EFFECTS OF SOLID WASTE MANAGEMENT IN EMBU TOWN, EMBU COUNTY, KENYA

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DECLARATION

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

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DEDICATION

This Research Project is dedicated to my parents, Samuel Njagi Karugu and Margaret Marigu, my sister Dr. Joan Murugi Njagi-Ngugi, my brother-in-law Dr. Matthew Piero Ngugi, my brothers, Jim Muriithi Njagi and Martin Mugendi Njagi, my sister-in-law Grace Ngele Mugendi, my niece Megan Wawira Mugendi, my cousin David Munene, our esteemed family friend Anthony Ireri and all my relatives and friends for their immense financial, spiritual and academic support.

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ABSTRACT

Challenges of solid waste management are a problem that plagues all countries of the world for example Kenya. Solid waste is the remnant of the refuse that is discarded by the public and collected either in a managed system or in a mismanaged way. It also includes garbage or trash which consists of everyday items discarded by the public, for example plastic papers and containers, kitchen refuse, and market waste. Solid waste is managed in order to protect human health and the environment. The situation is especially dire in developing countries where governments are unable to cope with the ever increasing volumes of solid waste in urban centres. Dumped solid waste is accompanied by rodents, bad smell, and people scavenging for things to sell. When solid waste is not managed properly, it can result in diseases in both human beings and animals and also degrade the environment. This study looked at solid waste management in Embu Town, Embu County. In Kenya, urban centres are facing problems such as lack of proper policies and poor implementation of policies dealing with solid waste management, lack of finances, lack of proper institutions to deal with solid waste and lack of public awareness and cooperation from the communities when it comes to dealing with solid waste management. Some urban centres have been able to come up with their own by laws for solid waste management. Involving the private sector in solid waste management has been adopted in major towns and cities in Kenya to help cope with solid waste management. There is no available literature that shows the existence of such policies in Embu Town. The general objective of this study was to investigate the effects of solid waste management in Embu Town. The specific objectives of the study were: to identify policy development by Embu Town on solid waste disposal, to examine management of solid waste disposal used by Embu Town and to investigate the challenges of managing solid waste in Embu Town. The research done has focused on big cities and towns like Nairobi, Mombasa Nakuru and Eldoret. However, there is scant literature on medium and small towns like Embu. Lack of literature on medium and small like Nyeri, Naivasha and Embu prompted the researcher to embark on this research. This research sought to fill in such gaps in the solid waste management issues in Kenya. Results from the study of solid waste management in Embu Town may inform research and policy making in similar towns in other counties. The theory of new public administration (NPM) was used. This study used a descriptive survey research design. Purposive sampling was used to select 10 policy makers for interviews conducted by the researcher. 323 residents and business people were selected randomly and given questionnaires to fill on their own. The data collected was coded and categorized into patterns or themes. Research findings were presented using graphs and tables. Descriptive statistics such as frequencies and percentages were used to summarize the data in the questionnaires. Tables, graphs and pie charts were used to present the results. The research findings showed that Embu Town has yet to develop policies to deal with solid waste management. The disposal methods used in Embu Town include waste collection and dumping of waste in the open dumpsite. The research also found out that Embu Town faces many challenges in regard to solid waste management.

ABBREVIATIONS AND ACRONYMS

CBDs- Central Business Districts

CBOs- Community Based Organisations

CCK- Communication Commission of Kenya

EC- European Community

EPA- US Environment Protection Agency

EPR- Extended Producer Responsibility

GK- Government of Kenya

GP- Green Productivity

IWM- Integrated Waste Management

KCC- Kampala City Council

MSW- Municipal Solid Waste

MSWM- Municipal Solid Waste Management

NEMA- National Environment Management Authority

NGO- Non Government Organisation

NWMS- National Waste Management Strategy

OECD- Organization for Economic Co-operation and Development

PPP- Polluter Pays Principle

SWM- Solid Waste Management

UNEP- United Nations Environment Programme

UNHABITAT- United Nations Human Settlements Programme

DEFINITION OF TERMS

Management: The organization and coordination of the activities of a business in order to achieve defined objectives

Policy: A plan or course of action, as of a government, political party, or business, intended to influence and determine decisions, and actions.

Resource Recovery: This involves recycling of waste and using it as raw material. Recovery contributes to utilization of resources.

Solid Waste: Solid waste is the remnant of the refuse that is collected and discarded by the public either in a managed system or in a mismanaged way.

Waste Disposal: This has traditionally been done by the disposal of waste to landfill sites.

Waste Minimization: This involves the economic reduction of the volume of waste during production and helps in reducing waste at the source.

Waste Prevention: The avoidance of the production of certain wastes, sometimes by regulation. This addresses mainly the industrial sector in order to promote the use of cleaner technology.

Waste Treatment: This involves reducing negative impacts of waste to humans and environment

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CHAPTER ONE

1.0. INTRODUCTION

This chapter consists of the background of the study which was to investigate the effects of solid waste management in Embu Town. The town is situated below the slopes of Mt. Kenya. It was chosen after the researcher noted that there are scanty studies in medium towns on solid waste management (Muchiri, 2013). Casual observation showed that Embu Town has problem with garbage in the town centre garbage indicating a problem in the solid waste management department. The content of the first chapter includes the background, identifying the problem, developing objectives and research questions, research premise, justification, scope, limitations and delimitations of the study.

1.1 Background of the study

Solid waste is the remnant of the refuse that is collected and discarded by the public either in a managed system or in a mismanaged way. It also includes garbage or trash which consists of everyday items discarded by the public, for example plastic papers and containers, kitchen refuse, and market waste. According to Munala & Moirongo (2011), solid waste is managed for a number of reasons including protection of human health and promotion of the quality of the environment and ensuring sustainability of a clean and healthy living environment.

Waste management serves as a good performance indicator for municipalities. Although it is an essential service, solid waste management is not efficiently performed by many cities and towns authorities in developing countries. The most common problems associated with solid waste management in developing countries include: irregular collection services, low collection coverage, open dumps and uncontrolled informal waste scavenging activities (Wang, Jie, Yoonhee, & Takuya, 2011).

According to the United Nations Human Settlements Programme (UNHABITAT) (2010), the environmental movement emerged in the 1960s. Since 1970 developed

countries have been investing heavily in recycling and waste management. Some of the challenges developing countries face is managing their towns and cities. One such challenge that has become a threat to the health of the population is poor management of waste disposal including solid waste, poor management of sewage system. In the last 20 years, high income countries have been investing resources in recycling. However, developing countries have been facing numerous challenges in the area of solid waste management. These include: financial constraint, giving low priority to solid waste management sector, and negative public attitudes towards solid waste management (Wang, Jie, Yoonhee, & Takuya, 2011).

In Kenya, increasing environmental awareness coupled with high cost of production has led manufacturing industries to embrace recycling as a cheaper source of raw materials. Consequently, poor people in Kenya living near waste dumpsites make a living out of scavenging for recyclable solid waste. This is common in dumpsites like Dandora in Nairobi, Gioto in Nakuru, Kachock in Kisumu and Mwakirunge in Mombasa which are located within the boundaries of the urban areas. Hazardous chemicals found in dump sites are harmful to human beings. Without proper gear, humans are in danger of contracting skin, respiratory, and eye infections (Munala & Moirongo, 2011; Remigios, 2010; Rotich, Zhao & Dong, 2006).

Poor management of solid waste is a major problem affecting all urban areas in Kenya. Some are managing their waste better than others. The situation in Embu town is similar to other urban centres like Nairobi, Nakuru, Eldoret and Mombasa. Compared to these urban centres, little studies have been done in Embu town concerning solid waste management. Nakuru Municipal council was able to formulate and implement its own solid waste management policies to help in managing waste. Nakuru, Nairobi and Eldoret municipalities have also adopted public private partnerships in order to effectively deal with solid waste (Gachahi, 2012).

The challenges facing local authorities in Kenyan urban areas in relation to solid waste management are similar. Such problem include; financial mismanagement of funds available, lack of proper equipment for waste collection and disposal, lack of proper implementation of policies, few workers some who are untrained to handle

waste and lack of cooperation from the community (Wang, Jie, Yoonhee, & Takuya, 2011).

Muchiri (2013) noted that there has been some effort to clean up Embu Town. Some local residents in collaboration with the prison community teamed up with Embu County, and Embu GK prison to clean the town and recycle garbage. This was done through a one year project called Aiding Creation of a Recycling System in a Society Project in 2013.

Lack of proper management has led to problems in discarding solid waste in Embu Town. From reviewed literature and observation, it seems that Embu town requires policies and directions which will help the County Government to dispose solid waste properly. This study sought to identify the effects of solid waste management in Embu.

1.2. Statement of the Problem

Solid waste management is a major issue in urban areas. Solid waste dumped along the roads and inappropriate places has become a disturbing scene in many urban centres. This sight is accompanied by rodents, bad smell and people rummaging through the open dumps looking for things to sell. Open dumping results in diseases in both humans and animals, it affects the quality of the environment and to some extent the plants that grow near the dumpsites. When it rains, some of the solid waste is carried by water and clogs drainage pipes which results in flooding.

According to Githinji (2013), the then Embu municipal council was accused by NEMA as not having the capacity to collect waste effectively within their jurisdiction. Piles of garbage are found on the streets and in estates despite the council's effort to collect waste daily. There is also limited number of vehicles and staff needed for effective solid waste management. NEMA suggested that the then Embu municipal council should contract private firms that deal with waste management and partner with them in order to provide the community with better services.

Disposal of solid waste in Embu town is very poor especially in low-income estates. The collection of garbage from communal sites is supposed to be done regularly but this is not the case in most places. Priority is given to the central district, industrial area and high income residential areas. As a result of urbanisation, people have encroached on the designated waste disposal areas. This results in solid waste being dumped along the roads, near the markets and in residential areas. The waste services offered by the municipal council are not adequate to cater for the ever growing volumes of solid waste. Composting and burning is generally practiced in estates that have large compounds and within the rural areas (NEMA, 2009).

The studies that have been done concerning solid waste in Embu have not dealt on the role of county government in solid waste disposal. Therefore this study sought to find out how the Embu County Government operate, plan and manages solid waste disposal including the policies that the management use to make the work of solid waste management effective and also the challenged faced by the County Government in regard to solid waste management. This study also ought to find out whether there are any policies formulated by the Embu county government regarding solid waste management, whether they are properly implemented and how such policies influence solid waste management.

1.3. Objectives of the study

The general objective of the study was to investigate the effects of solid waste management in Embu Town. The specific objectives of the study were:

1) To analyse policy development by Embu Town on solid waste disposal.

2) To examine management of solid waste disposal used by Embu Town.

3) To investigate the challenges of managing solid waste in Embu Town.

1.4. Research Questions

From the objectives, the study's research questions were:

1) Which were the existing policies in Embu Town on solid waste disposal?

2) How was solid waste managed in Embu Town?

3) What were the challenges faced when managing waste in Embu Town?

1.5. Research Premises

This study was based on the following assumptions;

1) There were no specific policies in Embu Town in reference to solid waste management.

2) Solid waste was inappropriately managed in Embu Town.

3) There was lack of coordination between the Embu Town management and the residents.

1.6. Justification and Significance of the study

Due to devolution medium and small towns are bound to develop and become bigger thus the need to formulate policies and regulation to deal with solid waste. With proper solid waste management, Embu town will attract investors and tourists which in turn will increase job opportunities for the people of Embu and increase revenue for the county government. In order to improve waste management, vision 2030 recommends that policies and regulations should be made and implemented, awareness on waste management created and municipalities should encourage public private partnerships.

Much literature on solid waste management in Kenya focuses on large towns and cities like Nairobi, Nakuru, Eldoret and Mombasa. Some of this literature is mentioned in chapter two. There is little literature on rural towns like Embu in regard to solid waste management. Hopefully, results from this study of solid waste

management in Embu Town will help inform research and policy making in similar towns in other counties.

1.7. Scope, Limitations and Delimitations of the study

The study was to investigate the effects of solid waste disposal in Embu town. However, the study concentrated only on how management deals with solid waste and not any other area of waste disposal. The study covered the Embu town which is the headquarters of Embu County. It involved interviewing the policy makers who are involved in solid waste management in Embu Town. The study focused on solid waste management in Embu Town after devolution. Questionnaires were administered to the business people and residents of Embu Town. The researcher faced numerous challenges in the course of research. There was limited time and unwillingness by some respondents to answer questions. A number of questionnaires were not returned. Another problem was finances because the study was self financed.

However, these challenges were dealt with by the researcher. The researcher planned the time to avoid time wastage; the researcher took the initiatives to revisit some of the respondents and got first hand information from those who had no returned the questionnaires. The researcher also sourced extra finances and cut some of the expenditures like the number of trips.

CHAPTER TWO

2.0. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Literature review

This chapter focuses on how solid waste management in select countries including the United States, Europe, Asia, and Africa. It also discusses solid waste management in some urban centres and cities in Kenya, the methods they use for waste management and challenges faced.

2.1.1. Introduction

Solid waste management can be defined as the process associated with controlling the generation, storage, collection, transfer and transport, processing, and disposal of solid waste in ways that do not harm the environment or compromise the health of people. It includes all administrative, financial, legal, planning, and engineering functions involved in the solutions to all problems of solid waste (Takenaka, 2007). Municipal solid waste management refers to the collection, transfer, treatment, recycling, resources recovery and disposal of solid waste in urban areas (Ogwueleka, 2009).

Few material resources and money were available before the industrial revolution. As a result there was minimal waste since products were repaired and reused (UNHABITAT, 2010). Industrialization and globalization have led to increased quantity and quality of goods that are produced and traded throughout the world. This together with increased human population has led to increase in waste generation as items are used and discarded with no real attachment or need for repair. The amount of solid waste produced is directly proportion to the population. Rapid urbanization has resulted to increase in solid waste in urban centres (Rajput *et al.*, 2009).

Many projects started in developing countries by external agencies on solid waste management have failed greatly because of lack of or discontinued funding and lack of adaptability to the local situation. There is need to use the right technology

adaptable to the situation in small towns and cities. It is also advisable to involve all the stakeholders such as the local authority, the users of those services and the external agents who help facilitate those services when it comes to decision making (Muniafu & Otiato 2010; UNHABITAT, 2010).

Developed countries generate larger amounts of wastes than developing countries but their solid waste management facilities are adequate. Generally, solid waste is dumped off in low-lying areas without taking any precautions or operational controls causing diseases and environmental degradation (Rajput *et al.,* 2009: Ogwueleka, 2009). Developing countries with weak economies, low technical capacities and poor infrastructure, inability to enforce environmental legislation, financial mismanagement and poor administrative find it hard to control the ever increasing amount of solid waste (Muniafu & Otiato, 2010; Remigios, 2010; UNEP, 2005).

The most common method of waste disposal in developing countries is landfills with open dump being the most commonly used in most urban centres. These open dumps are neglected or poorly managed and maintained. Most of the existing dump sites are also not fenced (Remigios, 2010; UNEP, 2005).

According to Remigios (2010), there are some ways in which we can improve the current situation concerning solid waste management. Firstly, by using integrated waste management this includes waste reduction, recycling, composting, and reuse. Secondly, by creating public awareness and changing people's attitudes towards solid waste management. This will enable people to have a positive attitude and have the willingness to participate in good waste management practices. Lastly since dumping is the most viable method of solid waste disposal municipalities need to regulate dumping and have proper management of these dumps.

2.1.2. Solid waste management United States of America

Spiegelman & Sheehan (2005) observed that in North America the municipal solid waste management started a little more than a century ago. There was rise in epidemics of contagious disease as a result of crowding in industrial cities. This led to

political support for public investment in municipal sanitation infrastructure first to provide clean water and sewerage and later, at the turn of the 20th Century, to provide for the collection and disposal of municipal refuse. Pressure from citizens' groups compelled cities to replace or supplement the private cart men who provided refuse collection services with uniformed garbage collectors working for the city or for city contractors. By 1914 half of 150 cities surveyed were providing municipal refuse collection and by 1930 MSWM had been transformed into an institutionally organized, technology focused, municipally operated service. Between the 1960s and 1970s a little product recycling occurred. In the 1980s there was widespread involvement of municipal in product recycling and the quantities of MSW recovered and recycled increased.

Like in countries in Europe, Extended Producer Responsibility (EPR) emerged as a promising alternative to MSWM for product wastes. This concept was introduced in Germany in 1991. In the USA some states have ERP programs for beverage containers and in 2004 the state of Maine adopted a legislation that requires computers manufacturers to finance the recycling of computers and television sets collected in the MSWM system (Spiegelman & Sheehan, 2005).

According to Gershman (2010), recycling is the best way to manage a majority of waste materials and it also generates revenue as shown by recent data available in the US. The recycling plants provide employment for many people and generate billions in annual revenue. Recycling is one of the best ways to managed most solid waste because to is friendly to the environment. There is need for government, manufacturers and consumers to come together and formulate a unified national policy on recycling for better management of solid waste. This way every person will have a responsibility towards better solid waste management.

2.1.3. Solid waste management in Europe

Morselli, Vassura and Passarini, (2008) note that the European Union waste policy is based on the concept of waste hierarchy which aims at waste minimisation. It also aims at reduction of use of landfills. An upgraded strategy for waste management was

compiled in which the basic objectives of EU policy were outlined. These objectives included: to prevent waste and promote re-use, recycling and recovery so as to reduce the negative environmental impacts.

According to Plesea and Visan (2010), the first regulations in relation to waste collection in Europe started in the 18th century where technical standards were implemented in all major cities during the industrial revolution. In the mid eighties, the 3R principles of Reduce, Reuse, and Recycle, became commonly use in many countries. In the decade that followed this principle became increasingly used due to increase in solid waste generation as a result of significant economic growth and improved standards of living. Increase in solid waste generation led to a shortage disposal capacity. More advanced countries realised the need for solid waste management. There was development awareness in communities of the need to reduce landfill disposal and adapt to recovery and recycling of resources. Proper management of solid waste is a central pillar of far-sighted, sustainable environmental policies.

The polluter pays principle holds the polluting party responsible for paying for the damage done to the natural environment. It is regarded as a regional custom because of the strong support it has received in most of the Organization for Economic Co-operation and Development (OECD) and European Community (EC) countries. It is mentioned in Principle 16 of the Rio Declaration on Environment and Development (Plesea & Visan, 2010).

Milios (2013) observed that in Sweden there is clear division and responsibilities for all actors involved in solid waste management. For example the municipalities are given the responsibility of collecting and disposing solid waste produced by households with the exception of products which are covered under producer responsibility. The extended producer responsibility is where the producer is responsible for their products throughout their lifecycle. When the products are no longer in use, the producer is responsible for disposing them. In Sweden the producer is responsible for goods like cars tyres, recycled papers, batteries and electrical and electronic products.

2.1.4. Solid Waste Management in Asia

According to Visvanathan, Adhikari & Ananth (2007), past practices of solid waste management included simply transporting waste to distant places and dumping or burning. These practices are not viable because of inadequate space, increasing value of land and harmful effects to human beings and the environment. Lack of proper technology and manpower for managing solid waste is a problem in many Asian countries. Although some governments have formulated better production options to tackle solid waste, this has only been implemented in capital cities only. Resource recovery and recycling is mostly dominated by informal sector. In most of the developing Asian countries 3R technologies are usually initiated by private sectors and NGOs.

Xioalong (2011) noted that in China, landfills and incinerators are widely used in disposing of solid waste. Most of the solid waste produced in China is not separated at source which makes it difficult to manage though they are trying to introduce waste separation by providing waste collection bins for waste that can be recycled and for biodegradable waste. Waste separation can be a success in China if some key elements are enforced. These include; environmental awareness and education which can be offered in schools and public places, public awareness campaigns, legal framework for implementation of waste separation, introduction of waste management fees, punishment for failure to comply, improving infrastructure for waste separation, and possible funding schemes for waste separation.

Like in Africa, Asian developing countries' solid waste disposal methods are open dumps and sanitary landfills. Asian governments are taking into consideration the Green Productivity (GP) measures such as reduction, recycling, reuse and recovery as essential elements in solid waste management. People are encouraged to separate their waste so as to facilitate recycling (Hwa, 2007).

2.1.5. Solid Waste Management in Africa

According to Ogwueleka (2009), in Nigeria, the state and local government environmental agencies are responsible for solid waste management. The informal solid waste collection in some cities charges a fee for their services and the private companies involved in garbage collection are more efficient than the government though some tend to exploit the people. In most urban areas in Nigeria, big stationary containers are placed in waste generation areas and people take their waste to these containers. Trucks are used to collect solid waste. More than half of these trucks are out of service and the remaining few usually break down often due to overuse. This results to inadequate waste collection in urban areas and no collection at all in others.

Ogwueleka (2009), also points out that lack of sufficient funds is one of the problems facing is lack of sufficient funds. This has resulted to lack of sufficient trucks for waste collected and poor pay for the workers. The agencies are understaffed and the workers are not properly trained and as a result there is inefficiency and ineffectiveness in solid waste management. Inappropriate sitting, design, operations and maintenance of dumps and landfills have increased transfer and disposal cost and also inadequate onsite storage facilities. Non-appreciation of the magnitude of the waste management is a problem. Poor road network also hinders collection of solid waste.

Mosidi (2011) noted that management of waste was not a priority in South Africa fifteen years ago. Before 1994, only practices dealing with waste disposal were taking place. Waste management in the past has been uncoordinated and poorly funded. This was characterized by inadequate waste collection services for a large portion of the population, illegal dumping, unlicensed waste management activities which include unpermitted disposal facilities, permitted landfills, insufficient waste minimization and recycling initiatives, a lack of waste information, lack of regulation and enforcement of legislation, and limited waste related legislation. In order to have an effective solid waste management system, the National Waste Management Strategy (NWMS) emphasizes the need for integrated waste management. This involved

coordination of functions within waste management. To address the funding problem, the NWMS invoked the Polluter Pays Principle (PPP).

According to Ogola, Chimuka, & Tshivhase (2011), South Africa adopted the National Waste Management Strategy which is based on reuse, reduce, and recycle in 1999. In 2000, Integrated Pollution and Waste Management Policy (IPWM) was established. Its goals which were to be achieved through the National Waste Management Strategy (NWMS) of 2001 focused on integrated waste management planning, waste information system, general waste collection, waste minimization, recycling, waste treatment and disposal, capacity building, education and awareness.

Thompson-Smeddle (2009) notes that there is much legislation governing various aspects of waste related issues. The National Environmental Management: Waste Management Act (NEMWA. 2008) is now the overall governing act for all spheres of waste management. Integrated Waste Management (IWM) includes: Waste Prevention, Waste Minimization, Resource Recovery, Waste Treatment, and Waste Disposal. Waste disposal is the most ineffective but remains the most common waste treatment method in South Africa. In South Africa municipal and private contractors take waste to refuse transfer stations (RTS) where it is compacted, put into containers and taken to the landfill. There are drop off facilities managed by municipalities, NGOs or community organization where people take garden waste, plastics, paper, cardboard, glass, e-waste and other household waste that can be recycled.

Okot-Okumu (2012), points out that in the early 50s and 60s MSWM system in East Africa was centralised and effective. This was due to the fact that there was low population in the urban centres and resources were available. Now the system has been decentralised and it also includes the private sector. Also due to rural urban migration, the population in urban centres has increased and the system is not able to cater for all the needs of the people. Services provided by private contractors make the situation better. The poor who live in urban areas receive very low or no services at all mainly because they live in areas where the roads are in accessible and they live in unplanned facilities.

According to Halidi (2011), a lot of solid waste still remains uncollected in Tanzania due to poor waste collection services. This waste is dumped on open spaces along streets and roads. In high income areas solid waste is collected door to door and in low income areas it is done through communal collection. Poor solid waste collection and transportation can be attributed to high operational costs, inaccessibility of some locations, poorly paid workers, poor state of the waste collection vehicles and lack of proper supervision among others.

Riedijk (2010) observes that uncontrolled dumping is becoming a problem such that public spaces that used to have public recreational functions have been gradually turned to open dumpsites. In some towns like Moshi, there are semi-controlled landfills which are safer than open dumps. Tanzania's National Environmental Management Council (NEMC) which was established in 1983 is the leading advisory, coordinating and regulatory agency responsible for the protection of the environment and sustainable use of natural resources. Its main functions are to enforce pollution control and to perform the technical arbitration role in Environmental Impact Assessments (EIA). Environmental management is a fairly new topic among policy makers in Tanzania. Although the National Environmental Policy dates from 1997, the Environmental Management Act (EMA) which provides the basis for implementation of this policy was enacted in 2004 and came into force in 2007.

Katusiimeh (2012) points out that it is the mandate of the Ugandan Ministry of Local Government to provide its citizens with waste collection and disposal services. NEMA coordinates monitors and supervises environmental management in Uganda. It is semi-autonomous with agencies involved in environmental protection. The Kampala City Council (KCC) had the statutory requirement of collection, storage and disposal of waste. Though the City Council placed communal containers in specific locations where households took their waste, they were not enough resulting to open dumping in illegal places. The new system was introduced after the formal privatization of solid waste management in 2000. This was done by enacting the solid waste management ordinance. Communal containers were removed from most areas and households and institutions started paying private companies for collection of

solid waste. Even with the domination of private sector in solid waste management, KCC still involves itself in collection and transportation of solid waste to the dumpsite.

2.1.6. Solid waste management in Kenya

According to Gakungu, Gitau, Njoroge, & Kimani (2012), Kenya's environmental laws and related policies were reviewed so as to deal with emerging environmental challenges. This led to the enactment of the Environmental Management and Coordination Act (EMCA) of 1999. According to the Act, individuals have the responsibility to safeguard and enhance the environment. It also guarantees every Kenyan a clean and healthy environment. Every person has a right to a clean and healthy environment as provided for in the Constitution of Kenya under section 4. This section also includes the right to have the environment protected for the benefit of present and future generations. Under section 69(2) every person should cooperate with state organs and other persons to conserve and protect the environment and also ensure sustainable development in the use of natural resources.

In the National Environment Policy 2013, the policy statements on state that: the government will develop and integrated national waste management strategy; promote the use of economic incentives to manage waste; and promote waste recovery, recycling and reuse by offering incentives for cleaner production (National Environment Policy, 2013)

In *Municipal Solid Waste Management Challenges in Developing Countries-Kenya Case Study* done by Rotich, Zhao & Dong (2006) notes that it is the responsibility of the Kenyan local authorities to collect and dispose of solid and liquid municipal wastes within their areas of jurisdiction. The local authorities face certain challenges when dealing with solid waste management. These challenges include lack of capacity to deal with the rising volume of solid waste. There is financial mismanagement of funds available and there is also poor implementation of laws governing solid waste management.

Rotich, Zhao & Dong (2006) observe that recycling industries have also begun to search for recyclable materials in the dumpsites. Some self-help groups do recycling of solid waste in order to sell their products and earn a living. Some local authorities such as Nairobi, Eldoret and Mombasa have embarked on providing services through training and hiring of qualified personnel. The Ministry of Local Government approved the involvement of the private sector through privatization of some of the services so as to improve management of municipal solid waste collection and disposal. The private sector municipal solid waste collection and disposal services have been successful in the Central Business Districts (CBDs) and in upper class residential areas in Nairobi.

Gakungu, Gitau, Njoroge, & Kimani (2012), in *Review of Municipal Waste Management: A Case Study of Nairobi, Kenya*, noted that about 30 to 40 per cent of the solid waste generated in urban areas is uncollected. Less than 50 per cent of that population does not receive solid waste collection services. Also most of the vehicles used to collect and transport waste are out of order. Low priority is given to solid waste management and there is limited focus on control mechanism on solid waste management. It is necessary to examine the composition of waste generated in households in order to develop and implement effective strategies to deal with it.

According to Gachahi (2012), Nakuru was the first municipal to develop environmental by-laws and embrace community based organisations (CBOs) and Non Governmental Organisations (NGOs) dealing in solid waste management. An example is Practical Action which worked in collaboration with the then Nakuru Municipal Council and National Environmental Management Authority (NEMA) to develop plans to help communities living within the dumpsites and to support their waste management projects. Practical Action also works with Nakuru Collectors and Recyclers Management to deal with the waste generated daily. The Nakuru waste management sector aims to improve living conditions and create job opportunities through effective and sustainable solid waste program.

Mwanzia, Kimani & Stevens (2013), in *Integrated Solid Waste Management: Decentralised Service Delivery Case Study of Nakuru Municipality, Kenya*, noted that

in 2006, new by-laws were brought into force in Nakuru. They provided for decentralized service delivery for domestic waste collection, transportation and safe disposal at the Council refuse site. The then Nakuru Municipal Council organized regular clean-ups, seminars, workshops and training for stakeholders to create awareness about solid waste management and to ensure compliance by residents and the licensed organisations. Some of the challenges which hinder proper solid waste management in Nakuru included; firstly, inaccessibility to some areas especially low income areas due to bad roads. Secondly, lack of sustainable finances especially in young waste enterprises. Thirdly, high prices which the waste enterprises are required to pay and finally solid waste spreading to the roads due to overflowing dumpsites.

Kazungu (2010), in *Improving Governance for Sustainable Waste Management in Nairobi* noted that although Nairobi City has both a public and privatized waste-governance systems in place, however private sector participation is still very low. Lack of support and regulation of private solid waste collectors in Nairobi has resulted to the collectors operating in small scales and concentrating mostly in wealthy neighbourhoods. Solid waste is dumped at Dandora dumpsite which is owned and operated by the city council of Nairobi. The Department of Environment which plays a regulatory role in relation to private sector participation in solid waste management does not have well established performance requirements for registered private companies.

Opinde (2010) noted that in Eldoret, the then municipal council put in place mechanisms and procedures for implementing the responsibility of Solid Waste Management. The department of Environment is an administrative department within the municipal council and it is responsible for collection, transportation and disposal of waste. In areas where solid waste is not collected by the municipal council, pits are dug for depositing the waste. This poses public health concerns if the pits are not well managed.

The then Eldoret municipal concentrated on collecting waste from the CBD where it provided litter bins while neglecting the sub urban zones which have high population density. Solid waste is dumped in the open at the entrance in the market place. Block

collections is used in residential areas where only one gate serves multiple houses. The dumpsite is located at an abandoned quarry and during the rainy seasons, it is difficult to access leading to poor dumping. The municipal has adopted private public partnership. The private waste collectors awarded contracts by the municipal undertake solid waste collection in designated locations. This service is paid for by the waste generators and those unable to pay are not attended to. This results to waste being dumped in open places (Opinde, 2010).

According to study Yen (2012), in *The Management of Residential Solid Waste in Mombasa, Kenya*, collection of solid waste is done through communal collection or door to door collection. In communal collection, residents are charged for dumping their waste at predetermined sites which made it easier for the then municipal to collect because the trucks only go to those areas. The waste is collected daily in collection sites where huge volumes of solid waste are generated like in the market areas. In other areas collection is done once per week or once per two weeks depending whether the site is considered full or not. This waste overflows out of the containers and in some collection site the containers are not available leading to open dumping. Door to door collection is done by garbage collectors who collect waste from households mostly at a fee and take it to the nearest collection point. In areas where waste is not collected, residents usually illegally dump in the open and sometimes burn the waste in the open. The then Mombasa municipal disposed its solid waste in two open dumpsites located at Kibarani and Mwakirunge.

In Mombasa the problems of poor solid waste management are; bad smell from the dumpsites, lack of maintenance of the garbage trucks, animals' health being compromised because of grazing near the dumpsite and scavenging especially by young people who drop out of school in order to make money (Yen, 2012).

According to a study done by Mwakumaya (2010), on solid waste management in Kilifi Town, the challenges facing solid waste management are vast and are projected to increase in the future. In Kilifi, there are only three operating vehicles for collection and disposal of solid waste. Workers are few most of them are not trained to handle solid waste. They also lack proper primary equipment for handling solid waste.

Sometimes the waste is not collected daily leading to pile up of solid waste. Some residents do not dispose waste properly which results in littering. The containers for collecting solid waste are sometimes stolen or vandalized which results in people dumping waste anywhere since there are no containers to put it in. Finally lack of funding is a major challenge facing Kilifi Town in relation to solid waste management.

The methods of disposal used in Kilifi Town are: landfill which is located on an abandoned quarry at Mtondia; incineration which is used by hospitals and other health facilities; recycling and reuse is not a very common practice in Kilifi Town but it is encouraged; and finally composting which is widely used especially in households (Mwakumaya, 2010).

According to a study by Omuterema (2013) on *Disposal Alternatives for Electronic Waste in Korogocho and Dandora Informal Settlements: Implications on Waste Management in Urban Centres in Kenya,* electronic waste is increasing every day in Kenya. There is lack of policies and regulations to deal with this type of waste in Kenya. E-waste emits substances which are harmful and if not managed properly can cause damage and humans and the environment. Most of the e-waste generated comes from radios and mobile phones. Majority of those who handle e-waste have not undergone any training on how to manage such waste. The main sources of e-waste are shops and private sources. Some of the institutions charged with charged with enforcing environmental policies and statutes include NEMA, Public Health Department at the City Council of Nairobi, Ministry of Health and Sanitation and Communication Commission of Kenya (CCK). Although this study was on solid waste, it concentrated on electronic waste which is produced by electric gadgets.

According to a study done in Embu by Muchiri (2013) on *Strategy for Solid Waste Management for the Municipal Council of Embu*, solid waste management is a major concern. Most of the waste produced is not collected leading to spread of infectious diseases, blocked sewers and litter in the streets through improper dumping. The local authority is overwhelmed by the rapidly growing amount of solid waste produced. The stakeholders involved in solid waste management include the Central

Government, Municipal Council of Embu, community based organisations (CBOs) and individuals. The Central Government is responsible for establishing institutional and legal framework for solid waste management. The Municipal Council of Embu was responsible for providing solid waste management services like waste collection and disposal. CBOs are not regulated and they carried out their activities such as recycling without supervision. The study concentrated on developing a strategy for improving solid waste management in Embu Municipality. The study did not get views oh how the business community in Embu Town is affected by improper solid waste management.

2.1.6. Summary and Research Gaps

From the literature reviewed, it has become clear that Kenya has been faced with challenges in solid waste management due to issues like lack of political support, skilled manpower, proper technology and institutional systems and lack of proper financing. Also the people's attitude towards keeping the environment clean is an important issue. Poor management of solid waste in Kenya is not only in big cities but it is also been experienced in smaller towns like Embu town.

Morselli, Vassura, and Passarini (2008) notes that when it comes to solid waste management developing countries should learn from past experiences of developed countries and try to achieve similar results in a shorter time and with less negative impacts to the health of people and the environment. This can be done with innovative technologies, proper legislation, proper monitoring and control tools and proper management skills.

The studies done in Kenya on solid waste management concentrate mostly on large towns and cities like Nairobi, Nakuru, Eldoret, and Mombasa. There is a literature gap on solid waste management in rural town Embu Town which are growing at a fast rate due to devolution and rural urban migration. There is also need to concentrate on policy formulation and implementation for these upcoming urban centres in order to help deal with the increasing volumes of solid waste produced.

2.2. Theory and conceptual framework

According to Haque, public sector has been characterised by weaknesses such as managerial inefficiency, public inaccessibility, economic inertia and excessive corruption. Such factors lead to the emergence of New Public Management model since 1970s in capitalist nations. They advocated for a neo-liberal framework.

New Public Management (NPM) theory

In the 1980's, western countries concentrated on modifying the public sector to make it more competitive and the public administration to improve transparency, accountability, flexibility, efficiency, effectiveness and improve on customer satisfaction. This movement was later known by academics as new public management which is seen as a body of managerial or ideological thought based on ideas generated in the private sector and imported to the public sector. It seeks to improve efficiency in goods and service delivery and government performance (Nazmul, Kabir, & Ashaduzzaman, 2012).

The new public management theory was first used by Christopher Hood in his article in 1991. New public management concerns customer orientation and market orientation which improves cost efficiency. It is oriented towards outcomes and efficiency through better management of public budget. It addresses the recipients of public services as customers thus the need for efficient services (Oduro-Kwarteng, 2011).

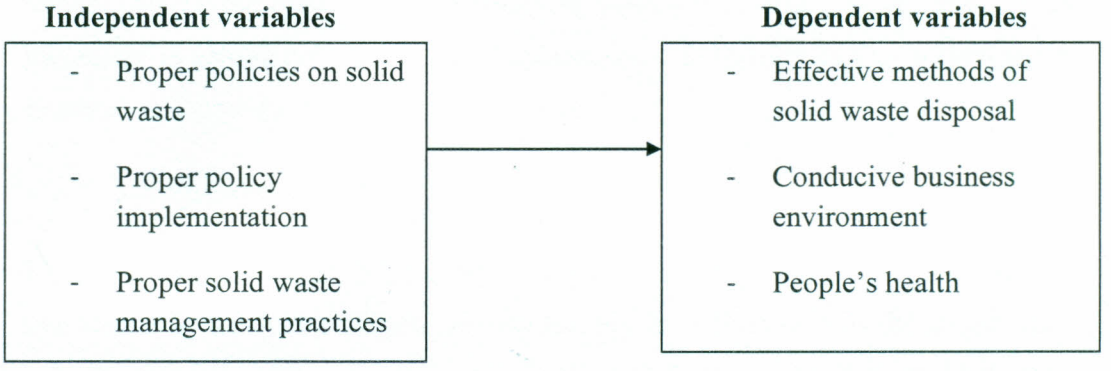
In a study done by Dijki, and Oduro-Kwarteng (2007), on *Urban Management and Solid Waste Issues in Africa*, NPM theory was used to show that the monitoring and enforcement of the collection, transportation and disposal activities of waste companies are inadequate because of weak enforcement of Nairobi City Council by-laws. This is because the City Council does not carry out solid waste services when needed thus resulting to illegal dumping. If the Embu County Government were to improve on their solid waste services the consumers of those services will be willing

to pay to ensure continued service provision. That way the County Government will have even more finances to improve on solid waste management.

2.2.2. Conceptual Framework

Figure 2

Conceptual Framework



(Source: researcher)

The conceptual framework shows that in order for Embu Town to have effective solid waste management, attractive business environment to attract investors and the protection of human health, the County government needs to formulate proper policies dealing with solid waste management and ensure that those policies are effectively implemented. There is also need for proper solid waste management practices to deal with the rapidly increasing volumes of solid waste produced in Embu Town.

CHAPTER THREE

3.0. RESEARCH METHODOLOGY

3.1. Research Design

A descriptive survey research design was used to establish management of solid waste in Embu Town. This is because the study sought to acquire detailed information from respondents on the effects of solid waste management in Embu Town. This design was useful in getting the residents and business owners' opinion on how solid waste is managed in Embu and how they were affected.

3.2. Site of the Study

The study was conducted in the town of Embu in Embu County. Embu is a medium size town which is located approximately 120 km from Nairobi. It is the largest town in Embu County and it also serves as the capital of Embu County. It is divided into 4 municipal sub-locations namely Dallas/stadium, Kamiu, Njukiri and Nthambo. Data collection was done in Dallas/stadium sub-location. This is because it is the closest to the Embu CBD and is comprised of estates for high income, middle income and low income earners. Data was collected from Blue Valley estate, Dallas estate, Majengo estate and Shauri Yako estate.

3.3. Target Population and sample size

The study targeted 10 policy makers involved in solid waste management in the Embu County government, 323 residents and business owners in Embu Town. Embu Town has approximately 42,692 people (National Population and Housing Census, 2009). Mugenda & Mugenda (2003) suggests the following formula for target population greater than 10,000. 80 people were sampled randomly from each estate.

$n=Z^2pq/d^2$

Where: n= desired sample size

z= standard normal deviation required confidence level

q= 1-p

d= level of statistical significance set

The sample size will be $1.96^2 \times 0.3(1-0.3)/0.05^2 = 323$ people

3.4. Sampling Techniques

This study employed purposive sampling to choose the policy makers who were available and willing to be interviewed. Simple random sampling was used to select residents and business owners.

3.5. Research Instruments and Data Collection

This study used questionnaires and interviews as the instruments of data collection. The interviews were conducted by the researcher with the policy makers in Embu Town. The researcher with the help of research assistants administered the questionnaires to the selected sample of residents and business owners. The respondents were required to fill in the questionnaires on their own without the researcher's or the research assistants' help. The policy makers were from the Department of Environment, Environmental Health and Public Health. Those residents and business people who were willing to participate in the study were given questionnaires to fill on their own.

3.6. Data management and analysis

Data analysis involves making deduction and inferences from what has been collected in a survey (Kombo & Tromp, 2006). Data analysis involved identifying, coding and categorizing patterns or themes found in data. Data from the questionnaires was entered in statistical package for social scientist (SPSS) version 20 in order to get frequencies which presented using graphs and tables. Excel was used to get frequencies for open ended questions in the questionnaires which were then presented using tables and graphs. Frequencies and percentages were used to summarize the

data in the questionnaires. Results from the interviews were summarized and narrated in the discussion of results.

3.7. Ethical considerations

Permission to conduct the research was sought from graduate school of Kenyatta University. A research permit was sought from NACOSTI. Informed consent was sought from respondents prior to administering the questionnaires. Participation was voluntary and all respondents were accorded their rights. The respondents were promised that the responses given were to be used only for the purpose of the study hence confidentiality will be guaranteed.

CHAPTER FOUR

4.0 DATA PRESENTATION, ANALYSIS & DISCUSSION

4.1 Introduction

This chapter includes the presentation of data collected from the respondents. The responces were coded and entered in statistical package for social scientist (SPSS) version 20 to get frequencies and percentages. Excel was also used to get frequencies for open ended questions. Frequencies and percentages are shown using graphs and tables for the questions in the residents and business people questionnaires. Data from the interviews coded, summarised in a table and narrated in the discussion. The data was presented and discussed according to the research objectives. The research objectives were as follows;

1) To analyse policy development by Embu Town on solid waste disposal.

2) To examine management of solid waste disposal used by Embu Town.

3) To investigate the challenges of managing solid waste in Embu Town.

4.2 Data presentation & discussion

4.2.1 Demographic data

4.2.1.1 Characteristics of the respondents

Sex of the respondents

The respondents from households were mostly female at 58.6% while the male were 39.5%. The respondents' ages ranged from 17 years to 72 years old with the mean being 37.5, median being 37 and the mode being 40. 64.6% of the business people who responded to the questionnaires were female and 34.1% were male. The age of the respondents ranged from 20 years to 51 years with the mean being 32.7, median being 30 and the mode being 30. This is shown in Table 4.1.

Table 4.1

Sex Of Respondents (Percentage of Respective Total in Parenthesis)

Sex	Household[a]	Business people[b]
Male	64 (39.5)	55 (34.1)
Female	95 (58.6)	104 (64.6)

Source: Researcher

Note.N= 323.

[a] *n*=162.

[b]*n*=161.

Level of education

From the table 4.2, the highest level of education for most of the residents was secondary school at 35.2%, followed by primary school at 28.4% and college/universiry at 20.4%. For the business people, 57.1% had attained secondary education followed at primary at 21%.

Table 4.2

Level of Education of the Respondents(Percentage of Respective Total in Parenthesis)

Level of education	Households[a]	Business people[b]
College/university	33 (20.4)	32 (19.9)
Secondary	57 (35.2)	92 (57.1)
Primary	46 (28.4)	35 (21.7)
None	23 (14.2)	0 (0%)

Source: Researcher

Note.N= 323.

[a]*n= 162.*

[b]*n=161.*

Occupation

The table 4.3 shows that 8% of the residents who responded to the questionnaire were civil servants, 10.5% were farmers, 40.1% were business owners and 39.5% were unemployed.

Table 4.3

Occupation of the Respondents (Percentage of Respective Total in Parenthesis)

Occupation	Household[a]
Civil Servant	13 (8.0)
Farmer	17 (10.5)
Business owner	65 (40.1)
Unemployed	64 (39.5)

Source: Researcher

Note N=323

[a]*n=162.*

4.2.2 Policy development by Embu Town on solid waste disposal

According to interviews conducted with the policy makers, no policies on solid waste management have been developed by the County of Embu so far. 7 out of the 8 respondents (70%) said that Embu County is yet to develop solid waste management policies for the County. They are currently using the national environmental policies and regulations. According to Florence Wanjao (O.I., 20/03/2015), the County Environmental Officer said that they were working on developing solid waste management policies for the County. They work with the national policies on waste management solid but they are not effectively implemented.

Some urban cities like Nakuru were able to formulate their own policies on solid waste management. This made it easier to even include and regulate the private sector and ensure proper solid waste service delivery to the people (Gachahi, 2012). The

new public management theory advocates for the inclusion of the private sector in public sector management in order to improve service delivery and accountability. Lack of policy development on solid waste management in Embu Town has contributed to poor solid waste management.

According to the data collected from the questionnaires, there at least 16% said that they do not receive collection services at all. This shows that some solid waste still remains uncollected. The residents and business people are not satisfied with the solid waste management services provided by the County Government. Their responses show that 73.5% and 61.5% of the residents and business people respectively rated the solid waste management services as not adequate. One of the recommendations that were made by the respondents was public private partnership in order to improve on service delivery. There is need for Embu Town to develop solid waste management policies which are unique and address its situation and also include other stakeholders like community based organisations and non-governmental organisations. Strategies should be developed for proper implementation and monitoring of both national and local environmental policies and regulations.

4.2.3 Management of solid waste disposal used by Embu Town

According to data collected from the interviews with policy makers, the Embu county government provides collection and disposal services to Embu Town. It collects solid waste from the estates, community dumps, and waste disposal bins in the town centre and then dumps it at the dumpsite which is near the Embu airstrip. The road leading to the dumpsite is sometimes impassable especially when it rains hence the workers are forced to take the solid waste to the dumpsite in Kiritiri. According to Florence Wanjao (O.I., 20/03/2015), who is the Embu County Environmental Officer, they are in the process of acquiring land for sanitary landfills. This will help improve on solid waste disposal. They have available funds and they have also identified a site in Mecca for the landfill.

Table 4.4 shows that most of the solid waste in Embu Town is collected by the County government. According to the residents who answered the questionnaires, the

County government collects about 53.1% of the waste and private contractors collect 30.2% of the waste. There is still about 14.8% who do not receive any collection services from neither the County government nor private contractors. 58.4% of the business people said that their solid waste is collected by the county government. 18.6% said that they do not receive any solid waste services from the county government or private sector.

Table 4.4

Who Collects Solid Waste (Percentage of Respective Total in Parenthesis)

	Households[a]	Business people[b]
County government	86 (53.1)	94 (58.4)
Private contractor	49 (30.2)	35 (21.7)
None	24 (14.8)	30 (18.6)

Source: Researcher

Note.N= 323.

[a]*n= 162.*

[b]*n=161.*

Some of the respondents who do not receive solid waste management services claimed to pay a collection fee. Others claimed not to pay any charge and yet their waste was collected. Overall about 59.3% of the resident respondents pay a collection fee and 38.9% do not. For the business people, 62.3% paid collection fee and 36% do not pay any fee. This shows that shows lack of proper monitoring and implementation of payment systems.

Table 4.5 show that more than half of both the residents and business people who responded to the questionnaire said that their solid waste was collected once a week. 16% and 19.9% of the residents and business people respectively do not receive any collection services. None of the business people who responded had their waste collected daily. Since most of the households receive waste collection services once a week, it means that they have to find ways to store the waste until it is collected.

Some of them end up dumping the waste inappropriately. The longer it takes for the waste to be collected, the more the waste accumulates.

Table 4.5

How often is Solid Waste Collected (Percentage of Respective Total in Parenthesis)

How often is solid waste collected	Households[a]	Business people[b]
Daily	12 (7.4)	0 (0)
Weekly	98 (60.5)	115 (71.4)
Biweekly	16 (9.9)	3 (1.9)
Monthly	7 (4.3)	9 (5.6)
Not at all	26 (16)	32 (19.9)

Source: Researcher

Note.N= 323.

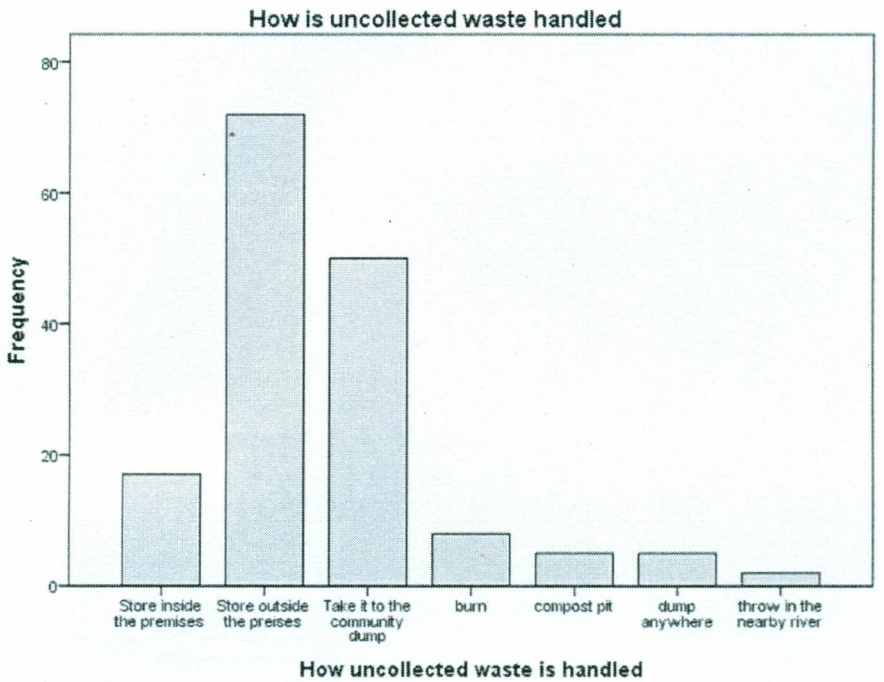
[a]*n= 162.*

[b]*n=161.*

Since most of the solid waste produced by residents of Embu Town is not collcted daily, the residents have to look for ways to store it until it is collected. About 10.5% of the residents who answered the questionnaire stored their uncollected solid waste inside their premises while 44.4% stored theirs outside the premises. 30.9% of the residents took their uncollected solid waste to the community dump. 3.1% of the respondents said that they dumped their uncollected waste anywhere. This is illustrated in figure 2.

Figure 2

How is uncollected Solid Waste handled by Households

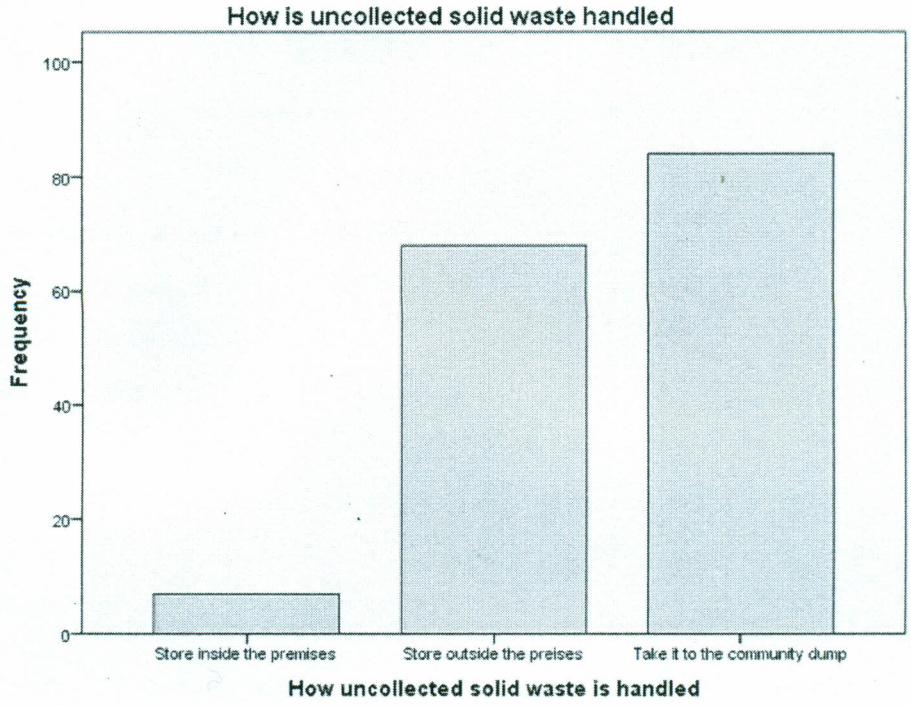


Source: Researcher

As illustrated in figure 3, 52.2% of the business people took their uncollected waste to the community dump. 4.3% of the respondents stored their uncollected waste inside their premises while 42.2% stored it outside their premises.

Figure 3

How is uncollected Solid Waste Handled by Business People



Source: Researcher

Table 4.6 shows that 69.8% and 50.9% of the residents and business people respectively felt that the solid waste management services they received were not adequate. 17.9% and 13.7% of the residents and business people respectively felt that the services were moderately adequate while only 3.7% and 1.9% of the residents and business people respectively felt that the services they received very adequate. Majority of the respondents felt that the solid waste management services they receive are not adequate. This shows that the county government needs to improve on solid waste collection in Embu Town.

Table 4.6

How adequate are the Solid Waste Services (Percentage of Respective Total in Parenthesis)

Classification	Households[a]	Business people[b]
Very adequate	6 (3.7)	3 (1.9)
Adequate	11 (6.8)	52 (32.3)
Moderately adequate	29 (17.9)	22 (13.7)
Not adequate	113 (69.8)	82 (50.9)

Source: Researcher

Note.N= 323.

[a]*n= 162.*

[b]*n=161.*

Discussion

The most common method of waste disposal in Embu Town is collection from the communal dumps and estates and dumping in the dumpsite. Collection is done mostly once a week in most areas. Though the County government collaborates with a private contractor in some areas, more than half of the people in Embu Town get solid waste services from the County Government. According to responses from the residents and business people, more than half the respondents were not satisfied with the current solid waste services provided by the County Government. To improve on this, respondents recommended privatisation of solid waste management and public private partnership. This is in line with the new public management theory which encourages management of public sector like the private sector to ensure customer satisfaction.

In high income estates like Blue Valley and middle income estates like Dallas, the government collaborates with a private contractor who supplies the residents with polythene papers for storing solid waste until it is collected. The private contractor then collects the solid waste and takes it to a collection point from where the county

governments collects it and take it to the dumpsite. The residents have to pay a weekly fee for the polythene papers provided. This has helped reduce the number of open dumps along the roads. This is similar to Mombasa Town according to a study done by Yen (2012) on where solid waste collection through communal collection or door to door collection once per week or once per two weeks. The residents have to pay a fee for door to door collection of solid waste. Since the waste is not collected daily, it accumulates. Most of the respondents store their solid waste outside their premises. This leads to illegal dumping since the residents may not want heaps of foul smelling solid waste outside their residence. This shows that there is need for the county government to increase the frequency of solid waste collection. There is also need for the County Government to collaborate with the private sector in order to improve their services and ensure customer satisfaction.

Data from the questionnaires showed that some respondents claimed to pay a fee for solid waste management yet they did not receive the services. Others did not pay yet they received the services. According to the interviews, the fee for solid waste management is included in the water bill. This money however, does not go into management of solid waste. This leads to loss of funds which could have been used in management of solid waste. As a result the residents fail to receive proper solid waste management services yet they pay for it. In new public management theory, the public sector should be market oriented and customer oriented. The public sector should have means of generating its own income for example through taxes and service fees in order to provide excellent services and ensure customer satisfaction. There is need for the County Government to come up with a system of collecting a solid waste management fee which will aid in improving services. This way, residents will get proper services and value for their money.

4.2.4. Challenges of managing solid waste in Embu Town

Policy makers

From the interviews, the policy makers characterised the challenges faced in solid waste management service as shown in table 4.7.

Table 4.7

Challenges Facing Solid Waste Management in Embu Town

Challenge	Very serious	Serious	Not so serious	Not a challenge
Some people are not given service	3	4	1	
The service is not frequent enough	1	5	2	
Lack of county authority to make financial and administrative decisions related to waste management	1		6	1
Lack of financial resources for waste management	2	3	3	
Lack of trained personnel in waste management		3	3	2
Lack of equipment for waste management	4	3		1
Lack of vehicles for waste management	6	2		
No proper institution for solid waste management service			6	2
Lack of legislation		4	3	1
Lack of enforcement measure and capability	3		5	
Lack of planning (short, medium and long term plan)		3	3	2
Rapid urbanization outstripping service capacity	2	1	3	2
Difficult to locate and acquire landfill site				8
Poor response to waste minimization (reuse/recycling)	4	1	3	
Uncontrolled use of packaging material	3	3	2	
Poor public cooperation			3	5
Poor cooperation by Government agencies	3	3	1	1

Source: Researcher

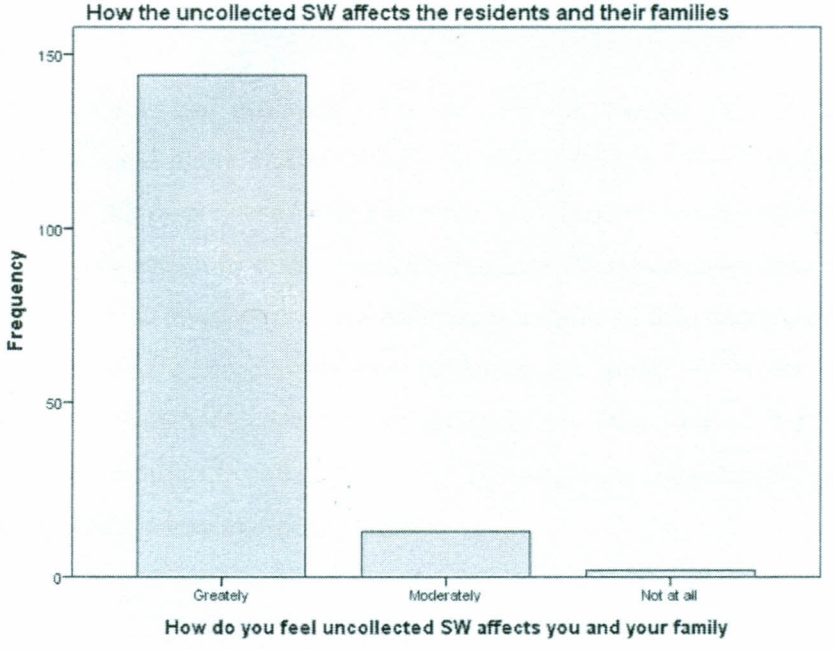
The challenges on solid waste management that the interviewees thought were serious and needed immediate attention include: lack of enough vehicles for solid waste collection and disposal; lack of enough equipment of enough equipment for solid waste management; some people are not given solid waste management services; and collection services not being frequent enough. According to the interview with the County Environmental Officer, the county of Embu has only four vehicles for solid waste collection for the whole county. At the time of the interview, one vehicle was out of service so they were only using three. They are waiting for funds to acquire two more vehicles for waste collection and disposal.

4.2.4.1 Effects of uncollected solid waste

As shown in figure 4, 88.9% of the residents felt that uncollected solid waste affected them and their families greatly, 8% of them felt that the affects were moderate and 1.2% of the respondents felt that the uncollected solid waste did not affect them at all.

Figure 4

How do Residents Rate Effects of Uncollected Solid Waste them and their families



Source: Researcher

Table 4.8 shows how the respondents rated the solid waste management services they received from the County Government. 73.5% and 61.5% of residents and business people respectively thought that the services were not adequate. Only a small percentage of both residents and business people rated the solid waste services provided by the County Government as adequate.

Table 4.8

How do you Rate Solid Waste Services Provided by County Government (Percentage of Respective Total in Parenthesis)

	Households[a]	Business people[b]
Adequate	6 (3.7)	8 (5)
Barely adequate	34 (21)	52 (32.3)
Not adequate	119 (73.5)	99 (61.5)

Source: Researcher

Note.N= 323.

[a]*n= 162.*

[b]*n=161.*

The residents had different views on how uncollected solid waste affected them. Table 4.9 and figure 5 show the effects as given by the respondents from households. Most of the respondents stated that the bad smell emanating from uncollected solid waste was affecting them and their families. Diseases were also a major concern. Most of these diseases are spread by vermin found in the uncollected solid waste. The waste acts as a breeding ground especially for mosquitos which spread malaria to residents. Another concern was that some children play in the waste, sometimes looking for things to sell or play with. The waste contains sharp objects like glass and metal which cause injury to residents.

Table 4.9

The Effects of Solid Waste on Residents (Percentage of Respective Total in Parenthesis)

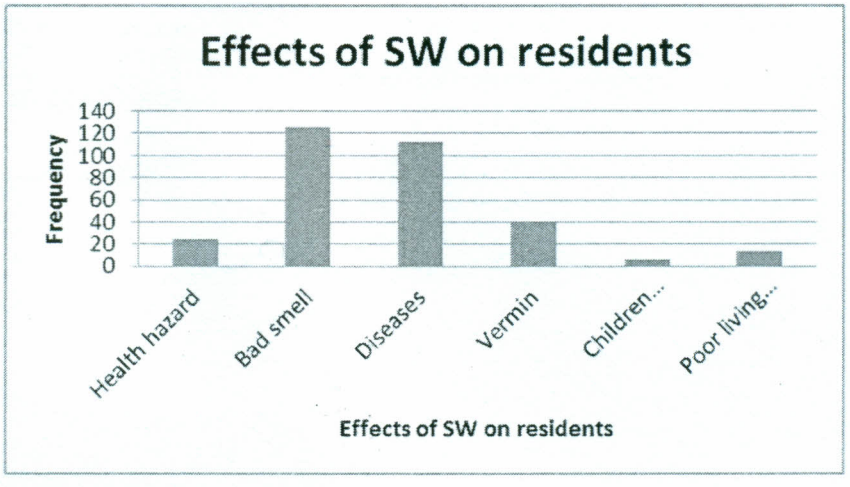
Effects of solid waste on residents	Frequency
Health hazard	24 (14.8)
Bad smell	125 (77.1)
Diseases	112 (69.1)
Vermin	40 (24.7)
Children scavenging	5 (3.1)
Poor living conditions	13 (8)

Source: Researcher

Note. n=162.

Figure 5

The Effects of Uncollected Solid Waste on Residents



Source: Researcher

Table 4.10 and figure 6 show the effects of uncollected solid waste on the environment as given by the respondents. The uncollected solid waste acts as a breeding ground for mosquitoes. This was a problem for most of the respondents. Another major effect according to the respondents was environmental degradation. The wind normally spreads the solid waste especially polythene papers which block the drainage systems thus water does not drain properly especially during rainy seasons.

Table 4.10

The Effects of Solid Waste on the Environment -Residents (Percentage of Respective Total in Parenthesis)

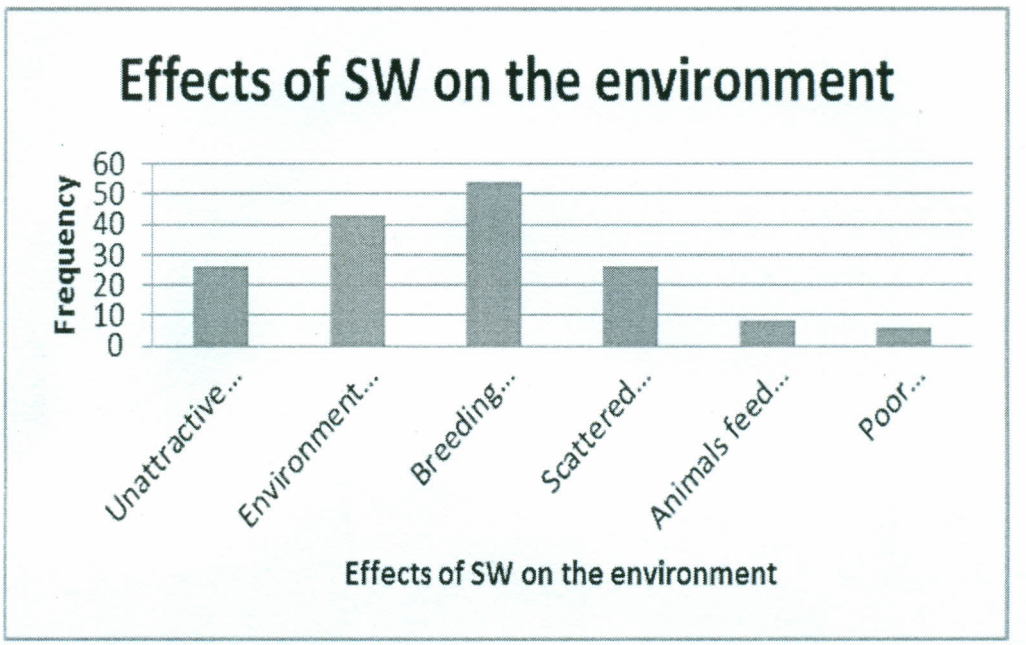
Effects of solid waste on the environment	Frequency
Unattractive environment	26 (16)
Environmental degradation	43 (26.5)
Breeding ground for mosquitoes	54 (31.5)
Scattered trash	26 (16)
Animals feed on trash	8 (4.9)
Poor sanitation	6 (3.7)

Source: Researcher

Note. n=162

Figure 3

The Effects of Uncollected Solid Waste on the Environment (Residents)



Source: Researcher

69.6% of the business people felt that uncollected solid waste greatly affected their businesses, 19.9% felt that their businesses were moderately affected and 9.3% of the businesses were rarely affected by uncollected solid waste.

Figure 7

How do business People Rate the Effects of Uncollected Solid Waste on their businesses

Source: Researcher

77% of the business people who answered the questionnaire stated that bad smell was the major problem affecting them and their businesses as a result of uncollected solid waste. 39.6% complained of vermin which hide in the uncollected solid waste. 22.3% of the respondents complained of diseases affecting them. This is shown in the table 4.11 and figure 8.

Table 4.11

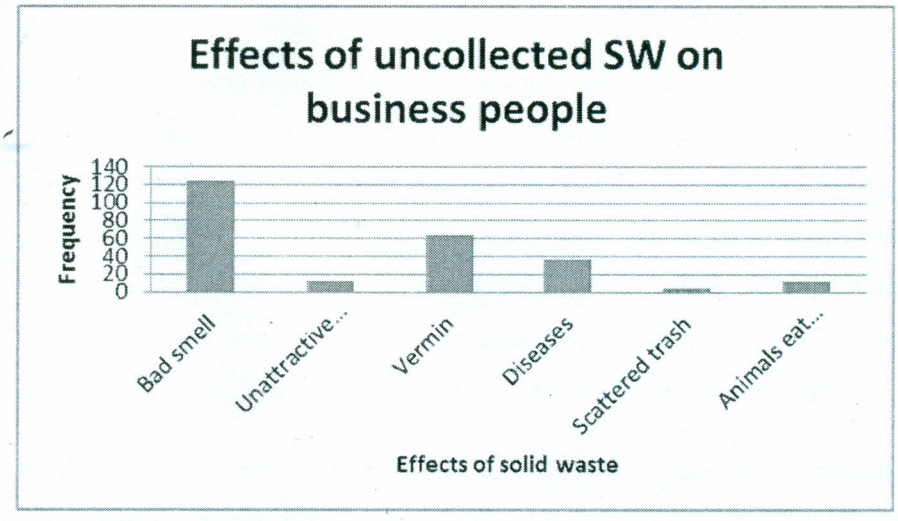
The Effects of Uncollected Solid Waste on Business People (Percentage of Respective Total in Parenthesis)

Effects of uncollected solid waste on business people	Frequency
Bad smell	124 (77)
Unattractive environment	12 (7.5)
Vermin	64 (39.6)
Diseases	36 (22.3)
Scattered trash	4 (2.5)
Animals eat the waste	12 (7.5)

Note. n=161

Figure 8

The Effects of Uncollected Solid Waste on Business People



Source: Researcher

Discussion

Lack of enough vehicles and equipment for solid waste management are among the challenges that are facing Embu Town in regard to solid waste management. Data from the interviews shows that the respondents facing thought that lack of vehicles and equipment for solid waste management were very serious challenges that Embu County. This is supported by the recommendations made by the residents and business people on how the County can improve on solid waste management. They said that the County should buy more vehicles and equipment to ensure that solid waste is collected frequently. There are only three operating vehicles available for solid waste collection and disposal in the whole county. These vehicles sometimes break down. According to a study done by Mwakumaya (2010), in Kilifi Town, the situation is similar to that of Embu. There are only three operating vehicles for collection and disposal of solid waste. Workers are few most of them are not trained to handle solid waste. They also lack proper primary equipment for handling solid waste.

Some areas do not receive solid waste services. This leads to illegal dumping especially beside the roads. Priority is given to the CBD and some estates. Low income areas like Shauri Yako estate complain of lack of frequent solid waste services. This was also the case in Nairobi according to a study done by Gakungu, Gitau, Njoroge, & Kimani (2012), where about 30 to 40 per cent of the solid waste generated in urban areas is uncollected. According to Opinde (2010), litter bins are provided in the CBD where the sub urban zones which have high population density are neglected. Another challenge is infrequent collection off solid waste which also leads to illegal dumping. There is need for the county government of Embu to increase the days of waste collection in order to prevent solid waste accumulation.

Bad roads sometimes contribute to poor solid waste collection especially during the rainy seasons. When it rains some roads become impassable and the workers cannot access all areas in order to collect waste. This results in illegal dumping due to accumulation of solid waste. During the rainy season, the road leading to the dumpsite becomes impassable. This forces the workers to dump the waste along the road near

the dumpsite or take to the nearest dumpsite which is in Kiritiri. A similar situation was observed in Eldoret by Opinde (2010). One of the problems in public sector that led to new public management was public inaccessibility. There is need for collaboration with all stakeholders involved in solid waste management including the private sector so that all people can get these services.

Most respondents stated that uncollected health affected them greatly. They mostly complained of bad smell and vermin which spread diseases. The waste contains sharp objects such as glass and metals which pose as a health hazard to the residents of Embu Town. The wind spreads polythene papers to other areas and they sometimes cause blockages in the sewerage system. This was also observed by Muchiri (2013). The uncollected solid waste becomes a breeding ground for mosquitoes which spread malaria. This shows that the health of residents of Embu Town is adversely affected due to poor solid waste management. The county government needs to improve of waste collection and disposal. The waste should be collected frequently to prevent it from accumulating. The uncollected solid waste also affects businesses especially hospitality businesses due to bad smell and flies.

4.2.5 Recommendations for improvement of solid waste management in Embu Town

The following were the recommendations made by those interviewed for improvement of solid waste management in Embu Town.

- Creations of awareness to the public on how best to manage their solid waste for example reuse and recycle. Also sensitize the public to take action for example, reusing plastic containers and bags.

- Design policies that discourage generation of a lot of waste especially on product packaging, for example using biodegradable packages.

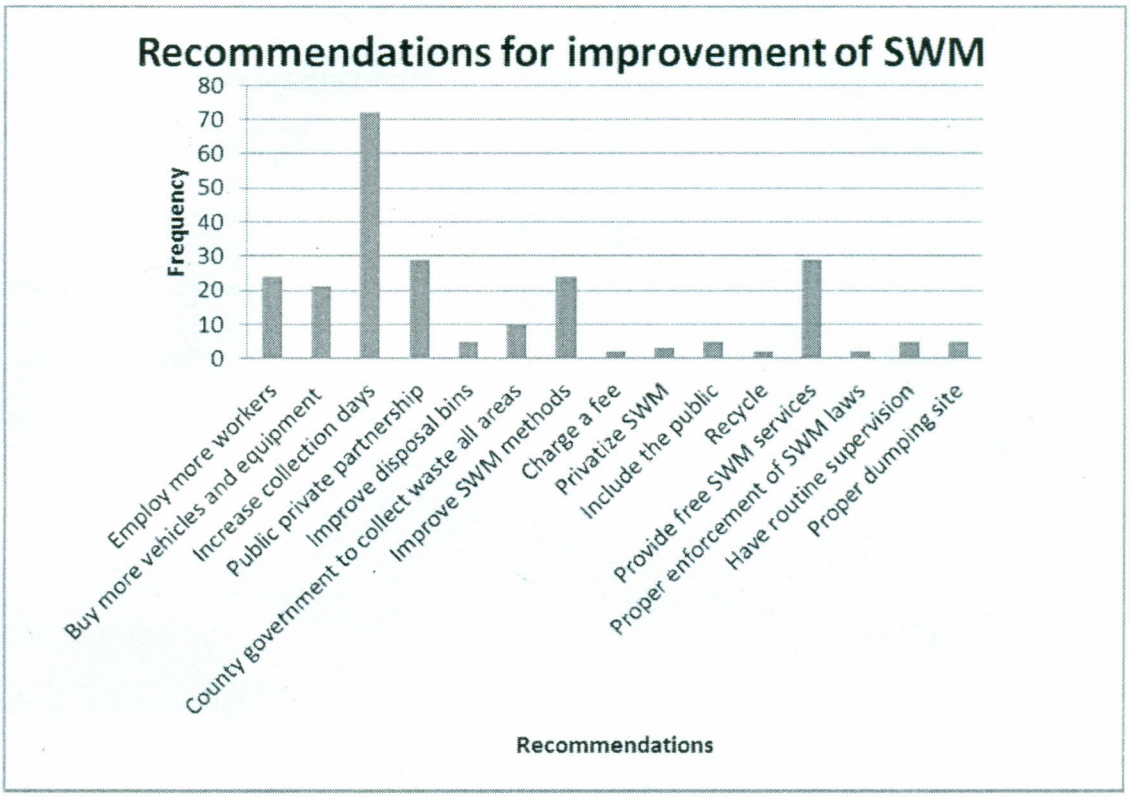
- Encourage public private partnerships so that the public can receive the best services and value for their money.

- There should be political goodwill for the goals of solid waste management to be realised.
- Priority should be given to solid waste management.
- Have good systems which enable the county government to collect solid waste frequently and also use best methods of solid waste collection.
- Increase the number of waste collection vehicles acquire equipment for garbage collection and management. Also train officers or recruit trained officers in the field.
- Enforce policies and ensure proper implementation of those policies.

As shown in figure 9, 44.4% of the residents thought that in the County government increased days of solid waste collection, then solid waste management would improve. 18% respondents recommended that the County government should adopt public private partnership to improve on their services. Policy makers and business people also recommended for the County Government to adopt public private partnership. This will be a step towards new public management. By involving the public sector in the management of solid waste, the County Government will be able to deliver quality services to the public. Others recommended that the government should employ more workers and buy more vehicle and equipment for solid waste collection and disposal. This concurs with the data from interviews where the interviewees also recommended that more vehicles and equipment for solid waste management should be bought.

Figure 9

Recommendations by Residents on Improvement of Solid Waste Management



Source: Researcher

62.1% of the respondents thought that if the days of collection were increase, then solid waste management would improve. 17.4% respondents wanted the county government to employ more workers, 7.5% respondents felt that the government should buy more vehicles for waste collection and another 7.5% felt that the public should be involved in order to improve solid waste management. This is shown in table 4.12

Table 4.12

Recommendations by Business People for Improvement of Solid Waste Management (Percentage of Respective Total in Parenthesis)

Recommendations for improvement of SWM	**Frequency**
Increase collection days	100 (62.1)
Increase the workers	28 (17.4)
Increase SW collection trucks	12 (7.5)
Dig compost pits	4 (2.5)
Involve the public	12 (7.5)
Public private partnership	4 (2.5)
Provide waste bins	12 (7.5)
Daily monitoring	4 (2.5)

Source: Researcher

Note. n=161

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of findings

Embu Town is yet to develop policies on solid waste management which are easily adaptable to the local situation. They are currently using the national environmental policies and regulations. The County government provides solid waste collection and disposal services to the people. The method of waste disposal used by the county government involves collection from communal receptors or dumps and estates and dumping in the dumpsite. Some high and medium income areas like Blue Valley estate and Dallas estate and the CBD receive frequent and better solid waste services than low income areas like Shauri Yako estate. This is expected to change in the future because Embu County is in the process of designing a landfill which will improve on waste disposal.

Challenges that face Embu Town on solid waste management include lack of sufficient vehicles and equipment for solid waste collection and disposal. There is lack of proper policies and poor policy implementation. The county government is overwhelmed by the ever increasing volume of solid waste. As a result, some areas do not receive collection services. Collection is mostly done on a weekly basis which results in accumulation of solid waste and sometimes illegal dumping. Uncollected solid waste produces foul smells and it pollutes the air. It also acts as a breeding ground especially mosquitoes and flies which spread diseases. This affects the health of the residents living nearby. It also attracts scavengers looking for valuable things to sell and animals which eat and spread the waste around. Sharp objects found in the waste can cause injury to people. Uncollected waste causes environmental degradation and also makes the environment unattractive.

5.2 Conclusion

Solid waste management is one of the most important services which should be available to all. This is not the case in Embu Town because the county government is not able to cater to the needs of all its residents. Embu Town faces many challenges

which need to be addressed in order to improve solid waste management. There is a need for policy formulation on solid waste management and proper policy implementation. There is also need to employ more workers and buy more vehicles and equipment for solid waste management. There is also need to develop a payment system for solid waste management so that the money collected can go directly to waste management. This will help the county government to provide better services to their residents and the residents will get value for their money.

5.3 Recommendations

From the challenges which were identified after analysis of the data collected, this study made the following recommendations. Firstly, there is need for Embu Town to develop policies for solid waste management in order to deal with the challenges that it is facing. There should also be proper implementation and monitoring of policies. New public management theory advocates for transparency and accountability. Different stakeholders should have distinct responsibilities in order to encourage accountability. Regulations should and penalties should be formulated to encourage compliance and transparency. Secondly, the County Government should acquire more vehicles and equipment in order to improve on solid waste collection and disposal. It should employ more workers to aid in solid waste management.

Thirdly, the County Government should increase the frequency of waste collection according to the waste generated in order to reduce accumulation of waste which leads to illegal dumping. It should also ensure that all residents of Embu Town receive solid waste services. Fourthly, the County Government should consider public private partnership. This is another aspect of new public management. The County Government should work with the private sector or privatise some services in order to provide the best services to their customers. If solid waste management is privatised, it will create a competitive market where companies will be competing to provide the best services to their customers. The private sector will help ease the burden of solid waste collection and disposal. Lastly, this study found out that the collection of fee for solid waste is not standardized. This has led to loss of revenue which could have been used to improve services. The County Government should develop a payment

mechanism for collection of solid waste management fee. The fee will generate income to help in improving solid waste management services. For example it can be used to purchase more vehicles and equipment.

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A1: LIST OF ORAL INFORMANTS

S/N	NAME	DEPARTMENT	DATE OF INTERVIEW
1.	Florence Wanjao	Embu County Environmental Officer	20/03/2015
2.	Eng. Stephen Njiru	Ministry of Lands, Environment and Water	20/03/2015
3.	John Maina Munyeki	Department of Environmental Health	20/03/2015
4.	Elias Njue	Department of Environmental Health	19/03/2015
5.	Mary Munyua	Department of Environmental Health	19/03/2015
6.	Rose Njue	Department of Environmental Health	19/03/2015
7.	Mercy Kithinji	Department of Public Health	18/03/2015
8.	Jackson Njeru	Department of Public Health	18/03/2015

A2: INTERVIEW GUIDE

SAMPLE INTERVIEW GUIDE FOR POLICY MAKERS OF EMBU TOWN ON THE MANAGEMENT OF SOLID WASTE IN EMBU TOWN

1. How long have you worked in Embu?

2. Are there policies for solid waste management in Embu County? Yes [ ] No [].

   If *Yes,* name them

   .....

   .....

3. To what extent is the implementation of these policies effective?

   Very Effective [ ]

   Effective [ ]

   Not Sure [ ]

   Not Effective [ ]

4. a) Which methods of waste disposal are used in Embu Town? (you can tick more than one)

   Burning [ ]

   Recycling [ ]

   Compost pits [ ]

   Energy production from waste [ ]

   b) Name any other methods used ----------

---

5. The following statements indicate challenges faced in solid waste management service. Please tick appropriate space to indicate how serious the challenge is Embu Town.

Challenge	**Very serious**	**Serious**	**Not so serious**	**Not a challenge**
Some people are not given service				
The service is not frequent enough				
Lack of county authority to make financial and administrative decisions related to waste management				
Lack of financial resources for waste management				
Lack of trained personnel in waste management				
Lack of equipment for waste management				
Lack of vehicles for waste management				
No proper institution for solid waste management service				

Challenge	Very serious	Serious	Not so serious	Not a challenge
Lack of legislation				
Lack of enforcement measure and capability				
Lack of planning (short, medium and long term plan)				
Rapid urbanization outstripping service capacity				
Difficult to locate and acquire landfill site				
Poor response to waste minimization (reuse/recycling)				
Uncontrolled use of packaging material				
Poor public cooperation				
Poor cooperation by Government agencies				
No problems				

6. How can the challenges be addressed?

.....

.....

.....

.....

7. What should be done to improve solid waste management in Embu Town?

.....

.....

.....

.....

A3: QUESTIONNAIRE

SAMPLE QUESTIONNAIRE FOR RESIDENTS ON THE MANAGEMENT OF SOLID WASTE IN EMBU TOWN

Introduction and purpose of the research

Dear respondent,

My name is Njagi Diana Nyakio. I am student of Kenyatta University. I am conducting a research on Effects of solid waste management in Embu Town. I request you to take part in my study because your home is located within my area of study. You have been chosen randomly from the people who live in Embu Town. If you agree to participate you will answer or fill in a questionnaire with statements regarding waste management in Embu Town. Participation is voluntary. This research is for academic purposes and any findings will never be traced back to you. Information collected will only be used for study purposes only. You are not required to pay me or my research assistant for taking part in this study. Similarly we will not pay you money for participating in the study.

Thank you

Indicate your response by a tick against the appropriate brackets for each statement.

DEMOGRAPHIC DATA

1. Sex: Male [ ] Female [ ]

2. Age: ---------- years

3. Level of education 1) College/University [ ]

2) Secondary [ ]

3) Primary [ ]

4) None [ ]

4. Occupation 1) Civil servant [ ]

2) Farmer [ ]

3) Business owner [ ]

4) Unemployed [ ]

SOLID WASTE MANAGEMENT PROCEDURES

1. Who collects your solid waste? 1) County government [ ]

2) Private contractor [ ]

3) Other (specify).....

2. Do you pay any fee for collection of solid waste?

Yes [ ] No [ ]

3. How often is it collected?

Daily [ ]

Weekly [ ]

Biweekly [ ]

Monthly [ ]

Not at all [ ]

4. If the solid waste is not collected daily how do you handle it?

1) Store inside the premises [ ]

2) Store outside the premises [ ]

3) Take it to the community dump [ ]

4) Others (specify) ----------

5. How would you classify solid waste management services you receive?

1) Very adequate [ ]

2) Adequate [ ]

3) Moderately adequate [ ]

4) Not adequate [ ]

EFFECTS OF SOLID WASTE MANAGEMENT

6. How do you feel that the uncollected solid waste affects you and your family?

1) Greatly [ ]

2) Moderately [ ]

3) Not at all [ ]

7. What are these effects?

.....

.....

.....

.....

8. What are the other effects of the uncollected solid waste on your surrounding environment?

.....

.....

.....

.....

.....

9. How adequate are the solid waste management services provided by the County government?

1) Adequate [ ]

2) Barely adequate [ ]

3) Not adequate [ ]

10. What recommendations would you give for the improvement of solid waste management in Embu Town?

.....

.....

.....

THANK YOU FOR YOUR PARTICIPATION

INFORMED CONSENT BUSINESS PEOPLE SURVEY

Introduction and purpose of the research

Good morning/afternoon/evening. My name is Njagi Diana Nyakio. I am student of Kenyatta University. I am conducting a research on Effects of solid waste management in Embu Town. I request you to be a participant in my study because your home is located within my area of study. You have been chosen randomly from the people who live in Embu Town. If you agree to participate you will answer or fill in a questionnaire with questions regarding the above topic. Participation is voluntary. This research is for academic purposes and any findings will never be traced back to you. Information collected will only be used for the purpose stated earlier only. You are not required to pay me or my research assistant for taking part in this study. Similarly we will not pay you money for participating in the study. Thank you

Indicate your response by a tick against the appropriate brackets for each question.

DEMOGRAPHIC DATA

1. Sex: Male [ ] Female [ ]

2. Age in years

3. Level of education 1) College/University [ ]

2) Secondary [ ]

3) Primary [ ]

4) None [ ]

SOLID WASTE MANAGEMENT PROCEDURES

1. Who collects your solid waste? 1) County government [ ]

2) Private contractor [ ]

3) Other (specify).....

2. Do you pay any fee for collection of solid waste? Yes [ ] No [ ]

3. How often is it collected?

1) Daily [ ]

2) Weekly [ ]

3) Biweekly [ ]

4) Monthly [ ]

5) Not at all [ ]

4. If the solid waste is not collected daily how do you handle it?

1) Store inside the premises [ ]

2) Store outside the premises [ ]

3) Take it to the community dump [ ]

4) Others (specify).....

5. How would you classify solid waste management services you receive?

1) Very adequate [ ]

2) Adequate [ ]

3) Moderately adequate [ ]

4) Not adequate [ ]

6. Does the uncollected solid waste affect your business?

1) Greatly [ ]

2) Moderately [ ]

3) Rarely [ ]

7. What are these effects?

.....

.....

.....

.....

.....

8. Do you think the solid waste management services provided by the County government are?

1) Adequate [ ]

2) Barely adequate [ ]

3) Not adequate [ ]

9. What recommendations would you give for the improvement of solid waste management in Embu Town?

.....

.....

.....

.....

.....

THANK YOU FOR PARTICIPATING

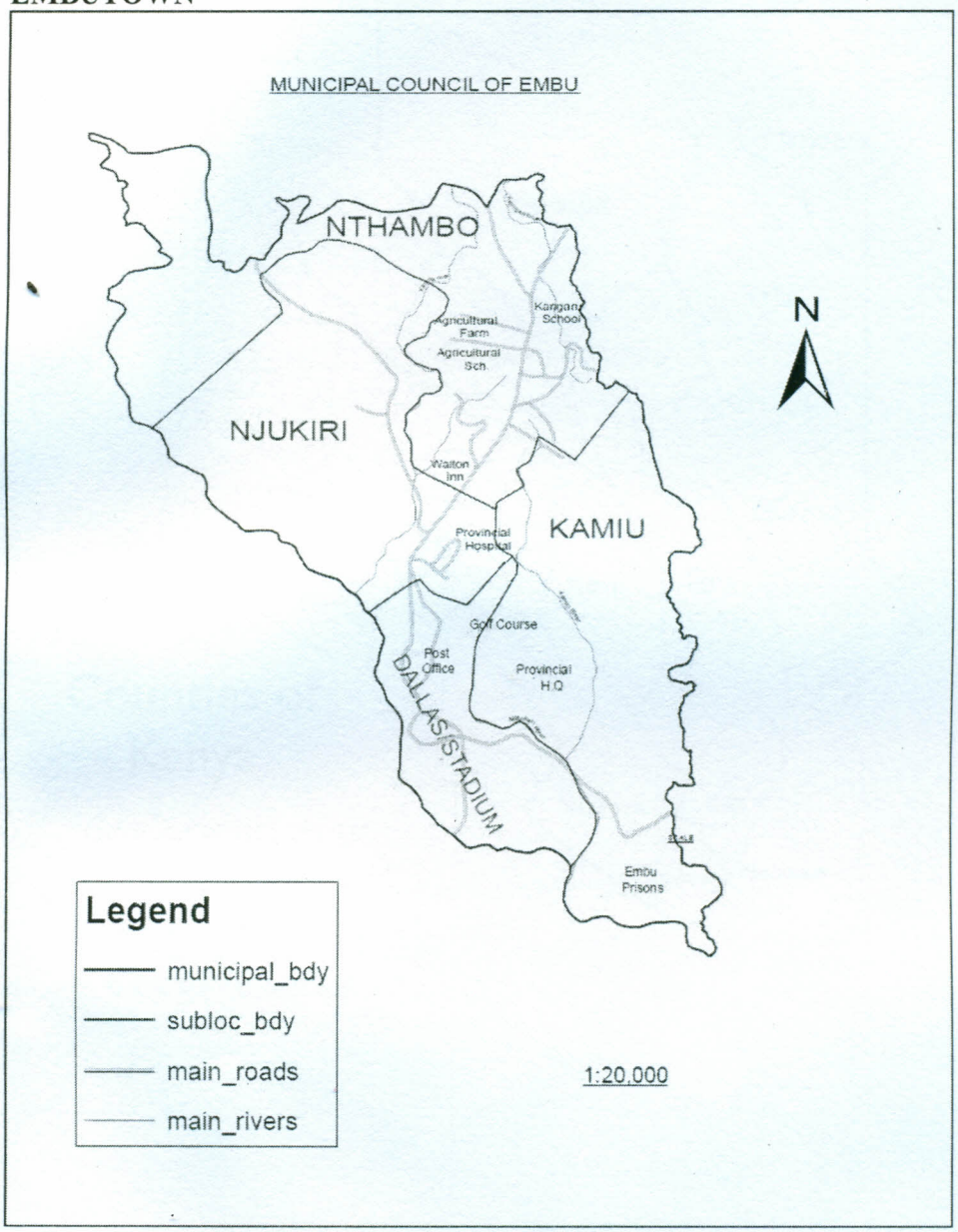
A4: WORK PLAN

ACTIVITY	APRIL 2013 -JAN 2014	AUGUST 2014	SEPT 2014 - JAN 2015	FEB 2015- MARCH 2015	APRIL 2015
Proposal development					
Defence of proposal					
Data collection					
Data analysis					
Project writing & final submission					

A5: THE BUDGET FOR THE STUDY

DESCRIPTION	**(Ksh)**
Papers (4 reams) @500	2,000
Pens and pencils (10) @ 20	200
Printing and photocopying/binding	15,000
Transport	3,000
Per diem for research assistance	20,000
Miscellaneous expenses	5,000
TOTAL	**52,200**

A6:MAP OF EMBUTOWN



Source: Muchiri (2013)

A7: MAP OF KENYA

Source: www.geocurrent.info

NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No.

Date:

30th June, 2015

NACOSTI/P/15/2177/5788

Diana Nyakio Njagi
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Effects of solid waste management in Embu Town, Embu County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Embu County** for a period ending **6th November, 2015.**

You are advised to report to **the County Commissioner and the County Director of Education, Embu County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. S. K. LANGAT, OGW
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Embu County.

The County Director of Education
Embu County.

THIS IS TO CERTIFY THAT:
MISS. DIANA NYAKIO NJAGI
of KENYATTA UNIVERSITY, 0-60100
EMBU,has been permitted to conduct
research in *Embu County*

on the topic: *EFFECTS OF SOLID WASTE MANAGEMENT IN EMBU TOWN, EMBU COUNTY, KENYA*

for the period ending:
6th November,2015

Permit No : NACOSTI/P/15/2177/5788
Date Of Issue : 30th June,2015
Fee Recieved :Ksh 1,000

.....
Applicant's
Signature

.....
Director General
National Commission for Science,
Technology & Innovation