

**FACTORS INFLUENCING HOUSEHOLD SOLID WASTE DISPOSAL AND  
MANAGEMENT IN GARISSA TOWN, GARISSA COUNTY, KENYA**

**By**

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Department of Real Estate and Construction Management of the University of Nairobi.**

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## DECLARATION

This research report is my original work and has not been presented for a diploma/ degree in any other university.

Signed -----

Date-----

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This report has been submitted for examination with my approval as the University Supervisor.

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## **DEDICATION**

I would like to dedicate this Postgraduate Research project first to Almighty God for giving me life and good health during the time of carrying out this research. Dedication also goes to my family; loving wife Hellen and our three angels Jeniffer, Brandy and Mcdonald. May this work inspire you to greater heights of exploration in your desired professional fields.

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## TABLE OF CONTENTS

DECLARATION .....	ii
DEDICATION .....	iii
ACKNOWLEDGEMENTS .....	iv
LIST OF ABBREVIATIONS AND ACRONYMS .....	x
ABSTRACT .....	xi
<b>CHAPTER ONE</b> .....	1
<b>1:0 NTRODUCTION</b> .....	1
1.1. Background of the Study .....	1
1.2 Statement of the problem .....	6
1.3 Purpose of the Study .....	7
1.4 Objectives of the Study .....	7
1.5 Basic assumptions of the Study .....	8
1.6 Study Hypotheses.....	8
1.7 Research Questions .....	8
1.8 Significance of the Study .....	8
1.9 Delimitation of the Study.....	9
1.10 Limitation of the Study .....	9
1.12 Scope of the Study .....	9
1.13 Definitions of Significant Terms .....	11
<b>CHAPTER TWO</b> .....	14
<b>2.0 LITERATURE REVIEW</b> .....	14
2.1 Introduction.....	14
2.2 Solid Waste Disposal/collection Methods .....	15
2.2.1 Recycling of Solid Waste.....	16
2.2.2 Reuse.....	20
2.2.3 Source Reduction.....	22
2.3 Household Size and Solid waste Disposal.....	24
2.4 Influence of Location of Household on Solid Waste Disposal.....	25
2.5 Education and Household Waste disposal .....	28
2.6 Solid waste Disposal facilities and collection Services .....	29

2.6.1 Landfill.....	29
2.6.2 Incinerators .....	29
2.6.3. Composting .....	30
<b>2.6.4 Recycling plants</b> .....	<b>31</b>
<b>2.6.5 A civic amenity site</b> .....	<b>34</b>
<b>2.6.6 A transfer station</b> .....	<b>35</b>
2.7 Theoretical Framework.....	35
2.8 Conceptual Framework.....	37
2.9 Legal and Institutional Framework Governing Solid Waste Management .....	38
2.10 Similar Research done elsewhere .....	40
<b>CHAPTER THREE</b> .....	<b>42</b>
<b>3.0 RESEARCH METHODOLOGY</b> .....	<b>42</b>
3.1 Introduction.....	42
3.2 Research Design.....	42
3.3 Target Population.....	42
3.4 Sampling Technique and Sample Size.....	42
3.5 Data collection Instruments .....	43
3.6 Data Collection Methods and Techniques .....	43
3.7 Instrument Validity .....	43
3.8 Reliability of the instrument .....	44
3.9 Data collection procedure .....	44
3.10 Data Analysis .....	45
3.11 Ethical considerations .....	45
<b>CHAPTER FOUR</b> .....	<b>46</b>
<b>4.0 DATA PRESENTATION AND ANALYSIS</b> .....	<b>46</b>
4.1 Introduction.....	46
4.2 Influence of level of awareness/education on the various methods solid waste management	47
4.3 Influence of Education of Household head on Solid Waste Disposal .....	49
4.4 Influence of Household Size on Disposal of Solid Waste .....	53
Table 4.7: Respondent Household Size .....	53
4.5 Influence of Garbage Disposal Facilities on Disposal of Solid Waste .....	55

4.6 Hypothesis Testing.....	56
<b>CHAPTER FIVE</b> .....	57
<b>5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS</b> .....	57
5.1 Introduction.....	57
5.2 Summary of the Findings.....	57
5.3 Discussion of the study .....	61
5.3.1 To find out the influence of levels of education/awareness on methods of disposal of solid waste.....	61
5.3.2 To establish whether location of household influences disposal of solid waste.....	61
5.3.3 To investigate the influence of garbage disposal/collection facilities on disposal of solid waste .....	62
5.4 Conclusion .....	63
5.5 Recommendations.....	64
5.5.1 Policy Recommendations.....	64
5.5.2 Recommendation for Further Research .....	67
<b>REFERENCES</b> .....	68
Appendix 1: Letter of introduction .....	71
Appendix 2: Questionnaire for household survey .....	72
Appendix 3: Photographs.....	77
Appendix 3 : Operationalization Table.....	80

## LIST OF TABLES

Table 2.1: Some waste reduction tips .....	23
Table: 4.1: Questionnaire Return Rate Table .....	46
Table 4.2: Common Household Waste Items .....	48
Table 4.3: Education Level of Household Heads .....	49
Table 4.4: Disposal Methods Employed by Respondents as per their education levels.....	50
Table 4.5: Methods of Waste Disposal Preferred by Households .....	51
Table 4.6: Respondents' Awareness/education of importance of proper methods of waste management .....	52
Table 4.7: Respondent Household Size .....	53



## LIST OF FIGURE

Fig. 2.1: Conceptual Framework. ....	37
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## **LIST OF ABBREVIATIONS AND ACRONYMS**

<b>CP</b>	Cleaner Production
<b>ENGOS</b>	Environmental Non-governmental Organizations
<b>IE</b>	Industrial Ecology
<b>MDGs</b>	Millennium Development Goals
<b>NEMA</b>	National Environment Management Authority
<b>SPSS</b>	Statistical Package for Social Sciences
<b>UNCED</b>	United Nations Conference on Environment & Development
<b>UNEP</b>	United Nations Environment Programme.

## **ABSTRACT**

Despite the Local County Government effort to clean up the Town of Garissa, the garbage accumulation situation in the residential and entire town continues to worsen day after day. The situation is made even worse by the presence of plastic bottles and polythene papers which are visible in every part of the town. Besides that, piles of garbage are seen in many areas outside residential areas and these become an eyesore to visitors coming to Garissa for the first time. Further, the concentration of population and business activities in the town and the accompanying of rapid increase in the volume of solid waste generated from production and consumption activities have led to the prevailing situation.

This study investigated the factors influencing disposal and management of household solid waste in Garissa Town of Garissa County, Kenya. The objectives of the study were; to determine how various methods of waste disposal and management are impacted by the levels of education/awareness, to investigate the influence of location of Household on disposal of solid waste, and to investigate the influence of garbage disposal facilities/technologies on disposal and management of solid waste. Descriptive survey was used as a research design for this study while cluster, purposive and random sampling techniques were used to select the sample.

A sample of 400 respondents was used for this study. A questionnaire was used as the main instrument for collecting data for this study although guided interviews and observation was also used to gather knowledge and information. Data collected was analysed using SPSS package and then it was presented by use of frequency and percentage Tables. The study found that the residents of Garissa Municipality are not aware of any outlined method and responsibility of waste management adopted by the authorities for keeping the Municipality clean. There is no specific way of waste disposal and management which can be called the norm or best practise for the Municipality's Households . As such therefore there is no such a way of doing things and

which has been sensitized to the residents. From the study also, it was is also found that there was nothing to show any relationship between household location and amount of waste produced. From the findings, it was found that different households living in different residential areas generated different quantities of waste depending on their sizes rather than their location. From the findings also, it is also clear that there is no adequate waste disposal mechanism/technologies/facilities available to most residents living in Garissa Township.. As such, most household waste are scattered all over residential places, giving a bad image to the environs of the Municipality . Further, surface dumping of household waste is the most common form of waste disposal applied by residents. Other methods include burning and burying in the ground, though burying of domestic waste is quite rare.

The study recommends that, Garissa town county government should put up designated waste dumps in all residential areas so as to ensure that residents do not scatter their household waste all over the place as they currently do. If dumping places are available, people would see the sense of taking their waste to the designated places rather than throw them all over the place as they currently do. Residents of Garissa Township should be sensitized to stop depositing their waste near residential areas as this exposes them to the danger of contracting diseases. Instead, the council should designate specific places for waste deposit and collection. The local council should contract the private waste collectors to extend the services they currently provide to the shop owners operating along the main streets to residential areas. This would reduce the amount of garbage in the residential areas.

## CHAPTER ONE

### 1:0 NTRODUCTION

#### 1.1. Background of the Study

Urbanization is a complex phenomenon that provides opportunities and benefits for countries but also associated with the process and problems of social, economic and environmental nature. In countries around the world, one major environmental problem that confronts municipal authorities is solid waste disposal. Most county governments are confronted by mounting problems regarding the collection and disposal of solid waste. In high-income countries, the problems usually centre on the difficulties and high cost of disposing of the large volume of waste generated by households and businesses. In lower-income countries, the main problems are related to collection, with between one-third and one-half of all solid waste generated in Third World cities remaining uncollected.

Today, municipal solid waste collection and disposal are particularly problematic in developing country cities, but many Western cities have also grappled with this problem in the past (and some probably still do). In his book *Rubbish*, Girling (2005) observed that before the 20th century, many cities in Europe “drowned in a sea of garbage” with most of their municipal solid waste being dumped into rivers and open sewers. Municipal waste services were then poor and rivers like the Rhine and Thames were nothing more than open sewers as they were heavily polluted with waste and were major sources of infectious diseases (Girling, 2005:10). Nowadays, Western countries generally rely on land filling to overcome the problem of waste accumulation (Girling, 2005; Pacione, 2005). The landfill seems to have a special attraction for municipal waste managers because it offers a cheap and convenient option for waste disposal compared with other strategies such as reuse, recycling and energy recovery (Charzan, 2002). In fact, with

the exception of few countries like Austria, the Netherlands and Denmark who recycle substantial proportions of their waste, most countries in Europe and North America still dump the bulk of their municipal solid waste in landfills (OECD, 2000; Girling, 2005). Thus, the current requirement for countries to move up the waste hierarchy remains a real challenge for even the rich and technologically advanced countries (OECD, 2000).

The generally poor waste situations in developing country cities and the perpetuation of social and environmental injustice against the poor remain critical challenges and deviate from the objectives of the Millennium Development Goals (MDGs), Agenda 21 and other moves to address the 'Brown Agenda' problems to improve the living conditions of the poor. In line with the situation in poor country cities generally, Kenyan towns are grappling with mounting solid waste and other environmental problems with socio-spatial inequalities in the distribution of the waste burden.

**Refuse Materials by kind, composition and Source:**

kind	Composition	Sources
Garbage	Wastes from preparation,cooking, market handlingstorage and sale of produce	Household, restaurants and markets.
Rubbish	Combustible:paper,wood,yard trimmings	
	Non-combustible: metal,tin,glass.	
Ashes	Residue from fire used for cooking and on-site incineration.	
Street Refuse	Sweeping, leaves,content of litter receptacles	
Dead animals	Cats,Dogs,Goats,Cows, Horses	
Abandoned Vehicles	Unwanted cars left on public property.	
Industrial waste	Processing waste, lumberscraps	Factories, power plants
Demolition wastes	Construction materials, masonry pipes, metals	Demolition sites
Construction waste	Construction materials, pathological and radioactive waste	Hospitals, hotels, stores, institutions
Sewerage treatment	Solids from course screening and government chambers septic tank storage	Sewerage treatment plants, septic tanks

Source: American Public Works Municipal refuse disposal Association, 1996 pp.12

The worsening solid waste disposal situation in Kenyan urban settlements has attracted attention among the populace. The solid waste problem is also receiving a lot of media attention shown

by the frequent featuring of waste disposal issues in newspapers, TV and radio discussions. Additionally, several Environmental Non-Governmental Organisations (ENGOS), institutions and individuals have expressed concerns about the deplorable solid waste situation in towns while communities keep complaining to the authorities about waste that is engulfing their neighbourhoods and the health implications for their members. One of the most important outputs of the Earth Summit (United Nations Conference on Environment and Development) in 1992 was Agenda 21, an action plan for the 1990s and well into the twenty-first century, elaborating strategies and integrated programme measures to halt and reverse the effects of environmental degradation and to promote environmentally sound and sustainable development in all countries (UNCED, 1992).

Agenda 21 included an action plan for cities wishing to enhance urban sustainability. These recommendations included institutionalizing a participatory approach and improving the urban environment by promoting social organization and environmental awareness. The need to promote actively, to strengthen and expand waste re-uses and recycling systems was also recognized in Agenda 21. The consensus on sustainable development which emerged from the Earth Summit must be transformed into action by engaging in a period of decentralized experimentation” (Brugmann, 1994: 129).

Sub-Saharan Africa is one region where this experimentation is actively occurring now, especially after the 1980s economic crisis which resulted in increased hardship for most of the region's poor. The serious problems which confront African cities as a result of the 1980s' economic crisis have been well documented (Stren and White, 1989). One enduring consequence



is the inability of African governments to sustain adequate levels of urban services. As continuing economic hardship forces a growing number of migrants to urban areas in search of employment, an even greater strain is placed on urban pressure points like solid waste management. Both financially and physically, a city may be unable to provide waste collection, especially to the urban poor occupying peri-urban or other geographically inaccessible areas. The urban poor are left to contend with waste disposal on their own. The lack of support given to the urban poor in this area has serious consequences on their health and on the urban environment. Thus, in cities of the developing world, the management of solid wastes is now an issue of vital importance to urban sustainability. In Garissa Municipality, the methods used to dispose solid waste generated at the household level are not sustainable. Increasing urbanization, rural-urban migration, rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation from domestic activities.

Unable to provide adequate waste disposal and other environmental services within their entire jurisdictions, municipal authorities in most developing countries tend to concentrate their waste collection efforts in official and wealthy areas while the poorer areas receive little or no service for waste removal even though waste collection operations are usually funded with public resources (Lohse, 2003). Besides, waste disposal facilities/technologies, which are usually poorly maintained, are frequently sited in the neighbourhoods of the poor and other vulnerable population groups (Camacho, 1998; Bullard, 2005) which implies the shifting of environmental burdens on the poor which is the case of Garissa Municipality.

## **1.2 Statement of the problem**

The problem investigated in this study is the worsening solid waste situation found in urban settlements in Garissa Town. The concentration of population and business activities in the towns is being accompanied by a rapid increase in the volume of solid waste generated from production and consumption activities. Against this situation of mounting waste production, municipal authorities in the county seem unable to organise adequate collection and safe disposal of waste within their jurisdictions, despite their good effort of trying to ensure the same is taken care of. As a result, urban settlements in the counties are saddled with a worsening solid waste situation which proves to be intractable and threatens public health and the environment. A cursory observation within the towns shows visible aspects of the solid waste problem including accumulation of garbage, heavy street litter, waste-clogged drains and water bodies and stinking gutters ( Rotich 2005).

A familiar scene in Garissa town is littering, choked gutters, heaps of household waste, overflowing skips, and general absence of skips in a good number of neighborhoods in the town. Refuse dumps are seen almost at the back of every house, especially in the outskirts. The recent proliferation of polythene bags in the last two years for packaging has compounded the situation in the study area. If the situation is left unchecked it can result in the outbreak of communicable diseases such as cholera, typhoid and other sanitation related ailment and further put unbearable pressure on the already overstressed health facility in the town( Ng'ang'a 2012).

In spite of the concerns frequently raised by concerned groups, institutions and individuals among the populace, the solid waste situation in the urban centres continues to worsen, thereby posing serious threats to public health and the environment. Besides, the environmental burdens

associated with the worsening solid waste situation appears to fall more heavily on the poor even though waste removal and disposal are public funded and regulated. This study sought to find out the factors influencing disposal of this solid waste at the household level. It deeply and comprehensively investigated and analyzed these factors with a view of improving the waste management systems to make them effective and sustainable. The findings are a reflection of the scenario in the municipality, the region and Kenya as a whole.

Low income residential areas in the town tend to be neglected and get irregular refuse collection services. Refuse trucks are rarely seen in these places. Garbage is spread over by wind. These places lack refuse bins and garbage is dumped along roads making collection difficult and rotting and awful stench emitted. Residents live with nuisance and inconvenience created by decomposing garbage. Some people attribute this to gross mismanagement and inefficiency of local authorities concerned. Clean environments and good health for urban worker are key to greater productivity( Kaloki F.K, 1992). This could be achieved on solving the refuse problem.

### **1.3 Purpose of the Study**

The purpose of this study was to examine the factors influencing the disposal household solid waste in Garissa Town of Garissa County.

### **1.4 Objectives of the Study**

The study focused on the following specific objectives:

- i. To determine how various methods of waste management are impacted by the levels of education/awareness.
- ii. To investigate how location of household influences disposal of solid waste.

- iii. To investigate the influence of garbage disposal facilities/technologies on disposal of solid waste.

### **1.5 Basic assumptions of the Study**

The study was guided by the following assumptions:

- i. That there was to be co-operation from the heads of various families, the members of the
- ii. That the respondents will understand the questions correctly and answer them well.
- iii. That the researcher will be able to access all the respondents that are sampled in this study.

### **1.6 Study Hypotheses**

1. The level of solid waste disposal management in Garissa Municipality is significantly influenced by the level awareness of most of the household heads.
2. Impaired household solid waste management in Garissa Municipality is due to lack of enough equipment.

### **1.7 Research Questions**

The research was guided by the following questions:

- i). What is the impact of, levels of education/awareness on the various methods of solid waste management?
- ii). What is the influence of location of household on disposal of solid waste?
- iii). How does garbage disposal facilities/technologies influence disposal of solid waste?

### **1.8 Significance of the Study**

The results of this study will be important to the policy makers whose mandate is to provide safe environment for the residents of Garissa town who have been grappling with waste disposal

issues in the estates and by extension which have posed a health as well as environmental degradation concerns to them. The results of the study will assist to bring out the county assembly debate on Health and Environmental concerns of the residents and therefore come up with favourable legislation on the same.

The County Government of Garissa will also gain from the study in that it can know the factors that influence waste disposal in the town and the challenge so as to deal with the factors as well as the challenges in order to ensure that the environment is clean and the health of it's residents is assured.

### **1.9 Delimitation of the Study**

The study examined the factors that influenced the disposal of household solid waste. It was conducted in the municipality of Garissa and only the household heads responded to the study.

### **1.10 Limitation of the Study**

The researcher found it challenging in reaching the homes which had been sampled due to the vastness of the study area. There was also the problem of illiteracy especially among the local community who could not understand English and that is why a research assistant was trained to assist in filling of the questionnaire and for follow ups.

The religious orientation was an hindrance to some extent as women household heads shied away from the researcher because of cultural norms.

### **1.12 Scope of the Study**

This Study is organized into five chapters. Chapter one outlines the background to the study, the statement of the problem, the purpose of the study, objectives of the study, Study hypothesis,

research questions, significance of the study, basic assumptions of the study, organization of the study and definitions of significant terms.

Chapter two outlines the key theories of the literature review as per the objectives of the study which are; to determine how various methods of waste management are impacted by the location and levels of education/awareness, to investigate how the how household size influences disposal of solid waste, and to investigate the influence of garbage disposal facilities on disposal of solid waste.

Chapter three gives the research design, the target population as well as sample size and sampling procedures. It also outlines the data collection methods, the validity and reliability of data collection instruments and the operational definition of variables.

In chapter four, the data collected is presented, analyzed and interpreted as per the objectives of the study while chapter five has given the summary and discussions of findings, recommendations and areas of further research.

### **1.13 Definitions of Significant Terms**

**Domestic Solid Waste:** all materials emanating from households whose use is no longer required

**Environment:** The sum total of all living and non-living things that affect any living organism.

**Industrial Ecology:** Identifying and implementing strategies for industrial systems to more closely emulate harmonious, sustainable ecological systems.

Waste management: is the collection, transport, processing, recycling or disposal of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each. Waste management practices differ for developed and developing nation, for urban and rural areas, and for residential and industrial, producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator. Solid Waste Disposal, disposal of normally solid or semisolid materials, resulting from human and animal activities, that are useless, unwanted, or hazardous. Solid wastes typically may be classified as follows: Garbage: decomposable wastes from food Rubbish decomposable wastes, either combustible (such as paper, wood, and cloth) or noncombustible (such as metal, glass, and ceramics) Ashes: residues of the combustion of solid fuels Large wastes: demolition and construction debris and trees

**Reuse:** Rely more on items that can be used over and over instead of throw away items. For example, take a refillable coffee cup to the office instead of plastic throw away cups.

**Repurpose:** Use something for another purpose instead of throwing it away. For instance, the use of a car tyre for making a swing.

**Recycle:** The process of recovering discarded products and materials for reprocessing and conversion into new or different products for re-use

**Regulations:** Legal restrictions promulgated by a government authority to manage waste.

**Sustainability:** The ability of the earth's various systems, including human cultural systems and economies, to survive and adapt to changing environmental conditions indefinitely.

**A municipality:** is usually an urban administrative division having corporate status and usually powers of self-government or jurisdiction. The term *municipality* is also used to mean the governing body of a municipality. A municipality is a general-purpose administrative subdivision, as opposed to a special-purpose district. The term is derived from French "municipalité" and Latin "municipalis"

**Municipal solid waste (MSW):** commonly known as trash or garbage , refuse or rubbish is a waste type consisting of everyday items that are discarded by the public

Waste can be classified in several ways but the following list represents a typical classification:



Biodegradable waste: food and kitchen waste, green waste, paper (can also be recycled); Recyclable material: paper, glass, bottles, cans, metals, certain plastics, fabrics, clothes, batteries etc. Inert waste: construction and demolition waste, dirt, rocks, debris. Electrical and electronic waste (WEEE) - electrical appliances, TVs, computers, screens, etc. Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys. Hazardous waste including most paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and containers Toxic waste including pesticide, herbicides, fungicides

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Introduction

This chapter consists of a review of literature relevant to the study. The review is based on the objectives of the study stated in chapter one. The main criteria that determine the amount of household waste produced and the extent of waste recycling (Parfitt *et al.*, 1997) include:

- Household or per capita income (or proxy variable such as property value);
- Number of occupants living in a household;
- An individual's age;
- Population density of an area (a proxy for the extent of urbanization).

Addressing the issue of municipal solid waste is an important policy objective and one which is becoming increasingly challenging to address. On the one hand, while the awareness of the external effects of waste generation is increasing, there is resistance by society to the development of new landfills and incineration facilities. On the other hand, municipal solid waste generation has grown significantly over the last decades as a result of higher incomes, more intensive use of packaging materials and disposable goods, and increased purchases of durable material goods. This problem is projected to continue to grow, despite current efforts to reduce the material content of products and to stimulate the reuse of products and packaging and the recycling of materials and substances. Municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African municipalities. This is because even though these municipalities are using 20-50 percent of their budget in solid waste management, only 20-80 percent of the waste is collected. The uncollected

or illegally dumped wastes constitute a disaster for human health and the environmental degradation (Achangken, 2003). To plan a municipal solid waste (MSW) management strategy for a given region, it is essential to know the quantity of waste generated and its composition. Various authors have shown that the amount of waste generated by a country is proportional to its population and the mean living standards of the people (Wertz 1976; Grossmann et al. 1974). Medina (1997) related waste generation rates to income levels of people. However, it has been shown that these are not the only governing factors.

Amongst other socioeconomic factors that have been said to influence MSW generation are persons per dwelling, cultural patterns, education, and personal attitudes (Al- Momani 1994; Grossmann et al. 1974). In recognition of the importance of a reliable tool to predict the MSW characteristics, various researchers have attempted to construct models to predict these parameters. They found that relationships obtained between various parameters vary by country. This has been attributed to variations in consumer behaviour and lifestyles.

## **2.2 Solid Waste Disposal/collection Methods**

Disposal of solid wastes on land is by far the most common method in Kenya and probably accounts for more than 90 percent of the nation's municipal refuse e.g the Dandora dumpsite in Nairobi. Incineration accounts for most of the remainder, whereas composting of solid wastes accounts for only an insignificant amount. Selecting a disposal method depends almost entirely on costs, which in turn are likely to reflect local circumstances. The most common solid waste disposal methods include the following:

### **2.2.1 Recycling of Solid Waste**

Recycling is the process whereby discarded products and materials are reclaimed or recovered, refined or reprocessed, and converted into new or different products(Wegelin E. A, 1990). This term is often used in a wider sense to describe the complete cycle, from collection to production of new objects, or secondary raw materials, from reclaimed material. Recycling is just one of the ways we can minimize waste. Other waste minimization methods include re-use (using an item again for the same purpose for which it was originally made, e.g. re-using a container such as a bottle or glass jar) and repair (mending an item which was unserviceable because of damage or malfunction). Another way of reducing the amount of waste we produce is to divert certain waste materials or substances which have been discarded by one generator to another manufacturer who can use them as raw materials in a different process. This is called waste exchange. Yet another way to reduce the waste stream is to compost the rapidly biodegradable fraction of the waste stream and use the compost to enrich the soil for growing vegetables or other plants. This is in reality a form of recycling. Another form of composting which uses earthworms to speed up the breakdown of organic waste is called ‘vermiculture’.

Biodegradable/organic waste is waste that will decay and eventually go back into the soil and nature. It includes garden refuse (e.g. grass clippings) and animal, fruit or vegetable leftovers resulting from the handling, preparation or cooking of foods. Biodegradable waste includes the ‘wet fraction’ or putrescible fraction (materials that rot) of the general waste stream. If the ‘wet fraction’ is separated at the point of generation from the ‘dry fraction’ (largely the recyclable packaging materials), the dry fraction remains ‘clean’ and therefore more valuable for recycling (US Environmental Protection Agency 2012, page 45).

Recycling is a key factor in the management of solid waste. Recycling turns materials that would otherwise become waste into valuable resources. Not only does recycling divert materials from the landfill, but it also conserves natural resources while using existing ones. The traditional 'end of pipe' solution, which focused on dealing with waste once it was produced is, no longer adequate. Now, instead of concentrating on the storage, collection and disposal components of the waste management system more attention is given to the avoidance of waste as a first priority. We must make sure that we have tried every possible way to prevent or reduce waste before we consider re-using or recycling waste material. Recycling programs can affect consumptive as well as recycling behaviors which ultimately impact on both natural resource utilization and the landfill problem.

For community recycling programs to be successful, ease of access is a key requirement and has typically been achieved through regular curbside pick-ups and/or conveniently located drop-off centers (Marans 2009). Municipalities are in a unique position to encourage the kind of lifestyle choices that will promote sustainable living. They can achieve this by taking into account economic, social and natural environmental factors in their decisions and the activities that they undertake. Our constitution embodies the principle that all citizens have the right to live in an environment that is not detrimental to their health and well being - municipal county representatives and officials have a legal duty to make choices that will ensure that the areas under their control do not become degraded or polluted. The way that a municipality controls and manages the waste that is generated within its boundaries has a significant effect on the quality of life of its residents.

When we produce waste it eventually returns to the natural environment - to land, water or the air, and if it is not properly managed it causes pollution which can be easily transferred from one part of the environment to another, e.g. uncontrolled burning of waste results in air pollution. Numerous studies have examined conservation behavior, including household recycling and its socio-psychological determinants. For example, general environmental attitudes have played a large part in studies of conservation behavior (Heberlein, 1981; Weigel, 1985) with most investigators agreeing that positive attitudes, including the importance of a specific behavior can be useful predictors of that behavior.

The environment that receives the waste must be able to assimilate it (take it up) without becoming degraded or polluted. Waste must be managed in a way that does not have an adverse effect on the environment, and that is affordable, acceptable and as convenient as possible to the people who might be affected by it. Although there is currently no law requiring recycling, future recycling targets might be regulated by law. Such targets should set realistic levels of recycling within achievable time frames and be agreed in consultation with the key role-players in the recycling chain. A phased approach should be adopted to achieve such targets:

- Inclusion of recycling options in Integrated Waste Management Plans which should be an element of an Integrated Development Plan required of every municipality by law.
- Requiring business and industry to produce recycling plans as part of their broader environmental strategy
- Municipalities and other government departments adopting a procurement (purchasing) policy that requires a certain proportion of the products they purchase to contain recycled

material e.g. paper, lubricating oil, traffic cones, envelopes, plastic desktop accessories, refillable ink cartridges.

- Registration of recyclers operating within the municipal area.
- Municipal support for recycling initiatives in the form of bylaws that facilitate the location, operation and use of such facilities.

Recycling occurs informally at landfills, uncontrolled dumps, and on streets in many countries. Scavengers or waste pickers often collect materials for reuse or sale without any organization, supervision, or regulation. While scavenging or waste picking can be very effective at reducing the amount of plastic, glass, metal, and paper ultimately requiring disposal, pursuing these activities can be harmful to worker health. Incorporating scavengers or waste pickers into organized or formal recycling programs can improve the quality of their working conditions and the local environment. Composting can also improve local economies and the environment—by turning organic waste, which is a large portion of many city waste streams, into a marketable product for urban and agricultural uses. Together, recycling and composting can provide income, significantly reduce waste, and decrease greenhouse gas emissions. This fact sheet describes the benefits of formal recycling and composting activities and provides steps on how you can incorporate scavenging or waste picking into formal recycling and composting programs. At the end of this fact sheet, a case study from Brazil shows how businesses organized scavengers and waste pickers into successful recycling cooperatives.

Establishing and managing formal recycling and composting programs require significant local government time and resource investments. However, these investments can save money in the

long term by allowing governments to maximize existing recycling and composting activities before making significant investments in collecting and transporting waste. Internationally, recycling initiatives are formalized as in the case of the EU and the USA or less structured as implemented in Kenya, India and Botswana. Formalized structures rely on government intervention to enhance market conditions to promote recycling. Policy instruments that have been implemented include directive-based regulations, economic instruments, voluntary agreements and education/ information activities. These have resulted in an increase in the level of recycling but have not significantly impacted on the total quantity of waste generated (Annexure, 2005).

It is important that the Municipality of Garissa encourages their residents to take up recycling, and by putting in place policies that will not discourage individuals or companies who would wish to invest in the recycling industry.

### **2.2.2 Reuse**

To reuse is to use an item again after it has been used. This includes conventional reuse where the item is used again for the same function, and new-life reuse where it is used for a different function. In contrast, recycling is the breaking down of the used item into raw materials which are used to make new items. By taking useful products and exchanging them, without reprocessing, reuse helps save time, money, energy, and resources. In broader economic terms, reuse offers quality products to people and organizations with limited means, while generating jobs and business activity that contribute to the economy. Current environmental awareness is gradually changing attitudes and regulations, such as the new packaging regulations, are



gradually beginning to reverse the situation. One example of conventional reuse is the doorstep delivery of milk in refillable bottles; other examples include the retreading of tires and the use of returnable/reusable plastic boxes, shipping containers, instead of single-use corrugated fiberboard boxes (Zurbrugg,2003).

It makes economic and environmental sense to reuse products. Sometimes it takes creativity: Reuse products for the same purpose. Save paper and plastic bags, and repair broken appliances, furniture and toys. Reuse products in different ways. Use a coffee can to pack a lunch; use plastic microwave dinner trays as picnic dishes. Sell old clothes, appliances, toys, and furniture in garage sales or ads, or donate them to charities. Use resalable containers rather than plastic wrap. Use a ceramic coffee mug instead of paper cups. Reuse grocery bags or bring your own cloth bags to the store. Do not take a bag from the store unless you need one( Girling,R. 2005)

### **Advantages of Reuse**

Reuse has certain Energy and raw materials savings as replacing many—potential advantages: single use products with one reusable one reduces the number that need to be manufactured. Reduced disposal needs and costs. Cost savings for the business and consumers as reusable product is often cheaper than the single use products it replaces. Some older items were better—many single use products it replaces. Refurbishment can bring—handcrafted and appreciate in value sophisticated sustainable well paid jobs to underdeveloped economies( Ogawa,H., 2005)

## **Disadvantages of Reuse**

Disadvantages are also apparent: Some requires cleaning or transport, which have environmental costs. items, such as free on appliances or infant auto seats could be hazardous Reusable products—or less energy efficient as they continue to be used. need to be more durable than single-use products, and hence require more material per item. This is particularly significant if only a small Sorting and proportion of the reusable products are in fact reused. preparing items for reuse takes time, which is inconvenient for consumers and costs money for businesses( Ogawa,H., 2005).

### **2.2.3 Source Reduction**

Source reduction, also known as waste prevention, means reducing waste at the source. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction also is important in manufacturing. Light weighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction. Source reduction can: Save natural resources; Conserve energy; Reduce pollution; Reduce the toxicity of our waste; and Save money for consumers and businesses alike

**Table 2.1: Some waste reduction tips**

For Consumers	For Businesses/Organizations
Buy only what you need	Join EPA's free WasteWise Program
Buy reusable or refillable products	Reduce office paper waste by implementing a formal policy to double-side all draft reports, and by making training manuals and personnel information available electronically.
Buy in bulk and/or economy sizes. Avoid single-serving sizes.	Improve product design to use less materials.
Buy products with less packaging	Reduce all forms of packaging waste: <ul style="list-style-type: none"> <li>• Redesign packaging to eliminate excess material while maintaining strength.</li> <li>• Work with customers to design and implement a packaging return program.</li> <li>• Switch to reusable transport containers.</li> <li>• Purchase products in bulk.</li> </ul>
Bring your own bag	Keep mailing lists current.

Source: Hardoy, J E, 2001 *Enviromental Problems page19*

Reducing solid waste is reducing the amount of garbage that goes into our landfills. These are items we use each day, and then get rid of by putting them into the trash. Solid waste comes from homes, businesses and industries. If you want to reduce solid waste, Purchase items in bulk. Products that are packaged in larger packages typically use less packaging per product than smaller packages. ( Chris, Jenny, 1990). The best way to manage waste is to not produce it. This can be done by shopping carefully and being aware of a few guidelines: Buy products in bulk. Larger, economy-size products or ones in concentrated form use less packaging and usually cost less per ounce. Avoid over-packaged goods, especially ones packed with several materials such as foil, paper, and plastic. They are difficult to recycle, plus you pay more for the package. Avoid disposable goods, such as paper plates, cups, napkins, razors, and lighters. Throwaways contribute to the problem, and cost more because they must be replaced again and again. Buy durable goods - ones that are well-built or that carry good warranties. They will last longer, save money in the long run and save landfill space. At work, make two-sided copies when ever possible. Maintain central files rather than using several files for individuals.(Davies, A 2008). It would help a lot in managing the waste situation in Garissa Municipality if the above can be implemented and the policy enforced.

### **2.3 Household Size and Solid waste Disposal**

The waste generating potential of households is dependent on several factors. The most important is household size, i.e. the number of persons present in the household. This influences the rate of generation of several categories of waste, including packaging wastes, putrescible kitchen waste, miscellaneous plastic waste and miscellaneous combustible waste. Its effect is the same in each case; as the number of persons in the household increased, so the amount of such waste produced by the household increased (Jones Alan, 2008).

Logically, large households would be expected to generate much more solid waste than small households. This is because they consume more in terms of food and other items (Naing, 2009).

As family size and income are the most significant factors affecting the quantity of solid waste from household consumption, a study on the relationship among these is vital in the decision making on waste management strategies (Sivakumar, 2012). Concerns about the environmental impacts of consumption and production, such as loss of natural resources, climate change and other environmental damage caused by emissions and waste, have been addressed at the global level by the United Nations since the 1992 Earth Summit, in Rio de Janeiro. The 2002 Johannesburg World Summit on Sustainable Development called for the development of a 10-year framework of programmes to promote sustainable consumption and production patterns. This challenging task is co-ordinated under the UN-led Marrakech process.

#### **2.4 Influence of Location of Household on Solid Waste Disposal**

Municipal solid waste collection schemes of cities in the developing world generally serve only a limited part of the urban population. The people remaining without waste collection services are usually the low-income population living in peri-urban areas. One of the main reasons is the lack of financial resources to cope with the increasing amount of generated waste produced by the rapid growing cities. Often inadequate fees charged and insufficient funds from a central municipal budget can not finance adequate levels of service. However not only financial problems affect the availability or sustainability of a waste collection service. Operational inefficiencies of SW services operated by municipalities can be due to inefficient institutional structures, inefficient organizational procedures, or deficient management capacity of the institutions involved as well as the use of inappropriate technologies. (Zurbrugg, 2003).

With regard to the technical system, often the "conventional" collection approach, as developed and used in the industrialized countries, is applied in developing countries. The used vehicles are sophisticated, expensive and difficult to operate and maintain, thereby often inadequate for the conditions in developing countries. After a short time of operation usually only a small part of the vehicle fleet remains in operation.

In many countries there is currently great interest in involving private companies in solid waste management. Sometimes this is driven by the failures of municipal systems to provide adequate services, and sometimes by pressure from national governments and international agencies. Arrangements with private companies have not all been successful, and as a result some opposition to private sector involvement is now in evidence.

An important factor in the success of private sector participation is the ability of the client or grantor - usually a municipal administration to write and enforce an effective contract. Many municipalities do not know what it has been costing them to provide a service, so they cannot judge if bids from the private sector are reasonable. The contract document must be well written to describe in quantitative terms what services are required and to specify penalties and other sanctions that will be applied in case of shortcomings. Monitoring and enforcement should be effective. It is also important that the rights of both parties are upheld by the courts. Three key components of successful arrangements are competition, transparency and accountability. (Zurbrugg, 2003).

As an alternative to large (often international) companies that can provide most or all of the solid waste services in a city, micro enterprises or small enterprises (MSEs) or Community-based Organisations (CBO) can be involved for services at the community level (neighbourhoods or the small city administrative zones). They often use simple equipment and labour-intensive methods, and therefore can collect waste in places where the conventional trucks of large companies cannot enter. The MSEs may be started as a business, to create income and employment, or they may be initiated by community members who wish to improve the immediate environment of their homes.

A recurring problem with collection schemes that operate at the community level is that these systems generally collect and transport the waste a relatively short distance up to a transfer point, from where the waste should be collected by another organization - often a municipality. Problems of co-ordination and payment often result in the waste being left at transfer points for a long time creating a hygienic unsatisfactory condition. Another approach is to recycle as much of the waste locally (decentralized) so that there is very little need for on-going transport of collected waste. ( Zurbrugg, 2003).

Most of the problems experienced in solid waste management in developing countries originate in cultural set ups, weak financial bases and management planning( Kaloki, F.K, 1992). Majority of residents in fast growing cities like Nairobi in Kenya live in unplanned settlements. If the residents are considered as squatters, refuse collection services are not readily made available to them reason being that these areas do not enjoy automatic mandate of the local authorities in refuse collection responsibility; they are thus reluctant to serve them, seeing these are illegal

residents who want to benefit from services they don't pay for. These areas are inaccessible to large collection vehicles, owing to narrow lanes ( Kaloki F.K,1992).

## **2.5 Education and Household Waste disposal**

Education is an important factor in the disposal of solid waste at the household level. A person who has had some knowledge regarding the importance of natural environment will not throw away garbage in an unsustainable manner. The most important landmark for environmental education at an international level was without a doubt the International Conference on Environmental Education organized by UNESCO and UNEP at Tbilisi in former USSR in 1977. The goals of environmental education were defined as creating environmental awareness; impart general knowledge for a basic understanding of environment, acquiring environmental friendly attitudes and values and to generate new patterns of behaviour towards environment. The more recently held United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992, popularly known as the Earth Summit, adopted an action plan for Sustainable Development, Agenda 21. Chapter 36 which is devoted to education states that

"Education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues" Education without communication is simply impossible. Communication in turn will only work with an appropriate medium. In the case of environmental education at educational establishments classes at school, college or universities level serve as this medium. As far as environmental education outside educational establishments is concerned mass media and traditional media like family, neighbours and colleagues have the role of the medium that enables people to communicate successfully. In the following paragraph these three different kinds of media (institutional, mass and traditional



media) will be examined to find out on their efforts made in creating environmental awareness and how more or less successful they are.

## **2.6 Solid waste Disposal facilities and collection Services**

### **2.6.1 Landfill**

Sanitary landfill is the cheapest satisfactory means of disposal, but only if suitable land is within economic range of the source of the wastes; typically, collection and transportation account for 75 percent of the total cost of solid waste management. In a modern landfill, refuse is spread in thin layers, each of which is compacted by a bulldozer before the next is spread. When about 3m (about 10 ft) of refuse has been laid down, it is covered by a thin layer of clean earth, which also is compacted. Pollution of surface and groundwater is minimized by lining and contouring the fill, compacting and planting the cover, selecting proper soil, diverting upland drainage, and placing wastes in sites not subject to flooding or high groundwater levels. Gases are generated in landfills through anaerobic decomposition of organic solid waste. If a significant amount of methane is present, it may be explosive; proper venting eliminates this problem.

### **2.6.2 Incinerators**

In incinerators of conventional design, refuse is burned on moving grates in refractory-lined chambers; combustible gases and the solids they carry are burned in secondary chambers. Combustion is 85 to 90 percent complete for the combustible materials. In addition to heat, the products of incineration include the normal primary products of combustion—carbon dioxide and water—as well as oxides of sulfur and nitrogen and other gaseous pollutants; nongaseous products are fly ash and unburned solid residue. Emissions of fly ash and other particles are often controlled by wet scrubbers, electrostatic precipitators, and bag filters.

### **2.6.3. Composting**

Waste materials that are organic in nature, such as plant material, food scraps, and paper products, can be recycled using biological composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity. The intention of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter.

Composting operations of solid wastes include preparing refuse and degrading organic matter by aerobic micro organisms. Refuse is pre-sorted, to remove materials that might have salvage value or cannot be composted, and is ground up to improve the efficiency of the decomposition process. The refuse is placed in long piles on the ground or deposited in mechanical systems, where it is degraded biologically to humus with a total nitrogen, phosphorus, and potassium content of 1 to 3 percent, depending on the material being composted. After about three weeks, the product is ready for curing, blending with additives, bagging, and marketing.

The use of open dumps for MSW in Kenya makes environmental pollution highly probable. Both surface water and groundwater remain vulnerable to MSW pollution because disposal dumps were chosen for convenience rather than based on environmental safety considerations. The extent of groundwater pollution in and around the dumpsites still is unknown because adequate pollution assessment studies have not been done conducted on the groundwater. Based on the degree of surface water pollution, it is possible to identify when pollution is taking place in the

groundwater. An investigation into the extent of pollution of groundwater urgently needs to be carried out within the vicinities of the MSW dumpsites.

When solid waste is disposed into land sites, it decomposes and generates methane. Most of this methane is released into the air, despite the presence of methane capturing systems at landfills, meaning additional local and national environmental issues arise. Global methane emissions from landfill sites are estimated to be between 30 and 70 million tons each year, according to Green House Gas. Improper storage can also cause an increased risk of fire and explosion if improper methods are used.

To be successful, a large scale composting program must be located carefully and odours must be controlled, because people do not want to live near a giant compost pile or plant. Composting programs must also exclude toxic materials that can contaminate the compost and make it unsafe for fertilizing crops and lawns (Miller, 2007).

#### **2.6.4 Recycling plants**

Recycling is a process to change materials (waste) into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to plastic production. Recycling is a key component of modern waste reduction and is the third component of the "Reduce, Reuse, Recycle" waste hierarchy.

There are some ISO standards related to recycling such as ISO 15270:2008 for plastics waste and ISO 14001:2004 for environmental management control of recycling practice.

Recyclable materials include many kinds of glass, paper, metal, plastic, textiles, and electronics. Although similar in effect, the composting or other reuse of biodegradable waste—such as food or garden waste—is not typically considered recycling. Materials to be recycled are either brought to a collection center or picked up from the curbside, then sorted, cleaned, and reprocessed into new materials bound for manufacturing.

In the strictest sense, recycling of a material would produce a fresh supply of the same material—for example, used office paper would be converted into new office paper, or used foamed polystyrene into new polystyrene. However, this is often difficult or too expensive (compared with producing the same product from raw materials or other sources), so "recycling" of many products or materials involves their reuse in producing different materials (e.g., paperboard) instead. Another form of recycling is the salvage of certain materials from complex products, either due to their intrinsic value (e.g., lead from car batteries, or gold from computer components), or due to their hazardous nature (e.g., removal and reuse of mercury from various items). Critics dispute the net economic and environmental benefits of recycling over its costs, and suggest that proponents of recycling often make matters worse and suffer from confirmation bias.

Specifically, critics argue that the costs and energy used in collection and transportation detract from (and outweigh) the costs and energy saved in the production process; also that the jobs produced by the recycling industry can be a poor trade for the jobs lost in logging, mining, and other industries associated with virgin production; and that materials such as paper pulp can only be recycled a few times before material degradation prevents further recycling. Proponents of recycling dispute each of these claims, and the validity of arguments from both sides has led to enduring controversy.

Standardized recycling labeling can also have a positive effect on supply of recyclates if the labeling includes information on how and where the product can be recycled.

## **Recycling consumer waste**

### **Collection**

These systems lie along the spectrum of trade-off between public convenience and government ease and expense. The three main categories of collection are "drop-off centres," "buy-back centres "and" curbside collection".

### **Drop-off centres**

Drop-off centres require the waste producer to carry the recyclates to a central location, either an installed or mobile collection station or the reprocessing plant itself. They are the easiest type of collection to establish, but suffer from low and unpredictable throughput.

### **Buy-back centres**

Buy-back centres differ in that the cleaned recyclates are purchased, thus providing a clear incentive for use and creating a stable supply. The post-processed material can then be sold on, hopefully creating a profit. Unfortunately, government subsidies are necessary to make buy-back

centres a viable enterprise, as according to the United States National Solid Wastes Management Association it costs on average US\$50 to process a ton of material, which can only be resold for US\$30.

### **Distributed Recycling**

For some waste materials such as plastic, recent technical devices called recyclebots enable a form of distributed recycling. Preliminary life-cycle analysis(LCA) indicates that such distributed recycling of HDPE to make filament of 3-D printers in rural regions is energetically favorable to either using virgin resin or conventional recycling processes because of reductions in transportation energy

### **Sorting**

Early sorting of recyclable materials: glass and plastic bottles in Poland

A recycling point in New Byth, Scotland, with separate containers for paper, plastics and differently colored glass. Once commingled recyclates are collected and delivered to a central collection facility, the different types of materials must be sorted. This is done in a series of stages, many of which involve automated processes such that a truckload of material can be fully sorted in less than an hour. Some plants can now sort the materials automatically, known as single-stream recycling. In plants a variety of materials are sorted such as paper, different types of plastics, glass, metals, food scraps, and most types of batteries. A 30 percent increase in recycling rates has been seen in the areas where these plants exist( Gilpin, A 1996)

#### **2.6.5 A civic amenity site**

(CA site) or household waste recycling centre (HWRC) is a facility where the public can dispose of household waste and also often containing recycling points. Civic amenity sites are run by the

local authority in a given area. Collection points for recyclable waste such as green waste, metals, glass and other waste types (including WVO) are available. Items that cannot be collected by local waste collection schemes such as bulky waste are also provided. In the United Kingdom, civic amenity sites are informally called "tips" or "dumps" (Hotrichter, R. 1993).

### **2.6.6 A transfer station**

is a building or processing site for the temporary deposition of waste. Transfer stations are often used as places where local waste collection vehicles will deposit their waste cargo prior to loading into larger vehicles. These larger vehicles will transport the waste to the end point of disposal in an incinerator, landfill, or hazardous waste facility, or for recycling. In the future, transfer stations could be equipped with material recovery facilities and with localized mechanical biological treatment systems to remove recyclable items from the waste stream (Elliot, J. 2006). For these transfer stations to work properly, the proximity principle which advocates that waste should be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional or sub regional level should be observed especially so for Garissa Municipality where the proximity principle is not followed and therefore you find a lot of waste falls down even during transportation (Municipal Environment Officer, 2013).

### **2.7 Theoretical Framework**

Two related concepts, social justice and environmental justice, have been employed in this study, to investigate the problem of household solid waste disposal in Garissa County. There are, however, other theoretical frameworks that could also be used such as political ecology, sustainable waste management and good governance. Political ecology (Blaikie, 1985; Bailey and Bryant, 1997), for instance, could be used to study how political, economic and social

factors affect the organisation of waste while the concept of good governance (frequently employed by the World Bank/IMF in its surveillance over the transparency of government accounts, the effectiveness of public resource management and the transparency of the regulatory environment for private sector activity) (IMF, 1997) could be a useful framework for examining aspects of the waste management system in Kenya such as the management of financial and other resources for waste management and the regulatory framework for private sector involvement in waste management.

Within the broader framework of sustainable development, the concept of sustainable waste management (see Section 2.1.7) is also an appropriate framework for studying not only the effects of improper waste management on human health and the natural environment but also the implications of current waste management practices for resource conservation and environmental sustainability (Schubeller *et al.*, 1996; Watson and Bulkerley, 2004).

However, one single study cannot easily be embedded within all these theoretical frameworks so a choice had to be made among them, thus, social/environmental justice. Furthermore, existing studies on solid waste management in developing country cities show that social justice and environmental justice have received less attention than the other concepts in the investigation of environmental issues. Following these concepts in the current study was, therefore, seen as an opportunity to examine an important environmental problem from a different perspective.



## 2.8 Conceptual Framework

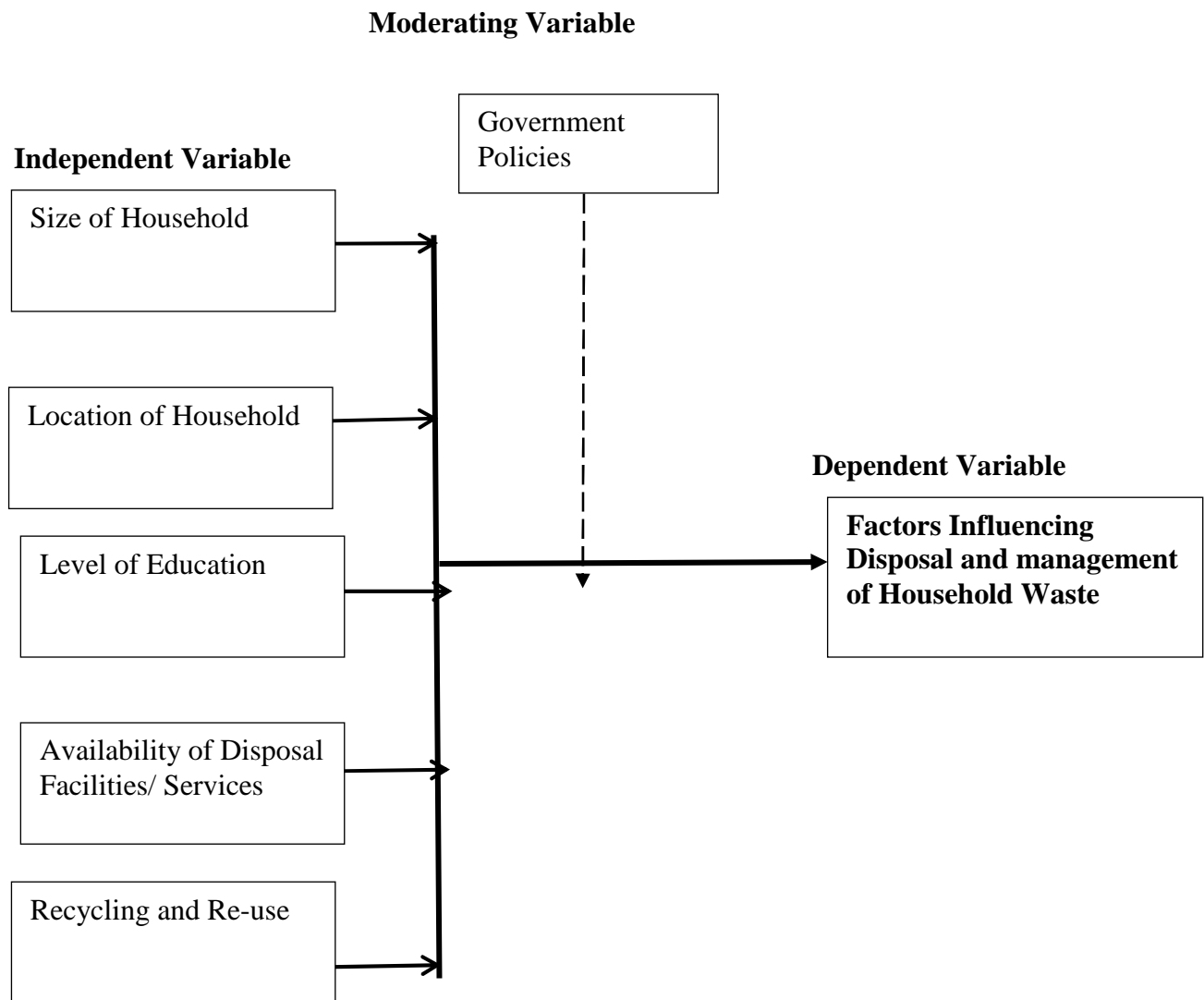


Fig. 2.1: Conceptual Framework.

The most critical independent variables are Size of Household, Location of Household, Level of awareness, Availability of disposal facilities, and Recycling and re-use. The bigger the household the higher the generation of waste and hence accumulation if not well managed. There is also a believe that the location of household determines the solid waste disposal and management especially when you compare between an informal settlement and a formal one. An informed and a sensitized community tend to be more organized in terms of solid waste disposal and management than one where nobody cares about how such is done. Solid waste disposal is also affected by the availability of disposal facilities and recycling and re-use.

## **2.9 Legal and Institutional Framework Governing Solid Waste Management**

Local government authorities are generally responsible for the provision of solid waste collection and disposal services. They become the legal owner of waste once it is collected or put out for collection. Responsibility for waste management is usually specified in bylaws and regulations and may be derived, more generally, from policy goals regarding environmental health and protection( Ali, M. 1999). Besides their legal obligations, local governments are normally motivated by political interests. User satisfaction with provided services, approval of higher government authority Commercial and industrial establishments are interested in effective waste collection and, in many cases, waste minimization. NGOs may help to increase the community's capacity to manage waste collection. Local governments are motivated by political interests as well as legal obligations. Describing Municipal Solid Waste Management.

The authority to enforce bylaws and regulations, and to mobilise the resources required for solid waste management is, in principle, conferred upon local governments by higher government authorities. Problems often arise when local government's authority to raise revenues is not

com-menstruate with their responsibility for service provision. Besides solid waste management, municipal governments are also responsible for the provision of the entire range of infrastructure and social services. Needs and demands for MSWM must therefore be weighed and addressed in the context of the needs and relative priorities in all sectors and services. To fulfil their solid waste management responsibilities, municipal governments normally establish special purpose technical agencies, and are also authorized to contract private enterprises to provide waste management services( Shubeler, P. 1996). In this case, local authorities remain responsible for regulating and controlling the activities and performance of these enterprises. Effective solid waste management depends upon the cooperation of the population, and local governments should take measures to enhance public awareness of the importance of MSWM, generate a constituency for environmental protection and promote active participation of users and community groups in local waste management. National Government National governments are responsible for establishing the institutional and legal framework for MSWM and ensuring that local governments have the necessary authority, powers and capacities for effective solid waste management. In many countries, responsibility is delegated with-out adequate support to capacity building at the local government level. To assist local governments to execute their MSWM duties, national governments need to provide them with guidelines and/or capacity-building measures in the fields of administration, financial management, technical systems and environmental protection. In addition, national government intervention is often required to solve cross-jurisdictional issues between local government bodies, and to establish appropriate forms of association when in most metropolitan areas effective waste management.((Claveland,D. 1991)

## **2.10 Similar Research done elsewhere**

Similar research has been carried out in this field. Cheserek G. J., Opata G. P in their thesis

“Housing and the Environment: Eldoret Case Study”, analyses Garbage, solid and liquid waste, poor drainage, water pollution and air pollution as the major environmental problems.

The so-called pit latrines and bathrooms are temporary structures made of plastic paper, tins and wood; without doors or roofs in dilapidated state, as one could easily see human faeces on the toilet and bathroom floors. The poor state of pit latrines and bathing facilities explained the presence of diseases related to poor hygiene, with children being the most affected (51%); followed by women (35%) who spend most of their time in and around the house. Least affected are men (14%), because they working outside their residences.

From their data; 54% of the respondents had primary education; 20% had no formal education,

Data on income showed from their study showed that; 33% had no source of income;

32 earned below Ksh. 900 per month; 10% earned between Ksh. 900-1900; 13% earned between Ksh. 2000-3000 and 12% earned more than Ksh. 3000. These results implied that low income households were less educated and had poorly paid occupations that made it difficult for them to meet their basic need of decent shelters, and hence the state of living in areas with poor waste management.

The difference between this research and the previous one is that the present lays emphasis on examination of the factors which lead to the present state of affairs in Garissa Municipality, the situation of littered town with all manner of garbage, blocked drainage systems, animal car cases, tree branches and many more. By so doing the research intends to find out how various methods of waste management are impacted by the location and levels of education/awareness, how

household size influences disposal of solid waste and to investigate the influence of garbage disposal facilities on disposal of solid waste. It is hoped that results and findings of this study will make contribution to improvement of existing situation of poor waste disposal and management in Garissa town.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the research methodology that was used in the study. It covers the research design, target population, sampling techniques and sample size, research instruments, validity and reliability of the instruments, data collection procedure and data analysis procedure.

#### **3.2 Research Design**

The research design constitutes the blue print for the collection, measurement and analysis of data (Kothari, 2003). A descriptive survey was used in the description of the state of affairs or the current status of the variables in the study. The study employed descriptive analysis to establish opinions and knowledge about the factors that influence the disposal of household waste. Any research undertaking involves lots of cost implications hence this design will be deliberately selected for the study because it allows for quick data collection at a comparatively cheap cost (Grinnell, 1993).

#### **3.3 Target Population**

The target population was residents of Garissa Municipality who are affected by unsustainable disposal of solid waste. Key informants facilitated access to data relating to the volume and type of solid waste generated and the available means of disposal. Key informant household heads were studied.

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

In order to get a proportional representation of the targeted respondents, the study used a combination of Cluster, purposive and random sampling techniques. According to Orodho (2009) 10% to 20% sample of the population was representative enough to be used as a sample.

For this study 20% of the total population was selected as a sample with 400 household participating in the study.

Garissa Municipality was divided into five areas through cluster sampling. Purposive Sampling allows the research to use cases that have the required information with respect to the objectives of the study (Mugenda and Mugenda, 2003: 50). In this respect, purposive sampling was applied to choose Central Division because it was within Garissa Town which is affected by the problem of waste disposal due to urbanization. After the cluster sampling random sampling was used to select the 400 household heads who participated in this study.

### **3.5 Data collection Instruments**

Data collection tools involved designing questionnaires for selected Household heads and guided interview schedules for officers from the environment department of Garissa Municipality and also for officers from National Environment Management Authority.

### **3.6 Data Collection Methods and Techniques**

Data was collected by the use of questionnaires. The questionnaires comprised both closed-ended (structured), and open -ended (unstructured) questions in order to encourage in depth responses. Some questionnaires were filled by the respondents themselves (especially for the literate respondents), while the rest were administered by the researcher with the assistance of trained assistants (for the illiterate respondents).

### **3.7 Instrument Validity**

Validity is the accuracy and meaningfulness of inferences, which are based on the research results , it is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. (Mugenda and Mugenda, 2003:99). For the validity of the study to be enhanced, the researcher sought advice and periodic reviews by the University Supervisors

and lecturers in the specific disciplines applied. Researcher sought to obtain the maximum possible cooperation from all the respondents by establishing a friendly relationship prior to conducting the interviews. All respondents were made to appreciate the purpose of the study, confidence was inspired into them and they were put at ease by establishing some rapport before the actual interviews. The efficiency and effectiveness of the questionnaires was reviewed with the supervisor time after time.

### **3.8 Reliability of the instrument**

Orodho (2003) states that reliability of instrument concerns the degree to which a particular measuring procedure gives similar results over a number of repeated trials. To test reliability of instrument, the research used the split- half technique. The researcher aimed at determining the consistency or reliability coefficient. The value for this will range between 0 (no reliability) to +1 (perfect reliability). The instrument was broken into equivalent halves after administering. Each subject was treated separately and scored accordingly. The scores were computed and the two halves correlated using Pearson's correlation coefficient. A correlation coefficient ( $r$ ) of about 0.75 was established which according to (Orodho, 2009) is considered high enough to judge the reliability of the instrument.

### **3.9 Data collection procedure**

After approval of the research by the University supervisor, a research introduction letter was obtained from the chairman, Department of Real estate and Construction Management of the University of Nairobi . The researcher then paid a courtesy call to the County Commissioner, Garissa to inform him of the study. The instruments were administered, after authorization from the administrators. The questionnaires were drop and pick type, so the respondents were given one week to fill. After one week the questionnaires' were collected. Due to the vastness of the



study area sampled the researcher was assisted by research assistants whose duty was mainly to follow up the questionnaires and assist those who were illiterate.

### **3.10 Data Analysis**

Data analysis is the process of bringing order, structure and meaning to the mass of information collected. It involves examining what has been collected and making deductions and inferences (Kombo and Tromp, 2006; Mugenda and Mugenda, 1999). This study employed descriptive statistics to analyse the data collected. According to Gay (1992), descriptive survey is commonly represented by use of frequency and percentage Tables. Thus descriptive statistics involves collection, organization and analysis of all data relating to the population under study. SPSS package was used to analyse the data. This software is efficient and able to handle large amounts of data.

### **3.11 Ethical considerations**

Consent of the participants was sought whereby they agreed to participate in the study through voluntary informed consent without threat or undue inducement. In addition the respondents were assured that the information they gave was to be kept confidential and used only for the purpose of research. For anonymity the respondents were requested not to write their identities in the questionnaire section while the appropriate chain of command was followed before the commencement of the data collection process.

## CHAPTER FOUR

### 4.0 DATA PRESENTATION AND ANALYSIS

#### 4.1 Introduction

This chapter provides the findings of the study. The findings are presented according to the specific objectives of the study. The analysis is done by considering each of the objective, analyzing each of the questionnaire and interview schedule item relating to that objective and giving the findings on that particular objective and then discusses the results. A thematic analysis of the data is also performed. Finally, the various responses given by the different respondents on identical research objectives are compared to find if the respondents concur on various issues or not. The common responses are then considered to be representing the actual situation. An attempt is made to find possible reasons for the difference in the response from different respondents whenever they arise.

**Table: 4.1: Questionnaire Return Rate Table**

Type respondents	Total	Returned (f)	%
Township	200	175	87.5
Iftin	80	65	81.2
Waberi	70	60	85.7
Bour-algi	30	21	70.0
Kora-Kora	20	13	65.0
Total	400	334	83.5

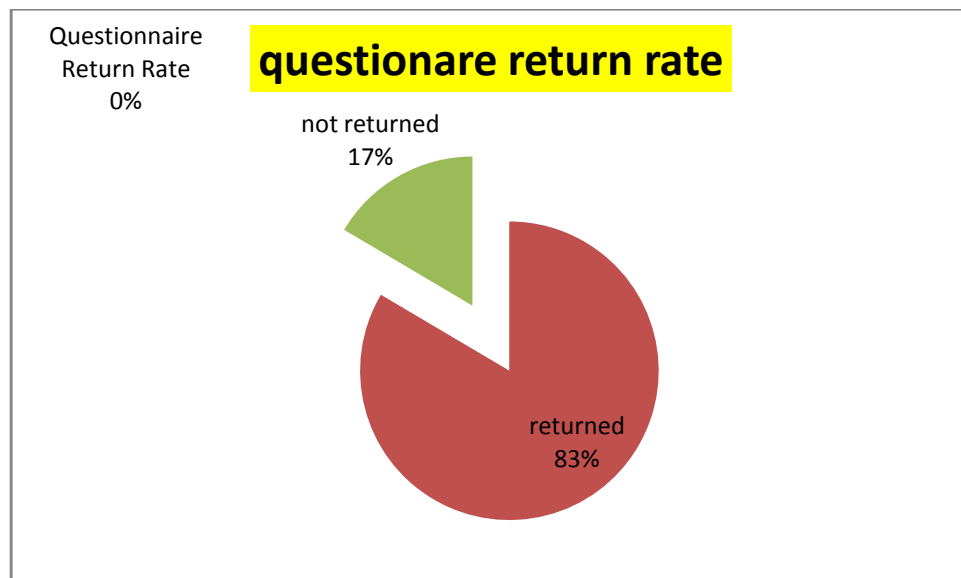


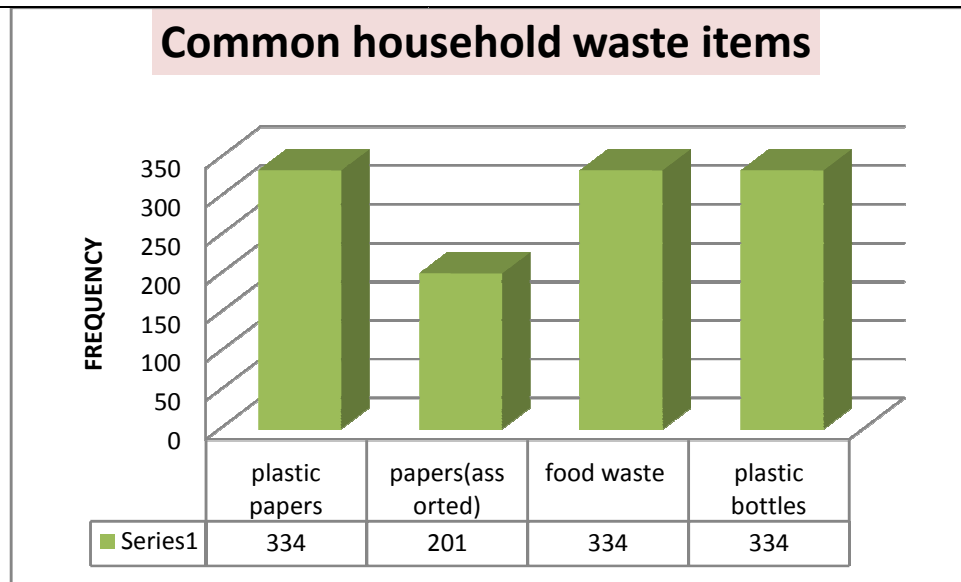
Table 4.1 indicates that among the distribution of the questionnaires as they were distributed to the household heads in the division. Out of the 400 questionnaire distributed 334 (83.5%) were returned, which is a good response rate.

#### **4.2 Influence of level of awareness/education on the various methods solid waste management**

The first research question was: What is the influence of levels of awareness/education of the various methods of waste management? To get answers to this question, respondents were first asked to identify the items commonly found in their household waste. Several forms of household waste were identified and results were presented in Table 4.3

**Table 4.2: Common Household Waste Items**

Item	Frequency	Percentage
Plastic Papers	334	100
Papers (assorted)	201	50.25
Food Waste	334	100
Plastic Bottles	334	100



From Table 4.2, it can be noted that households generate many kinds of waste, ranging from plastic papers (commonly referred to as paper bags) (100%) food waste (100%), plastic bottles(100%), and varieties of papers (50.25%). This therefore implies that all of these forms of waste are generated at household level in large quantities, creating significant environmental and economic burdens.

### 4.3 Influence of Education of Household head on Solid Waste Disposal

The fourth research question was: How does the level of education of members of a household influence disposal of solid waste? To get answers to this question, respondents were asked to state the highest education level of the head of the household. The findings in this objective are given in Table 4.8.

**Table 4.3: Education Level of Household Heads**

<i>Area</i>	<i>Township</i>	<i>Iftin</i>	<i>Waberi</i>	<i>Bour-algi</i>	<i>Kora-kora</i>
	<i>n = 175</i>	<i>n=65</i>	<i>n=60</i>	<i>n=21</i>	<i>n=13</i>
<i>Education level</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>	<i>%</i>
No formal education	37.1	38.5	15.4	14.3	15.4
Primary level	20.0	15.4	25.0	23.8	38.5
Secondary level	7.1	7.7	16.7	14.3	23.1
Tertially colleges	8.6	7.7	11.7	14.3	7.8
University Level	8.6	7.7	11.7	23.8	15.4

From Table 4.3 majority of the respondents had no formal education or had only gone up to primary school level of education. Those who stayed in Iftin had the highest percentage (38.5) of those who had no formal education followed by Township with 37.1%. As for primary school level Kora-Kora's response led with 38.5% followed by Waberi 25% and Bour-algi had 23.8% response of those who had gone up to primary education. Secondary education, tertially and university levels had the least respondent from all the five areas.

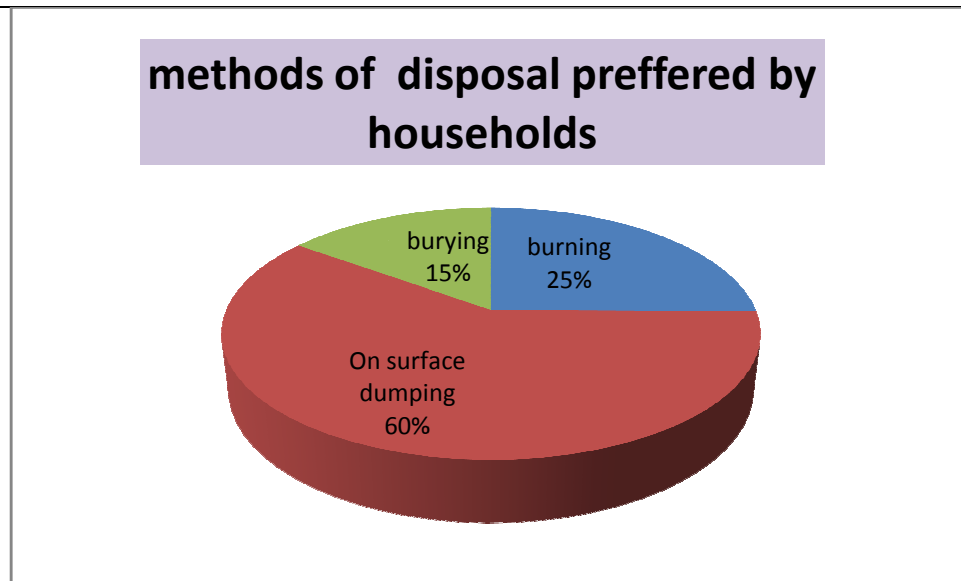
**Table 4.4: Disposal Methods Employed by Respondents as per their education levels**

Disposal method/ Educational levels	Communal containers %	roadside collection %	track visit %	waste dump %	other %
No formal education	7.1	8.3	15.4	10.0	75.6
Primary level	20.0	15.4	25.0	23.8	38.5
Secondary level	7.1	7.7	23.1	14.3	16.7
Tertiary education	8.6	7.7	11.7	14.3	7.8
University Education	5.3	3.3	56.9	13.0	0

After analyzing data from respondents as shown in Table 4. 9 it was found out that the respondents who had university education majority (56.9%) disposed their waste in a manner that is acceptable to the environmental requirements (truck visit) with non indicating that they used the others option. While there was no particular pattern of waste disposal by respondents with other levels of education, the general trend was that households with little education identified with the “others” category as a means of waste disposal. For instance those who had gone up to primary level had 38.5%, those of secondary level majority 23.1% used track visits while those had tertiary levels of education indicated that majority 14.3% used waste dump. The results communicate that levels of education have influence on the type of waste disposal method used. It is observed that the number of respondents using the “others” method of waste disposal decreases as the level of education increases. In the same way, the number of respondents using roadside collection, a method of dumping waste beside undesignated points along the road to await collection also tends to diminish.

**Table 4.5: Methods of Waste Disposal Preferred by Households**

Method of Disposal	Frequency	Percentage
Burning	84	25.1
On surface Dumping	200	59.9
Burying	50	15
<b>Total</b>	<b>334</b>	<b>100</b>



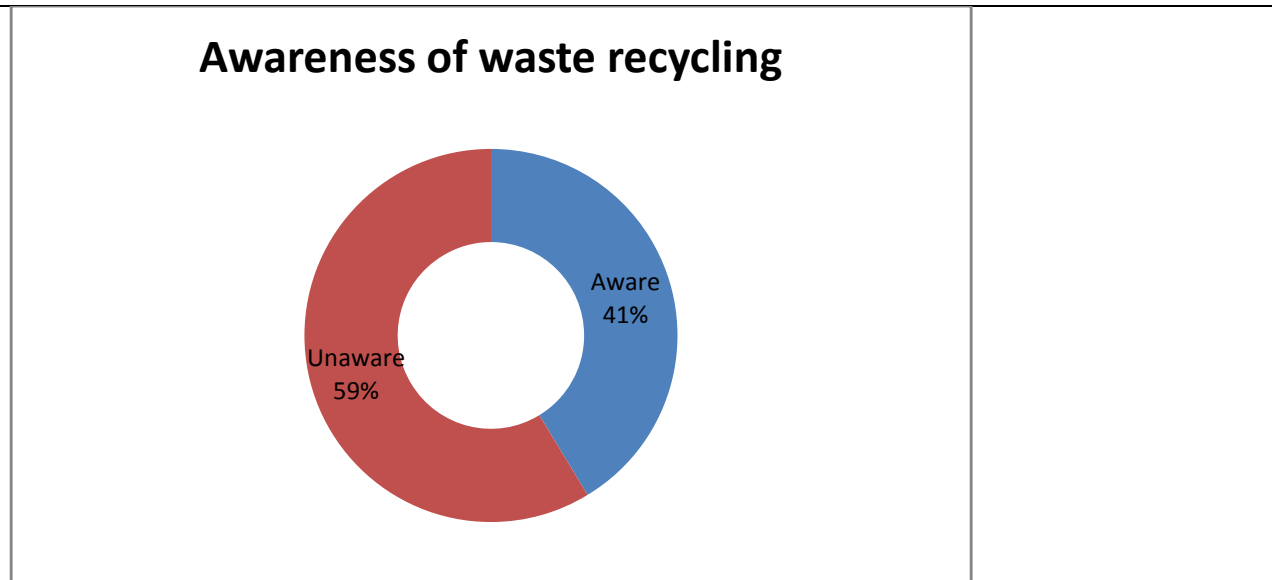
From Table 4.5, it is observed that the most prevalent method of disposal was through the surface dumping 59.9%. This is a term used to describe all forms of dumping on the ground surface that included roadside dumping, throwing in the nearest bush, throwing on the open drainages or simply dumping any form of waste anywhere outside ones house, whether the place is a designated dumping ground or not. It was followed by waste disposal through burning, a method identified by 25.1% of all respondents on average. Burying as a method of waste disposal was identified by only 15% of all respondents on average. The fact that most respondents were using on surface dumping is a clear indication that there is a general inappropriate dumping of waste by residents of Garissa Township.

In order to gauge whether the waste disposed by residents were recycled, respondents were asked to state whether they were aware whether any of the waste that generated were recycled.

The results were presented on Table 4.5.

**Table 4.6: Respondents’ Awareness/education of importance of proper methods of waste management**

Awareness Level	Frequency	Percentage
Aware	138	41.3
Unaware	196	58.7
Total	334	100



From Table 4.6, it is observed that majority of the respondents (58.7%) are not aware of any of the importance of proper methods of waste disposal and management. Only 41.3% on average were aware of the importance disposing waste properly. Respondents who were aware about household waste being the responsibility of the individual were further asked to identify the type of waste that they were aware of being recycled. All respondents in this category identified only one type of waste – plastic bottles, as being recycled. None of the other types of waste were



identified as being recycled. Hence, most household waste is not recycled except plastic bottles that were recycled to a certain extent only. The unavailability of recycling activities and plants in the study area explains why there is so much litter around the town and its environs.

Recycling is a worthwhile activity with many benefits to the society and the environment. It reduces the amount of solid waste going into landfills and incinerators, saves energy, creates valuable jobs and helps preserve natural resources for future generations.

In order to fully participate in recycling, consumers must buy recycled products. There are many items that can be purchased, from notebook paper to clothes.

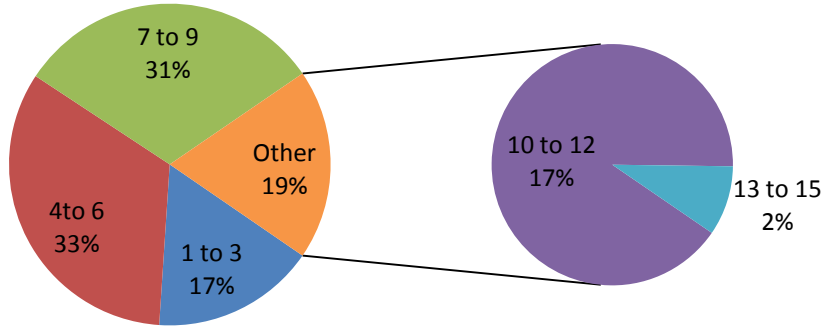
#### **4.4 Influence of Household Size on Disposal of Solid Waste**

The second research question was: What is the influence of household size on disposal of solid waste? In order to get responses to this question, respondents were asked to state the number of people living in his/her house. Table 4.5 provides the household size of respondents.

**Table 4.7: Respondent Household Size**

Household Size	Frequency	Percentage
1-3	55	16.5
4-6	111	32.2
7-9	104	31.1
10-12	58	17.4
13-15	6	1.8
Total	334	100

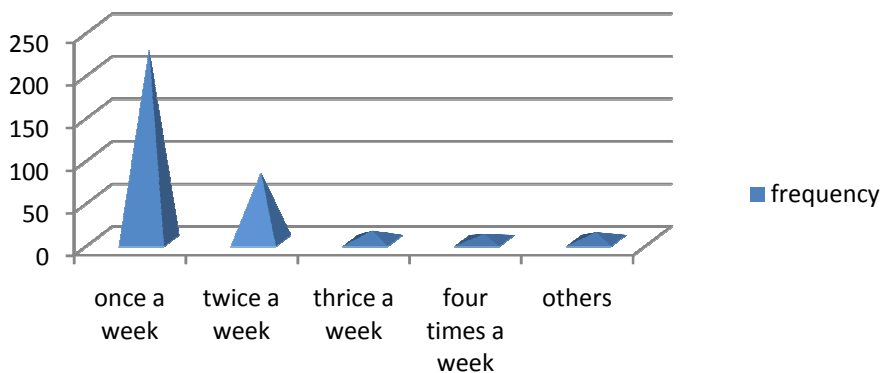
## Influence of household size on disposal of solid waste



From Table 4.7, it is observed that most households had members ranging from 4-10 people in all residential places studied. Only six households (1.8%) had more than 13 members. The mode group, the household size that majority of respondents indicated was that with 4-6 children. 32.2% of all respondents had household sizes this much.

In order to gauge the relationship between household size and solid waste disposal, respondents were asked to state the number of times they disposed their household waste in their regular disposal site per week. Table 4.7 portrays these results.

## Frequency of waste disposal per week



According to Table 4.8 majority of the respondents 67.0% disposed their waste once per week followed by those who did it twice with 24%. This means that the households collect their waste at one point for the seven days then it is disposed while the others do it and then it is disposed twice per week. Households with many members were however found to have more waste to dispose off, and therefore disposed off their waste at higher frequency per week

#### **4.5 Influence of Garbage Disposal Facilities on Disposal of Solid Waste**

The fifth research question was: How does garbage disposal facilities influence disposal of solid waste? The facilities investigated in the field were those that could be used for keeping waste before collection by relevant bodies, people or companies. Closed ended questions were used to explore this objective, in which alternatives of communal container, waste dump, truck visit, and roadside container were provided. Besides, an independent alternative referred to as “others” was also provided. The results of this objective are similar to those obtained and discussed in the fourth objective. However, a few other issues require re-visiting.

The study found that there are no specific facilities provided to residents wherever they stay, in which they should put their domestic waste. Individuals keep their personal waste storage facilities such as small carton boxes, commercial waste paper baskets, buckets or troughs within their house confines. When such containers are filled, the owners take them out to the nearest illegal garbage dump that mushroom the residential centres. Alternatively, waste is deposited on open fields anywhere, along footpaths, beside the roads or even in drainage tunnels, thereby blocking such tunnels. Garbage, a collection of different forms of waste, is responsible for the blockage of drainage channels in Garissa Township.

There is a garbage dump where trucks that collect waste dump them, but the point is far off from most of the residential places such that very few people actually take their garbage to the place.

There are waste collection bins supplied by private individuals, but these do not reach residential places. As such, most residents discharge household waste in no particular places, but they are eventually picked by town council authorities for dumping in the dumping ground. Thus, there are no domestic waste collection facilities in most residential areas in Garissa Municipality.

#### **4.6 Hypothesis Testing**

The research hypothesis was, “the level of solid waste disposal management in Garissa is significantly influenced by the level education/awareness of most of the household heads, and impaired household solid waste management in Garissa Municipality is due to lack of enough disposal/collection facilities. The result findings and analysis indicate that the hypothesis can be accepted based on the following;

The first aspect of the hypothesis can be tested using data analysed and it was found out that the respondents who had university education majority (56.9%) disposed their waste in a manner that is acceptable to the environmental requirements (truck visit) with non indicating that they used the others option as shown above using table 4.7.

The second aspect of the hypothesis, that impaired household solid waste management in Garissa Municipality is due to lack of enough equipment can be accepted based on the observation that storage, collection, transport, and disposal equipment are inadequate to cope with the rate of refuse generation that is increasing rapidly as population and the Municipality grow.

## CHAPTER FIVE

### 5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter provides the summary of the research findings, discusses them and draws conclusions based on the findings. The chapter also provides recommendations both on policy as well as on further research. The chapter starts by enumerating the study findings then provided the conclusion of the study, based on the findings. It then provides both policy recommendations and recommendations for further research as the final section.

#### 5.2 Summary of the Findings

The questionnaire return rate attracted 83.5%. That means that only 16.5% questionnaires were not returned. Many kinds of waste were generated by the residents, ranging from plastic papers (commonly referred to as paper bags) (100%) food waste (100%), plastic bottles(100%), and varieties of papers (50.25%). This therefore implies that all of these forms of waste are generated at household level in large quantities, creating significant environmental and economic burdens.

Most prevalent method of disposal was through the surface dumping 59.9%.

This is a term used to describe all forms of dumping on the ground surface that included roadside dumping, throwing in the nearest bush, throwing on the open drainages or simply dumping any form of waste anywhere outside ones house, whether the place is a designated dumping ground or not. It was followed by waste disposal through burning, a method identified by 25.1% of all respondents on average. Burying as a method of waste disposal was identified by only 215% of all respondents on average. The fact that most respondents were using on surface dumping is a clear indication that there is a general inappropriate dumping of waste by residents of Garissa Township.

Also majority of the respondents (58.7%) are not aware of any of the waste generated being recycled. Only 41.3% on average were aware of some of their waste being recycled. Respondents who were aware about household waste being recycled were further asked to identify the type of waste that they were aware of being recycled. All respondents in this category identified only one type of waste – plastic bottles, as being recycled. None of the other types of waste were identified as being recycled. Hence, most household waste is not recycled except plastic bottles that were recycled to a certain extent only. The unavailability of recycling activities and plants in the study area explains why there is so much litter around the town and its environs.

Most households had members ranging from 4-10 people in all residential places studied. Only six households (1.8%) had more than 13 members. The mode group, the household size that majority of respondents indicated was that with 4-6 children. 32.2% of all respondents had household sizes this much. The finding also indicate that majority of the respondents selected the “others” option for waste collection. This was a collection of several waste disposal methods that did not require any collection at all. They included such disposal mechanisms described as throwing near a bush, throwing waste near garbage dump on ones way to work, pouring waste along footpaths where they would be scattered all over and pouring waste next to unofficial garbage dumps.

Information emanating from Table 4.8 shows that there was near parity in the respondents using the “others” choice among all residential areas. The proportion of respondents using the method was Township 40%, Iftin 38.5%, Waberi, 26.7, Bour-almi, 33.3% and Kora-kora, 38.5%.

Residents of the five settlement areas therefore disposed off their solid waste using this unhealthy method in the same proportion. Therefore, in this respect, location of household does not influence the method of disposing waste by respondents in the study area.

Apart from the “others” method used by most respondents in disposing waste, other methods employed included roadside collection. It was found that a garbage collection company had been hired recently which collected household waste on behalf of the local town council. The company placed small buckets in front of shops along the streets. Users of such premises were expected to dump their waste in these containers that employees of the company then collected them after specific period. Other methods employed included the use of communal containers, taking waste personally to the dump site, and garbage collection by truck visit which scored the least in all the areas except in Bour-algi area where it had the second highest response.

Another finding of the study which is of concern is that majority of the respondents had no formal education or had only gone up to primary school level of education. Those who stayed in Iftin had the highest percentage (38.5) of those who had no formal education followed by Township with 37.1%. As for primary school level Kora-Kora’s response led with 38.5% followed by Waberi 25% and Bour-algi had 23.8% response of those who had gone up to primary education. Secondary education, tertially and university levels had the least respondent from all the five areas.

Other findings are that respondents who had university education majority (56.9%) disposed their waste in a manner that is acceptable to the environmental requirements (truck visit) with

non of them indicating that they used the others option. While there was no particular pattern of waste disposal by respondents with other levels of education, the general trend was that households with little education identified with the “others” category as a means of waste disposal. For instance those who had gone up to primary level had 38.5%, those of secondary level majority 23.1% used track visits while those had tertiary levels of education indicated that majority 14.3% used waste dump. The results communicate that levels of education have influence on the type of waste disposal method used. It is observed that the number of respondents using the “others” method of waste disposal decreases as the level of education increases. In the same way, the number of respondents using roadside collection, a method of dumping waste beside undesignated points along the road to await collection also tends to diminish.

On the last objective the study found that there are no specific facilities provided to residents wherever they stay, in which they should put their domestic waste. Individuals keep their personal waste storage facilities such as small carton boxes, commercial waste paper baskets, buckets or troughs within their house confines. When such containers are filled, the owners take them out to the nearest illegal garbage dump that mushroom the residential centres. Alternatively, waste is deposited on open fields anywhere, along footpaths, beside the roads or even in drainage tunnels, thereby blocking such tunnels. Garbage, a collection of different forms of waste, is responsible for the blockage of drainage channels in Garissa Township. There is a garbage dump where trucks that collect waste dump them, but the point is far off from most of the residential places such that very few people actually take their garbage to the place. There are waste collection bins supplied by private individuals, but these do not reach residential places.



As such, most residents discharge household waste in no particular places, but they are eventually picked by town council authorities for dumping in the dumping ground. Thus, there are no domestic waste collection facilities in most residential areas in Garissa Township.

### **5.3 Discussion of the study**

This sub-section will discuss the findings of the study as in comparison to the literature reviewed. It is arranged as per each objective. Majority of the respondents 67.0% disposed their waste once per week followed by those who did it twice with 24%. This means that the households collect their waste at one point for the seven days then it is disposed while the others do it and then it is disposed twice per week. Households with many members were however found to have more waste to dispose off, and therefore disposed off their waste at higher frequency per week

#### **5.3.1 To find out the influence of levels of education/awareness on methods of disposal of solid waste.**

The results communicate that levels of education have influence on the type of waste disposal method used. It is observed that the number of respondents using the “others” method of waste disposal decreases as the level of education increases. In the same way, the number of respondents using roadside collection, a method of dumping waste beside undesignated points along the road to await collection also tends to diminish. Literature had also shown the same that a person who has had some knowledge regarding the importance of natural environment will not throw away garbage in an unsustainable manner (Zurbrugg,2003).

#### **5.3.2 To establish whether location of household influences disposal of solid waste.**

The locations of households have no influence on the amount of waste generated by the people living there. Different households living in different residential areas generated different

quantities of goods depending on their sizes rather than their location. There was nothing to show any relationship between household location and amount of waste produced.

### **5.3.3 To investigate the influence of garbage disposal/collection facilities on disposal of solid waste**

Garissa Municipality uses open dumping and burning of the collected refuse. Collection trucks bring refuse into the dumping site and tip anywhere where the drivers find convenient. Refuse is left burning. The dumpsite is about 2 kilometres from the town centre. The dumpsite is not sheltered from rain which means not all waste is burned during rain.

There are no domestic waste collection facilities in most residential areas in Garissa Township. The study found that there are no specific facilities provided to residents wherever they stay, in which they should put their domestic waste. Individuals keep their personal waste storage facilities such as small carton boxes, commercial waste paper baskets, buckets or troughs within their house confines. When such containers are filled, the owners take them out to the nearest illegal garbage dump that mushroom the residential centres. Alternatively, waste is deposited on open fields anywhere, along footpaths, beside the roads or even in drainage tunnels, thereby blocking such tunnels. Garbage, a collection of different forms of waste, is responsible for the blockage of drainage channels in Garissa Township. There is a garbage dump where trucks that collect waste dump them, but the point is far off from most of the residential places such that very few people actually take their garbage to the place.

## **5.4 Conclusion**

From the findings it is clear the residents are not aware of any outlined method and responsibility of waste management adopted by the authorities for keeping the Municipality clean. There is no specific way of waste disposal and management which can be called the norm or best practise for the Municipality's Households . As such therefore there is no such a way of doing things and which has been sensitized to the residents, and therefore this leads to the reason why majority of the residents said that they are not aware of any standards or norms and therefore the failure of the municipality to sensitise their people on the importance of personal responsibility to keep Garissa town clean.

From the findings also it was found that different households living in different residential areas generated different quantities of waste depending on their sizes rather than their location. There was nothing to show any relationship between household location and amount of waste produced. This agrees with the literature review where it was mentioned that where there is presence of informal settlements the authorities shun the provision of basic services because they (authorities) think that services are given to those who pay for them. Apparently therefore such a scenario of informal settlements is not available in Garissa and hence the reason why location is not an issue in so far as factors affecting waste disposal and management is concerned.

From the findings as discussed in the previous section, it is also clear that there is no adequate waste disposal mechanism/technologies/facilities available to most residents living in Garissa Township. People therefore dump household waste anyhow, not necessarily due to their personal wish, but probably due to lack of designated waste disposal mechanisms or points. Private garbage collectors have come up to supplement the local town council, but they are not of much

help to the residents since they mainly serve the people operating businesses on the streets. Those living in residential areas are not served by such private individuals who are more effective in performing the duty. The council trucks that collect garbage are also not efficient since they cannot reach all residential areas. It is therefore necessary for the local council to look into the garbage collection and come up with solutions that can assist the local population.

## **5.5 Recommendations**

### **5.5.1 Policy Recommendations**

Private individuals should be encouraged to start household solid waste recycling plants in Garissa Township. Measures should be put in place to have county government subsidies provided to individual or group of individuals undertaking an investment in recycling of solid waste being generated in the Municipality. This is because there are many household waste products within the township, but it is scattered all over the place, becoming an eyesore to the general public. Such a company can recycle the waste and earn income through county government subsidies, while at the same time giving rise to a clean environment

Entrepreneurs currently collecting plastic bottles should start a recycling plant right within Garissa Township itself. This is because the company currently ferries the plastic bottles for recycling in other parts of Kenya, thereby robbing Garissa residents off the necessary revenue in terms of employment and other taxes to the local council.

Out of the metric tones of garbage generated daily by the residents of Garissa Municipality, only a small percentage is collected. The rest is left in the estates piling into mountains of stinking refuse forming an eyesore and become a health hazard especially for those in high density areas.

To help improve the Municipal's waste disposal and management, the following recommendations are hereby being made;

As many communal storage facilities as possible be set strategically not far from homes. This is especially important for densely populated areas. This reduces the route and the time spent by the collection truck.

The Garissa town county government should put up designated waste dumps in all residential areas so as to ensure that residents do not scatter their household waste all over the place as they currently do. If dumping places are available, people would see the sense of taking their waste to the designated places rather than throw them all over the place as they currently do. Residents of Garissa Township should be sensitized to stop depositing their waste near residential areas as this exposes them to the danger of contracting diseases. Instead, the council should designate specific places for waste deposit and collection. The local council should contract the private waste collectors to extend the services they currently provide to the shop owners operating along the main streets to residential areas. This would reduce the amount of garbage in the residential areas.

Garbage should be collected regularly to stop overflowing, forcing people to drop solid waste around containers. Strict financial management needs to be taken by local authorities to ensure enough funds are left to attract skilled personnel in solid waste departments. The Municipality needs to reorganize their operations in a way that waste management is not left to operate under another department, but should be an independent department.

There should be encouragement of private and public participation and the municipality to consider operating a sound public relation programme aimed at securing public approval and ensuring confidence in waste collection and transportation operations. New innovations on equipment and information on Municipal refuse management should be annually updated and passed to the Municipality residents or exhibited at industrial shows.

Selection and maintenance of equipment should be done carefully. A sound maintenance programme is needed with planned and preventive maintenance principles being very important. Personnel involved in waste management need to be trained to familiarize with procedures in the system, routes and equipment. To update skills and knowledge supplementary training may be necessary. Workers should be taught on the importance of their job in relation to the proper functioning of the Municipal. They should be motivated by being given the necessary facilitation.

Initial emphasis may be placed on optimizing the ratio of supervisory personnel to direct labour , establish by-laws and regulations that indicate resident participation in waste management by outlining methods of household storage, adopting a system of record keeping on equipment and maintenance supplies of spare parts.

Clarify responsibilities for instance by making specific collection crews responsible for specific routes and assigning equipment to individual drivers or oprators chain of communication and co-ordination for workers in reporting complaints, optimize ratioof maintenance personnel to equipment and provideworkshop and infrastructure needed for ease in carrying out repairs.

I do also suggest that owners of premises provide dustbins required by their tenants. This could be made enforceable obligation by the Municipality which should in turn provide big communal dumping dustbins. This will help in cutting down the municipality's expenditure.

### **5.2.2 Recommendation for Further Research**

Further research in understanding the nature of structure and operational powers of Garissa Municipality on guiding and controlling waste management and control is recommended. The research will entail inter alia institutional relationships, overlaps and conflicts if any across departments in the county as well as the Municipality and how these impact on the process of waste management in the town. Particular attention will be laid on the exact information required for this particular institution to effectively and efficiently operate

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## **Appendix 1: Letter of introduction**

Dear Sir,

### **REQUEST FOR CO-OPERATION**

I am postgraduate Diploma student of the University of Nairobi carrying out a study on the solid waste situation in this town as part of my research project. As a stakeholder in the waste sector, your views are important in this study and I would be grateful if you could provide information on this important topic. I would like to assure you that the information you provide in the questionnaire will be treated confidentially and anonymously and will be used solely for the purpose of this research.

Please find attached a copy of the questionnaire for the study.

Thank you for your assistance.

Boniface Mutuku Mule

#### **Contacts:**

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E-mail: bmmule@gmail.com

**Appendix 2: Questionnaire for household survey**

**SECTION A: Introduction**

i. Name of suburb/Estate .....

ii. How long have you lived in this neighborhood? Years ..... Months.....

iii. How many people live in your house? .....

iv. what is the highest level of education of household head?.....

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**SECTION B: Household waste generation and disposal practices**

1. Please indicate the items commonly found in your household waste and how often you generate them

<b>Common household waste items</b> (e.g. food waste, paper, plastic)	<b>How often do you generate this?</b> (e.g. daily, weekly, occasionally)

2. How do you store your waste before disposal?

- In a closed container [ ]
- In an open container [ ]
- In a polythene bag or sack [ ]
- Other [ ] **Please indicate:** .....

3. In the table below, please indicate with a tick (√) the type of waste collection service available to your household.

Waste collection service	(√)	Question to proceed to
Home collection		
Roadside collection		
Truck visit		
Communal container		Proceed to Q. 6
Waste dump		Proceed to Q. 10
Other (Please indicate).....		Proceed to Q. 14

4. In the table below, please indicate your service provider and frequency of the service.

Service provider	Frequency of service

5. Is your service provider able to keep to the agreed schedule for waste collection?

- Yes [ ]
- No [ ] what do you do with your waste then?

.....

-----

6. Is the waste container close to your home or other homes in the neighbourhood?

- Yes [ ] how close? ..... (e.g. distance in meters)
- No [ ]

7. Is the waste container emptied regularly?

- Yes [ ] how regularly is it

Emptied? .....

- No [ ] Do you know why?

Yes [ ] state

Reason: .....

No [ ]

8. How will you describe the sanitation situation around the waste container?

- Very satisfactory [ ]
- Satisfactory [ ]
- Poor [ ]
- Very poor [ ]

9. Do you suffer any nuisance from the waste container site?

- Yes [ ] what do you suffer from? .....
- No [ ] -----

11. Is the waste dump maintained (e.g. is the waste regularly removed or burned)

- Yes [ ] who maintains it? .....
- No [ ]

12. Do you suffer any nuisance associated with the waste dump?

- Yes [ ] what do you suffer from? .....
- No [ ]

13. How will you describe the sanitation situation at the waste dump?

- Very satisfactory
- Satisfactory
- Poor
- Very poor

14. Please indicate how you dispose of your waste

- Burning [ ]
- In the bush/ roadside/ drain [ ] specify: .....
- Burying [ ]

• Other method [ ] specify: .....

15. Why do you dispose of your waste by this method?

• I have no waste collection service [ ]

• I cannot afford service fee [ ]

• Other reason (please indicate) [ ] .....

16. Do you know of any environmental problems associated with your method of waste disposal?

• Yes [ ] what are they? .....

• No [ ]

17. Do you re-use some of the waste generated in your household?

• Yes

• No



**Appendix 3: Photographs**

**Samples of photos of the poor waste disposal/ management in Garissa County**



**Photo:** Littered compound and an open sewer just outside an estate in Garissa.



**Photo:** Plastic litter spread outside household in Garissa.



**Photo:** An uncollected garbage heap

**Appendix 3 : Operationalization Table**

Objective	Type of Variable	Indicator	Measure	Level of Scale	Approach of Analysis	Type of Analysis	Level of Analysis
To investigate the influence of the stipulation of recycling of solid waste on disposal of household waste	<b>Dependent Variable</b> Disposal of Household solid waste. <b>Independent Variable</b> Stipulation of recycling	Type of waste re-used. Type of waste recycled	Frequency  Percentage score	Nominal  Ratio	Quantitative and Qualitative	Non-parametric	Descriptive.
To investigate the influence of household size on disposal of	<b>Independent Variable</b> Size of Household	Method of disposal. Place of disposal.	Numbers  Percentage score	Nominal  Ratio	Quantitative and Qualitative	Non-parametric	Descriptive

solid waste.							
To determine the influence of the location of household on disposal of solid waste	<b>Independent Variable</b> Location of Household.	Proximity to disposal facilities. Presence of collection services.	Frequency  Percentage Score	Nominal  Ratio	Quantitative and Qualitative	Non-parametric	Descriptive
To investigate the influence of the level of education on disposal of household solid waste	<b>Independent Variable</b> Level of education.	Choice of waste disposal method.	Frequency  Percentage score	Nominal  Ratio	Quantitative and Qualitative	Non-parametric	Descriptive
To investigate the	<b>Independent Variable</b> Garbage	Availability Of facilities.	Numbers  Frequencies	Nominal  Nominal	Quantitative and Qualitative	Non-parametric	Descriptive.

influence of garbage disposal facilities on disposal of household solid waste	disposal facilities	Type of facilities.	Percentage score	Ratio			
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