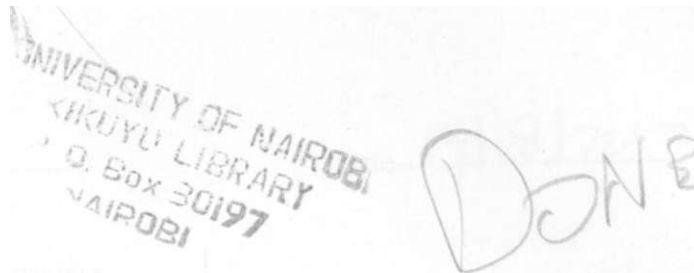# FACTORS INFLUENCING DISPOSAL OF HOUSEHOLD SOLID WASTE IN

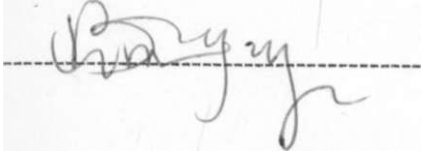# CENTRAL DIVISION GARISSA DISTRICT, KENYA

Ng'ang'a Bernard Njenga

A Research Report Submitted in Partial Fulfilment for the Requirements for the Award of

the Degree of Masters of Arts in Project Planning and Management,

University of Nairobi

2012

DECLARATION

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

-------------------------------- Date

NG'ANG'A BERNARD NJENGA

L50/62242/2011

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

₀ J . i j M i . 1

Mary Mbii

Lecturer

University of Nairobi

DEDICATION

To my family; loving wife Judy and our two angels Jackline and George

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

i

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

CP   Cleaner Production

ENGOS   Environmental Non-governmental Organizations

IE   Industrial Ecology

MDGs   Millennium Development Goals

NEMA   National Environment Management Authority

SPSS   Statistical Package for Social Sciences

UNCED   United Nations Conference on Environment & Development

UNEP   United Nations Environment Programme.

ABSTRACT

This study investigated the factors influencing disposal of household solid waste in Central Division Garissa District, Kenya. The objectives of the study were; to investigate the influence of the of recycling of solid waste on disposal of household solid waste, to investigate the influence of household size on disposal of solid waste, to determine the influence of location of household on disposal of solid waste, to investigate the influence of the level of education of members of a household on disposal of solid waste and to investigate the influence of garbage disposal facilities on disposal 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. Data collected was analysed using SPSS package and then it was presented by use of frequency and percentage Tables. The study found that there are no solid household waste recycling plants in Garissa Central Division, or any other place within Garissa District. As such, most household waste are scattered all over residential places, giving a bad image to the residential areas. 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 private individuals should be encouraged to start household solid waste recycling plants in Garissa Township. Such a company can recycle the waste and the residents to earn income, while at the same time giving rise to a clcan environment. Also, residents of Garissa should be sensitized to stop depositing their waste near residential areas as this exposes them to the danger of contracting diseases.   ^

ttis¹}! • /V..^*

CHAPTER ONE:

INTRODUCTION

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 city 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.

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 mto 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).

v

2

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 now 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 (Sfren 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, 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.

1.2 Statement of the problem

The problem investigated in this study is the worsening solid waste situation found in urban settlements in Garissa district. The concentration of population and business activities in Kenyan 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 country seem unable to organise adequate collection and safe disposal of waste within their jurisdictions. As a result, urban settlements in the country 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).

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.

1.3 Purpose of the Study

The purpose of this study was to examine the factors influencing the disposal household solid waste in Central Division of Garissa County with the aim of enhancing understandings of the problem and the key issues affecting urban solid waste disposal in , and also to identify possible solutions to the problem.

1.4 Objectives of the Study

The study focused on the following specific objectives:

i. To determine how the recycling of solid waste influences disposal of household solid waste.

ii. To investigate how the household size influenced the disposal of solid waste.

iii. To establish whether location of household influences disposal of solid waste.

iv. To find out the influence of levels of education of members of a household on disposal of solid waste.

v. To investigate the influence of garbage disposal facilities on disposal of solid waste.

1.5 Research Questions

The research was guided by the following questions:

i). What is the influence of the of recycling of solid waste on disposal of household solid waste?

ii). What is the influence of household size on disposal of solid waste?

iii). What is the influence of location of household on disposal of solid waste?

iv). How does the level of education of members of a household influence disposal of solid waste?

v). How does garbage disposal facilities influence disposal of solid waste?

1.6 Significance of the Study

The results of this study will be important to 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 the residents.

The municipal council 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.

1.7 Delimitation of the Study

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

.

1.8 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 Somali 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 Islamic religion was an hindrance to some extent as women household heads shied away from the researcher because of his gender.

1.9 Assumptions of the Study

The following assumptions were made by the study:

i). The sample selected was representative of the entire population.

ii). * All other factors were assumed to be constant and that recycling and re-use, household size, location of the household, level of education and collection facilities are the only factors that influence inappropriate disposal of solid waste.

iii). Responses received from respondents were true, honest and transparent.

1.10 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.

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.

1.11 Summary

This chapter analyzed the background of the problem of household solid waste disposal. The purpose of the study and statement of the problem have been highlighted leading to the objectives and research questions. The limitations and delimitations of the study have been highlighted and possible ways of overcoming them suggested. The key assumptions made have been stated and a brief definition of significant terms to used in this study has been given.

CHAPTER TWO:

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 urbanisation).

Addressing the issue of municipal solid waste is ah 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 cities. This is because even though these cities 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 Influence of Recycling on Solid Waste Disposal

Recycling is the process whereby discarded products and materials are reclaimed or recovered, refined or reprocessed, and converted into new or different products. 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) anc* repair (mending an item which was unserviceable because of damage or malfunction). °ther way of reducing the amount of waste we produce is to divert certain waste materials or

11

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).

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, bit 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 betore 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 landtill 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 loeated 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 councillors 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, 198 1; Weigel,l985) 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 tor urban and agricultural uses. Together, recycling and composting can provide income, ^{SI}gnificantly 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 ^corporate scavenging'^ 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 formalised as in the case of the EU and the USA or less structured as implemented in Kenya, India and Botswana. Formalised 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).

2.2.1 Industrial Ecology

This is an interdisciplinary field that focuses on the sustainable combination of Business, Environment & Technology. The word 'industrial' represents how humans use natural resources in the production of goods and services. Ecology refers to the concept that our industrial systems should incorporate principles exhibited within sustainable natural ecosystems.

Industrial ecology is the shifting of industrial process from linear (open loop) systems, in which resource and capital investments move through the system to become waste, to a closed loop system where wastes become inputs for new processes. Industrial ecology views industrial systems as being integral to ecological systems not separate from them.

The development of industrial ecology is an attempt to provide a new conceptual framework for *understanding* the impacts of industrial systems on the environment. This new framework serves to identify and then implement strategies to reduce the environmental impacts of products and processes associated with industrial systems, with an ultimate goal of sustainable development. Industrial ecology is the study of the physical, chemical, and biological interactions and interrelationships both within and between industrial and ecological systems. Additionally, some researchers feel that industrial ecology involves identifying and implementing strategies for industrial systems to more closely emulate harmonious, sustainable, ecological ecosystems.

Fundamental to industrial ecology is identifying and tracing flows of energy and materials through various systems. This concept, sometimes referred to as *industrial metabolism*, can be utilized to follow material and energy flows, transformations, and dissipation in the industrial system as well as into natural systems. The mass balancing of these flows and transformations can help to identify their negative impacts on natural ecosystems. By quantifying resource inputs and the generation of residuals and their fate, industry and other stakeholders can attempt to minimize the environmental burdens and optimize the resource efficiency of material and energy use within the industrial system. Industrial ecology is an emerging field. There is much discussion and debate over its definition as well as its practicality. Questions remain concerning how it overlaps with and differs from other more established fields of study. It is still uncertain whether industrial ecology warrants being considered its own field or should be incorporated into other disciplines. This mirrors the challenge in teaching it. Industrial ecology can be taught as a separate, semester-long course or incorporated into existing courses. One goal of industrial ecology is to change the linear nature of our industrial system, where raw materials are used and Products, by-products, and wastes are produced, to a cyclical system where the wastes are reused

as energy or raw materials for another product or process(Garner A, 1995). Industrial ecology is rooted in systems analysis and is a higher level systems approach to framing the interaction between industrial systems and natural systems. This systems approach methodology can be traced to the work of Jay Forrester at MIT in the early 1960s and 70s; he was one of the first to look at the world as a series of interwoven systems {*Principles of Systems*, 1968, and *World Dynamics*, 1971; Cambridge, Wright- Allen Press). Donella and Dennis Meadows and others furthered this work in their seminal book *Limits to Growth* (New York: Signet, 1972). Using systems analysis, they simulated the trends of environmental degradation in the world, highlighting the unsustainable course of the then-current industrial system. In 1989, Robert Ayres developed the concept of *industrial metabolism*: the use of materials and energy by industry and the way these materials flow through industrial systems and are transformed and then dissipated as wastes.3 By tracing material and energy flows and performing mass balances, one could identify inefficient products and processes that result in industrial waste and pollution, as well as determine steps to reduce them. Robert Frosch and Nicholas Gallopoulos, in their important article "Strategies for Manufacturing" (,*Scientific American* 261; September 1989, 144-152), developed the concept of industrial ecosystems, which led to the term *industrial ecology*. Their ideal industrial ecosystem would function as "an analogue" of its biological counterparts. This metaphor between industrial and natural ecosystems is fundamental to industrial ecology. In an industrial ecosystem, the waste produced by one company would be used as resources by another. No waste would leave the industrial system or negatively impact natural systems. In 1991, the National Academy of Science's Colloqium on Industrial Ecology constituted a watershed in the development of industrial ecology as a field of study. Since the Colloqium, memtfcrs of industry, academia and government have sought to further characterize

and apply it- In early   The National Academy of Engineering published *The Greening of*

Industrial Ecosystems (Braden Allenby and Deanna Richards, eds.). The book brings together

many earlier initiatives and efforts to use systems analysis to solve environmental problems. It

identifies tools of industrial ecology, such as design for the environment, life cycle design, and

environmental accounting. It also discusses the interactions between industrial ecology and other

disciplines such as law, economics, and public policy.

2.2.2 Cleaner Production

This is a preventive, company-specific environmental protection initiative. It is intended to

minimize waste and emissions and maximize product output. By analyzing the flow of materials

and energy in a company, one tries to identify options to minimize waste and emissions out of

industrial processes through source reduction strategies. Improvements of organization and

technology help to reduce or suggest better choices in use of materials and energy, and to avoid

waste, waste water generation, and gaseous emissions, and also waste heat and noise. There is a

need for manufacturing companies to make products with a longer life span in order to prevent

the accumulation of solid and toxic wastes."CP is the continuous application of an integrated

preventative environmental strategy to processes, products and services to increase efficiency

and reduce risks to humans and the environment (UNEP 1991).

According to International Declaration on Cleaner Production, which was adopted at the fifth

International High Level Seminar held in South Korea in September, 1998, CP was defined as

ollows: "We understand Cleaner Production to be the continuous application of an integrated,

Preventive strategy applied to processes, products and services in pursuit of economic, social,

safcty and environmental benefits." This shows us that CP includes not only the

18

improvement in the producing process, but also various categories in a wide range. UNEP is attempting to disseminate the concepts and concrete technologies of CP much further by urging governments, companies and other entities concerned to sign the International Declaration.

According to a report "Cleaner Production and Eco-efficiency" published by UNEP/WBSCD (World Business Council for Sustainable Development) in 1998, governments need to carry out a review of legislation while stakeholders need to cooperate and coordinate in order to promote cleaner production, the result of which would be less resource usage and waste by a society as a whole and greater creation of value.

The concept was developed during the preparation of the Rio Summit as a programme of UNEP (United Nations Environmental Programme 1992) and UNIDO (United Nations Industrial Development Organization) in 1992 under the leadership of Jacqueline Aloisi de Larderel, the former Assistant Executive Director of UNEP. The programme was meant to reduce the environmental impact of industry. It built on ideas used by 3M in its 3P programme (pollution prevention pays). It has found more international support than all other comparable programmes. The programme idea was described as to assist developing nations in leapfrogging from pollution to less pollution, using available technologies. Starting from the simple idea to produce with less waste Cleaner Production was developed into a concept to increase the resource efficiency of production in general. UNIDO has been operating a National Cleaner Production Centre Programme with centres in Latin America, Africa, Asia and Europe. Greater integration °f the Cleaner Production strategy with sustainable consumption practices is necessary to reconcile economic development with environmental protection.We have to develop initiatives lo influence consumer choices, and to motivate them towards more rational and sustainable °°nsumptien patterns ('-UNEP 2001).

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 private sector participation is the ability of the client or grantor - usually a municipal Ministration to write and enforce an effective contract. Many municipalities do not know what I [11] has been costing them to provide a service, so they cannot judge if bids from the private sector

• reasonable. The contract document must be well written to describe in quantitative terms services are requited 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 of-ten 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 recusing 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).

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 i way garbage in an unsustainable manner. The most important landmark for environmental

22

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.

i

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 Methods and Collection Services

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. 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:

2.6.1 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

Stro d by wet scrubbers, electrostatic precipitators, and bag filters.

24

2.6.3. Composting

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 bn 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 odors 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).

2.7 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 tfie 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 el al., 1996; Watson and ^ulkerley, 2004). However, one single study cannot easily be embedded within all these theoretical framework*, so a choice had to be made among them, thus, social/environmental

26

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.

2.7.1 Social Justice and Urban Solid Waste Management

It is desirable, at least from an egalitarian perspective that the collective benefits of society (such as public money and natural resources) as well as its collective burdens (such as public debt and pollution) are equally allocated among its members. In the real world, however, vulnerable members of the population such as the poor and minority groups are discriminated against as they frequently receive less of the benefits and bfcar more of the burdens (Tilly, 2004). Such discrimination against vulnerable groups in society has been conceptualized as 'social injustice' (Clark, 1985; Miller, 1999; Syme and Nancarrow, 2001). As defined by Atkinson (1983:3) the term social justice refers to "perceived unfairness or injustice of a society in its distributions of rewards and burdens". Syme and Nancarrow (2001: online) have also referred to social injustice as "when not all people within a society have equal access to facilities, services or systems within that society". Advocacy for social justice is therefore an effort to correct injustices in society and to achieve fair and just treatment for all societal groups in the distribution of collective rewards and burdens.

2.8 Conceptual Framework

Moderating Variable
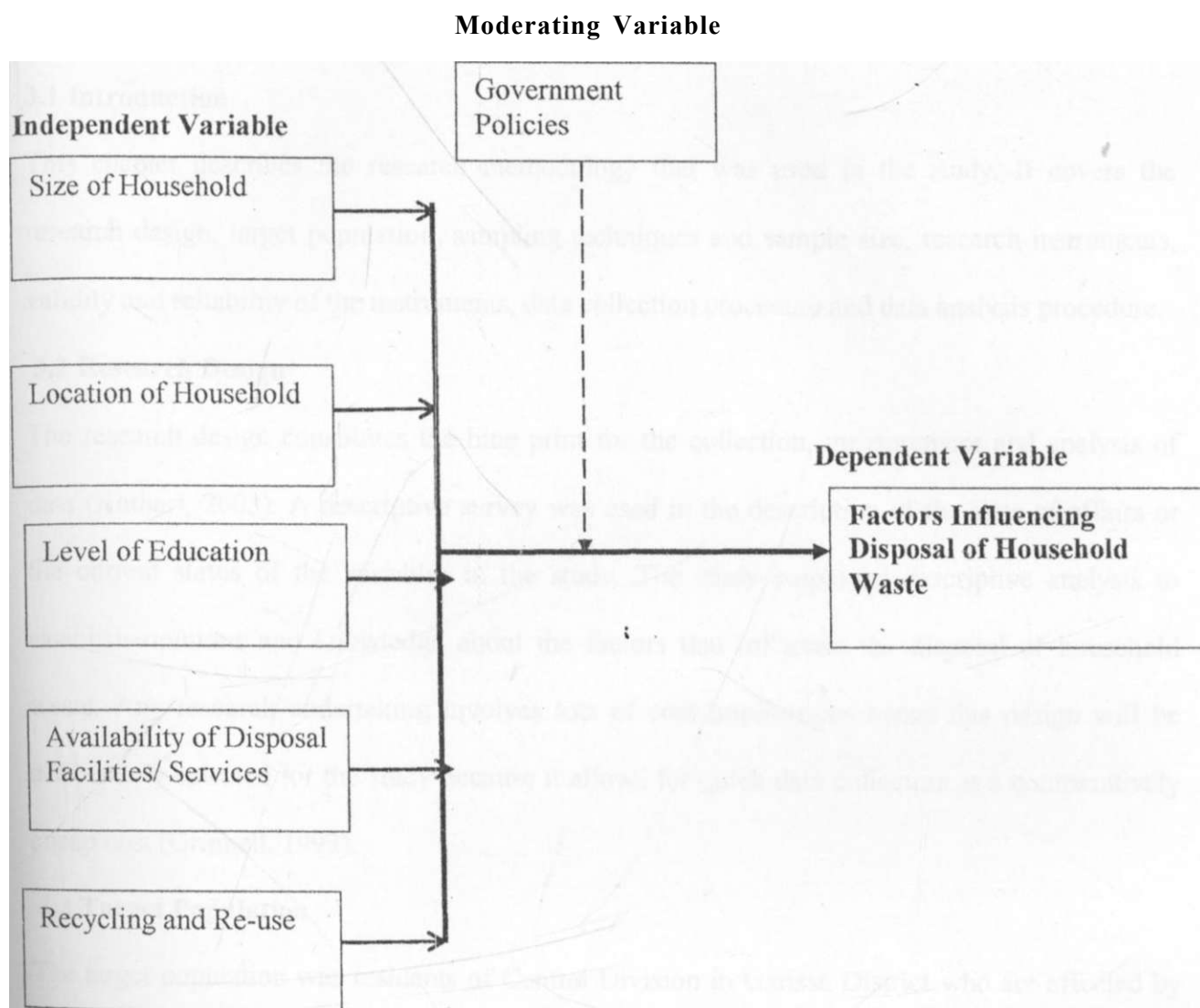
Fig. 2.1: Conceptual Framework.

CHAPTER THREE:

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 Central Division in Garissa District 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. There are 20929 households in Garissa Central Division (Population Census, 1999) distributed as given in the following Table 3.1.

Table 3.1: Distribution of Households in Central Division, Garissa District

Location	Frequency	Percentage
Township	11966	57.2
Iftin	4469	21.4
Waberi	3396	16.2
Bour-Algi	531	2.5
Kora-Kora	567	2.7

Source: District Statistics Office (2009)

i

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 Central Division was divided into five areas through cluster sampling shown on Table 3.1. Purposive Sampling allows the research to use cases that have the

i Squired 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 Wlthm 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 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).

3.6 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 phnomenon 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 resipondents 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.

^ Reliability of the instrument

Orodho (2003) states that reliability of instrument concerns the degree to which a particular Uniig procedure gives similar results over a number of repeated trials. To test reliability of l*Strument, the research used the split- half technique. The researcher aimed at determining the latency or reliability coefficient. The value for this will range between 0 (no reliability) to +1

o

(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.

3.8 Data collection procedure

After approval of the research by the University supervisor, a research permit which authorizes the researcher to cany out the study was obtained from the National Council of Science and Research at Utalii House, Nairobi. The researcher then paid a courtesy call to the District

Commissioners, to inform them 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.

3.9 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 ^Presented by use of frequency and percentage Tables. Thus descriptive statistics involves I P Action, organization and analysis of all data relating to the population under study. SPSS Package was used to analyse tjje data. This software is efficient and able to handle large amounts of data.

3.10 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.

Table 3.2: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	**Dependent Variable** Disposal of Household solid waste. **Independent Variable** 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 solid waste.	**Independent Variable** Size of Household	Method of disposal. Place of disposal.	Numbers Percentage score	Nominal Ratio	Quantitative and Qualitative	Non-parametric	Descriptive
To determine the influence of the location of household on disposal of solid waste	**Independent Variable** 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 I household jolid waste	**Independent Variable** Level of education.	Choice of waste disposal method.	Frequency Percentage score	Nominal Ratio	Quantitative and Qualitative	Non-parametric	Descriptive
n f r investigate the "tflucnce of Mibagc disposal facilities on Sosal of ^schold ^ waste	**Independent Variable** Garbage disposal facilities	Availability Of facilities. Type of facilities.	Numbers Frequencies Percentage score	Nominal Nominal Ratio	Quantitative and Qualitative	Non-parametric	Descriptive.

34

CHAPTER FOUR:

RESEARCH FINDINGS 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)	/o
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

TL

I `ᵉ 4.1 indicates that among the distribution of the questionnaires as they were distributed to household heads in the division. Out of the 400 questionnaire distributed 334 (83.5%) were

B¹¹¹^ means that a total of 66 (16.5%) questionnaires were not returned.

4.2 Influence of Recycling of Solid Waste on Waste Disposal

The first research question was: What is the influence of the stipulation of recycling and of solid waste on disposal of household solid waste? 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 piastic 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.

influence of recycling of solid waste was tested **by** two questions. The first question sought **I identify** the various forms of disposal mechanisms of domestic waste, while the second question sought to find out whether the residents were aware of any individual, group or P ^ V that makes use of the wastes they generate. The findings of the first question are ^^ented in the following table!*

v

Tabic 4.3: 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
Total	334	100

From Table 4.3, 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 thb 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, 'he results were presented on fable 4.4.

Tabic 4.4: Respondents' Awareness of Waste Recycling

Awareness Level	Frequency	Percentage
Aware"	138	4L3
Unaware	167	58.7
Total	334	100

From Table 4.4, it is observed that 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

i

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. Recycling is a worthwhile activity with many benefits to the society and the ^vironment. 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.

I   to fully participate in recycling, consumers must buy recycled products. There are many F ® [8] that can be purchased, from notebook paper to clothes.

4.3 Influence of Household Size oil 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 4.5: Respondent Household Size

Household Size	Frequency	Percentage
7-3	75 ~ ~	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

From Table 4.5, it is observed that most house holds 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 ᵉre asked to state the number of times they disposed their household waste in their regular disPosal cite per week. Table 4.7 portrays these results.

Table 4.6: Size of Households and Frequency of Waste Disposal Per Week.

Frequency of disposal	Frequency	Percentage
Once a week	224	67.0
Twice a week	80	24.0
Thrice a week	12	3.6
Four times per week	8	2.4
Others	10	3.0
Total	334	100

According to Table 4.6 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

-

4.4 Influence of Household Location on Solid Waste Disposal

The third research question was: What is the influence of location of household on disposal of solid waste? This question sought to gauge the relative location of households to their method of waste disposal and collection services. The types of waste collection services provided in this Question were communal container, roadside collection, truck visit, waste dump and "others" °Ption. It was found that many people chose the "others" option as their means of waste Election. These/'others" wejre specified in various forms, the most predominant being "never Elected" This implies diat the waste was disposed in any available place without any regard on

whether it would be collected by any means of garbage collection or not. Table **4.7** provides the various garbage collection methods given by respondents and the proportion of respondents who specified each in the three residential areas.

Table 4.7: Waste Collection Methods Used By Households

Area	Township	Iftin	waberi	Bour-algi	Kora-kora
	n = 175	n~65	n=60	n=21	n=l3
Collection methods	%	%	%	%	%
Communal container	20	30.8	21.7	14.3	0
Roadside collection	14.3	15.4	**23.3**	14.3	23.1
Truck visit	8.6	7.7	11.7	23.8	0
Waste dump	17.1	7.7	16.7	14.3	38.5
Others	40.0	38.5	26.7	33.3	38.5

41
From Table 4.7 it is observed 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 4.7 shows that there was near parity in the respondents using the 'others" choice among all residential areas. The proportion of respondents using the method *as Township 40%, Iftin 38.5% Waberi, 26.7, Bour-algi, 33.3% and Kora-kora, 38.5%.

Residents of the five settlement areas therefore disposed off their solid waste using this

m

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.

4.5 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 4.8: Education Level of Household Heads

Area	Township	Iftin	Waberi	Bour-algi	Kora-kora
	n- 175	n=65	n=60	n=21	n=13
Education level	%	%	%	%	%
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 4.8 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 4.9: 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
Tertially 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 tertially 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.

4.6 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 Central Division.

45

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-algi, 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 ^{n}on of them indicating that they used the others option. While there was no particular pattern of ^{w}aste disposal by respondents with other levels of education, the general trend was that households with little education idtuitified with the "others" category as a means of waste

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 tertially 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 determine how the recycling of solid waste influences disposal of household solid waste.

This study found out that there are no solid household waste recycling plants in Garissa Township, or any other place within Garissa District. As such, most household waste are scattered all over residential places, giving a rather bad image to the residential areas.

5.3.2 To investigate how the household size influenced the disposal of solid waste.

Most households studied had four to nine people living together. There were other households with thirteen to fifteen people, though these were not so many. The amount of household waste generated by families increased with increase in the number of people living together in one unit. This was concluded from the fact that larger families disposed their household waste more number of times than those housing fewer people. These results are in line with literature reviewed which indicated that 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 'tems(Sivakumar, 2012).

v

5.3.3 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.

5.3.4 To find out the influence of levels of education of members of a household on 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).

5.3.5 To investigate the influence of garbage disposal facilities on disposal of solid waste

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

v

J

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 discussed in the previous section, it is clear that there is no specific waste disposal mechanism 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.

5.4 Recommendations

5.4.1 Policy Recommendations

Private individuals should be encouraged to start household solid waste recycling plants in Garissa Township. 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, while at the same time giving rise to a clean environment.

y

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.

The Garissa town council 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.

5.4.2 Recommendation for Further Research

This study covered only three residential areas within the township out of the seven available. The researcher, being a single individual, could not afford to study a larger area than that studied. The findings of this study cannot therefore be generalized for the entire Garissa Township, let alone other townships. It is therefore recommended that a more comprehensive study should be carried out to determine the waste disposal methods in the same place so as to come up with

- r e generalizable results and therefore recommencing. Before then, the fmdmgs **and**

recommendations given may only be applied in the studied areas only.

REFERENCES

Ali, M. (1999). *Topiclist.php3?topic.* Retrieved 04 15, 2012, from www.sanicom.net.

Armah, N. (1993). Waste Management. *The Future of Our Cities* (pp. 78-83). Accra: Ghana Academy of Arts & Sciences.

Bell, J. (1991). *Doing Your Research Project.* Milton Keynes: Open University Press.

Bilitewski, B. (1997). *Waste Management.* Berlin: Springer Publications.

Blaikie, N. (2000). *Concepts of Waste Management.* Retrieved 05 21, 2012, from www.ai1icledirectorysite.com: Article

Burgress, R. (1984). *In the Field. An Introduction to Field Research.* London: Routledge.

Camacho, D. (1998). *Environmental Injustices, Political Struggles: Race, Class and the Environment.* Durham: Duke University Press.

Chazan. (2002). *world/europe.* Retrieved 05 23, 2012, from www.news.bbc.co.uk.

Claveland, D. (1991). Migration in West Africa: A Savannah Village Perspective. *International African Institute,* 222-246.

Cohen, L. (2000). *Research Methods in Education.* London: Routledge Falmer.

Council, U. E. (2000). *The Stakeholders' Guide to Sustainable Waste Management.* London.: Environmental Council.

Creswell, J. (2003). *Research Design: Qualitative, Quantitative and Mixed Method Approaches.* Thousand Oaks: Sage.

Davies, A. (2008). *The Geographies of Garbage Governance: Interventions, Interactions and Outcomes.* London: Ashgate.

Denscombe, M. (2002). *Ground Rules for Good Research. A 10 Point Guide for Social Researchers.* Buckingham: Open University Press.

Denzin, N. (1989). *The Research Act. A Theoritical Introduction to Sociological Methods.* New   Jersey: Prentice Hall.

Devas, N. (1999). *The Relationship Between Urban Governance, Service Delivery and Poverty.* Birmingham: University of Birmingham.

Elliot, J. (2006).^/? *Introduction to Sustainable Development.* Newyork: Routledge.

Filcak, R. (2004). Environmental Justice Cures Many Ills. *Policy Journal of The Local Government and Public Service Reform Intiative. ,3-7.*

Giddicks, A. (1993). *The New Resource Wars: Native and Environmental Struggles Against Multinational Corporations.* Boston: South End Press.

Gilpin, A. (1996). *Dictionary of Environment and Development.* Newyork: John Wiley and Sons.
i

Girling, R. (2005). *Rubbis! Dirt on Our Hands and Crisis Ahead.* London: Transworld.

Goldman, B. (2005). *Not Just Prosperity: Achieving Sustainability with Environmental Justice.* Washington, DC.: National Wildlife Federation.

Grix, J. (2005). *The Foundations of Research.* London: Palgrave.

Grinnel, M. R. J. R. (1993). *Social Work Research an Evaluation.* 4th Ed. Illinois: F.E

Guba, E. (1985). *Competing Paradigms in Qualitative Research.* New York: Sage.

Hardoy, J. E. (2001). *Environmental Problems in an Urbanizing World.* London: Earhtscan.

Hotrichter, R. (1993). *Toxic Struggles. The Theory and Practice of Environmental Justice.* Philadelphia:
New Society Publishers.

Kironde, J. (1999). *Managing the Monster: Urban Waste and Governance in Africa.* Dar es Salaam.

Miller, D. (1999). *ej/principtes.html.* Retrieved 05 23, 2012, from www.ejnet.org.

Denzin, N. (1989). *The Research Act. A Theoritical Introduction to Sociological Methods.* New   Jersey : Prentice Hall.

Devas, N. (1999). *The Relationship Between Urban Governance, Service Delivery and Poverty.* Birmingham: University of Birmingham.

Elliot, J. (2006). *An Introduction to Sustainable Development.* Newyork: Routledge.

Filcak, R. (2004). Environmental Justice Cures Many Ills. *Policy Journal of The Local Government and Public Service Reform Intiative. ,* 3-7.

Giddicks, A. (1993). *The New Resource Wars: Native and Environmental Struggles Against Multinational Corporations.* Boston: South End Press.

Gilpin, A. (1996). *Dictionary of Environment and Development.* Newyork: John Wiley and Sons.

Girling, R. (2005). *Rubbis! Dirt on Our Hands and Crisis Ahead.* London: Transworld.

Goldman, B. (2005). *Not Just Prosperity: Achieving Sustainability with Environmental Justice.* Washington, DC.: National Wildlife Federation.

Grix, J. (2005). *The Foundations of Research.* London: Palgrave.

Grinnel, M. R. J. R. (1993). *Social Work Research an Evaluation.* 4th Ed. Illinois: F.E

Guba, E. (1985). *Competing Paradigms in Qualitative Research.* New York: Sage.

Hardoy, J. E. (2001). *Environmental Problems in an Urbanizing World.* London: Earhtscan.

Hotrichter, R. (1993). *Toxic Struggles. The Theoiy and Practice of Environmental Justice.* Philadelphia: New Society Publishers.

Kironde, J. (1999). *Managing the Monster: Urban Waste and Governance in Africa.* Dar es Salaam.

Miller, D. (1999). *ej/principles.htmT.* Retrieved 05 23, 2012, from www.ejnet.org.

Ogawa, H. (2002). *Sustainable Solid Waste Management in Developing Countries.* KuaJa Lampur: Western Pacific Regional Environmental Health Centre.

Orodho, J. A. (2009). Elements of Education and Social Science Research Methods. 2nd Edition.

Kanezja Publisher.Kenya

Timney, M. (1998). *Environmemtal Injustice. Examples from Ohio.* Durham: Duke University Press.

Appendix 1: Letter of introduction

Dear Sir,

REQUEST FOR CO-OPERATION

I am an M.A 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.

Bernard Ng'ang'a

Contacts:

Phone: 0722869132

E-mail: ben_gash@yahoo.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?

SECTION B: Household waste generation and disposal practices

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

Common household waste items (e.g. food waste, paper, plastic)	How often do you generate this? (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 (V) the type of waste collection service available

to your household.   *

Waste collection service	(V)	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

            *   v

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

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 (V) the type of waste collection service available to your household.

Waste collection service	(V)	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?
i

Yes [ ] state

reason...........1.

No[ ]

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

• Very satisfactory [ ]

• Satisfactory [ ]

• Poor[J

• 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 [J specify:_

• Burying [ ]

• Other method [ ] specify:

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

• I have no waste collection service [ ]

• 1 cannot afford service fee [1

• 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