the urban centres was good. This implies that the county government has greatly improved on waste management within the county.

#### **4.5.3 Problems Encountered in Waste Collection**

Table 4.5 presents the findings on the problems encountered in waste collection. As seen in the table 4.5 some of the problems encountered include: bulkiness of waste, storage method and device, foul smell, disposal site is far from some residence, transportation, poor network and services, poor collection, dumping site is inaccessible, injuries at the dumpsite, inefficiency.

**Table 4.5: Problems Encountered in Waste Collection**

<b>Waste management process</b>	<b>Problems encountered</b>
<b>Storage of domestic solid waste</b>	Bulkiness of waste Storage method and device Foul smell
<b>Collection and transportation of domestic solid waste</b>	Disposal site is far-off from some residences Transportation network and services are poor Poor collection
<b>Disposing domestic solid waste</b>	Dumping site is inaccessible Injuries at the site
<b>Reusing domestic solid wastes</b>	Inefficiency
<b>Recycling domestic solid wastes</b>	Inefficiency and lack of knowledge

According to one of the informants who worked in garbage collection and disposal for a long time, the above challenges have greatly hindered efficient collection and disposal. Giving an example of residential flats, he observed that many landlords do not construct receptacles for their waste and instead, prefer that tenants dump their waste outside the gates. Also many of these landlords do not want to engage services of private garbage collectors since they term them as extra expenses. In some cases when they actually hire, they want the waste to be collected only once a week. This brings about the problems of foul smell and general nuisance caused by the domestic solid waste. As a result, the County Government has constructed receptacles and in some areas, put skips to reduce this problem.

#### **4.5.4 Effectiveness of Solid Waste Management Methods**

Table 4.6 shows that to a very large extent storage of domestic waste is effective, Collection and transportation of domestic solid waste (60.1%), disposing domestic solid waste (55%), reusing domestic solid wastes (72%), recycling domestic solid wastes (69%), storage of domestic solid waste (74%), collection and transportation of domestic solid waste (60.1%).

**Table 4.6: Effectiveness of Solid Waste Management Methods**

Statement	Very Effective (%)	Moderately effective (%)	Effective (%)	Ineffective (%)	TOTAL (%)	N
Storage of domestic solid waste	70.0	20.0	5.0	5.0	100.0	50
Collection and transportation of domestic solid waste	60.0	11.7	20.0	8.3	100.0	50
Disposing domestic solid waste	55.0	35.0	5.0	5.0	100.0	50
Reusing domestic solid wastes	71.7	25.0	3.3	0.0	100.0	50
Recycling domestic solid wastes	68.3	23.3	8.3	0	100.0	50
Storage of domestic solid waste	75.0	23.3	1.7	0	100.0	50
Collection and transportation of domestic solid waste	60.0	30.0	5.0	5.0	100.0	50

According to one of the respondent official who is in charge of environment within Kiambu Town, under the Kiambu County Government, there are quite a number of unattended SWM issues within the county. He pointed out the issue of illegal dumping as well as burning of solid waste further leading to air pollution as the biggest challenge. Other challenges included inadequate vehicles for waste collection, impassable roads, and inaccessibility of some areas especially the slum and high density areas thus making it difficult to collect waste. According to him, public education and sensitization would contribute significantly to easing the problem of solid waste management. With increased public knowledge on solid waste handling, government agencies would be able to engage them more in managing solids waste especially from the sources. Public should be engaged more in terms of reduction, reuse as well as recycling of waste.

On collection and transportation, even though 60% felt that it was effective, there was a portion of respondents who felt that a lot should be improved. This was especially in terms of collection frequency. According to the team handling solid waste management within the county, waste collection especially within the towns should be done on a daily basis. However, due to challenges of inadequate vehicles and personnel, it is not always possible to achieve this. Another challenge faced by the collection team is the residents who do not dump waste at designated receptacles thus making it harder for the collection team as they have to



spend so much time on the fields. This problem is, however, being addressed by arresting and prosecuting those found dumping illegally even though most of the dumping is done at night. The Chief Officer (Environment) also noted that since devolution, waste collection within the County had increased from 25% to over 70% and this is evident in the data collected by the researcher.

A significant figure of respondents indicated that they re-use their waste. The researcher interpreted this as a result of the rural-urban nature of Kiambu county. A number of people indicated re-using of plastic containers as well as the polythene bags. Other types of waste that were considered re-used were the kitchen waste which is given to pig farmers to be used as feed. This was more evident especially in hotels and restaurants. For some facilities such as wholesale shops and supermarkets, there were designated garbage collection companies who collect the recyclable waste polythene wrappings as well as containers for sale to recycling facilities.

On the issue of storage of domestic solid waste, over 75% indicated that the storage methods were very effective. This was more evident in the flats because most landlords had done receptacles within their plots. The receptacles were emptied at least once a week and thus did not create nuisance. Only a number of residential areas did not have receptacle/waste storage facilities especially for the low cost houses and the slum areas.

According to one of the key informants, the County Government of Kiambu as well as NEMA are responsible for the licensing of waste transport vehicles. There are specifications before a vehicle is licensed to carry and transport waste. There are some organizations, self-help groups as well as individuals who engage in waste transport and disposal as a business. The County Government also has vehicles for transporting waste collected in the municipal areas to the designated dumpsite. The licences indicate the area of collection and the disposal site to which the waste will be directed.

Any vehicle which is licensed to carry waste is required to have a tracking document which indicates the area from which waste is collected as well as where the waste is being disposed. The vehicle is also required to be well covered to minimize waste from falling off during transportation. Based on the data collected by the researcher, the respondents felt that transportation of waste was very effective with 60% of the respondents indicating as such. This was attributed to the fact that most of the waste transport vehicles were well covered and thus did not drop waste as they moved.

#### **4.6 Conclusion**

According to the above findings, the nature and sources of waste seem to determine the systems used in management of solid waste within the county. Solid waste management has improved drastically compared to the previous system of government. With proper coordination of stakeholders, solid waste management is likely to improve with the devolved system of government.

## **CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter gives a comprehensive discussion of findings aligned to the study objectives. These findings are aligned to prior studies to demonstrating whether there is collaboration or objection, this is important in enabling the researcher to make a viable conclusion and recommendations. Below is the discussion:

### **5.2 Summary**

#### **5.2.1 Sources and nature of wastes generated within municipal areas of Kiambu County**

The study showed that majority of the respondents stated that plastic papers were the main sources of waste generated in Kiambu County. This was followed by food remains, containers, waste cloth, metallic wastes, glass and finally batteries. The study also revealed that the sources and nature of waste was highly determined by the lifestyles and age groups of the people living in the sampled areas. Most of the residents in these areas are the working class and this explains the nature of waste generated.

#### **5.2.2 Extent of awareness of the solid waste management problem in Kiambu County municipal areas**

According information gathered during the study over 94% of people interviewed had undergone undergraduate studies. The relationship between level of education and solid waste management cannot be underestimated. This is because education helps shape people's attitudes. During the study period, the researcher also found out that many of the respondents were understood the basics of solid waste management issues. They also understood the risks of improper waste management to both the environment as well as human health. However, many projected frustrations on lack of proper structures by the county government to handle solid waste.

#### **5.2.3 Major stakeholders in solid waste management within Kiambu**

The study showed that there are various stakeholders involved in solid waste management in Kiambu County. The study further revealed that solid waste management stakeholders in Kiambu County include the local authority; community based organizations, churches, NGOs, and self-help groups as well as private firms. However, the Local Authority/County Government was the major stakeholder in solid waste management within the County.

#### **5.2.4 Effectiveness of the current solid waste management methods used by the Kiambu County Government**

To achieve the above objective, a number of factors were observed like frequencies of waste collection; problems encountered as well as ranking of service provision were observed. Majority of the respondents would prefer waste to be collected once in a week, on the other hand 25% wanted it collected twice a week, 6% once in two weeks 4% twice a month and finally 3% once in a month. In addition majority of the respondents ranked the services of domestic waste collectors to be good (51%), very good (31%), poor (12%) and very poor (6%). This implies that the services are good.

The study also established that some of the problems encountered include: Problems encountered included; bulkiness of waste, storage method and device, foul smell, disposal site is far from some residence, transportation network and services are poor, poor collection, dumping site is too dirty, injuries at the site, some do not burn completely, surrounding made untidy, inefficiency.

Finally the study showed that that to a very large extent storage of domestic waste is effective, transportation and domestic solid waste collection, disposing of these waste, reusing, recycling domestic solid wastes, storage of domestic solid waste, transportation and collection of domestic solid waste.

#### **5.3 Policy Recommendations**

- Create awareness about integrated solid waste management and especially on how Kiambu County residents can reduce, reuse and recycle the generated solid wastes at the household level.
- Kiambu County government needs to employ the integrated approach in handling and managing solid waste; this would mean officially involving other stakeholders interested in improving waste management services in the County. The County government of Kiambu should work closely with the NGOs in empowering the self- assist self-help groups with the skills required in waste management. The approach formulated should reflect the entire cycle of waste from generation to final disposal.
- The County Government of Kiambu should also consider implementing waste-to-energy projects where solid waste can be used to generate energy and thus contributing to green energy sources as well as helping to build resilience to climate change. This should be

given priority especially with the current upgrading of the Kangoki dumpsite. The County Government should gear towards achieving zero waste as outlined in the National Solid Waste Management Strategy.

- There is a great need to harmonize reporting systems to ensure collaboration between private partners as well as government agencies. This will also help to curb duplication of efforts and also proper implementation of the laid out strategies of solid waste management. Kiambu County in collaboration with other government as well as non-government agencies should put in place public awareness and sensitization programmes to encourage people on the Reduce, Re-use and Recycle strategy. This would go a long way into easing solid waste management within the county.
- It is also imperative that solid waste management is incorporated into fundamental county planning. This is because of the growing populations as well as in expanding urban centers. This will go a long way into ensuring that solid waste management is planned for even with the increasing population.
- Lastly, there is need for the County Assembly of Kiambu to come up with legislation on solid waste management. This law should be harmonized with other existing laws and be formulated in such a way that it addresses the unique problems that solid waste management is facing within the County.

#### **5.4 Recommendations for Further Studies**

Future research in this area could carry out a stake-holders' mapping in order to see how all the stakeholders discussed can come up with an integrated approach in carrying out domestic solid waste management in Kiambu County.

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## **APPENDICES**

### **Appendix I: Letter of Introduction**

Dear Sir/Madam,

#### **RE: REQUEST TO COLLECT DATA**

I am a postgraduate student at the University of Nairobi.

Pursuant to the pre-requisite course work, I am currently conducting a research project on **Effectiveness of Solid Waste Management in Kiambu County**. I kindly request you to participate in this study by assisting in filling the questionnaires and providing with any other relevant information. The information collected will be treated with utmost confidentiality and is for academic purpose only. The findings and recommendations of the research will be availed to you upon completion of the research

Thank you in advance.

Yours faithfully,

Beatrice Kanani

## Appendix II: Questionnaire

### Section I: Demographic Characteristics

Circle the appropriate response from the alternatives provided

i) Name (optional): \_\_\_\_\_

**ii) Age**

18-25 [ ]

26-35 [ ]

36-45 [ ]

46-55 [ ]

Above 55 [ ]

**iii) Gender**

Male [ ]

Female [ ]

**iv) Highest level of Education (tick one)**

Doctorate [ ]

Masters [ ]

Bachelors [ ]

Secondary [ ]

Others (Please specify) \_\_\_\_\_

**v) How long have you lived in Kiambu County?**

2 - 4 years [ ]

5 – 7 years [ ]

8 – 10 years [ ]

Above 10 years [ ]

**vi) How long have you worked in Kiambu Municipality?**

2 - 4 years [ ]

5 – 7 years [ ]

8 – 10 years [ ]

Above 10 years [ ]

**Section II: Sources of Solid Waste**

a) What are the main source of urban solid waste in Kiambu County?

1	Plastic papers
2	Food remains
3	Containers
4	Batteries
5	5 Glass
6	Waste cloth
7	7 Metallic wastes
9	Others:

*b) In case there are no waste collectors indicate in the following table the waste disposal system(s) you use for disposing each waste*

	Open dumping	Composting	Recycling	Burning	Other Methods
Household waste					
1 Plastic papers					
2 Food remains					
3 Containers					
4 Batteries					
5 Glass					
Waste cloth					
7 Metallic wastes					
8 Wooden wastes					
9. Waste cloth					

(c) Kindly List any other sources of solid waste not listed above.

.....

.....

.....

.....

.....

.....

(d) Do you dispose your solid waste in designated areas:

a) Yes b) No

If No how do you dispose your solid waste?

.....

.....

(e) Does your neighborhood have industrial wastes disposed around?

a) Yes b) No

If Yes which one?

.....

.....

(f) List down the types of solid waste disposed by the nearby schools and health facilities

.....

.....

.....

.....

.....

**Section III: Stakeholder in Solid Waste Management**

1 (a) Are there any Community based organisations, churches, self-help groups, Non-governmental organizations, local authorities or private firms involved in management of waste in the area?

a) Yes b) No

If Yes which organizations/groups are they?

.....  
 .....

(b) Indicate in the table below the role(s) (e.g waste separation, collection, transportation, purchasing waste, recycling, and disposal e.t.c) played by each of these groups/organizations

	Organization/groups	Activity/role played by each group
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

2. Are there any stakeholder meetings held to discuss issues of solid waste management?

a) Yes b) No

If yes how often are they held?

.....  
.....

3. Do you receive any support from the other Non-Government organizations on solid waste management?

a) Yes b) No

If Yes which kind of support?

.....  
.....

4. Kindly list the challenges faced by stakeholders on solid waste management

.....  
.....  
.....  
.....

5. Kindly state the role played by the government on promoting stakeholder involvement in solid waste management programmes.

.....  
.....  
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**Section IV: How effective are the current solid waste management methods and approaches in Kiambu County?**

(a) How often would you want the waste to be collected in a month?

- I. Once a week
- II. Twice a week
- III. Once in two weeks
- IV. Twice a month
- V. Once in a month

(b) How do you rank the waste collection services available within your area?

- a) Very good
- b) Good
- c) Poor
- d) Very poor

(c) Indicate the problems you encounter while handling domestic solid wastes through-out these processes

	Waste management process	Problems encountered
1	Storage of domestic solid waste	
2	Collection and transportation of domestic solid waste	
3	Disposing domestic solid waste	
4	Reusing domestic solid wastes	
5	Recycling domestic solid wastes	



(d) To what extent is the solid waste management methods effective.(Tick only one box for each attribute, where 1= very small extent, 2= small extent, 3 = moderate extent, 4 = larger extent 5 = very large extent)

	1	2	3	4	5
Storage of domestic solid waste					
Collection and transportation of domestic solid waste					
Disposing domestic solid waste					
Reusing domestic solid wastes					
Recycling domestic solid wastes					
Storage of domestic solid waste					
Collection and transportation of domestic solid waste					

(e) Which other solid waste management methods can be used by Kiambu Municipality

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## **Appendix III: Key Informant Interview Guide**

### **Section I: Sources of Solid Waste**

1. Do you think Kiambu Municipality is a hub of solid waste
2. What are the major sources of solid waste within Kiambu County?
3. Do you think the lifestyle of the people in Kiambu County affects solid waste management?

### **Section II: Stakeholder in Solid Waste Management**

1. What is your role in the management of domestic solid wastes in Kiambu County?
2. Do you undertake any activities for managing domestic solid wastes in Kiambu County?
3. Are there any stakeholders involved in undertaking the above activities?

**Section IV: How effective are the current solid waste management methods and approaches in Kiambu County?**

1. Kindly state your opinion on how Kiambu County Government has handled solid waste management?
2. What do you regard to be the challenges faced by Kiambu County Government in handling solid waste management?
3. Please recommend the various ways of handling solid waste management?