ASSESSMENT OF THE EFFECTIVENESS OF THE POLICY FRAMEWORK ON SOLID WASTE MANAGEMENT IN NAIROBI, KENYA

BY

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DECLARATION

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DEDICATION

This thesis is dedicated to my late parents John Abungu Kidera and Mama Dinah Opiyo Abungu, my husband Elly Otieno Ogutu and my children Wendy Adhiambo, John Otieno, Benjamin Opiyo and Robin Ananiah Ogutu.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADB	African Development Bank
AfDB	African development bank
CBO	Community Based Organizations
CFSP	County Fiscal strategy paper
CLI	Cleaner Lagos Initiative
CTM	Concurrent Transformative model
EMCA	Environmental management and coordination Act
EPA	Environmental Protection Agency.
EPR	Extended producer responsibility
EU	European Union.
FGD	Focus Group Discussion
GCK	Government County of Kiambu
GHGS	Green House gases
GOR	Government of Rwanda
GOUK	Government of United Kingdom
GWMO	Global waste management outlook
IAD	Institutional Analysis Development.
IPCC	Intergovernmental panel on climate change.
ISWA	International solid waste Association
IWMS	Integrated waste management system
JICA	Japan international cooperation Agency
JKUAT	Jomo Kenyatta University of Agriculture and Technology.

KII	Key informant interview
KIPR	Kenya institute for public policy research
KNCPC	Kenya cleaner production centre
KTTC	Kenya Technical Training College.
LASEPA	Lagos state Environmental protection Agency
LAWMA	Lagos waste management Authority
LSETF	Lagos state Environmental Trust Fund
LSRDB	Lagos state Refuse Disposal Board
LSWDB	Lagos state waste disposal board
MEAs	Multilateral Environmental Agreements.
MENR	Ministry of Environment and Natural Resources, Kenya
MINELA	Ministry of Environment and Lands
MOEOJ	Ministry of environment of Japan
NCC	Nairobi City County
NEAP	National Environmental Agency Plan.
NEMA	National Environment Management Authority
NSWMS	National solid waste management Strategy.
PPP	Public private partnership.
REMA	Rwanda Environment management Authority
ROK	Republic of Kenya
RRI	Rapid Results Initiative.
SCP	Sustainable consumption and production
SDGs	Sustainable Development Goals

SEPA	Swedish environmental protection
SWM	Solid Waste Management.
SWMRs	Solid waste management Regulations.
TPB	Theory of planned behaviour
TSET	The socio ecological theory
UN	United Nations
UNCED	United Nations conference on Environment and Development
UNEP	United Nations Environmental Programme
UNFCC	United Nations Framework convention on climate change
UON	University of Nairobi.
USA	United States of America.
WB	World Bank
WFD	Waste framework directive
WHO	World health organisation
WMI	Wangari Maathai Institute
WRMA	Water Resources Management Authority
WTE	Waste to energy

ABSTRACT

Waste management is problematic world over and it is the greatest hurdle for municipal governments within the urban areas to manage due to rapid population growth which increases generation of waste. Solid wastes are generated by all types of human engagement as a result of industrial, social and domestic activities. Waste if not properly managed within the urban settlements / cities, impacts on public health and the general environment. Solid waste specifically causes pollution of surface and ground water, blockage of drains and streams resulting to flooding. The general objective of the study was assessing the effectiveness of the policy framework on solid waste management within institutional, financial, technical and regulatory facets, using the case of Nairobi City County. The theoretical framework was based on institutional and capacity building theories where the multi – tier pillars of institutions and all the elements influence sustainable solid waste management system and empowering individuals, communities and institutions, expected to perform their functions and solve problems. Theory of planned behaviour (TPB) and socio ecological theories (TSET) helped to examine human behaviours because people are always at the centre of any environmental activities. The conceptual framework assumed that within institutional, financial, technical and regulatory facets are dependent on existing governance instruments (laws, regulations and policies) and their levels of implementation, public perceptions and awareness, attitudes and practices and compliance. The study adopted a mixed study design and data was collected using surveys, through structured questionnaires, using a mobile based geo-referenced data management system called KMacho. This involved initial coding of the questionnaire for uploading into the system for data collection. Data was then collected using mobile phones installed with the application. This was collaborated with key informant interviews (KII), focus group discussion (FDG) and spatial satellite geo-spatial images. Random sampling was used to select focus group discussion and key informant interview groups, because any member of a group has an equal chance of being selected. The survey design was considered more efficient since it is convenient data with high level of accuracy in representing a large population. The collection method has good statistical significance and provides precise results. The sample size in this study included 385 households. The sample was determined using stratified sampling procedure. They were randomly selected

and to minimized biasness, a systematic random sampling within the estates was done and the subject units were either male or female household heads. Purposive sampling was used to collect data on the spatial extent of illegal dumping sites. This data was generated from high resolution satellite images of 2003, 2007, 2013 and 2017 which identified dumping sites which were selected based on their spatial resolution characteristics and their spatial coverage. Majority of the respondents 291 out of 385 (76%) were aware of what makes the environment clean or dirty, were aware of the policies and regulations on solid waste management and how it can influence their behaviour on the way they handled their generated waste. However, majority of 62% agreed that the enforcement of these policies has not been carried out properly, as opposed to 36% of respondents who indicated that there is a problem in relation to the implementation of these policies. Majority, 269 out of 385 (69%) were willing to comply with the policies on segregation of waste and the 3R concept (reduce, reuse and recycle), but there were poor structures in place to empower them, thus the negative attitude portrayed by the public towards solid waste management through the culture of indiscriminate littering and lack of environmental ethics and values. This was confirmed by majority of the respondents, 254 out of 385 (66%) who agreed that public awareness needs to be conducted more on SWM by NCC. This provide evidence to inform policy decisions that, different policy interventions are required focussing on SWM and the public responsibility and greater management capacity at all levels to enhance a sustainable system

Keywords: Solid waste management, policy frameworks assessment, environmental governance, public responsibility, sustainable solid waste management, Nairobi.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The world is urbanizing at an unprecedented rate, accelerating the quantities of solid waste generated. The composition of the waste is more complex than ever before, resulting to environmental challenges (Wilson, 2007).

Waste management is continually a great challenge at all levels; globally, regionally and locally. The greatest hurdles in management of solid waste are in the hands of Municipal Governments (local authorities) in urban areas. (Narayana, 2008). The solid waste is as a result of industrial, social and domestic activities that are on increase in quantity and variety due to rapid growth in population and technological advancements (Sakurai, 2012).

All types of human engagement lead to the generation of some type of waste. According to Republic of Kenya, (2000), waste include liquid, solid, gaseous and radioactive materials which are disposed in the environment in large quantities with adverse effects in the environment (JICA, 2010).

Waste management in Nairobi County is a perilous undertaking in that increasing urbanization, rural-urban migration; rising standards of living and rapid development associated with population growth have resulted in increased solid waste generation by industrial, domestic and other activities (NCC, 2006). The capacity of urban authorities is inadequate to manage the challenges of waste management brought by increased solid waste generated. Consequently, effective management of waste is one of the biggest environmental problems in cities like Nairobi (JICA, 2010).

An efficient solid waste management system has remained difficult to achieve in Nairobi County. This is as a result of insufficient funding, unskilled personnel and the inability of the City authorities to collect and dispose of waste, poor implementation of policies / regulations on solid waste management and lack of environmental values and ethics and skewed public attitude towards waste. The notion that waste is seen as mere waste of no value that can be exploited to bring economic benefits, has led to indiscriminate dumping impacting negatively on the environment and public ill- health problems (Ikiara, 2006; Majale, 2011; Oyake-Ombis, 2012).

Sources of waste are household (domestic), commercial premises, markets, institutions, industries, construction and demolition and hospital (health care) categorized into hazardous and non – hazardous. 68% of the total waste generated in Nairobi is from domestic waste while the others combined (industries, markets, roads and other activities) contributed by 32%. Waste management activities are aimed at protecting human health and the environment which includes; collection, reduction, recycling, composting, combustion and disposal in properly designed and managed landfills. However, these activities require careful planning and financing carried out through a policy framework on solid waste management (UNEP, 2006; Otieno, 2010).

Solid waste management (SWM) refers to an organized system of activities which include; control of waste generation, collection, storage, transportation, segregation of waste, processing, treatment, recovery and disposal of solid waste. The objective of SWM is to protect the health of the population, promote environmental quality and build sustainable systems (Iyeke and Ohwovoriole, 2011; U.S. EPA, 2015).

Waste, if not properly managed within the urban settlements / cities has devastating effects. It increases the risk of ill-health in people, causes damage to ecosystems and accelerates the destruction of the environment. It causes blockage of drains and stream flows resulting in flooding. Intergovernmental Panel on Climate Change (IPCC, 2010) estimate that Solid Waste (SW) accounts for 5% of global greenhouse (GHG) in 2010, caused by methane emissions from landfill sites.

Waste contributes to the pollution of surface and ground water, obnoxious smell from open decomposition (rotting), litters the land and makes it lose its aesthetic value, gaseous and smoke emissions including Greenhouse Gases (GHGs), increased risk of diseases such as typhoid, malaria, over and above hinders the achievement of sustainable development among others (Achankeng, 2003; World Bank, 2005b; UNEP and ISWA, 2015).

As a remedy, only a well-established management operated within a policy framework on SWM will reduce the environmental damage through conservation of the limited and scarce resources (Daskalopolous, 2010). Thus, a policy framework is important for SWM, which is key to sustainable development for any nation and the international agenda has been prioritized on solid waste management.

Policy framework is a set of principles, comprising of long – term goals and used as a basis of making rules, decision making, planning and development of any organizational system that leads to intervention (Oxford, 2002). Policy framework on Solid Waste Management includes National

laws, Acts, regulations, regional and international conventions, treaties and agreements which are ratified and domesticated to by national governments (UNEP, 2006).

The policy framework transcends all the levels, international (global), regional, national and local. Policy spells out what is to be done and the desired outcomes and citizens use it globally to hold Governments accountable for public service delivery, for instance solid waste management. Policies do evolve, and a good policy should lead to the development of several regulations and strategies, Kenya has gone through this process of policy change.

The evolution of policy implementation on SWM in Kenya has taken a progressive development of the policy landscape. The first policy framework relevant to SWM was the Penal Code of 1948 that forbade anyone to pollute the atmosphere and water sources. The local Government Act Cap 265(1963), which gave lead authorities power over sanitation of SWM services. The Public Health Act Cap 242(1986). However, standards for service provision was not defined by these Acts, neither did the requirement for waste minimization, resource recovery or recycling. Additionally, solid waste was not defined or classified (Gakungu *et al.*, 2012).

EMCA (1999) (Republic of Kenya, 2000) constituted a framework for the environmental laws in Kenya including waste generation and management. It reinforced the environmental provision within the sectorial laws. The objective of EMCA is total management of environmental issues in Kenya. It gives the citizens a right to waste free and secure environment and places responsibility on them to safeguard it. EMCA stipulates procedures and standards to regulate the management

of SW and categorized waste into hazardous and non-hazardous to accelerate its efficient management.

NEMA was established under EMCA in 2002 and the municipal /local authorities and their selected agents are subordinate to NEMA. NEMA has come up with regulations and strategies on solid waste management meant to improve environmental management in Kenya. The SWM regulations of 2006 issues specific regulations on the entire SWM system from collection, segregation and disposal, how to handle the waste (hazardous and non-hazardous) the actors involved, including waste transporters and generators (NEMA, 2010).

The National SWM Strategy of 2015 (NSWMS) objective is to work towards attaining ZERO WASTE PRINCIPLE and has established a common platform amongst stakeholders for action, meant to bring reforms in waste management. It introduced a new approach, which looks at waste as an economic asset that can reduce pollution of the environment; by being exploited to bring abundance monetary benefits for the citizens, such as employment. (NEMA, 2016).

The Water Act of 2006, amended in 2016 gives institutional framework for water governance in Kenya, emphasizes on water quality provisions and no pollution of water sources with waste or other pollutants, unless the discharge is treated to agreed standards as authorized by Water Regulatory authority (WRA).

The constitution of Kenya (2010) has devolved the SWM to the 47 counties and establish a legal basis for implementing the county integrated SWM plan. The County Government Act (2012) state

that counties are responsible for the entire system of waste management; from collection (removal), transportation, treatment, dumpsites management and SW disposal. Additionally, there are by – laws at the local level, Nairobi County has developed NCC by – laws of 2007 on SWM and the NCC integrated SWM plan (2010 – 2020) which envisages a world class city by adopting a sustainable SWM system of healthy, safe and secure environment for all. NCC SWM Act of March and October 2015 which is a legal framework for SWM for the County, is yet to be implemented by the county assembly (Government Printers, 2015; NCC, 2015; Talan, 2015).

Kenya Vision 2030 recognizes SWM initiative as one of the flagship projects. It recommended that Dandora dumpsite be moved to Ruai and counties to improve on their SWM systems, as a requirement to enhance the development of Kenya into a new industrialized state by 2030. (GOK, 2012)

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Some public Universities in Kenya including University of Nairobi (UON), Jomo Kenyatta University of Agriculture and Technology (JKUAT) and Kenya Technical Training College (KTTC), a technical institution, all have environmental policy statements which are aligned with environmental laws in Kenya, EMCA (1999), the constitution of Kenya (2010), and County Government Acts (GOK, 2015). UON environmental policy objective is to develop a sound environmental management system through adopting cleaner production methods by embracing the 3Rs method of reducing, re – using and recycling, encouraging use of no paper in its operations. KTTC environmental policy is to protect the environment, ensuring a clean and healthy environment by reducing waste and using resources efficiently to meet the environmental challenges of the next generation while JKUAT environmental management system (EMS) policy

is committed to maintain a sound environmental management system by ensuring that its operations are environmentally acceptable and sustainable by minimizing waste through the 3Rs method, reducing, re – using and recycling (UON, 2015; KTTC, 2014; JKUAT, 2015).

The 100 days Rapid Results Initiative on SWM was initiated by the Ministry of Environment and Natural Resources and National Environment Management Authority (NEMA), being part of the Ministry policy, involving County Governments, private public partnership (PPP), community-based organizations (CBOs), National Police Service among others. NEMA is the focal point of action for the ministry. The theme of the program was: 'keep Kenya clean' and it included various activities like enhancing compliance promotion, awareness creation, enforcing laws on compliance in Waste Management (WM) and involving stakeholders on the implementation of National Solid Waste Management Strategy (NSWMS). The objective was to improve on SWM in the Country, though the entry point was Nairobi City County (NEMA, 2016).

According to UNCED (1992), the Rio Declaration on Environment and Development, which forms agenda 21, states that effective management of solid waste, is a concern in the drive towards achieving sustainable development in all countries across the globe. The global policies and regulations aim at fostering integration of sustainable development (SD) principles into specific country policies and program initiatives that are in line with the global policies in management of solid waste.

1.2 Statement of the Research Problem

The environment has become a global policy issue as a result of complex environmental problems such as resource depletion, waste, pollution and global warming. Kenya supports the vision of a developing society where there is equality and people are environmentally conscious by not overexploiting the resources in the environment. Policies have therefore been developed to address issue of collection, transportation and disposal of waste (NEMA, 2010). These policies include the waste management Regulation of 2006 whose provisions outline the requirements for handling, storing, transportation, treatment, management of the dumpsites and disposal of all wastes categories (Republic of Kenya, 2000).

It places importance on waste reduction through re – using, recovery, cleaner production and segregation of waste at source. It also gives the opportunity for the private sector to invest in different aspects of SWM (NEMA, 2015). This policy framework cover each and every aspect of SWM. Unfortunately the policy framework appears problematic, not effective as expounded by low collection ratio, indiscriminate dumping in illegal dumpsites. Nairobi City County is characterized by piles of rubbish in every open space and along back- streets and roads, and in the informal settlements. The public have limited awareness on the importance of a clean and healthy environment. This has resulted to poor waste management. For instance, at the household level, waste is not segregated nor reuse, reduce and recycling are not practised leading to environmental pollution. Additionally, the individuals are hardly responsible for the waste they generate. This may have led to the current poor state of waste management, compounded by increased solid waste generation (UNEP, 2006; JICA, 2010; NEMA, 2015).

Therefore, the research targeted to an assessment of the effectiveness of the policy framework on solid waste management and its four elements; institutional arrangement, technical, financial and regulatory. It focuses to determine which aspects of the policy framework are problematic and hinders its implementation and effectiveness?

1.3 General Objective

The general objective of the study was an assessment of the effectiveness of the policy framework on solid waste management within institutional, financial, technical and regulatory facets in Nairobi City County.

1.4 Specific Objectives

1. To analyse the existing policy framework on solid waste management and its effectiveness in addressing SWM in NCC.
2. To evaluate the implementation level of the policy framework in solid waste management and its impacts in NCC.
3. To examine the impact of public awareness and environmental ethics on policy framework in SWM in NCC.

1.5 Justification

Population is in the increase in Nairobi County and this has resulted in increased solid waste generation, which will not reduce in the future and this shows the magnitude of the problem. If not addressed through a policy framework, Nairobi City County will be overwhelmed by waste, impacting negatively on public health, the environment, e. g climate change (UNEP, 2006).

Trends indicate that SWM is a great challenge in Nairobi City County and the current policy framework on solid waste management has not effectively address the problem (UNEP, 2006; UN Habitat, 2009). Thus, this reinforces the importance of an effective policy framework on SWM to reverse these challenges geared towards a sustainable SWM system (UNEP and UNITAR, 2013).

Research in an assessment of the effectiveness of the current policy framework on SWM is vital for the Government of Kenya to inform policy for achieving the Sustainable Development Goals number 11 which is meant to make cities inclusive, safe, resilient and sustainable (UNDP, 2016). It will also go a long way to achieving some of the targets for goal number 3 (ensuring healthy lives and promote well-being for all at all ages and goal number 6 (ensuring access to water and sanitation to all (UNEP, 2015). While waste management is addressed in a holistic manner through general policy arrangements on paper, there is need for proper inclusive institutional arrangements, adequate legal framework, and financial resources sustainability, regulatory and reliable technical provisions (Njoroge *et al.*; 2014).

1.6 Scope and Limitations

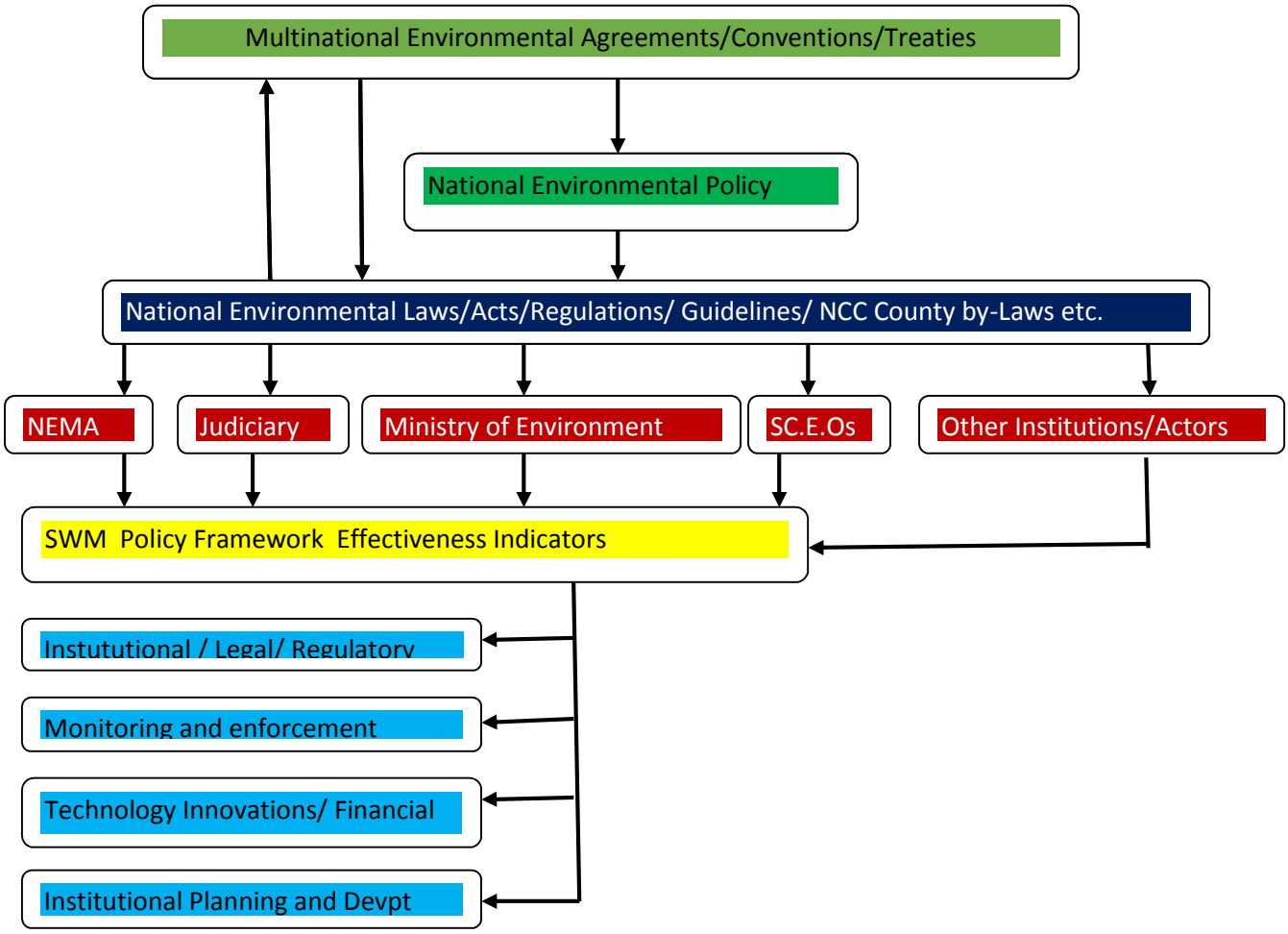
The study focused on the assessment of the effectiveness of the policy framework on Solid Waste management in Nairobi City County and its effectiveness is dependent on the availability of technical capacity, institutional arrangement, financial capacity (budget for SWM) and adequate technology transfer. The findings of the thesis will be replicated to other Counties in Kenya.

The study was limited to three selected households of Nairobi City County categorized into three zones, informal – lower (Kibra), middle (Embakasi) and finally upper (Lavington) due to financial and time constraints and the results may be generalized to other Counties in Kenya.

Research Design

The research is a cross-sectional design which encapsulates both qualitative and quantitative research. The probability sampling was employed in articulating the sample size from the target population. Data was collected through surveys- questionnaires, focus group discussions and key informant interviews as well as a geospatial mapping of locational dumpsites in the study area for the period 2003, 2007, 2103 and 2107.

1.7 Conceptual Framework



Key

– Global policies and Regulations / conventions / agreements on SWM**.**

– Framework for Kenya (policies / regulations on SWM at the National level.

- Components of the framework and guidelines include laws, Acts, regulations, NCC by – laws.

– Actors involved in SWM, NEMA and Ministry of Environment (Regulator), Lead - agencies – NCC – Sub - County Environment Officers, other institutions e. g PSP, GBOs, public.

- SWM Indicators (what entails effectiveness of the policy).

– Performance indicators (management tool). Include institutional and legal arrangement, monitoring and enforcement (Regulatory), technology (technical / SWM infrastructure) and financial sustainability which involve planning and development.

Figure 1.1: conceptual framework, source; Ogutu, 2017).

1.8 Theoretical Framework

1.8.1 Institutional Theory

Institutional theory involves a study of how institutions operate, and it involves Governance structure. It is based on the interaction of the three pillars namely; regulative, normative and cognitive that can either restrict or support the operation of organisations. (Scott, 1995., Zilber 2012).

It is an important framework that gives an explanation for change in organisations, based on the interplay between the three pillars. Regulative deals with policies, legal systems and obligations which include fear, coercion. Normative involves duties and responsibilities, moral obligation and norms. Cognitive have to do with cultural systems, values, beliefs and personal desire (Delbridge and Edwards, 2013)

These pillars determined the behaviour of individuals as they interact in their activities, be it social, economic and political. In relation to SWM, in terms of waste handling, policies are in place, the way the actors respond can influence the management to either success or failure of SWM systems.

This study used Institutional Analysis Development (IAD) framework, linked to institutional theory. The framework provides the correlations among the different components of the institutions. It assisted in organizing analytical and prescriptive capabilities. It contributed in the review of knowledge and created understanding on the institutional past efforts in addressing the identified concerns. The Institutional framework is helpful in the identification of various types of organizations' operational structural variables that differ from one institutional management to

another. The IAD uses multi – tier approach where one element of the framework is to identify focus for action and the most possible result emerging from interaction. The challenge with the IAD is on the voluntary environmental action by different groups and individuals that result into practical responses to environmental concern.

There is paradigm shift, which focuses on the individual actors and replaces with groups thereby NCC as an institution in SWM, has a multi –tier, pillars of the institutions. It encompasses regulative, normative and cultural cognitive, and they all work together thus the effectiveness of SWM systems. All the elements have to be aligned in the policy framework for SWM for a sustainable system (Wilson *et al*; 2015).

1.8.2 Capacity Building Theory

It is a conceptual approach that seeks to improve the performance of work units, departments and the whole organization to achieve its purpose and mission. It refers to capacity building as empowering individuals, communities and institutions to perform functions and solve problems, meant to achieve their development objectives in sustainable manner (UNEP, 2002).

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Inadequate capacity is a barrier to sustainable SWM in many urban centres of sub-Saharan Africa (UNEP, 2002). An effective and sustainable municipal solid waste management systems requires building management capacity from the local authority personnel, key stakeholders, technical, financial and regulatory for operating, maintaining and supervising the process (UNEP, 2002). However, many workers in the SWM including government institutions, private sector, NGOs,

and CBOs, have inadequate technical, regulatory and financial capacities to operate effectively (UNEP, 2002).

Capacity building in form of training, knowledge building and information gathering is vital in developing human resource and institutional capacity at all levels and it is a continuous process. This involved peer to peer training for all the stakeholders who are involved in waste management from waste pickers to government officials in the urban centres to attain sustainable SWM systems (LaFond et al., 2002). Additionally, the global community has recognized the importance of training and capacity building in SWM, for instance SDGs, goal number 17 emphasizes on strengthening human resource and institutional capacities (UNEP and ISWA, 2015).

Capacity building theory helped to define the role of actors who are involved in SWM systems, reflecting the differences of their operation based on their resources, activities and capacities.

1.8.3 Theory of planned Behaviour (TPB)

The theory of planned behaviour is one of the theoretical frameworks often used for predicting and understanding human behaviour (Ajzen, 1991). It has been used widely by previous studies to examine pro environmental behaviour, environmental knowledge and attitude in solid waste management. It describes the relationship between attitude and behaviour (Nigbur.,et al 2010). The theory postulates that the intention to perform a behaviour is guided by three factors; attitude which refers to behavioural belief, an individual's actions of a specific behaviour (is it good or bad thing to do?). Attitude is defined as a "function of salient beliefs at a given point in time" (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). Subjective norm, is a function of normative beliefs,

it's an individual's belief and the behaviour will be judged by others (what do others think l should do?) and lastly perceived behavioural control implies that the individual perceives that they can control the behaviour (can l do it?) (Ajzen, 1991).

This theory is relevant to this study; as it helped to explain the importance of complying with the policies and regulations on solid waste management (policy framework). Positive attitude in solid waste management through education and awareness via inclusivity, participation and involvement of empowering stakeholders through policy structures in place, to care for the environment, resulting to responsible behaviour towards the environment (Ajzen, 1991). When the public adopt the behaviour of complying to the polices in solid waste management, like minimizing waste generation, segregation of waste at source, no littering, among others, this would minimize negative impacts on the environment and human health, is desirable, thus they will have a positive attitude towards the behaviour to do so (Stern, 2000). Therefore, analytical and prescriptive benefits are crucial in empowering the society in complying with environmental laws and policies in solid waste management. It takes a combination of both individual level and environmental policy structures level interventions to achieve changes for a sustainable solid waste management system (Ajzen, 1991; World Bank, 2005a).

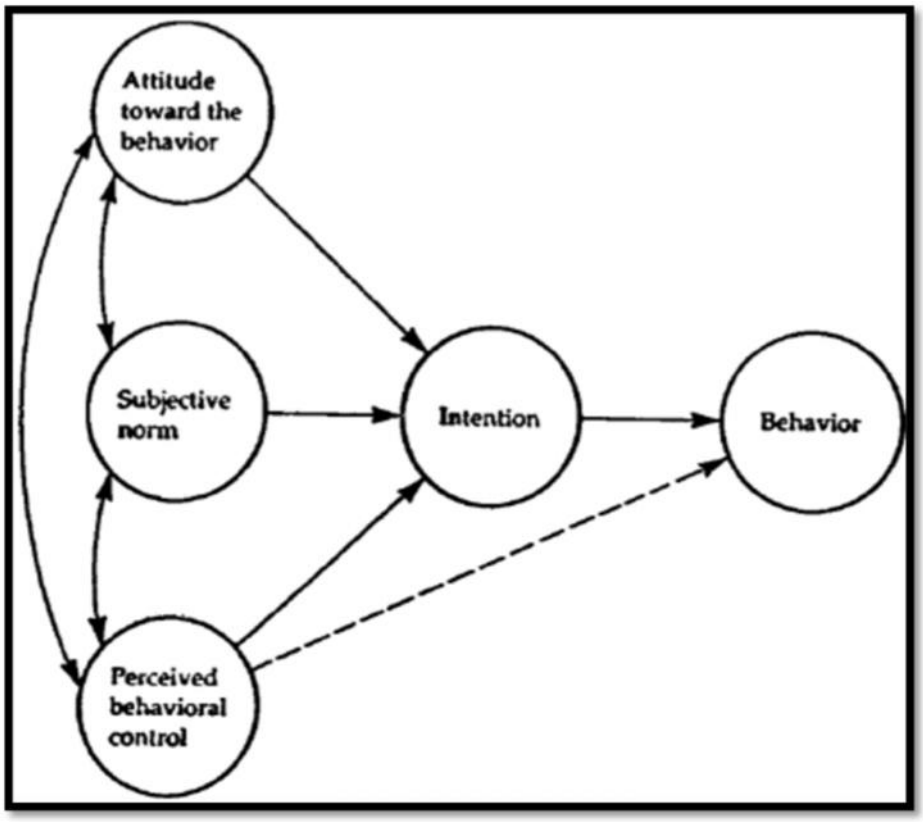

Figure 1.2: Theory of planned Behaviour Model Source: (Ajzen.I. 1991). Organizational Behaviour and Human Decision Processes, 50, P. 179-211.

1.8.4 The Social Ecological Theory (TSET)

The term ecology is derived from biological sciences and refers to the relationship between organisms and their environment, in the field of sociology, psychology, education and health. It focused on the interactions between people and their environment (Urie, 1979).

Pro- environmental behaviour, where the individual do not degrade the environment and comply with environmental policies and regulations, the public have to be motivated and educated to make those choices through collective efforts of all stakeholders including Government structures at local, national and global level (Abila *et al.*; 2013).

SWM is complex and the increased waste generation globally, nationally and locally reflects the magnitude of the problem, to overcome the challenge, socio – ecological theory can be applied through its four components which include; individual (the public), social environment, physical environment and policy environment (Stokols, 1992).

The theory posit that the individual personal factors like beliefs, socio economic status, knowledge, attitudes, beliefs among others can either increase or decrease environmental healthy choices, like proper waste disposal where there is no littering for a clean and healthy environment. Thus policy interventions should include education and awareness programs, in Nairobi County whose context is deplorable (Van Dijk *et al.,* 2007)

Social environment include cultural background, socio economic status of the community, institutions and organisations where the individual interacts which impact on waste management behaviour (Stokols, 1992). Additionally, the policy environments can influence the behaviour of the individual through community education, awareness programs, for instance the culture of most Nairobians of not seeing waste management as a public responsibility, not in my backyard syndrome, thus mushrooming of illegal dumpsites through littering, can be discouraged through such initiatives (Kasozi and Vanblottnitz, , 2010).

Physical environment includes natural and man – made and this is where environmental activities take place in terms of waste management system, infrastructure, and institutions with rules and norms that regulate how human's beings (people / public) interact with the environment. It also involves availability and access to these facilities, which are vital for sustainable waste

management system and this provide opportunities for intervention through Governance structures which should be prioritised before education (awareness programs in the communities, like Nairobi City County (Sallis, *et al.*, 1998).

Policy include legislation, regulatory, financial, environmental polices which impact on solid waste management which is illustrated in the figure 1.3 below (Urie, 1979).

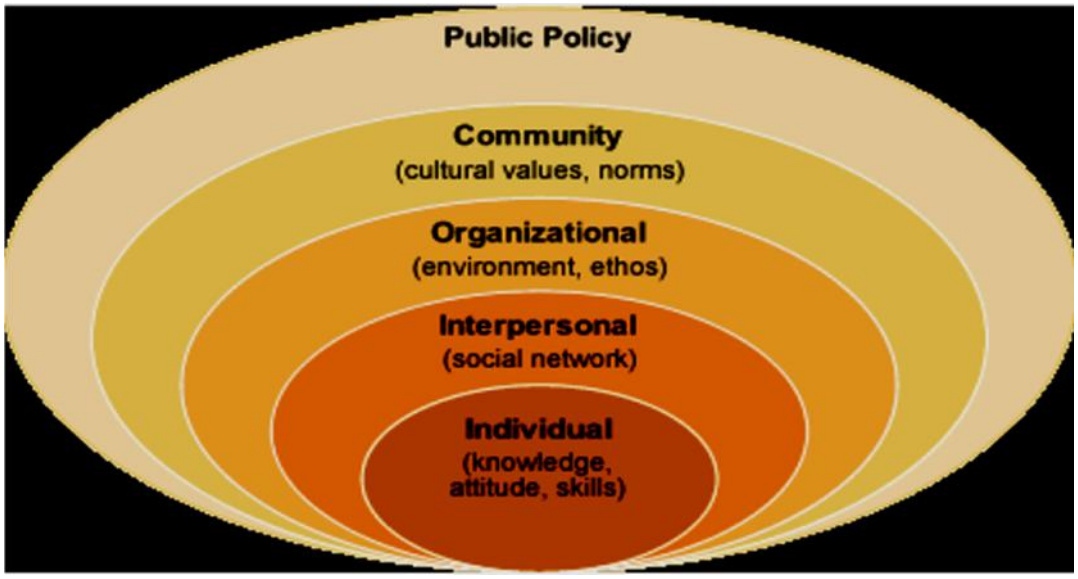

Figure 1.3: Socio – ecological theory model
Source: www.wikispaces.com/weeks+3%264+-+components+social-ecological+models

The theory of planned Behaviour (TPB) and Socio ecological theory, were both used in guiding analysis of human behaviour which is crucial to a sustainable waste management system since people are at the centre of any environmental activities (Urie, 1979).

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Solid Waste Management at Global Level

Globally, Solid waste generation has continued to increase due to rapid population growth, urbanization and other socio-economic aspects like personal income and consumption behaviours (World Bank, 2012). It is estimated that by 2025, waste generation will increase to 2.2 billion tonnes annually (Achankeng, 2003; World Bank, 2012). The per capita generation of waste has increased in the developed countries in the last three decades due to the developed economies that influence various aspects of individuals and the national development agenda that includes expansion of industrial and innovations in manufacturing products (AfDB, 2015). It further indicates that the waste generation in the developing economies is on a rapid increase accelerated by population growth, economic development, and change in the living standards leading to high consumption of resources (Wilson, *et al.*, 2012).

Waste management is one of those areas that are presenting challenges to the environment that requires policy framework which should transcend all the levels, international (global), regional, National and local (World Bank, 2014). Policy framework on SWM is important because it tackles waste problems head on, paving the way for sustainable SWM service. Solid waste management (SWM) refers to the management of the whole cycle of waste generation; from collection, storage, transport, source separation, processing, treatment, recovery and disposal. The objective of SWM is to build sustainability, protect human health and the environment (Medina, 2000; World Bank, 2006; Iyeke and Ohwovoriole, 2011).

Policies at the global scene did not start today and have grown steadily over the years since 1972 United Nations Stockholm conference. During the Stockholm conference, over 300 Multilateral Environmental Agreements (MEAs) were negotiated and the United Nations Environment Programme (UNEP) was established as the global watchdog for the management of environmental issues (UNEP, 2005). Twenty years later, the 1992 Rio de Janeiro Brazil conference (Rio +20) agenda 21 was adopted as the global action plan on sustainable development as the output of the conference, which is part of SWM strategy (UNCED, 1992). It called on countries to develop and enforce comprehensive National and local solid waste management policies, strategies, laws and regulations. This was a response to the challenges presented by unsustainable production and consumption evident in the generation of solid waste globally (UNCED, 1992).

Other treaties and agreements include the Bali Declaration on WM for human health and livelihood which was adopted in the 9th meeting of the conference of the parties (Cop 9) to the Basel convention at Bali, Indonesia (UNFCCC, 2008). It called for sustainable development through waste prevention and minimization and environmentally sound management of waste. In addition, this was reinforced recently when 171 countries signed the Paris agreement (2016) which identifies the concept of **'Zero Waste'** as a top priority in waste management (UN-HABITAT, 2010; UNFCCC, 2016).

Waste management is a problematic area of environmental policy and key public health and environmental concern in urban centres of many developing countries, more so in the capital cities. The public sector in many countries is unable to deliver services effectively, regulation of the private sector is limited and illegal dumping of domestic and industrial waste is a common practice

(Scheinberg, *et al.*, 2010). In industrialized nations, SWM is managed formally at a regional scale and in developing countries, it has been devolved to local governments where a combination of formal and informal actors manage waste. This was meant to improve service delivery which was declining in most developing countries (Van Dijk, 2004; UN-Habitat, 2008). Additionally, sectors dealing with waste management have often received little attention and limited funds from the municipal governments, impacting on service delivery, unlike the developed and industrialized nations, where the sector is given high priority and adequate funding (Jacobi and Besen, 2011)

Developed countries have made good progress in SWM through proactive policies and sound institutions, moved from waste management in a linear economy to integrated and sustainable resource and waste management within a circular economy; increasing recycling rates and stabilizing waste growth (World Bank, 2012). Thus, countries like USA, their policy framework on SWM is a collaborative effort involving all levels of government, federal state and local entities. Studies done in New York City show vast amounts of waste generated daily as 14 million tons (World Bank, 2014). However due to an effective policy framework on solid waste management focusing on reduction initiatives, recycling and composting, organic waste diversion, waste to energy plants and public education on recycling practices, has enable the city to manage its waste (World Bank, 2014; NYC,2014; NYC; 2015)

Studies done in European Union countries (EU), included an assessment of EU waste framework directive provides the legislative framework for waste management, from collection, transportation, recovery and disposal of waste including permitting, landfill directives, registration and inspection requirements (EU, 2010). Emphasis is on encouraging prevention, reduction through the 'waste hierarchy' by focusing on re- use of waste production and improving the quality

of products that can be recycled and reducing its effects. Waste is viewed as a resource of energy among others (EU, 2010).

Studies done in Germany, Denmark, Sweden, Norway and Belgium shows that they have instituted these provisions in their policy framework for SWM which has led to decreased SW, increased separation of waste for recycling to decreased amounts set out for disposal and genuine behavioural change by the public (Burnley, 2007; Gouk., *et al.,* 2015).

2.2 Overview of Solid Waste Management in Sub-Saharan Africa

Environmental problems in urban / cities, are problems that need long-term solution involving planning, resources, capacity and most African nations can hardly afford. Solid waste management is amongst these problems which is a critical problem because it is directly linked with protection of public health, safety and the environment (Njoroge *et al.,* 2014).

There is ineffective solid waste management in most developing countries and challenges of solid waste management in Africa are varied and complex ranging from infrastructure, less political commitment, social, economic resources (poor funding), and organisational, institutional management, regulatory, limited technological and legal (AfDB, 2014). In addition, poor public perception that waste collection is a social welfare service hence the reluctance to pay for waste collection, especially among the urban poor, resulting to under performance of service delivery and poor solid waste system (Okot- Okumu, 2012). Thus weakness in solid waste management scenario is visible in developing countries such as Ghana's Accra, Tema, and Kumasi, Tanzania's - Dar es salaam, Nigeria,s, Lagos, Uganda, s Kampala among others (UNEP, 2005; Ekere, 2009).

In Africa the legal policy and institutional frameworks regarding safe collection and disposal of solid waste are either lacking or inadequate. According to (Gladding, 2002) and (AfDB, 2015), SWM in Sub-Saharan Africa, had no national institutional management and policy frameworks until the early to mid-1980s. The urban authorities in this region were mandated to oversee the solid waste management within their administrative units. Most of the local authorities had no capacity to carry out this mandate. As a result of lack of capacity, the concept of solid waste management was not a priority (Palczynski, 2002).

(Medina, 2000) reported that some few local authorities hired qualified staff for planning and managing the technical experts in carrying out the solid waste disposal approaches. The majority less technical staff in local authorities could not lobby and influence financing of solid waste management. Thus, it has remained poorly financed sector within the local municipal authorities (Henry *et al.*,2006). As a result of ignorance and lack of environmental values and ethics, waste is often dumped along the roads and open fields by residents, leading to accumulation of dumping sites. However, the last two decades have witnessed an increase of awareness on the effects of such poor disposal of solid wastes. Due to increased awareness, some governments begun to establish policies and programmes that contribute to environmental management (AfDB, 2015).

The need to protect the environment has always been a priority of the United Nations (UN). However, the inadequate enforcement of policies and regulatory frameworks on environmental protection on waste management has led to environmental degradation in developing countries (Dawda, *et al.*, 2012). A study done on East African cities by (Palczynski, 2002) reveal that weak

enforcement of the law, lack of community awareness programmes on the issue of SWM, inadequate financial budgets, low political commitment and lack of Government interventions on intermediate methods of waste reduction – re-use, recycling, composting and incineration as reasons for unsustainable solid waste management system in those cities (Okot-Okumu, 2012).

Decentralization and private sector participation in SWM in Sub – Saharan Africa, where non – state actors, NGOs, private sector and community based organizations (CBOs) has been implemented (Gakungu *et al*., 2012). This has increased SW collection levels comparatively to when it was entirely dependent on municipalities. However, (van Dijk, 2006) states that, this is not sufficient, it requires policies and regulations which have to be enforced and performance evaluated. He concludes that, remedy to unsustainable SWM system will depend on the involvement of all stakeholders, their capacities, institutional arrangements and the capacity of the local Governments to monitor performance, regulate and facilitate the SW service delivery (Jacobi and Besen, 2011).

According to (Henry, *et al*., 2006), there is no single comprehensive legislative policy framework in Kenya or institutions entirely instituted to regulate the management of solid waste (SW). The policies (policy framework) relevant to SW are under pieces of legislations and statues such as EMCA 1999, the Local Authority Act cap 265 (1963) and the Water Act 2006, Public Health Act cap 242 and the physical Planning Act among others (Henry, *et al*., 2006) The public Health Act makes provisions for securing and maintaining health, including sanitation and waste, sewers, drainers / refuse pits and forbids accumulation of waste which can impact on people's health. The Local Authority Act gave local authorities the mandate to establish and maintain all SWM services.

Environmental Management and Coordination Act 1999 (EMCA) was constituted as an environmental law. It reinforced the environmental provisions within the sectoral laws (ROK, 1999). It was meant to coordinate all the lead agencies such as Local Authorities; through the standards and enforcement Review committee which issues policies for the handling, of any waste (ROK, 1999). NEMA which was established under EMCA NO 8 of 1999 as the main agent of the Government in the implementation of policies relating to the environment in Kenya, has developed several subsidiary legislation and guidelines on environmental management especially on SWM (UNEP and UN-Habitat, 2007)

Waste Management Regulations (WMRs) of 2006 by NEMA, offer legal provisions to streamline waste management in the Country. All parties handling all kinds of waste in Kenya have to adhere to these laws and the Counties are supposed to be compliant. The framework has designed the whole cycle of solid waste management in the handling of various categories of waste. It has classified different types of waste and identified the most appropriate disposal methods; focusing on waste minimization, cleaner production and segregation of waste at the source. National Solid Waste Management Strategy of 2015 (NSWMS) was meant to promote compliance with WMRs of 2006 within the counties and proposed **Zero waste** strategy and brought in a new approach of looking at waste as a resource that can be harnessed to create employment, wealth and reduce pollution of the environment (JICA, 2010; NEMA, 2014).

Though most of the environmental challenges are linked to waste pollution effect, blocked drainage systems and open landfills creates exposure to public health hazards among the children in the developing nations. Majority of the urban cities lack efficient techniques for collection and therefore not all of the generated waste is collected and disposed of (Mohammad, *et a.*,; 2013).

2.3 Solid Waste Management in Kenya

In Kenya, the Ministry of Environment and Natural Resources have the overall responsibility for SWM. Their responsibilities include; environmental legislation, policy formulation, issuing licenses and permits to waste operators and environmental standards, enforcement, monitoring and evaluation amongst others. Most counties, local authority and devolved units are responsible for waste collection, resource recovery, recycling and disposal within their jurisdiction in Kenya (AfDB, 2015).

Vision 2030 recognises the dysfunctional state of the County Governments in relation to effective SWM. If this may not be established, then there is a possibility to compromise on the environment and people's quality of health. Additionally, Vision 2030 recognises that efficient and sustainable waste management systems are required in Counties for a clean environment if Kenya is to develop into industrialized state by 2030 (GOK, 2006).

Waste management problems in Kenya are varied and complex, especially in Nairobi County, Estimates from World Resource Institute (WRI) shows that collection ratio of solid waste generated is low and the authorities were able to only collect and dispose of 50-60% of their solid waste. Geographically, SWM service is characterised by inequality where the western part of the city is well served by private firms and NCC, and the eastern part is hardly serviced. High income and some middle-income residential areas and commercial areas are well serviced. Low income areas (slums and other unplanned settlements (where 50 – 66% of Nairobi residents live is under serviced and CBOs cater for these areas. In addition, NCC has no engineered landfills and there is

only one official dumpsite at Dandora which is owned and operated by NCC thus waste disposal is done in open dumps with indiscriminate dumping in illegal dumpsites which has adverse environmental impacts (Odero,2012). Additionally, solid waste is not segregated and private waste collectors do not process waste in any way and this affects effective and efficient SWM, reflecting the inadequacies of the policy framework on SWM in Nairobi County (Njoroge, *et al.*, 2014).

Solid waste management in Kenya is bureaucratic and any operational decisions causes a delay because it is done by senior management in the environment departments in many counties, resulting to an inefficient system. The end result is prolonged decision making that affect the simplest responsibility required to be performed. The County engages private waste operators companies through contractual agreements and they have complimented the government's efforts, compliance to the set policies and regulations on solid waste management is challenging, as confirmed in a study by (Kazungu, 2010).

A study by Kasozi and Von Blottnitz, 2010 on SWM in Nairobi found that there were no monitoring mechanisms on the enforcement of the environmental Laws. They emphasized on the need for sanctions and penalties of waste mismanagement. Much as there was monitoring plan for the solid waste disposal, there was no practical implementation of the monitoring and evaluation plan in Nairobi City County (Kasozi and Vanblottnitz, 2010)

2.4 Institutional Framework for Solid Waste Management in Kenya

Institutional frameworks governing SWM includes; The Ministry of Environment and Natural Resources which is in charge of SWM in Kenya. Under the Ministry are the National Environment

Management Authority (NEMA) and the National Environmental Agency Plan (NEAP) that are charged with formulation of environmental policies (Rotich *et al*., 2006). The Ministry was responsible for drafting the Environmental Management Coordination Act (EMCA, 1999). Nairobi City County Government is responsible for solid waste management and this is bestowed on the County Executive Committee Member for Environment, Water, Energy and Natural Resources whose main role is to provide policy direction (NCC, 2015). The day to day operations of SWM is overseen by the Chief Officer for Environment and a section within Environment Department (monitoring, compliance, and enforcement section, whose role is to ensure compliance and enforcement to the set policies and regulations. In addition, the sub-county environment officers deployed in the seventeen sub-counties, enhance the work of the county chief officer for environment (NCC, 2015).

The Ministry of Lands is in charge of urban development. The Ministry of Health has the mandate under the Public Health Act to address all hazards as a result of solid waste disposal. Though the Ministry of Health has no mandate to regulate and manage hospitals' waste, its role is limited to the setting up of new hospital facilities in Kenya. At the County level, the Nairobi City County has the mandate for guiding and enforcing the SWM policy frameworks and by laws in the provision of solid waste management by both private and government efforts (NCC, 2015). Additionally, the Kenya National Cleaner Production Centre (KNCPC), came up with waste management strategy for waste management for NCC geared towards waste minimization and prevention through sustainable consumption and production. The Kenya Institute for Public Policy Research and Analysis (KIPPRA), it's an independent public institute, responsible for conducting research

in environmental issues including solid waste management and gives policy advice to the government and private sector (NEMA, 2015).

Despite the presence of legislative and institutional frameworks governing SWM, there is so much waste as a result of indiscriminate littering and illegal dumpsites, illustrating lack of coordination and enforcement of the various laws (Njoroge, *et al.,* 2014).

2.5 NEMA Action Plan for Solid Waste Management in Kenya

A review of waste management policy landscape by NEMA based on EMCA (1999) amended in 2015). Waste management regulation of 2006 and National solid waste management strategy of 2015 revealed that major urban areas, that is Nairobi, Mombasa, Kisumu, Nakuru, among others; have major challenges in waste management. Collection ratio is low and uncollected waste is disposed of indiscriminately and source segregation of waste not done, source recovery is at 10%, thereby impacting on the environment and public health and the opportunity to turn waste into wealth to promote waste reduction is lost (NEMA, 2016).

The provisions of EMCA, propagate end – of – pipe solution to waste which is disposal oriented. The WMR, 2006, outlines cleaner production principles for sustainable consumption and production to be applied by all stakeholders in the generation of waste. The NSWMS (2015) stipulate Zero waste strategy, waste seen as a resource to be harnessed to create wealth and employment in a clean environment (NEMA, 2015). This is reinforced by the Kenya constitution (2010, article 42) in the bill of rights which gives all citizens a right to a waste free and healthy environment for the benefit of the present and future generations but the responsibility to safeguard

is with the citizens through sustainable waste management (Constitution of Kenya, 2010). To close the gap of unsustainable SWM system, NEMA came up with plan of action provided in the policy brief in 2016, entitled; 'mainstreaming eco – innovation in the waste management Regulations in Kenya.'. This was meant to be a paradigm shift in the way of doing things geared towards adopting sustainable consumption and production, to achieve sustainable waste management systems, thus sustainable development (NEMA, 2015).

2.6 THE CONCEPT OF ECO – INNOVATION.

Eco – innovation means innovation in solid waste management through clean – development mechanism. Mainstreaming eco – innovation in waste management means that policies / regulations should be aligned to sustainable consumption and production (SCP). According to UNEP, 2012, SCP is defined "as holistic approach to minimizing the negative environmental impacts from consumption and production systems while promoting quality of life for all". The Rio+20 summit reiterated that, focus should be placed on sustainable consumption of goods and services in policies formulation within global cities (UNEP, 2012). Thus, a wakeup call on the Counties to exploit the potential of their resources to optimal levels through ecologically innovative systems and practices in the production of goods and services. Eco – innovation intervention is based on three components, technology, environmental and organisational. Thus, the regulated community are responsible for waste management through voluntary environmental programs to be set in the counties by the communities in their enterprises (KNCPC, 2012)

Transition to eco – innovation involves creating awareness on the communities to change their attitude on WM based on life cycle thinking through information dissemination and training in

resource efficiency, cleaner and renewable technologies and industrial symbiosis and Government institutions. Communities should adopt the culture of preventing waste generation at source through cleaner production and industrial symbiosis geared towards a circular economy, Waste is not just waste but a resource with value to create wealth (NEMA, 2016).

2.7 Comparative Studies of Policy Frameworks on Solid Waste Management within Global Cities

The Rio+20 conferences laid down a global policy framework, which is adopted by member states and the key issue was solid waste management which is significant since it is related to public health and the environment (UNDP, 2012). Globally, waste generation has increased with about 4 billion metric tons yearly; as a result of population growth, affluence and improved lifestyles. This calls for efficient management of solid waste as improper management impacts negatively on public health and environment and, degenerates the aesthetic value of a place, among others (Henry *et al*.,2006).

Policy framework is a set of principles, comprising of long – term goals and is used as a basis of making rules, decision making, planning and development of any organizational system that leads to intervention (Gerald, 2002). Policy framework on SWM takes the form of National laws, acts, regulations, strategies and guidelines including regional and international conventions, treaties agreements which are rectified and agreed to by national governments (Gerald , 2002). Legislation involves policies, regulations, acts of parliament which act as an effective instrument for environmental protection, planning, pollution prevention and control (UNEP and ISWA, 2015).

To help our understanding of how legislation and policy are being used in waste management world over, this study discusses a comparison of case studies using major cities. The study goes further to contrast different city frameworks on solid waste management with that of Nairobi.

A comparison of these cities' framework sheds light to why SWM is a key problem globally. The policy framework on solid waste management helps to outline the responsibilities and roles of individual State to implement the policy (UNEP and ISWA, 2015). However, there has been a gap that exists between the policy framework on solid waste management and the implementation, institutional issues and structures, lack of enforcement, lack of environmental values and ethics (empowerment) and legal and regulatory framework (Guerrero, *et al.*, 2013). Comparative analysis of cities drawn from both developed and developing countries elucidate the importance of policy frameworks on SWM as presented below:

2.7.1 Tokyo, Japan

The policy framework on solid waste management for Tokyo city, Japan, is based on two laws; waste management and public cleansing and Resource Utilization promotion.

Waste Management and Public cleansing law (2010) stipulate the following:

- Controls waste generation and that people should manage the waste they generate.
- Set standards for waste management in terms of waste treatment, waste management infrastructure to be used (facilities) and guidelines on waste operators.
- Development of Eco – town which are centres for material circulation.

- Promoting international cooperation in waste management based on the 3R concept with cooperation with the European Union (EU) and UNEP. Tokyo is the benchmark of this concept in Asia Pacific Regions (MOE, 2006, MOE, 2010).

Effective Utilization law, 2003, amended in 2013, aimed at waste reduction and include provisions of recycling containers and packaging, promotion of 3R concept (reduce, reuse and recycle), change in production for easily recyclable materials, sorting waste at the source, food recycling and home appliances. Numerical targets were set which are indicators for assessing performance and are updated regularly. To achieve this, recycling plazas and centres are established throughout Tokyo city and the media is used to disseminate information to enhance the public understanding of the 3R concept (MOE, 2015). Additionally, roles and responsibilities to be played by the consumers, municipalities and manufacturers (producers) in collection and recycling scheme is specified; and the public is encouraged to purchase eco – friendly goods which do not impact negatively on the environment (MOE, 2015a; MOE, 2015b).

Japan's policy framework on solid waste management takes a holistic approach where all stakeholders are brought on board; from the National Government, Local Government, the public and residents (consumers), business operators, the media, NGOs, research institutes, education institutes and Government organisations. Each entity perform its responsibilities aimed at achieving an effective waste management systems (Watanabe, *et al.*, 2015).

The National Government collects information on waste and analyses it, constitute the laws and regulations and National strategies, promotes technological development and provides technical and financial support to municipalities and prefectures (districts). Incentives are given to those

who have attained the targets for the 3R concept, through subsidies, awards and honours (Watanabe *et al.,* 2015). There is cooperation between the National Government and the education sector through promotion of environmental education and 3R concept included in the school curriculum. School going children are taught the concept and the spirit of **mottainai (means not letting things that have value go to waste and using all things as possible),** thus environmental values and ethics is inculcated in them (MOE, 2010).

Prefectures provide technological support to municipalities to effectively perform their responsibilities. They formulate waste management plans and grant licenses for waste disposal facilities and supervise industrial waste in areas under their jurisdiction. They also set emission limits (MOE, 2012).

Municipalities manage municipal waste in their jurisdiction and oversee the development and implementation of waste infrastructure. Municipalities also promote the independent activities of residents, for instance residents' associations, to reduce the quantity of waste generated in their areas (MOE, 2012).

Waste generating business operators are responsible for waste within their businesses and are expected to reduce waste through recycling, for instance industrial waste (MOE, 2012). Businesses are expected by the law to develop products and containers that can be processed as waste and provide the public with information on how to manage them. They are required to outsource waste management operations for effective waste management (ISWA, 2012).

Waste generators (consumers) are required by law to cooperate with the National and Local Governments by using recycled products and appropriate waste disposal methods. They are responsible for the waste they generate and manage it. No indiscriminate littering is allowed and the spirit of mottaini**)** is instilled among the public from childhood and through the education system. This spirit controls the generation of waste and motivate use of technology for reuse, recycling and effective use through energy recovery (Mizoiri, 2012).

The public participation in Japan starts with the Government providing periodic online reports and statistics on waste management. This is aimed at assisting the public to evaluate the real situation of waste generation and disposal and make suggestions for improvement. This has created a high awareness knowledge which is fostered by the policy framework on solid waste management. Thus, the amount of waste sent to landfills has reduced and this has increased the amount of recyclable products, making Tokyo city one of the cleanest cities (Mizoiri, 2012)

In Nairobi County, things are different, the waste generator is expected to be compliant with the policies and regulations on solid waste management, yet he has not been empowered for proper waste disposal, environmental education to create awareness hence the culture of littering indiscriminately (Rotich, *et al.*, 2006).

2.7.2 Beijing City (China)

China is the largest generator of municipal solid waste globally and it has surpassed United States of America by 2005 and it is estimated that by 2030, it will produce over 585 million tons per year of municipal solid waste which is on the upward trend. This situation is accelerated by the rapid

population growth, economic development, industrialization, urbanization and increase in consumption of goods and services, thus China is faced with a serious problem of managing its urban / cities solid waste (Li, *et al.;* 2009 ;Chen, *et al.*; 2010; and Wang, *et al.;* 2013).

Beijing is the capital of China and largest city situated in Northern China and has a population of more than 23 million. The average municipal solid waste generation in big cities in China, including Beijing is about 1.2 – 1.7 kg per capital per day. This is environmentally challenging leading to significant financial burden to the cities budget. Thus to address waste management challenges, China came up with a set of comprehensive policies and regulations (policy framework) on solid waste management (World Bank, 2005a).

The National Government set laws and guidelines for solid waste management for local Governments (cities) to follow and are allowed to domesticate these laws as per their requirements and practices for solid waste management. All stakeholders have to abide to these laws and they include; City Appearance and Environmental Sanitary Management Ordinance of 1992, law on prevention and control of environmental pollution caused by solid waste, 1996, amended in 2005, technical policies on the disposal of domestic waste and prevention of pollution (2000, amended in 2006 and circular economy law 2009. Beijing Municipal Environmental Protection Bureau (Beijing EPB) is responsible for the environmental protection in Beijing; (Bouanini, *et al*., 2013a; 2013b; Lianghu, *et al.*, 2014 and Lin and Yang, 2012).

City Appearance and Environmental Sanitary Management Ordinance of 1992 guides local Governments (municipalities) on solid waste management and sanitation in waste collection,

storage, transfers, disposal and treatment. Law on prevention and control of environmental pollution caused by solid waste, stipulates basic requirements for dumping, cleaning up, collection, waste to energy recovery (combustion), sanitary disposal, landfilling, incineration, transportation and ban on use of plastics, to reduce pollution. It emphasises the 3R concept (reduce, reuse, and recycling (Lianghu, *et al.*, 2014).

Technical policies on the disposal of domestic waste and prevention of pollution is aimed at waste reduction, setting standards (technology) for treatment of municipal waste and promoting eco – design and enhanced principals of 3R and polluter pays principle. Law on hazardous waste and medical waste (catalogue of hazardous waste), sets the standards for building infrastructure for disposal of hazardous and medical wastes and tightened control on imports of foreign waste. It gives the public the right to complain of improper disposal of such waste (Bouanini, 2013).

Circular economy law is meant to establish a circular economy and create a green economy through resource utilization, resource recovery in production, circulation and consumption thereby protecting the environment for sustainable development. It calls on the citizens to embrace the culture of resource conservation are encouraged to use recycled products (SEPA, 2005; SWM, 2010).

The above policy framework for solid waste management for China is comprehensive and geared towards a sustainable system. However, the municipality's lack infrastructural capacity on collection and transfer of waste and final disposal. The facilities for waste management are not adequate to treat and dispose of waste and their lack of knowledge and manpower required for

their operations, ending up with landfills and illegal dumpsites. Public policies on source separation has not worked well. Waste output exceeds its infrastructure capacity which worsened by the ever increasing volumes of waste that Beijing generates (Zhang, *et al.*, 2015)

The waste incinerators which have been built for renewable energy are pollution prone due to the over reliance on coal and is capital intensive. These produce greenhouse gas which impacts on public health and the environment thereby contributing to climate change. There is absence of public awareness and education on the demerits of coal usage by the Government leading to public opposition to waste incineration plants as the public was not involved in the planning stage (Xiao-Yan, *et al.,* 2014 and Zhang, *et al.,* 2010).

Beijing and its outskirts are surrounded by waste and experiences choking smog (chronic pollution) that is compared to "nuclear winter ".In addition, her emissions impact across boundaries and oceans, e. g Japan, Korea and North America. However, waste incineration can reduce the quantities of Municipal Solid waste (MSW) by 90% and incinerate over 1,000 tons per day which can help solve MSW generation. However, the Beijing Government has tried to overcome these challenges through a funding structure and improving technology to reduce high risk factors by developing waste to energy incinerators which has seen growth (Xiao, *et al*., 2007; UN – Habitat, 2010; Sharpiro, 2012; Bouanini, 2013).

The policy framework for solid waste management is hampered by inadequate cash flow and cost recovery through user charges and tipping fees compounded by quantities of waste generated which is a financial burden to municipalities that becomes unsustainable. Legislative arrangements

are complicated and more often than not overlap. For instance mandates between Government agencies, private service providers, National and local Government are not defined, thus coordination becomes a challenge. In addition, rules of engagement with the private sector, both local and international are not transparent especially on non – sustainable subsides and regulatory framework are unclear (IBRD, 2015; Judy Li, 2015).

The law on promoting circular economy has not been successful as guidelines for planning are weak or lacking. Local officials and citizens have not been sanitised through awareness campaign on the importance of recycling and embracing environmental values and ethics and caring for the environment through sustainable consumption. The approach is more of development model than an environmental one, taking a top – down approach of command and control (World Bank, 2017; Zhang, *et al.*, 2015).

2.7.3 Analysis of Solid Waste Management Policies in Tokyo and Beijing

Both cities have several policies designed to address the challenges of waste management brought about by rapid population growth, urbanization and industrialization. In Tokyo, waste management policies focus on public health, pollution control, environmental protection and establishment of a stable material cycle society. This is done through controlling waste generation, use of technology and research in energy recovery, recycling, reducing waste taken to landfills, promotion of 3R concept (reduce, re- use and recycle) and encouraging the use of recycled products by the public which impacting negatively on the environment.

In Beijing, waste management policies focus on control of environmental pollution caused by solid waste, mitigating impacts on public health and sets the requirements for dumping, cleaning up, collection of waste to energy recovery (combustion), incineration and transportation, technology in waste infrastructure, treatment and promoting a circular economy, to address the problem of massive waste generation. This is done through resource utilization and resource recovery in production and consumption and promoting the 3R concept which mitigates public health impacts.

Both policies have similar characteristics but different motives and results. Tokyo has succeeded in creating recycling economy and waste reduction whereby waste taken to landfills has reduced by 70% and there are no illegal dumpsites nor indiscriminate littering and pollution is not a problem. Tokyo's policies promote environmental value and ethics, caring for the environment, which is instilled in people from childhood through the spirit of **mottaini.** Her solid waste infrastructure in terms of waste to energy recovery is of high technology (combustion, incineration) and Japan provides environmental leadership globally and has established sustainable cities. European Union countries (EU) look up to her for waste management solutions and countries in Pacific Asia including China go there to benchmark on waste management. On the other hand, China waste management policies and infrastructure have been overwhelmed by vast generation of waste accelerated by population growth. Her waste infrastructure suffers from poor technology, inadequate cash flow, no effective regulatory and policy instruments and waste minimization and recycling has not taken off well. Most of the recycling is done by private and informal sector (70 %) and recycling rates are low due to insufficient infrastructure and recycling facilities. They are based in the outskirts of Beijing city (Zhang, *et al.*, 2015).

Negative health impacts of waste disposed via energy incinerators results in pollution and emission of greenhouse gases. This leads to cities in China experiencing smog, chronic pollution**.** However, through Government initiatives to improve technology in incineration, combustion and waste to energy, there is growth in the sector and USA benchmarks with Beijing on waste to energy projects. Tokyo solid waste management policy framework has outpaced Beijing, leaving her to catch up. That is where Tokyo was but transformed her policies in waste management and implementation and compliance to all the laws which is mandatory.

For both cities their solid waste management policies have shifted to reusing and recycling of natural resources. However, awareness and education are the main objectives of recycling program which is important to the success of policy implementation in which case Tokyo has performed better than Beijing.

Compared to Nairobi City County SWM system, both cities are ahead, moving towards a circular economy, focusing on reusing and recycling geared towards waste prevention and minimisation of waste which is a valuable resource. SWM is a collective responsibility and public awareness is high. NCC system lack waste minimization, reuse, recycling and composting and its focus on collection and disposal, end – of – pipe solutions. This illustrate why NCC faces serious challenges in SWM and its inability to overcome them (Mwangi, 2011).

2.7.4 Berlin City (Germany)

Germany is a member of the European Union (EU) and EU waste laws are the legal framework for EU member states which are in form of directives and regulations and are adopted and aligned

to the respective member states legislations. Policies for waste management in Germany is at two levels, EU and the federal state.

The policy used for waste management in member states is Waste Framework Directive (WFD) 2008 and waste prevention is given first priority in waste management and is based on the principle of producer responsibility and waste prevention programmes (product responsibility). It specifies wastes in their respective category and regulates their transportation, energy recovery and disposal of waste done in a controlled and treated manner so as not to impact on the environment negatively. Producers and distributors obligated to design materials that minimise waste in production and use with residual materials being recycled or disposed (EU, 2000; Wastler, 2011).

Germany Federal legislation for waste management is the closed – loop waste management Act (2012) which sets waste management measures at the level of European Union Waste Directive law and the focus is on waste prevention and reduction geared towards conservation of natural resources and protection of people and the environment when waste is generated. According to this Act, all waste is to be recycled by 2020 and targets to be met are set; 65% of household and 70% of all construction and demolition wastes respectively. It created a new hierarchy based on a five – level waste priorities, generally meant to deliver the best environmental outcome, starting with prevention, re – use, recycling, other recovery e. g. waste to energy and finally disposal. Rates for recycling are set and a nationwide uniform recycling bin which is mandatory has been introduced (Berlin Senate Department, 2000).

Technical feasibility, economic viability and social impacts are considered and have to be taken into account by all the actors and stakeholders involved in waste management including Government agencies. Priority is placed on re – use of products which is economically and environmentally recommendable than recycling. Thus, producer and distributors roles are vital in this Act and are obligated to design materials which minimise waste in production and use, and residuals materials are disposed or recycled (Germany Federal State, 2015).

Article 13 of the Act (KrWG) sets the waste prevention targets which are evaluated and replaced with new measures, aimed at enhancing waste prevention policies and were enforced by 2013 waste prevention programme (Federal Ministry for Environment Affairs, 2013).

Berlin City is a federal state of Germany and has a population of 4.5 million which has led to increased waste generation, thus proper and effective waste management is vital. The policies and regulations for solid waste management which are aligned with the federal state policies and regulations include the Closed Substance Cycle and Waste Management Act (1999) amended in (2010), waste management strategy (2010 -2020) and Regulations for procurements and the environment (2013)). The Closed Substance Cycle and Waste Management Act, has been enhanced by various ordinances of hazardous waste; the Hazardous Waste Ordinance, the Hazardous waste fees Ordinance, the Problematic waste Ordinance, and the Ordinance on the Exclusion of wastes from Disposal by Public Waste Utilities. It specifies different types of waste, their treatment and disposal which is aimed at reduction in the amounts of waste generated and increased re – use and recycling of waste so as to promote waste disposal that are environmentally compatible and cost effective. (BST, 2010; Nelles, *et al.*, 2016).

Section 5.1 of the closed – loop waste management Act (2012) Land Berlin (city) is responsible for the disposal of the waste generated within the city and compliance to the policies and regulations on solid waste management which is mandatory to all generators of waste in Berlin City, known as; 'duty to surrender' The collection and disposal of waste from private households and from other sources is taken care by the BSR (*Berliner Stadtreinigungsbetriebe*) a statutory body of Land Berlin (Nelles, *et al.*, 2016).

Article 18 of the Berlin Closed Substance Cycle and Waste Management Act gives assessment of the progress Berlin has made in waste prevention and waste recycling and involves waste reports and an audit which is prepared by Berlin senate department on a yearly basis. It consists of details about the nature, quantities, disposal and origins of all types of waste. Thus, provides data for the formulation of waste strategies and waste management plan. (Berlin Senate Department, 2000).

Waste management strategy of (2010 – 2020) has waste management plan which covers all types of waste, from domestic to construction to hazardous and waste treatment plants. Steps taken to plan focuses on development and trends in the waste flow including demographic changes. Has details of the nature, quantity and origins of the waste being generated currently; goals for the prevention, recovery, waste treatment capacity and disposal compliance projected for the next ten years. This information is disseminated to the public through the website and public participation is encouraged. Waste management plan is done on a yearly basis (Jaron and Flaschentrecher, 2012).

Regulations for procurements and the environment (2013) stipulates that all public organizations in Berlin must comply with the demanding criteria for active environmental protection which is embedded in the policies and regulations for solid waste management which is based on modern waste management methods.

Berlin and German in general has made tremendous progress in waste management and the European Union benchmark on its legislation. German is a model state in that field. Berlin became the first German federal state to introduce a model waste separation strategy, with a single recycling bin for light packaging together with similar materials. Consequently, this has impacted on the reduction of waste generated at 65% while recycled waste has increased at the same time. This is as a result of an effective combination of logistical optimization, modernized waste infrastructure, information dissemination, public participation and effective legislation on solid waste management coupled with high environmental standards of compliance. In Berlin, waste is a resource and valuable raw material (Germany Federal State, 2015).

2.7.5 Stockholm City (Sweden)

Sweden is a Scandinavian country and a member of European Union (EU). Key policy decisions and regulations in form of directives and ordinances on solid waste management decided by EU, dictates both National and Local waste governance in Sweden and they include; EU landfill directive (1999), waste framework directive (2008/98/EC), the EU green book on management of bio waste (2008), EU energy and climate policies (2008 – 2020), the Renewable Energy directive (2009) and EU waste hierarchy these are transformed into the respective member states policies, goals and guidelines (Bulkeley, *et al*., 2005; EU, 2010).

Swedish policy framework on solid waste management is based on the Environmental code of 1999, which is made up of integrated environmental legislation to promote sustainable development that ensures that present and future generations are assured of a sound, healthy environment, both at the national and local levels (municipalities). Stockholm is the capital city of Sweden and it falls under the municipalities included in the policies for solid waste management. This code established the Swedish environmental protection Agency (SEPA) and central environmental authority, the two bodies that formulate regulations, general guidelines and regulatory guidance and coordinate environmental policy and protection. They support Government in EU environmental policy and protection. The code also created County Administrative boards (Environment courts) responsible for issuing environmental permits (SEPA, 2000).

The policies and regulations include; landfill tax (2000) landfill ban on burnable waste and organic waste (2002), toxic and resource efficient natural cycles bill (2003) waste management as infrastructure with better planning bill (2002 / 2003), environmental objectives Bill, which include the rules of consideration (2005) waste plan, a strategy for sustainable waste management (2005), tax on incineration bill (2005), Environmental Objectives Bill (2005), Renewable Energy bill (2009) and lastly producer responsibility (SEPA, 2009).

Landfill tax and Landfill ban on burnable waste and organic waste promotes recycling and discourages landfill disposal. Toxic and resource efficient natural cycles are meant to promote energy recovery. Waste management as infrastructure bill stipulates that waste management involves monitoring, evaluation and regional planning based on national waste plan. The bill

created a waste council responsible for the implementation of waste policy. Environmental objectives bill (2005) specify targets for the reduction of municipal waste at 50% of household waste be recycled through material recovery and maximum use of resource from waste to minimise its impact on public health and the environment. Waste plan, a strategy for sustainable waste management contains data on municipality waste, sets measures on waste reduction meant to attain environmental objectives at national and regional levels and outlines future direction of waste management.

Renewable Energy bill involves a process known as waste-to-energy (WTE) where waste that is recycled is used as a resource, converted into electricity, biogas, and bio fertilizer and linked to sustainable consumption. Producer Responsibility (2009), promotes consumer participation and specifies responsibility of generators of waste, aimed at waste reduction and waste producers / generators who bear all costs related to the collection, recycling or disposing of their products (ETC/SCP, 2009).

Swedish Municipal Solid Waste Management (MSW) defined responsibilities for all actors involved and municipalities are obliged to have a waste management plan and are responsible for collection, processing and disposal of household waste. Municipalities may issue local regulations regarding the management of household waste, including fees. Households are meant to comply with municipal waste management regulations by ensuring that they sort their waste and dispose of it at the various available collection points which are maintained by the municipalities. County Administrative boards (Environment courts) do continuous inspection / supervision and monitoring activities to ensure enforcement of legislation and compliance by all stakeholders. (.ETC/SCP, 2009; Avfall Sverige, 2009; 2011).

Stockholm city waste management plan is focused on resource efficiency measures which is linked to the national waste plan and the city's own policy documents, and action plans coupled with high regulatory systems in place and waste hierarchy ingrained into Swedish people's lifestyle. All the actors along the waste management chain have to cooperate and ensure collective responsibility and collaboration between science (research), industry, and the public sector so that waste can be handled more effectively by maximizing value from waste geared towards prevention of impacts on health and environment.

Stockholm has adopted innovative solid waste management for sustainable solid waste management based on modern waste management which includes, recycling based on the waste plan, from waste management to resource efficiency, biogas strategy for Stockholm to increase collection of food waste whereby food waste is recycled into bio gas. A stationary pneumatic refuse collection system where the garbage is transported by air through pipes and compacted in sealed containers, using a vacuum system where it's conveyed to waste collection station. The waste is no longer collected by trucks. This has replaced the old-fashioned refuse room, problems of unpleasant odours is eliminated, multiple waste is handled simultaneously, waste and recyclables are not mixed which minimizes environmental impact such as energy consumption, gaseous emissions littering and reduction of waste volume through increased recycling.

Machine is used to handle waste and has multiple sorting functions which gives optimal sorting at the waste plant. The use of an e-service using a mobile application for the public to make suggestions and report any issue on SWM, for instance Stockholmers can directly on their smart

phone report an overflowing waste bin that needs to be emptied and the response is immediate. Others innovation include the smart bins with built - in technology to pack waste (Big Belly-waste baskets) fitted with solar-powered software, mobile devices and sensors that signals when the bins are about to become full and are supposed to be emptied. The bins are emptied four times a week while regular ones, three times a day which is cost effective and leads to less waste collection and reduced greenhouse gas emissions (SEPA, 2017; ISWA, 2017).

Sweden and the city of Stockholm is a role model on environmental issues across the globe and has excelled in waste prevention and waste management, Swedish recycling revolution has ensured less than 1% of its household waste ends up in the landfill and recycles 99% of its waste by 2018. Of the 4.4 million tons of household waste produced by the nation every year, 2.2 million tons are converted into energy by a process called waste-to-energy (WTE). It imports nearly 800,000 tons of waste from countries like the UK, Norway, Italy, and Ireland to sustain its WTE plants. Waste is a resource, it should not be wasted and therefore Sweden is on its way to achieving zero waste, and sustainable energy by 2020 (Swedish Cleantech, 2018; SEPA, 2018). Stockholm is rated as one of the leading cities in Europe in terms of waste water treatment and solid waste treatment and management, the first European Green city through sustained and successful environmental work (SEPA, 2018).

2.7.6 Analysis of Solid Waste Management Policies in Berlin and Stockholm

For both cities their policies and regulations on solid waste management are derived from European Union directives and the focus is on waste prevention based on the five level waste hierarchy which has been ingrained in the lifestyle of their citizens (SEPA, 2018). Both countries

have developed their policies, goals and guidelines on SMW at the EU level, resulting to high environmental regulatory systems being put in place based on resource efficiency measures and innovative solid waste management for sustainable SWM. All environmental issues are linked to sustainable development, policies and regulations involving all stakeholders in its planning process and implementation, the citizens own the system and thus compliance and enforcement is obvious. More recycling of waste and maximum value is derived from waste and desired effects are achieved (Swedish Cleantech, 2018).

Both countries have adopted a circular economy and waste management systems through their policies are sustainable, infrastructure is in place and more funding for waste projects and waste management is given priority. Both countries are champions in environmental management of solid waste and are role models globally, mentoring other countries to help them improve solid waste management.

2.7.7 Cape Town, South Africa

South Africa Constitution (1996), amended 2000, is the framework law on environment in South Africa and all policies on solid waste management are based on it. It gives right to everyone to a safe and healthy environment where one has a right to access waste collection, removal and cleaning services (DEAT, 2008). The main policy on solid waste management legislation, which are aligned with the council by – laws of South Africa cities is the National Environmental management Act (1998, amended 2000, 2008, and 2010) and the National waste management Bill (2007). It specifies production, consumption and waste generation cycle in terms of “cleaner production “and “sustainable consumption “, polluter pay principle and extended producer responsibility (EPR) (DEAT,2008).

This law is inclusive and it involves the participation, cooperation and efforts of manufacturers, producers and consumers of goods. Additionally, this law is reinforced by the national waste summit (2001), Polokwane Declaration signed and adopted by three stakeholders; the state (Government), business community and citizens. The objective is to reduce waste generation and disposal geared towards achieving zero waste by 2022. These laws focuses on waste management legislation (DEAT, 2008; 2010).

Other laws on solid waste management of the city of Cape Town include; the local Government Municipal structures and systems Act (1998, amended in 2000 MSA, 2000), the white paper on integrated pollution and waste management for South Africa (2000), Western Cape Health Bill, 2003, the local Government Municipal Finance Management Act (2003), Hazardous waste management policy (2005), Municipal service partnerships Act, 2005 (MSPSA), Illegal – dumping by – law, 2006 (Unicity by – law), National Framework for municipal Indigent policies (2006), National standards for waste information system law (WIS), tariff policy (2006), tariff policy (2006), National standards for waste information system law (2006) and National waste management strategy (NWMS, 1999).

The local Government municipal structures and systems Act is a five year strategic plan and includes the city's integrated Development plan (IDP) which involves projects and planning in waste management. Defined roles, responsibilities and services offered by the municipal of Cape Town are meant to be financially sustainable, accessible and equitable. The IDP promotes coordination between local, provincial and National Government.

The white paper on integrated pollution and waste management, stipulates measures of controlling pollution and waste minimisation. Western Cape Health Bill, defines responsibilities and regulations of health care waste management. The local Government Municipal Finance Management Act provides financial management of waste management infrastructure and their roles and responsibilities are specified. Hazardous waste management policy defines what is hazardous waste and sets regulation on how to manage it.

Municipal service partnerships Act gives guidelines on public private partnership (PPP) a partnership of the council with other stakeholders in solid waste management, include CBOs, NGOs, private businesses, communities and schools. They support national or provincial initiatives in solid waste management and the public must comply with all statues and codes of practice to discourage illegal practice. The sub – councils assist the council by monitoring the outcomes of service delivery and report any shortcomings to service departments for corrective action. Illegal – dumping by – law, makes it an offence to reduce waste or disposing by littering or dumping illegally (Lisa, 2010).

National Framework for municipal indigent policies, stipulates that waste management services to informal settlements is free and involves door-to-door waste collection per dwelling. Waste is separated at source. In case of space restrictions, it is deposited at a designated area approved by the municipal council of Cape Town. However, for formal settlements, private contractors provide waste management services, which are paid for by the residents. The private contractors have to

be approved by the council and registered on the council database. Tariff policy sets tariff charges for all waste management service providers by the council (Lisa, 2010).

National waste management strategy is based on waste minimisation and prevention and on the integrated waste management system (IWMS) and includes the Principles of prevention – before – waste generation, waste separation, streaming and diversion. The City of Cape Town has adopted the waste management hierarchy which is based on the integrated waste management system with focus is on waste minimisation and prevention (IWMP, 2015).

National standards for waste information system law is related to provincial waste information system of the city of Cape Town. All stakeholders involved in waste management are bound by this law. It is mandatory to provide data to the council on their waste management activities on a daily basis and includes waste disposal records, categories of waste for disposal at landfill site, transportation, equipment / infrastructure at waste disposal (transfer stations) and recycling among others. These reports are released on a monthly basis and solid waste management of the council and the IT and communication departments are responsible for the content. The data is accessible to the public.

The policies on solid waste management of Cape Town promotes environmental values and ethics, where awareness and education campaigns, referred to as waste wise campaigns are conducted and information on waste diversion, minimisation, recycling and waste management initiatives through avoidance, recycling and composting are disseminated. Communities are educated on environmental health to accept ownership and accountability on waste management in their places

of residence so that each generator or producer is responsible for waste minimization. The consumers are called to change their behavioural patterns by avoiding and reducing waste through littering or dumping waste indiscriminatingly.

The council has also partnered with the Western Cape education department and the principles of IWMP are included in the curriculum and all school going children are taught about the policies on solid waste management making it effective. This can be explained by the fact that the City of Cape Town is one of the cleanest cities in Africa as there is no littering or indiscriminate dumping of waste in the streets (CCT, IWMP, 2015)

2.7.8 Lagos, Nigeria

Lagos is a megacity, highly industrialized and the commercial hub of Nigeria which contributes 50% to 70% of the GDP to the Nigeria federal state. Lagos city is the fastest growing city in the world, with a population estimate of about 21 million and one of the largest generators of solid waste in Africa (Population Census Commission, 2015). This high population growth accelerates unsustainable waste generation rate which requires policy framework on solid waste management meant to protect the environment, public health and aesthetic landscape (UN-Habitat, 2014).

The constitution of the Federal Republic of Nigeria section (11, 20) of 1999 lays the legal framework for environmental management in Nigeria including solid waste management and the state is mandated to protect, improve the environment and safeguard water, air, land and forests. Policies and regulations for solid waste management are aligned to the constitution and they include; Edit Law (1977, 1979), Lagos Waste Management Authority Law (1991), Lagos State

Environmental Protection Agency Law (1996, 2000), Lagos Public Private Partnership Law (1997,2004) and Lagos State Environmental Sanitation Law (2000) (Ladan, 2015).

The Edit Law came into being in 1977 and its objective was to solve the problems of waste management brought by oil boom (industrialization). After enactment Lagos State Refuse Disposal Board (LSRDB), changed name to Lagos State Waste Disposal Board (LSWDB) which is responsible for solid waste management and includes collection and disposal of all types of waste (Lagos state Government, 1980).

Lagos Waste Management Authority (LSWMA), changed its name in 2007 to Lagos Waste Management Authority (LAWMA) and it's the environmental watchdog for Lagos state. It is responsible for collection, transportation, disposal of all types of waste and delivery of waste management services to the residents, public schools and establishments. It works together with the private sector through the public private partnership (PPPs). The monitoring, enforcement and compliance units monitor the state of the environment and ensures that there is enforcement of the policies and all stakeholders are compliant to these policies (Lagos state, 2010).

Lagos State Environmental Protection Agency Law (LASEPA) was created by law to be the regulatory agency of the state whose docket is protection of the environment and ensuring proper management of solid waste so that it does not impact on the environment negatively. LASEPA works closely with other state agencies; LAWMA, Ministry of Environment, Ministry of Water and Ministry of Health. Lagos Public Private Partnership (PPP) law allowed the private sector to

get into solid waste management activities to fill the gap of LAWMA capacity and infrastructure (LASEPA, 2014).

Lagos State Environmental Sanitation Law stipulates specific regulations on the entire solid waste management system from storage, collection, segregation and disposal, waste service fee, how to handle the waste and actors involved including waste transporters. The law forbids indiscriminate littering of any waste in public places, street or open land and waste to be disposed in designated waste disposal sites. In addition, there is community work which involves compulsory cleaning of the environment for three hours carried out every last Saturday of the month and movement of the residents and vehicles is restricted except for essential duties. Heavy penalties for non-compliance and Environmental Sanitation Corps (policemen) assist the State in the implementation of these provisions (Abiodun, 2009).

Despite a number of policies and regulations on solid waste management in Lagos State, only 20 – 30% of waste is collected. LAWMA as a regulator, enforcement and compliant Authority is ineffective. PPPs are inefficient and ineffective, cannot cope with the massive generation of waste which is compounded by ever increasing population, a great burden for Lagos State. This is worsened by funding limitation for implementation of integrated waste management system (3Rs), inadequate waste infrastructure, unsustainable policies and laws punitive in nature which do not give human face and institutional. (Lagos state Government, 2014; Taiwo, 2015).

Compliance to waste regulations law is a challenge as overflowing waste bins, overloaded collection trucks, compactor trucks are left on the streets for weeks. 60% of residents relay on cart

– pushers to collect their waste who end up disposing it into water channels and open spaces. Residents are reluctant to pay for the services and their attitude to waste disposal is wanting with majority disposing it in the streets, open spaces, canals and water bodies leading to ground water pollution and floods. Lagos city is littered with waste, UN – Habitat described it, “as dirty, unsanitary and aesthetically displeasing City “(UN – Habitat, 2015; Stella, 2014).

The Lagos state realised the gaps in the policies framework for solid waste management and in 2016, enacted the Environmental Management and Protection Bill, which came into force in 2017 September, where all existing laws were harmonised. The Law is meant to overhaul the SWM sector and develop an efficient system in line with standards of international best practices; sustainable, cleaner and healthier environment. To roll out this task, Lagos state government partner with visions cape, an international group of companies to provide solid waste management services with LAWMA being the regulator. (LAWMA, 2017; Bertram, *et al.*, 2017; UN-Habitat, 2014).

The bill established Cleaner Lagos initiative (CLI), meant to address the challenges of SWM in relation to air pollution, unsafe water, improper WM and upgrading the WM infrastructure, and addressing climate change. It was also meant to Promote Integrated WM system (3Rs) (reducing, recovering, recycling) and discourage public littering and improper disposal. Lagos State Environmental Trust Fund (LSETF) was to take care of expenditures in SWM and property owners were to pay Public utilities Levy (PUL). Lagos Environmental Sanitation Corps (LAGESC) were to help the city enforce regulations.

The informal sector was to be institutionalised and residents be involved in the enterprises of recycling through recycling banks where recyclables are disposed (LAWMA, 2017; Vanguard media, 2017; Guardian Newspaper, 2017). This is what Nairobi City County needs, an overhaul of solid waste management sector and harmonising all the existing regulations on SWM into one law, since they are not effective because enforcing them is a challenge and the public are reluctant to comply. This is evident by their behaviour of littering indiscriminately and tolerance to live in a dirty environment. This new law on solid waste management visualises Lagos state to become the greenest city in Africa by 2029 and reduce the vast generation of waste geared towards achieving zero waste (Stella, 2014).

2.7.9 Kigali Rwanda

The city of Kigali environmental laws are aligned to the policy and regulatory frameworks stipulated in Rwanda's Constitution (2003) and the National Environmental Policy and Vision 2020. Rwanda's Constitution (2003, amended 2014), lays out the legal framework for environmental protection at all levels from national to local and it is the National Environmental policy. It stipulates that every citizen is entitled to a healthy and adequate environment and has a responsibility to promote and protect it. Rwanda constitution and the city of Kigali has the following laws on solid waste management: Organic Law (2005), Vision 2020, the National Water and Sanitation Policy (2010) and City of Kigali Development Plan (2013- 2018) (GOR, 2000; REMA, 2005).

Organic Law on the Environment (2005) provides the modalities of protection, conservation and promoting a healthy environment. This involves; public participation in environmental issues, how to handle all types of waste, Environmental Education and sensitization at all levels for the entire population in waste management based on the principle of information dissemination and community sensitization in conservation and protection of the environment. The focus is on prevention strategies / programs and not rehabilitation, sustainable consumption and production for present and future generations. Littering is forbidden with punitive provisions for non – compliance. Additionally, the law defines the duties of state, decentralised entities, the public, and private sector in waste management and there are incentives for environmentalist, e. g tax reduction. The National Fund of the Environment in Rwanda (FONERWA) was established in the city of Kigali and is responsible for financial management of solid waste management (GOR, 2005; MINELA, 2005).

Vision 2020 (2002 – 2020), lays down the agenda and policies for the country's development which include waste management. According to vision 2020, at least 80% of Rwandan population in both urban and rural areas should have sufficient sewage and solid waste disposal systems so as to achieve equity and urban and rural areas are expected to mobilise adequate investment for sewerage and disposal systems (GOR, 2000).

The National Water and Sanitation Policy, focuses on solid waste management and institutional sector framework, supports the master plan for Kigali city and involves waste minimisation and waste as a resource, an intergraded waste management system to be adopted by the city of Kigali for sustainable management, upgrading and improving existing dumpsites, Private sector participation in solid waste management in terms of infrastructure and financial management, ban on plastics bags and penalties for those who break the law, the principle of cooperation by local authorities, international institutions, private and public sectors, all are expected to protect the environment at all times.

Additionally, checks and balances for efficiency and accountability in financial management of both urban and rural infrastructure development for solid waste. Protection of water resources not to be polluted by waste and promoting safe collection of waste, reuse and recycling systems was also ensured (GOR, 2010; REMA, 2013).

City of Kigali Development plan reinforces the environmental management, in terms of implementation and enforcement of environmental regulations for effective pollution management. The plan provides structure for coordination, monitoring and evaluation between all

decentralised entities in waste management. Database is established which includes detailed management of information system (MIS) on solid waste management which is updated regularly and accessible to the public and waste to power as a minimisation strategy for waste generation is promoted. (REMA, 2010; ADB, 2012).

All the development policies, planning and their operations at the national and provincial / district levels including full participation of the public are aligned to the environment and there is strong political will and Government support. Policies on solid waste management are drawn from aspects of Rwandan culture and traditional practices, which inculcate into the people environmental values and ethics, caring for the environment and has been translated into sustainable development programs. For instance**, umuganda** (community work) is carried out every Saturday of each month where every Rwandan participates in cleaning of the environment, is mandatory and clearing waste of the cities like Kigali is presided by the president, Paul Kagame. In 2016, he won a reward from UNEP for outstanding leadership in fighting climate change and driving national environmental action in waste management among others. Kigali city is very clean and free from any indiscriminate littering, it's a model city for solid waste management (Rwandapedia, 2014; UN – Habitat, 2016).

Nairobi City County needs to benchmark in Rwanda to help her improve her SWM system which is dysfunctional and not effective. SWM is a public responsibility in Rwanda and compliance to the set policies is mandatory unlike NCC where the public look at SWM as the responsibility of the Nairobi City County. Public education programs like that of Rwanda should be introduced and

the political class give support to such initiatives. This may impact positively for better SWM system (Ogutu, 2017).

2.7.10 Kenyan case studies: Kiambu County

Kiambu County is among 47 counties in Kenya and is made up of twelve (12) sub-counties which include; Limuru, Kikuyu, Kabete Lari, Gatundu South, Gatundu North, Githunguri, Kiambu, Kiambaa, Ruiru, Juja and Thika Town. Kiambu County is faced with high population growth and industrialization which accelerates waste generation and this has become a challenge, just like any other urban areas in developing countries. To address this challenge, the county government has come up with policies and regulations in form of Bills and Acts aligned to the Kenyan Constitution (2010) and EMCA (1999, amended 2015) which provides every citizen a right to live in a clean and conducive environment and the responsibility to maintain and safeguard it is placed on the citizens of Kenya (GOK, 2000; 2010).

The Water, Environment and Natural Resources Department is responsible for Solid Waste Management, Water and Natural Resources which makes up the three sub – sectors. The Directorate of Environment in collaboration with the county assembly formulate policies related to environment, solid waste management, issuing of licenses for waste transporters and environmental protection and awareness campaigns. The policies and bills include; Kiambu County Water and Sanitation Bill, 2015, County Fiscal Strategy Paper (CFSP), 2014, Policy Document on Recycling and Re – use (SWM) 2015 and Kiambu County Community and Neighbourhood Associations Promotion of Participation and Engagement Bill, 2016.

Kiambu county water and sanitation bill, 2015 aim at protecting water sources not to be polluted by waste, improving sanitation services and solid waste management for sustainable development in a clean and secure environment and regulate illegal dumping of waste. The CFSP gives guidelines on strategies to be adopted on how to overcome the challenges paused by solid waste management in the county. Policy document on recycling and re – use, 2015 stipulates on how to reduce solid waste generated and emphasis is on the people to adopt the 3R concept of reduce, re – use, and recycle and avoid improper disposal of municipal solid waste, which impact on the environment and public health negatively. Kiambu County Community and Neighbourhood Associations Promotion of Participation and Engagement Bill, 2016, this bill stipulates that waste management is a collective responsibility and involves cooperation between the community and County Government in service delivery and all the stakeholders in solid waste management and public participation which is enshrined in the Kenya constitution, 2010. The community participates in solid waste management in terms of compliance to policies, Acts / Bills since they are the beneficiary and thus owned it so it becomes sustainable. Additionally, there is promotion of public education on environmental values and ethics and education on waste reduction through the 3R concept, addressing negative impacts brought by unlawful practices of improper waste disposal (GOK, 2000, 2010).

Kiambu County under the department of Water, Environment and Natural Resources is the first in Kenya and in Africa, to have a system of handling solid waste management in a proper way. The county has established a semi-aerobic land fill, in partnership with UN-HABITAT at the former Kangoki dumping site, in Thika town, modelled on the Japanese Fukuoka University's technology application on solid and liquid waste management. The objective is to have modern

methods of disposing waste that will reduce fire outbreaks, insects, rodents, bad odour, global warming and increase the aesthetic value of the land, waste reduction and composting and recycling methods. Its efficiency is high, is able to manage 70-100 tonnes of waste daily which is cost effective, increases waste decomposition and cause reduction in methane emissions. Collection rate has increased from 25% to 75% (a leachate treatment system) (CGK, 2015; JICA, 2015).

The project is supported by UN-Habitat through a joint collaboration with the County Government of Kiambu, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Embassy of Sweden and Japan's Fukuoka University (Lands Ministry, Housing and Urban Development, 2015; GGK, 2015).

The County has adopted a proactive approach to the challenge of dumping, through this project. This will turn around the situation, the first of its type in Africa which is essential in environmental education, to educate communities on the impact of illegal dumping, thus Kiambu County Government's aims at providing an effective and efficient waste management service and systems. Kiambu county Government is used for bench marking and even Nairobi County goes there to benchmark on how they can improve waste management in the county (Lands Ministry, Housing and Urban Development, 2015; GGK, 2015)

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2.7.11 Kenya Perspective: Nairobi City County and Kiambu County

Nairobi is the capital city of Kenya and the largest city with a population of 4 million brought about by urbanization (rural – urban migration) economic development and industrialization and this has resulted to increased solid waste generation which is a big challenge for the County Government to manage. The first policy in environmental management is Environmental Management Coordination Act (EMCA, 1999, amended 2015) which was enacted as a framework law in Kenya for waste generation and management. The Act stipulates procedures, standards and guidelines to regulate the management of solid waste and categorised waste, hazardous and non-hazardous waste, domestic (municipality), industrial, hospital waste among others geared towards its efficient management. Under the act, responsibility for the storage, treatment and collection of hospital, industrial and hazardous wastes will be the generator and other solid waste will be dealt with by the local / county governments (GOK, 2000).

The Act established the National Environmental Management Authority (NEMA) in 2002 and works with lead agencies, local authorities and their selected agents and all of them are subordinate to NEMA. Other regulations include the solid waste regulations of 2006 which issues specific regulations on SWM system, from collection, segregation and disposal, how to handle the waste in their specific categories and the actors involved, generators and transporters (NEMA, 2010).

The National SWM strategy of 2015 stipulates ZERO WASTE PRINCIPLE and calls on stakeholders to improve waste management, looking at waste as a resource that can create employment and wealth and reduce pollution of the environment (NEMA, 2015).

The constitution of Kenya (2010) has devolved the SWM to the 47 counties through the County Government Act of 2012 which provides a framework for the counties and their county assemblies to formulate policies / regulations / acts in the management of solid waste in the respective counties (GOK, 2010). Thus Nairobi County has come up with laws / policies which include; NCC integrated SWM plan (2010 – 2020) which envision a healthy, safe, secure and sustainable SWM system and NCC SWM Act of 2016 (Government printers, 2015; NCC, 2015 ; Tilahun, *et al.*, 2016., 2017).

The NCC SWM Act 2015 provides a legal framework for the implementation of the county integrated solid waste plan encourages public participation and regulates the participation of the various actors in SWM in the county. NCC delivers its SWM services through the Department of Environment (DOE) in collaboration with private service providers. It categorises different types of waste from household, industrial, construction, biomedical, hazardous and non-hazardous and junk waste. It stipulates that SWM is a collective responsibility amongst all actors and stakeholders and every person is entitled to clean and healthy environment but has a duty to safeguard and enhance the quality of the environment. It has guideline to promote recovery of waste materials, through reduction, re – use, recycling and composting of waste by the various actors in SWM and applying cleaner production principles to minimise waste.

The County is zoned and the private service providers are expected to operate within their zone and it is an offence to go contrary to this. Additionally, generators of waste are expected to separate waste into various categories, organic, plastic, metal among others. Littering is an offence and waste transporters are expected to operate with a licence and their vehicles meet the set operational

guidelines and no scattering of waste in the streets. Litter coded bins green (organic), blue (plastics and papers) and brown (any other waste) are to be provided by NCC in public streets. It is an offence to destroy the litter bins or dispose waste outside the bins. Operators of waste treatment facilities like incinerators, recycling facility and composting must operate with a licence. Non-compliant to the Act is an offence with a fine of ksh 300,000 or six months imprisonment (Ngau and Kahiu, 2009; NCC, 2015).

Funding for waste done through executive committee in charge of finance, mandated to impose environmental levy to the generators of waste. NCC is responsible for waste disposal facilities and disposal sites which should conform to international recognised standards, have to be demarcated and fenced and no animals are allowed, those found are destroyed. There is only one dumpsite for the whole county, Dandora dumpsite where waste is taken (NCC, 2000).

NCC coordinates and supervise all activities in relation to waste management including private service providers and all the stakeholders. Despite the policies for solid waste management being in place and with increased solid waste generation at 2,475 tons of waste being produced each day, NCC cannot cope leading to uncollected waste which is disposed in unplanned dumpsites.

Coordination is a challenge amongst the SWM actors. There are over 150 private sector waste operators independently involved in various aspects of waste management whose activities are not controlled. NCC has not effectively regulated them and this is compounded by lack of enforcement of laws and regulations. The city has not prioritized SWM but due to inadequate infrastructure, insufficient funding, lack of environmental values and ethics and public awareness on proper SW

disposal coupled with the un-managed Dandora dumpsite and uncollected wastes make solid waste management in the County very challenging (Ngau and Kahiu, 2009; NCC, 2015).

The low- and middle-income areas have dysfunctional SWM services while in the high income areas, private waste collection companies collect the waste and residents pay for the services without really knowing where the waste will end up. Uncollected solid waste is one of Nairobi's most visible environmental problems which impacts on public health and accelerates climate change. In addition, enforcement on the treatment facilities is inadequate and pollutes the environment (Njoroge, *et al.*, 2014; NEMA, 2015).

2.7.12 A Critique on the Existing Policy Framework on Solid Waste Management Based on the Principles of Environmental Law in Nairobi City County

Environmental law refers to a collection of rules, laws and regulations, provisions from constitutions, agreements, statues and common law, controls how People interact with their environment. The laws may regulate activities which results to pollution such as fossil fuel emissions, dumping of wastes and the use of natural resources. The objective is to protect the environment (Okidi, *et al.*, 2001, Mark, 2008).

Kenya policies and Regulations on solid waste management (policy frameworks) are based on the principals of environmental law meant to protect the threshold of sustainable development in which development process is integrated with environmental protection. Sustainable development, "is that development which meets the needs of the present generation without compromising the ability of future generations in their needs by maintaining the carrying capacity of the supporting

ecosystems." (UN, 2010). This analysis is meant to give a critique of the existing policies and regulations on SWM (policy framework) based on the principles of environmental law in Kenya, mirroring NCC.

The Environmental Management and Coordination Act (1999), an act of parliament that established the legal and institutional framework for environmental management and governance in Kenya; and its provisions have captured the principles of sustainable development which includes:

(a) The public participation principle

(b) The principles of intergenerational and intra-generational equity.

(c) The polluter pays principle.

(d) The precautionary principle / prevention principle.

The principle of public participation stipulates that in the formulation of policies, regulations, strategies and plans for environmental management, the public should be involved in the decision making, which is important for local level development and compliance. In addition, the public should be provided with the information and made aware that their views and values were taken into account before enactment of any policy. This principle, in the context of solid waste management policies and regulations, hardly takes place. More often than not, they are not aware of the existing policies and this was confirmed by the researcher in her focus group discussion with the CBOs at Kibra and waste pickers at the dumpsite. From what is happening on the ground, there is so much waste and people litter indiscriminately on the streets from moving public vehicles to water sources. Nairobi and Ngong rivers are polluted with so much waste while unaware of the negative impacts it has on public health and the environment and yet according to waste

management Regulations of 2006, is an offence to do so. The household / public do not segregate waste from the source, the concept of waste minimization and prevention is an illusion this is contrary to the solid waste management strategy of 2015 and no wonder solid waste management in Nairobi County is a big challenge. However, with the devolved Government, decision making are taken at the county level and public participation is being enhanced but still more effort is required (GOK, 2000; UN – Habitat, 2011).

In the principles of intergenerational and intra-generational equity, intergenerational equity means sustainable use of resources, integration of environmental protection into development process to ensure that the use and conservation of the natural resources is maintained and enhanced for the benefit of future generations. On the other hand, Intra – generational equity means sharing of resources equitably among people and entitlement to a clean and healthy environment. In the context of solid waste management, the principles suggests equitable access to waste management services for all people in Nairobi County. On paper they are good principles, in practice it's not working effectively. Waste management services in Nairobi County is a spatially skewed service provision. The upper and middle class are well served, their collection coverage is high because they engage the services of private service providers whom they can afford to pay. On the other hand, informal settlements in lower class areas cannot afford to pay for such services and the CBOs who have filled the gap lack capacity and financial resources. This is compounded by increased solid waste generation, inaccessibility of those areas and waste is hardly collected which has serious consequences on their health and the environment (JICA, 2010; Kazungu, 2010).

The polluter pays principle states that those who cause or generate pollution be responsible for the cost. ln the solid waste management context it means that those who generate waste should bear the cost of managing it so that it does not impact negatively on human health and the environment. This principle in relation to Nairobi County where majority of the people look at waste as a problem which leads to the culture of littering and poor waste disposal practices. This is accelerated by lack of public awareness on waste handling which causes lack of empowerment on environmental values and ethics brought about by NCC institutions in charge of solid waste management who have not empowered the public (NCC Environment, water and energy department, 2016; Njoroge, *et al.,* 2014).

The precautionary principle / prevention principle involves internalisation of environmental externalities and integration of environmental protection into the development process. This principle means being good stewards of the environment which is an illusion to people in Nairobi County. However, some NGOs, private sector and Christian organisations in collaboration with NCC, have made some efforts to conduct public awareness on solid waste management, organising clean ups and sensitising the public on the importance of caring for their environment and the advantage of living in a clean and healthy environment (NCC, 2015).

The Kenya Constitution (2010) embraced the principles of environmental law, Article 42 which states that "every person has a right to a clean and healthy environment." and Article 2 of the fourth schedule, states that the County Governments shall be responsible for refuse removal, refuse dumps, and solid waste removal. In the context of solid waste management, the County is mandated to ensure that waste collection areas are zoned, regular collection of all solid wastes, and

waste collection facilities such as skips, bulk containers and waste cubicles are regularly emptied, to ensure the residents enjoy a clean and healthy environment.

However, this is not the case from reviewed literature as collection ratio is low, there are no clear designated zones or facilities for waste collection which are only available in central business district (town centre) resulting to rampant dumping of waste along the roads and rivers. In the informal settlements of Kibra, Mathare and others people are living with waste. In the backyards of the city such as River road, Tom Mboya Street among others wastes are strewn everywhere. This is exacerbated by the public attitude towards waste management and culture of improper waste handling through indiscriminate littering, yet the same constitution placed the responsibility on the public to help in protecting the environment. (GOK, 2010; NEMA, 2015; TISA, 2016)

2.7.13 Summary and Research Gaps

Review of literature has established that there is disconnect between the policy framework for solid waste management and its implementation and enforcement structures and the institutions involved.

A study by AfDB, 2015 on the existing arrangements for SWM in Kenya, established that the existing regulatory frameworks on SWM are inadequate and found in various Legislative Acts and the Nairobi County Government bylaws. It further affirmed that in all the legislations, there is none which specifically addresses the County solid waste alone. It further found that the existing legislations and regulation arrangements are limited in setting and defining operational standards and conditions addressing SWM in the specific county (Rotich *et al.,* 2006). For example, there

is no guidance available on the national government's regulations regarding treating, transporting and disposal of the solid waste with best practice in management and landfills. In addition, County Government Acts and by – laws are traditional in nature, disposal oriented, not consistent with WMRs of 2006 which is prevention oriented (Gakungu, *et al.*, 2012).

According to a study done by Etengeneng (2012) in South Africa, it found that existing governance arrangements for waste disposal doesn't necessarily lead to the implementation. There is need for monitoring framework with action points to improve in the entire management system of solid waste (UNEP and UN Habitat, 20007). A study on the impact of rapid population growth in Nairobi's waste management, found that despite the increase in population, the Nairobi City County government has not yet increased the sewerage infrastructure (Rotich *et al.,* 2006).

Karanja (2005) did a study on solid waste collectors for private sector service providers, community-based organizations and the City County. It was based on the expenses met by these actors in terms of waste collected per month. It revealed that there was inconsistency in records. He also established that there was no monitoring mechanism on the amount of solid waste collected per service provider and the details of solid waste collection areas.

Several studies on the East African cities found that the existing laws on WM are not being effectively enforced; (Liyala, 2011; Okot – Okumu and Nyenje; 2011; Oberlin, 2011). In addition, Muniafu, *et al.,* 2010, in a study for SWM in NCC, reported that policies on waste management are poorly coordinated; an alignment between the regulations and by laws and what is practised on the ground is different. A study by Oyake-Ombis (2012) on managing plastic waste in urban

Kenya, found that SWM system has no framework of engagement with informal WM actors and that their activities remain on the periphery of mainstream SWM.

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Karanja 2005 in a study on SWM in Nairobi on institutional arrangements, actors and contribution to sustainable development. Found out that there was lack of a regulatory framework, monitoring and enforcement of laws on collection, transportation and disposal activities of waste companies which are inadequate and attributable to weak enforcement of NCC by – laws.

The EMCA Act of 1999 by articulates the need for coordinated effort in the environmental management. Under the Act, the responsibility for collection of all the solid waste is with the source (EMCA, 1999). On the other hand, the disposal of the collected solid waste is the responsibility of the devolved unit of governance. The existing Laws are not adhered to and as a result there is absence of systematic approach to industrial and hospital hazardous waste disposals which are normally mixed with the local governance devolved unit wastes in the waste collecting bins across open places and along the roads in Nairobi (Kazungu, 2010). This leads to all types of waste being disposed of in the same way where some of the wastes are normally buried without following appropriate measures. The Law should include sanctions for those who break the Law on solid waste management (NEMA, 2015). Currently, there are sanctions on those that don't follow the existing regulations, this is done by the environment, monitoring compliance and enforcement unit of NCC which may have a challenge in enforcement (NCC, 2015). In view of the literature reviewed, the main question is; whereas the policy framework for solid waste management is in place, why is it not achieving the desired results, that is a clean and waste free Nairobi City County? This thesis set out to investigate this question.

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CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter dealt with the research methodology used in the study as guided by research objectives which included the presentation of the theoretical, analytical and statistical methods of the study. The chapter covered research design, area of study, data types and sources, data collection, target population and sample size, data collection instruments, data collection procedure which included satellite image data acquisition, data analysis and finally presentation of data.

3.2 Study Design

The study used descriptive research and purposive sampling designs. Descriptive research design was used because it is a case study of NCC. Descriptive research design is a field research whereby a researcher goes to the population of interest to ask certain issues about the problem being investigated. The objective of using descriptive design was to gather data and have no manipulation of the research context and no control over the variables. This type of research design deals with naturally occurring phenomena (Mugenda, 2008; Creswell, 2013).

Pole and Lampard (2002) notes that in research, the gathering of knowledge is aimed at enhancing the knowledge that follows two paradigms of qualitative and quantitative approaches. The study topic had broad outlook overlapping various academic disciplines from the applied social sciences field. The data generated from the overlapping discipline varied from general descriptive information common with human subject investigation to finite statistical data. For these two

different kinds of data generated, the study used both qualitative and quantitative approaches. The study also used Concurrent Transformative Mode (CTM), suitable for mixed study design and enables the Researcher to examine phenomena on a series of different levels in order to explain the results (Creswell, 2013).

Purposive sampling was used to collect data on the spatial extent of illegal dumping sites. This data was generated from high resolution satellite images of 2003, 2007, 2013 and 2017. The satellite images covering the identified dumping sites were selected based on their spatial resolution characteristics and their spatial coverage. Purposive sampling was used to enable extraction of data capturing illegal dumping sites on time series context for change detection analysis.

3.3 Area of Study

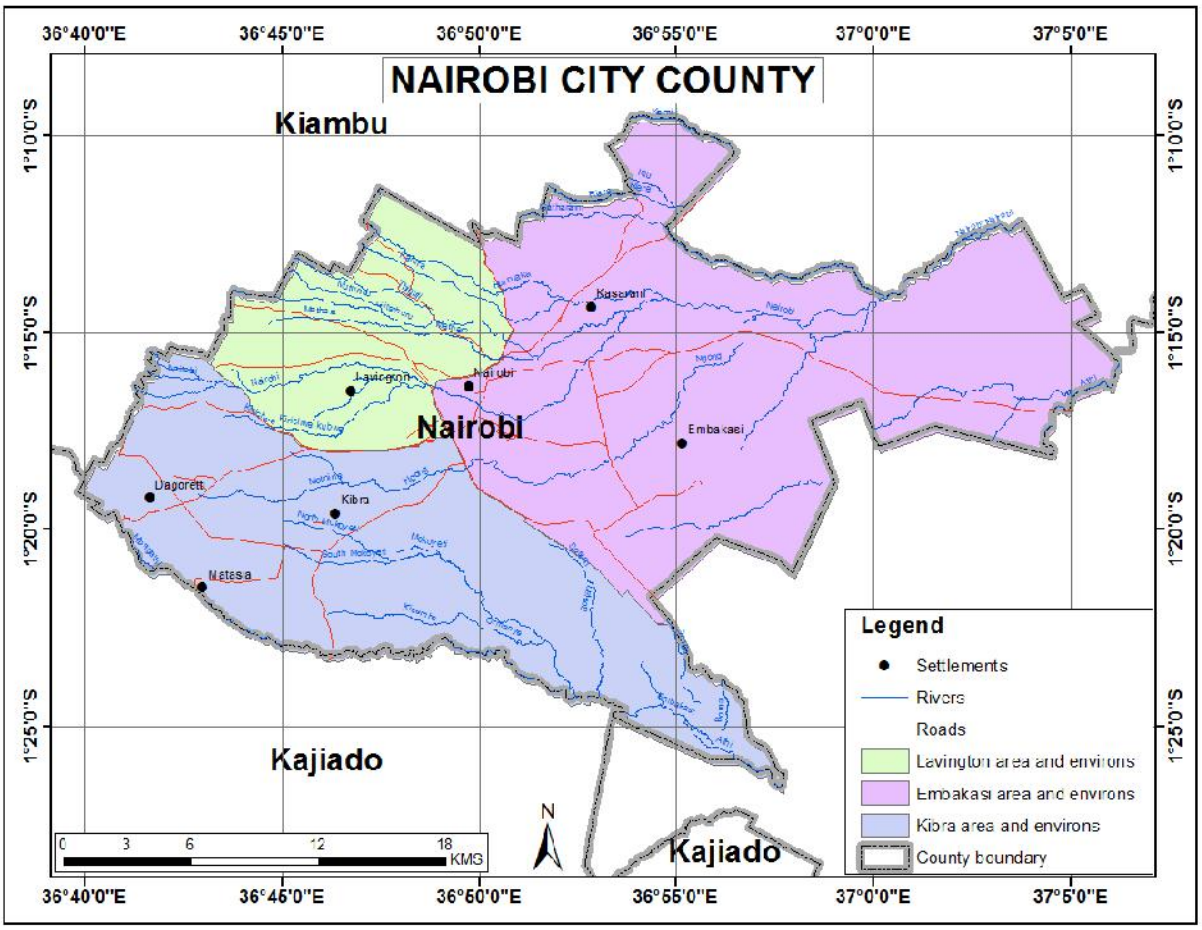

Figure 3.1: Nairobi City County (data source: Survey of Kenya)

Nairobi City County is the capital of the Republic of Kenya, the largest administrative, commercial and industrial Centre. The city lies between 36.60o and 37.10 East and 1.10o and 1.40o South on the River Athi basin in the southern part of the country. It is bordered by Kiambu County to the North, Machakos and Kiambu Counties to the East, Kajiado and Machakos Counties to the South

and Kiambu and Kajiado Counties to the West *(Fig 3.1)*. It covers an area of 695.1 km2 and has an elevation of 1,795 meters (5,889 feet) above sea level. It has a moderate climate with warm, wet and cold seasons. Wet seasons are in March to May, and October to December with moderate rainfall of 500 – 800mm. Warm seasons between January to March and September to October. Cold seasons are in June to August. December and February. In March, April and May (Gaisma, 2007, Nairobi Metro, 2008).

The city is globally connected and an important destination, regionally and locally and has been ranked as the 80th most visited city in the world. Is an established hub for business, culture, education and a global cuisine hub, with many hotels of different culture towering the landscape. It is the only city in the world with a National Park within the city. Multi-National Corporations such as; world class technology and research e. g Google, Cisco, Intel, IBM among others, have regional headquarters in Nairobi. UN presence in Nairobi through the headquarters of UNEP and UN - HABITAT which are global watchdog institutions in environmental matters. The city also hosts the African headquarters for the World Bank and International Monetary fund (IMF).

Government ministries who formulate laws on environmental management are based in Nairobi and include NEMA and Ministry of Environment and Natural Resources. Nairobi warrants protection environmentally in SWM so as to regain its lost glory as it was once referred to as the Green City in the sun (Nairobi Metro, 2008).

3.4 Data Types and Sources

The data used in this study were both primary and secondary types. Primary data was collected mainly by the use of structured questionnaires using a mobile based georeferenced data management system called KMacho. This involved initial coding of the questionnaire for uploading into the system for data collection. Data was then collected using mobile phones installed with the application. This allowed for taking the GPS coordinates, photos and description of the data collection points (Kmacho.co.ke).

For structured questionnaires there was interview schedules which involved key informant interview and focus group discussion (FGD) to elicit in – depth information about SWM in NCC. The focus group discussions were conducted amongst three groups; the community at the dumpsite (waste pickers), students at the University of Nairobi and service providers at the informal settlement in Kibra, community based organisation (CBOs). The questions in the questionnaire were in line with the study objectives as well as the research questions. The questionnaire had two sections. The first section sought to obtain general information or bio data of the respondents. The second part was devoted to the research questions. Secondary data was collected through literature review from both print and electronic sources. The study used visual presentation through taking relevant photographs of SW in NCC.

For policy consumers (household), institutions of higher learning, hotels and key SWM stakeholders, Stratified Random sampling was used because all members of a group have an equal and independent chance of being selected. The samples were obtained from the three different stratums (residential areas) within Nairobi City County; low income (informal settlement), middle

income group and high income zone that is Kibra, Embakasi and Lavington respectively. They were randomly selected. However, to minimise biasness of data, a systematic random sampling of households within the estates was done and the subject units would either be male or female household heads (RMLA, 2014).

Handled GPS receiver were also used on dumping sites. GPS points collected from the ground were achieved through visiting the locations of dumping sites and recording their ground coordinates in handheld GPS units. The digital camera was used to take photographs of all the dumping sites that were covered in the study. Internet was used for downloading high resolution satellite images from the supplier's website for identification of the relevant images.

Secondary data were collected from existing high resolution QuickBird images of 2003 and 2007, and WorldView-2 images of 2013 and 2017, both supplied by Digital Globe. These images were selected on the basis of their spatial resolution and cloud cover percentage. QuickBird image has 4 multispectral bands of 2.4m spatial resolution and 1 panchromatic band of 60cm spatial resolution. The multispectral bands are pan-sharpened based on the panchromatic band resulting to all bands with 60cm resolution that is pixel size of 60cm both in length and width. WorldView-2 image has 8 multispectral bands of 1.8m spatial resolution and 1 panchromatic band of 50cm spatial resolution. The multispectral bands are pan-sharpened based on the panchromatic band resulting to all bands with 50cm resolution, that is pixel size of 50cm both in length and width The selected images had a cloud cover percentage of less than 10 per cent. Other secondary data used were Nairobi County boundary shapefile, Kenya rivers shapefile, Kenya roads shapefile and Kenya settlements shapefile both of them from Survey of Kenya databases.

3.5 Data Collection

3.5.1 Field Reconnaissance

Field reconnaissance was carried out to record and collect data on the exact ground locations of some of the illegal dumping sites in Nairobi County. This data was collected by visiting the dumping sites and recording their ground coordinates in a handheld GPS unit. Ground coordinates of two hundred and seventy seven illegal dumping sites were collected and photographs of the sites taken. A list of the illegal dumping sites visited is as shown in figures3.2, 3.3 .3.4 and 3.5

3.5.2 Target Population and Sample Size

The target population used in this study was of two types. The first type was that for providing information on policy makers, policy consumers, learning institutions, dumpsite operators and other key stakeholders in solid waste management. The second type was that for providing information on the locations and changes in spatial coverage of the dumping sites. This second type was comprising of very high resolution satellite images that were used for capturing information on the spatial extent of the dumping sites. These images were composed of those acquired from 2003 to 2017. The 2003-2017 image acquisition period was chosen because very high resolution satellite images that are suitable for dumping sites spatial analysis were only available from 2003 (Groves, *et al.*, 2010).

The sample size for the first type of target population constituted of policy consumers selected from low residential area (Kibra), middle (Embakasi) and upper (Lavington Green) (consumers of policy), hotels; small (food kiosk) medium (restaurant) and big such as Serena, institutions such as UON, KTTC and JKUAT and those who operate the Dandora dumpsite. Policy makers (policy

community) that included; Ministry of Environment and Natural resources, National Environment Management Authority (NEMA), Ministry of industrialization, Devolution, Kenya water Resources Management Authority (WRMA) and the Ministry of Public Health. Otherwise the Nairobi City County-Ministry of Environment, United Nations Environmental Programme (UNEP) office in Nairobi and business community that include key stakeholders in SWM, waste operators / handlers – private service providers in Nairobi.

The sample size for the second type of target population constituted of four very high resolution satellite image acquired in 2003, 2007, 2013 and 2017. These images were supposed to have a uniform interval between them but slightly varied due to lack of cloud free images in some years.

Sample size calculation using Fishers Formulae (Sin-Ho Jung, 2014).

n= (Z^2 p (1-p))/e^2

Z is the value of corresponding confident intervals (1.96) i. e 95%

P = Estimated Proportion of the sample which is 0.5.

E is the margin error (0.05)

0.5x0.5=0.25

0.05x0.05 = 0025\ 0.25= 100

1.96 x 1.96= 3.8416

3.8416x100 = 38416

Sample size is 385 respondents.

n1 = (n (1+n/N))

N is the total population of the respondents.

n is the standard sample size.

n1 is the desired sample

n1 =385/1.00154

=384.408

385

Table 3.1: Population Distribution of the study Area. (IEBC, 2013).

Location (sub – counties).	Population	Sample	%
Kibera (low income, informal settlement).	250,000.	207	53.84
Embakasi (middle class).	137,000	114	29.51
Lavington (upper class).	77,334.	64	16.65
Total	464,334	385	100

Source: Ogutu, 2017.

3.5.3 Data Collection Instruments

Data collection involved use of different instruments. Primary data was collected mainly by the use of structured questionnaires *(Appendix 3)*, handheld GPS receiver, a digital camera and internet. For structured questionnaires there were interview schedules which involved key informant interviews and focus group discussions (FGDs) that elicited in – depth information about SWM in NCC. The questions in the questionnaire were in line with the study objectives as well as the research questions. The questionnaire had two sections. The first section was for obtaining general information or bio data of the respondents. The second part was devoted to the research questions.

Handheld GPS receiver was used to record the exact geographical locations of the different dumping sites that were subsequently used in helping to identify the corresponding dumping sites locations on the very high resolution satellite images. The digital camera was used to take photographs of all the dumping sites that were covered in the study.

The study used visual presentation through taking relevant photographs of SW in NCC. For policy consumers (households), institutions of higher learning, hotels and key SWM stakeholders, random sampling was used because all members of a group had an equal and independent chance of being selected.

Secondary data was collected through literature review for both print and electronics sources. Internet was used for downloading very high resolution satellite images from the image supplier's website. It was also used in accessing some of the literature review.

3.5.4 Data Collection Procedure

3.5.4.1 GPS Location Points Acquisition

The dumping sites that were covered in the study were visited, this covered the entire seventeen Sub-Counties which was done through transect walk and the coordinates of their exact geographical locations recorded in the handheld GPS receiver. Photographs of all dumping sites were also taken using a digital camera. The dumping sites geographical locations that were recorded in the handheld GPS receiver were downloaded to a computer and used to locate the positions of illegal dumping sites on the satellite images.

3.5.4.2 Satellite Image Data Acquisition

The shapefile of Nairobi City County was uploaded on the Digital Globe satellite image website for identification of the area of study. All satellite images covering the area of study that were acquired between 2001 and 2017 were screened for suitability based on cloud cover and time interval between successive images. Images of 2003, 2007, 2013 and 2017 were found to have a cloud cover of less than 10 per cent which is acceptable in satellite image analysis. They were, therefore, downloaded to be used in the analysis of illegal dumping sites in Nairobi.

3.5.4.3 Other Spatial Data Acquisition

Other spatial data were acquired from already existing databases and they included Nairobi City County boundary, rivers, roads and settlements shapefiles. These were formally requested from Survey of Kenya that is the authorised custodian. These other spatial data were used in preparation of illegal dumping sites maps.

3.6 Data Processing

The collected data sets were processed before interpretation and analysis. They were checked for accuracy, consistency in spatial resolution and completeness in coverage. The downloaded very high resolution satellite images were in a projected coordinate system of UTM Zone 36 South while the GPS collected dumping sites points were in geographic coordinate system. The GPS points were therefore projected to the same coordinate system as the satellite images before they were overlaid for identification of illegal dumping sites. This projecting was done using a GIS software.

Very high resolution satellite images were geo-rectified to remove the shift that usually occurs for satellite images acquired at different times as a result of variation of sensor flight height during image capture. This was meant to ensure that shifts between different images do not affect comparison of spatial extent of dumping sites on different images. The Quick Bird and WorldView-2 images used in the analysis had spatial resolutions of 60cm and 50cm respectively. They were processed to the same spatial resolution level before they were used in the analysis. WorldView-2 images were resampled from 50 cm resolution to 60 cm resolution to enable comparison with Quick Bird images.

3.7 Data Analysis

The collected data was checked for its consistency, accuracy and the level of completeness and the information was coded. The analysis of the coded data was done through descriptive statistics of frequency, cross tabulation, chi – square and standard deviations and percentages. This is because the data was descriptive. In addition, content analysis was also used.

The very high resolution satellite data were analysed spatially to capture both the extent and the area covered by the dumping sites on different satellite image data sets. This was captured using object based satellite image interpretation and it involved on-screen digitization of areas covered by the dumping sites. The on-screen digitization depicted the difference in spatial coverage of the dumping sites in 2003, 2007, 2013 and 2017. The GPS points collected from the field were overlaid on the satellite images to identify the locations of illegal dumping sites. The spatial extents of the

dumping sites on the different images were captured by digitizing polygons around the dumping sites. For instance, *Figures 3.2, 3.3, 3.4* and *3.5* show an illegal dumping site in Ngomongo.

Figure 3.2: Ngomong dumping site in 2003 (Data source Digital Globe)

Figure 3.3: Ngomongo Dumping site in 2007 (Data source: Digital Globe).

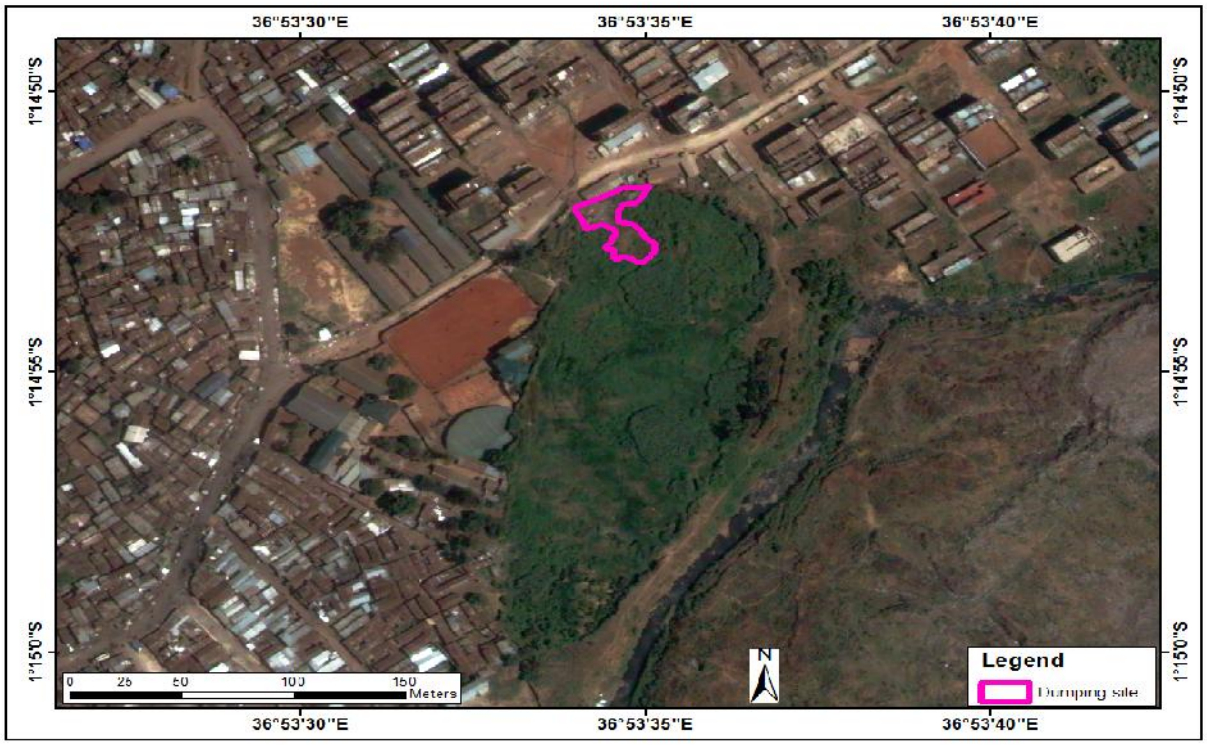

Figure 3.4: Ngomongo Dumping site in 2013 (source: Digital Globe).

Figure 3.5: Ngomongo Dumping site in 2017 (Source: Digital Globe).

CHAPTER FOUR

FACTORS AFFECTING THE USE OF ENVIRONMENTAL VALUES AND ETHICS IN SOLID WASTE MANAGEMENT IN NAIROBI COUNTY

(International Journal of Environment and Health 1 (1) (Ogutu, F.A., Kimata, D. and Kweyu, R (2018)

4.1 Abstract

The Kenyan 2010 constitution guarantees clean and healthy environment which seems to be threatened daily by the increased solid waste generation and mushrooming of dumpsites. This has been contributed by people's negative attitude towards waste management, which is a common habit in developing countries; resulting to illegal dumping and littering of waste in open spaces, drains and gutters thereby impacting negatively on the environment and human health. However, environmental governance in Kenya still lacks enforcement and empowerment at institutional and citizen levels to deal with solid waste management efficiently. This study sought to identify the factors that affect the use of environmental ethics and values in solid waste management. The research adopted a survey research design, the sample size included 385 household members from three main stratum namely: Kibera; Embakasi and Lavington. The data collection tool was a questionnaire. Stratified sampling procedure was used to arrive at the sample. Data collected using the questionnaires was fed in statistical package of social science (SPSS) version 20, coded, analysed and summarized using tables and figures. The results showed the main factors that affected the use of Environmental Values and Ethics in Solid Waste Management in Nairobi City included: lack of proper enforcement of environmental values, ethics and structures of Solid Waste Management; lack of empowerment of environmental values, ethics and structures of Solid Waste Management and poor implementation of environmental values and ethics structures in Solid

Waste Management. This study recommends that for there to be effective enforcement, empowerment and proper implementation of Environmental Solid Waste Management ethics and values, collective responsibility by stakeholders and inclusion of citizens is central.

Keywords: Environmental management, Solid waste management, Sustainable solid waste management, Environmental values, Environmental ethics.

4.2 Introduction

Globalization and solid waste management have two main linkages, and these linkages do not only influence and determine the variation of waste management practices such as the protection or promotion of the interests of consumers leading to reduction of the movements of hazardous waste between nations and worldwide spread of recycling. The other linkage is the waste management practices that affect the way globalization progresses like waste trafficking and establishment of global waste recycling markets. These practices are common because both main and recovered resources, supply the fuel for economic globalization, but also because social and policy responses to global environmental challenges constrain and influence the context in which globalization happen.

Waste generation in urban cities and municipal solid waste management is an environmental challenge globally especially in developing countries including Africa. Aspects of urban waste management are characterized by: inefficient collection methods; poor transportation infrastructure; insufficient financial resources; storage and treatment; lack of environmental values and ethics; inappropriate technology; Institutional structures and challenges in implementation and enforcement of waste policy regulations. This situation is accelerated by the rise of mismanaged

and unplanned towns and cities where large numbers of people who reside in relatively small areas in pursuit of livelihoods make waste disposal problematic. Consequently, unsustainable waste management systems is a major problem that urban planning managers have to deal with (Shaiful and Mansoor, 2003).

Solid waste is defined as any material which comes from domestic, commercial and industrial sources arising from human activities; which people have no value and regard it as useless. All forms of waste constitute municipal, biomedical, domestic or industrial if not treated and disposed of carefully are a threat to the health of people as well as the environment. If current trends continue, the world may see a fivefold increase in waste generation by the year 2025, and there is urgent need to inculcate environmental values and ethics in solid waste management in urban cities setup (World Bank, 2015). The main objective of the study is to investigate that Environmental ethics, values and legal policy structures affect solid waste management in Nairobi County. Most institutions and basically the entire population of Nairobi indicated that these effects have contributed so much in escalating the management of solid waste. Solid waste management in cities like Nairobi has been a great challenge due to a number of interrelated factors. This study intended to examine the factors affecting the use of environmental values and ethics in solid waste management in the context of Nairobi City, Kenya.

4.3 Methodology

The study adopted a survey research design. This design was considered more efficient since it has a high level of general capability in representing a large population. It is convenient data collection method; has good statistical significance and provides precise results (Mitchell and Jolley, 2012).

The sample size in this study included 385 households. The sample was determined using stratified sampling procedure. The samples were obtained from the three different stratums (residential areas): One representing an urban informal settlement (Kibra); middle income setting (Embakasi) and high income setting (Lavington).

The data collection tool was a structured questionnaire. It focused on identifying the factors that affect the use of Environmental Values and Ethics in Solid Waste Management among the residents of the three selected Nairobi residential areas (Adogu, *et al.*, 2015). The questionnaire also sought to identify the respondent's perceptions with regards to their understanding of the different grasp on sound environmental values and ethics as functioned in solid waste management in Nairobi City County. Data was then collected using mobile phones installed with the application. Household heads from each selected residential areas were considered for this study. The collected data were analyzed with the help of a statistical application, namely SPSS version 20. The findings were reported using frequencies and percentage. Figures were used to summarize the findings.

4.4 Results

4.4.1 Factors Affecting the Use of Environmental Values and Ethics in SWM

The study sought to establish the factors affecting the use of environmental values, ethics and structures of Solid Waste Management. Figure 1 shows the distribution of the responses on the factors affecting the use of environmental values, ethics and legal structures in SWM.

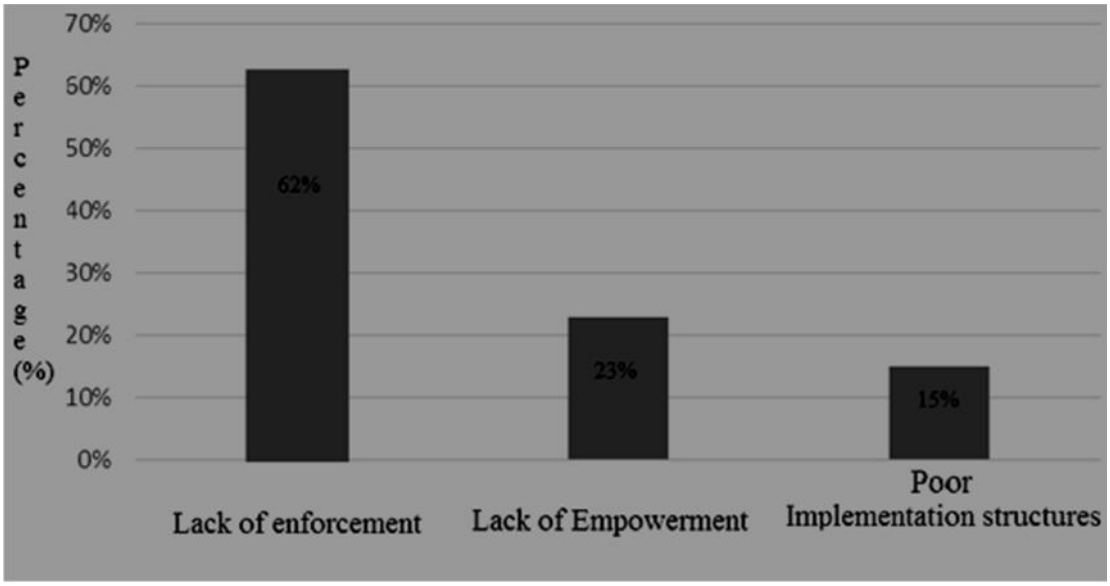

Figure 4.1: Factors affecting the use of ethics and values in solid waste management

Nearly two-thirds (62%) of the respondents indicated that lack of enforcement affected the use of environmental values and ethics and in Solid Waste Management. The other 23% of the respondents showed that lack of empowerment was the main factor affecting the use of environmental values and ethics and in Solid Waste Management. The rest (15%) indicated that poor law, policy and regulations implementation structures affected the use of environmental values and ethics and in Solid Waste Management.

4.4.2 Benefits of Implementing Environmental Values, Ethics and Legal Structures in SWM

The study was interested in finding out the benefits of implementing Environmental Values, Ethics and legal structures of Solid Waste Management. Figure 2 shows the responses.

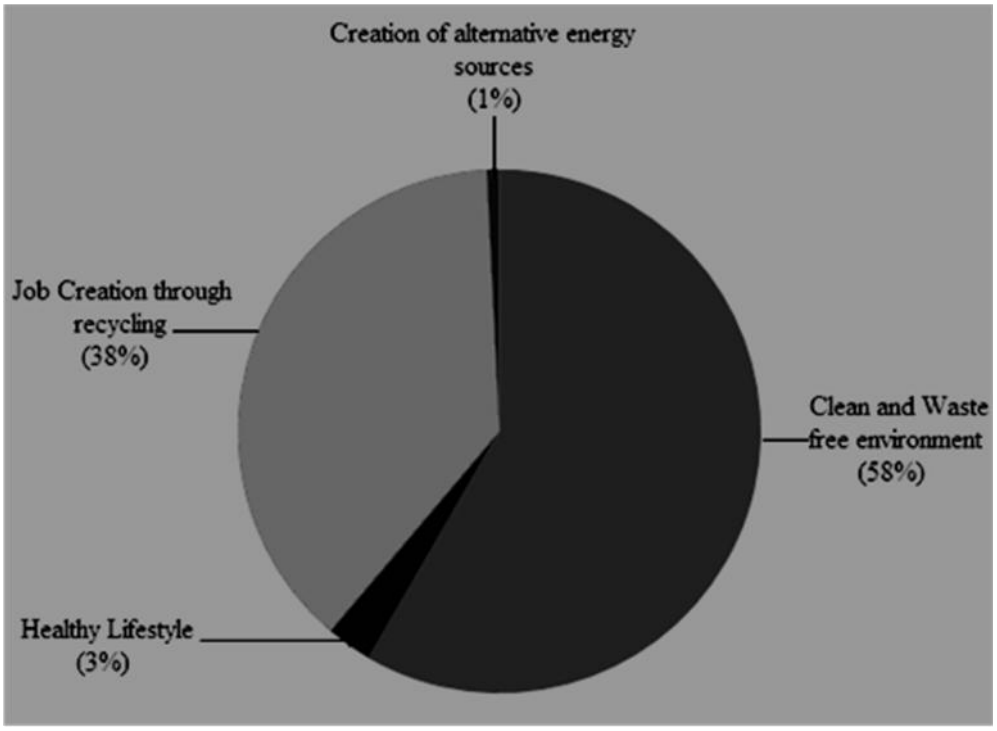

Figure 4.2: Benefits of using environmental values and ethics in SWM

As shown in Figure 4.2, (58%) of the respondents indicated that a clean and waste free environment would be the first notable benefit, while 38% of the respondents indicated that job creation through recycling of wastes would be beneficial. The rest of the respondents indicated that the main benefits would be living healthy lifestyle (3%) and creation of alternative energy sources (1%) from wastes would be beneficial.

4.4.3 Measures to Address the Effects of Environmental Values and Ethics in SWM

The respondents were asked to indicate measures that can be adopted to address the effects of Solid Waste Management as shown in Figure 4.3.

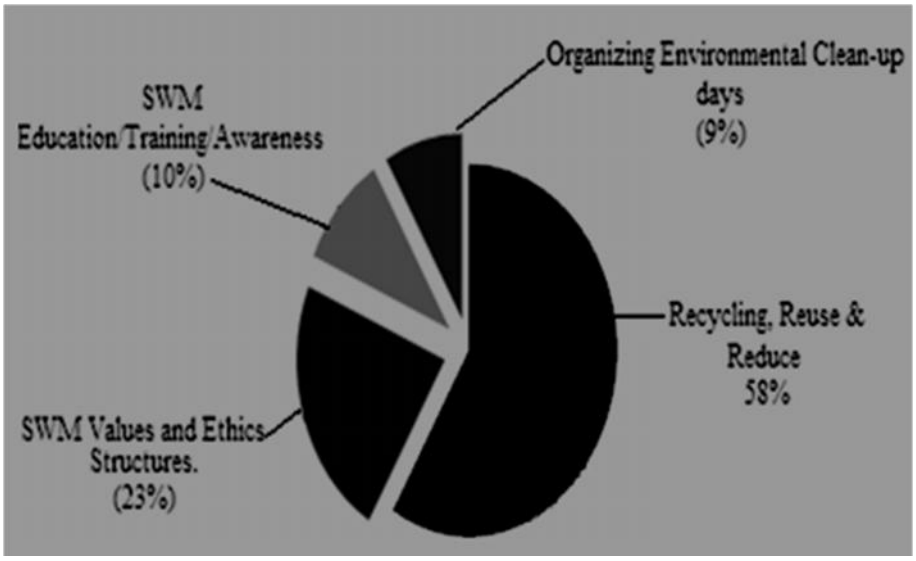

Figure 4.3: Measures to address the issue of solid waste management

Figure 3 shows that nearly two-thirds (58%) of the respondents indicated that recycling, reusing and reduction of solid waste would be the most appropriate measure in curbing Solid Waste Management. The rest of the respondents (23%) indicated that strict implementation of Solid Waste Management value and ethic structures would be the most effective measure. Organizing Solid Waste Management education (10%) and conducting environmental clean-up days (9%) were also indicated as measures to address the effects of Solid Waste Management

4.5 Discussion

From the findings, the main factors affecting the use of environmental values, ethics and legal structures in solid waste management was lack of proper enforcement of existing laws, policies and regulations. A majority of the people felt that weak enforcement of these legal provisions have contributed significantly to uncontrolled and poor disposal methods of solid waste in Nairobi County. The lack of empowerment among all relevant stakeholders responsible for the management of Solid waste was also cited as a factor that affected Environmental Values and

Ethics in Solid Waste Management and Poor implementation structures of Solid Waste Management values and ethics.

JICA (2010), stated that a majority of the respondents seemed to be aware of the existence of solid waste management regulations and policies but is neither empowered to enforce the policies and regulations using environmental values and ethics. This data, as suggested by other previous authors also suggests that environmental values and ethics when applied in solid waste management will require strong enforcement measures through empowered institutions and stakeholders (Onibokun and Kimuyi, 1999).

As suggested by other authors who conducted similar studies, environmental values and ethics when applied in Solid Waste Management will require strong enforcement measures through empowered institutions and stakeholders (Onibokun, *et al.*, 1999). This approach to embody environmental values and ethics in Kenya could assist in the weak links between various stakeholders in Solid Waste Management using environmental values and ethics as is supported by the data that shows respondents agreed there were benefits attribute to it.. This is so because majority of the respondents agreed that application of environmental values and ethics in Solid Waste Management would enhance waste free and clean environment. Thus, this is suggestive of the fact that once institutions fully adopt and implement laws, policies and regulations that address environmental values, ethics and legal structures holistically, this will result to competent, empowered environmental stewards in Solid Waste Management.

The data however sheds hope in the application of environmental values, ethics and legal structures in solid waste management in Nairobi County which can be replicated in other counties too (Shafiul and Mansoor, 2003).

From the study findings, all stakeholders should practice sustainable waste management activities such as recycling, reusing and reduction of solid waste as this will contribute significantly in addressing Solid Waste Management in Nairobi County. Organizing Solid waste management education and training and conducting frequent environmental clean-up days were considered as important in addressing solid waste management.

The benefits of proper Solid Waste Management are quite vast, and they include: clean and waste free environment; job creation through recycling of wastes; living healthy lifestyle and creation of alternative energy sources from wastes.

4.6 Conclusion

The findings of this study on the factors affecting the use of values and ethics in SWM can contribute to inform policy on environmental values and ethics through inclusiveness, involvement and participation of the stakeholders in managing solid waste effectively and efficiently.

The study recommends that the relevant authorities go a step further in ensuring that people are made aware on the sustainable values and ethics of Solid Waste Management as a way of effectively addressing the Solid Waste Management challenge. If all the stakeholders were properly mobilized and well resourced, this menace would be sustainably managed. Solid waste management entails proper mobilization of people's knowledge, attitudes, skills and participation

in sustainable waste management. Environmental education should be embraced at all stages of learning since this will go a long way in addressing this increasing challenge in Nairobi City among other towns in Kenya.

CHAPTER FIVE

ESSENCE OF ENVIRONMENTAL GOVERNANCE IN SOILD WASTE MANAGEMENT: A SPATIAL ANALYSIS OF THE UNPLANNED DUMPSITES IN NAIROBI COUNTY

(Africa Research Journal of Education and Social Sciences 5(2), (Ogutu, F. A., Kimata., D and Kweyu, R (2018)

5.1 Abstract

In Nairobi County, rapid urban settlement patterns have been on the increase and this in turn results to stretching the existing resources. Due to this, the existing Solid Waste Management systems have resulted to the mushrooming of unplanned dumpsites. Environmental governance in solid waste management is becoming a key pillar in the proper waste management strategies and dominates the development discourse. This has been a constant challenge since public facilities such as dumpsites are not properly mapped by the relevant authorities. Most Nairobi County residents are not conscious of proper and well-maintained waste management systems. The purpose of this study was to explicate the essence of environmental governance in Solid Waste Management using spatial analysis to study why unplanned dumpsites are on the increase in Nairobi County. This study adopted a descriptive research design, and the study areas were the two hundred and seventy seven unplanned dumpsites distributed across three main areas of study namely: Lavington and its environs, Embakasi and its environs and Kibra areas. Sampling was done through spatial analysis, the data sources were mainly from QuickBird images of 2003 and 2007, and WorldView-2 images of 2013 and 2017. Other secondary data used were Nairobi County boundary shape-file, Kenya rivers shape-file, Kenya roads shape-file and Kenya settlements shape-file they were all obtained from Survey of Kenya databases. This paper however

recommends that urban planners in Nairobi County should play a key role in managing Solid Waste. This paper provides a platform for other researchers to conduct further investigation on the essence of Environmental governance to promote Solid Waste Management in Nairobi County.

Keywords: Solid Waste Management, Environmental governance, unplanned dumpsites in Nairobi County, Environmental management spatial analysis, Solid Waste Management spatial analysis

5.2 Introduction

Domestic and industrial waste generation continues to increase world-wide just as growth in consumption and the spur in urbanization. Notably in developed countries, per capita waste generation has increased nearly three-fold over the last two decades, which translates to five to six times higher than that in developing countries (UNEP, 2005). Developing countries for instance, have not effectively implemented measures that control mushrooming of dumpsites in urban cities (UNEP, 2005). Solid Waste Management in many developing countries is predominantly portrayed by ineffective collection methods, inadequate coverage of the collection system and improper disposal of municipal solid wastes. Funding for waste management is always inadequate, thus real costs are never fully recovered (UNEP, 2005). Unplanned dumpsites in Nairobi city are growing in numbers and are due to poor garbage collection services offered by both the County government and other relevant service providers (Njoroge, *et al.,* 2014). There is a consensus that the various aspects of good governance are crucial in addressing Solid Waste Management challenges in cities globally, especially in developing countries. Environmental governance incorporates rules, processes, and behaviour by which interests are articulated, resources are managed, and power is exercised (Kazungu, 2010). This implies that governance structures include

laws, regulations and policies that guide any process of environmental management. Thus, effective environmental governance frameworks of Solid Waste Management should include practical, implemented and well enforced laws and regulations (Henry, *et al*., 2006). There should exist proper integration and collective implementation of both local and international conventions, policies and environmental administrative structures that ensure efficiency of service delivery is not compromised (Guerrero, *et al.,* 2013). Institutions that are mandated with ensuring that proper values that govern Solid Waste Management within a decision making process of their nations and individuals are essential (UNEP, 2016). Human activities generate waste which can be harmful to the environment, animals, plants and the ecosystem. However, only sound environmental governance can limit the damage done to the environment and reverse the mushrooming of unplanned dumpsites (Achere, 2012).

Environmental governance in Solid Waste Management addresses the inadequate infrastructure, financing, lack of clear roles and responsibilities of these authorities and uncollected and uncontrolled disposal of waste in public areas which have made the task more difficult, hence public health and sanitation is threatened by increased unplanned dumpsites (Muniafu and Otiato, 2010). Waste management systems in Africa currently are not well maintained at household level since thousands of tons of functional solid waste that are generated daily end up in open dumps and wetlands, contaminating surface and ground water and posing major health hazards to human beings and the environment as illustrated by the spatial analysis of the unplanned dumpsites in Nairobi County (Chuen, *et al.,* 2011).

Waste management in Nairobi County is a perilous undertaking in that increasing urbanization, rural-urban migration; rising standards of living and rapid development associated with population

growth have resulted in increased solid waste generation by industrial, domestic and other activities (Henry, *et al*., 2006). The increase in soli d waste generation has not been accompanied by equivalent increase in the capacity of urban authorities to deal with this problem of mushrooming unplanned dumpsites. The proper management of waste has thus become one of the most pressing and challenging environmental problems in Nairobi (JICA, 2010). The inability of city authority to collect and dispose waste, has led to indiscriminate dumping which further contribute to poor sanitary conditions and incidences of environment-related health problems (Ikiara, 2006; Oyake, 2012). This study sought to examine the essence of environmental governance of Solid Waste Management that result to unplanned dumpsites in Nairobi County.

5.3 Methodology

The study adopted a descriptive research design which provided a framework to examine current conditions, trends and status of events. Descriptive research design is more investigative and focuses on a particular variable factor. Data was collected in Nairobi County from existing high resolution QuickBird images of 2003 and 2007, and WorldView-2 images of 2013 and 2017, both supplied by Digital Globe. These images were selected on the basis of their spatial resolution and cloud cover percentage. QuickBird has a spatial resolution of 60 cm while WorldView-2 has 50 cm. The selected images had a cloud cover percentage of less than 10 per cent. Other secondary data used were Nairobi County boundary shape-file, Kenya rivers shape-file, Kenya roads shape-file and Kenya settlements shape-file both of them from Survey of Kenya databases. Field reconnaissance was carried out to record and collect data on the exact ground locations of some of the unplanned dumping sites in Nairobi County. This data was collected by visiting the dumping sites and recording their ground coordinates in a handheld GPS unit. Ground coordinates of two

hundred and seventy seven unplanned dumping sites were collected and photographs of the sites taken. These images were composed of those acquired from 2003 to 2017. The 2003-2017 image acquisition periods was chosen because very high resolution satellite images that are suitable for dumping sites spatial analysis were only available from 2003.

Handheld GPS receiver was used to record the exact geographical locations of the different dumping sites that were subsequently used in helping to identify the corresponding dumping sites locations on the very high resolution satellite images. The digital camera was used to take photographs of all the dumping sites that were covered in the study. The shape-file of Nairobi City County was uploaded on the Digital Globe satellite image website for identification of the area of study. All satellite images covering the area of study were screened for suitability based on cloud cover and time interval between successive images.

5.4 Results

The following were the results of the spatial analysis of the unplanned dumpsites in selected Nairobi neighbourhoods. The results are presented in the following order: Spatial analysis of the study location; spatial analysis of the illegal dumpsites in Nairobi County for the period of 2003-2017 and unplanned dumping sites patterns in Lavington, Embakasi, Kibra and their environs.

5.4.1 Spatial Analysis of the Study Location

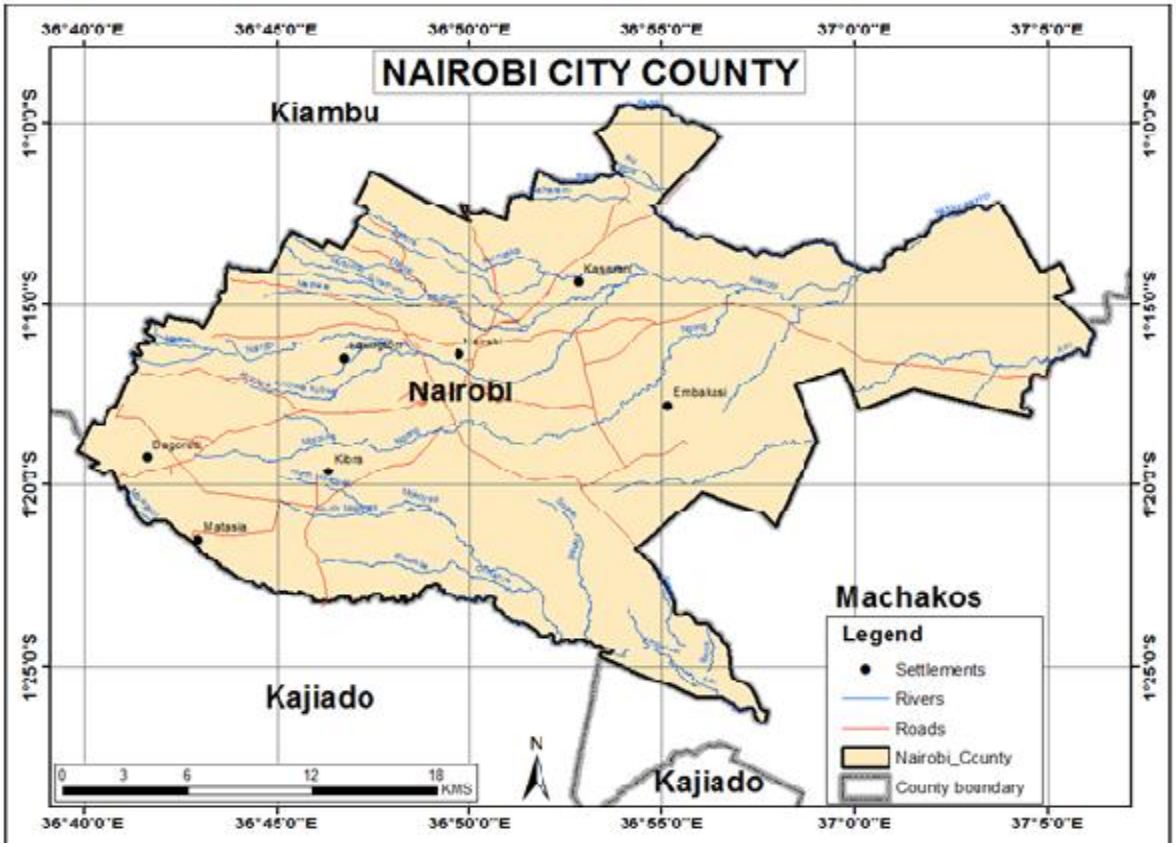

Figure 5.1: A map of the Study Location, Lavington, Embakasi and Kibra, Nairobi County

Figure 5.1 shows the map of Nairobi County and the three focus areas of the study, namely Embakasi, Lavington and Kibra which are the common illegal dumpsites of the County.

5.4.2 A Spatial Analysis of the Illegal Dumpsites in Nairobi County for the Period of 2003-2017

High resolution satellite data were analysed spatially to capture both the extent and the area covered by the dumping sites on different satellite image data sets. This was captured using object based satellite image interpretation and it involved on-screen digitization of areas covered by the dumping sites. The on-screen digitization depicted the difference in spatial coverage of the dumping sites in 2003, 2007, 2013 and 2017. The GPS points collected from the field were overlaid

on the satellite images to identify the locations of illegal dumping sites. The spatial extents of the dumping sites on the different images were captured by digitizing polygons around the dumping sites. The Figures 5.2, 5.3, 5.4 and 5.5 shows the spatial analysis results of the unplanned dumpsites in Nairobi County between the years 2003, 2007, 2013 and 2017.

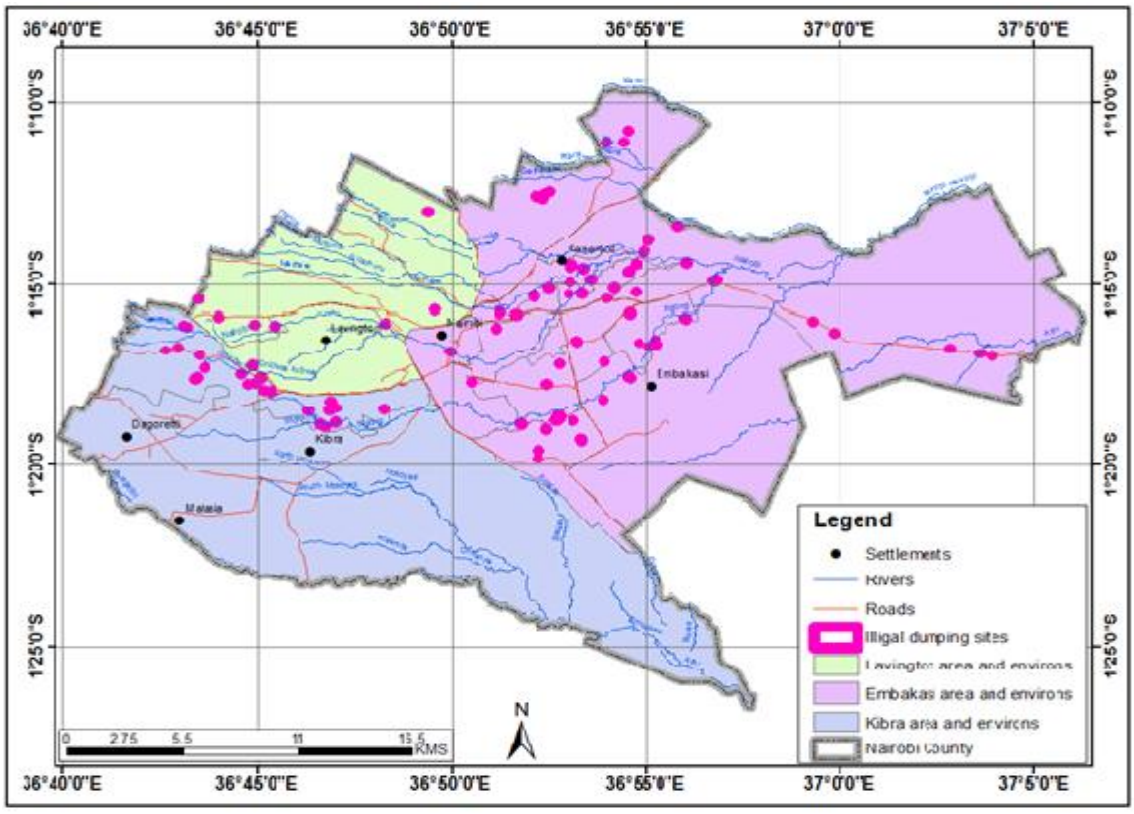

Figure 5.2: Distribution of unplanned dumping sites in Lavington, Embakasi and Kibra in 2003

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2003. The illustrated number of illegal dumpsites is concentrated on the three focus areas.

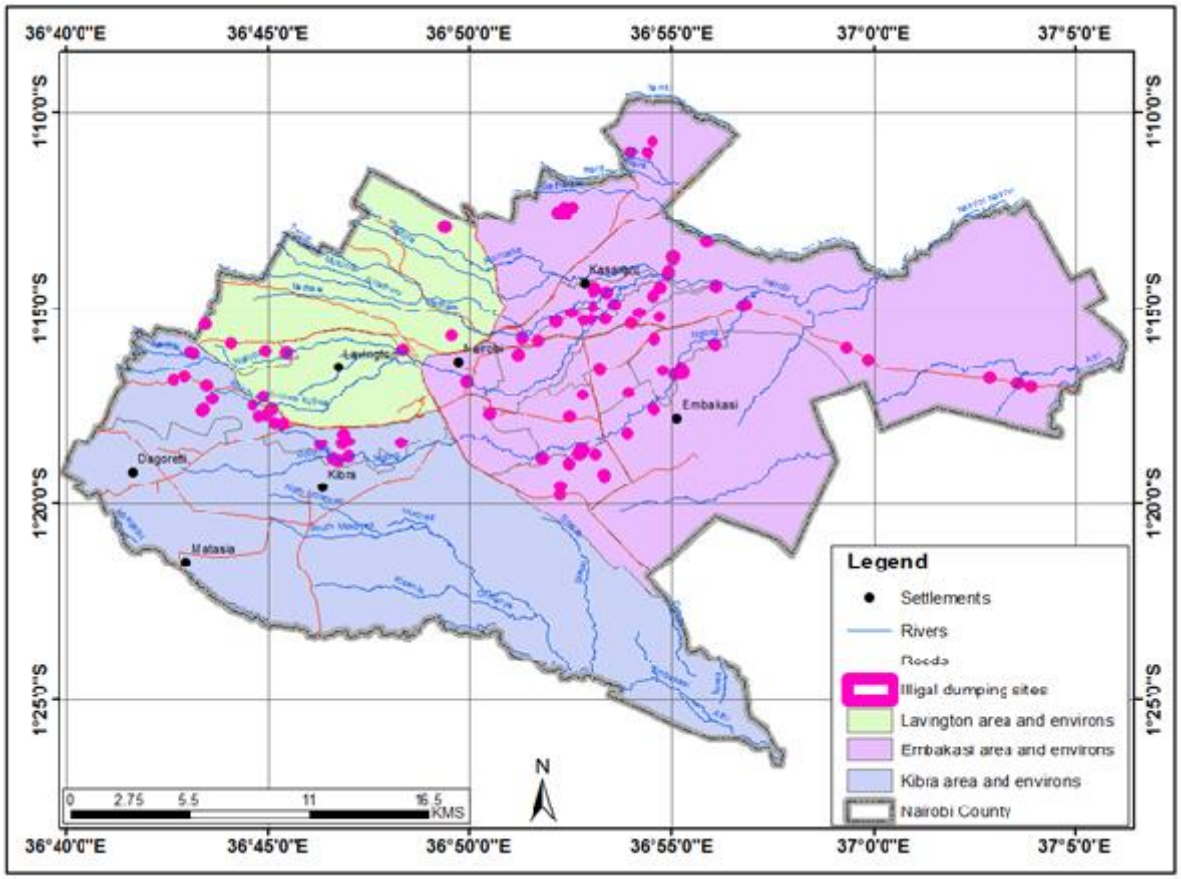

Figure 5.3: Distribution of Unplanned Dumping Sites in Lavington, Embakasi and Kibra in 2007

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2007. The illegal dumpsites are operational in the years 2003-2007.

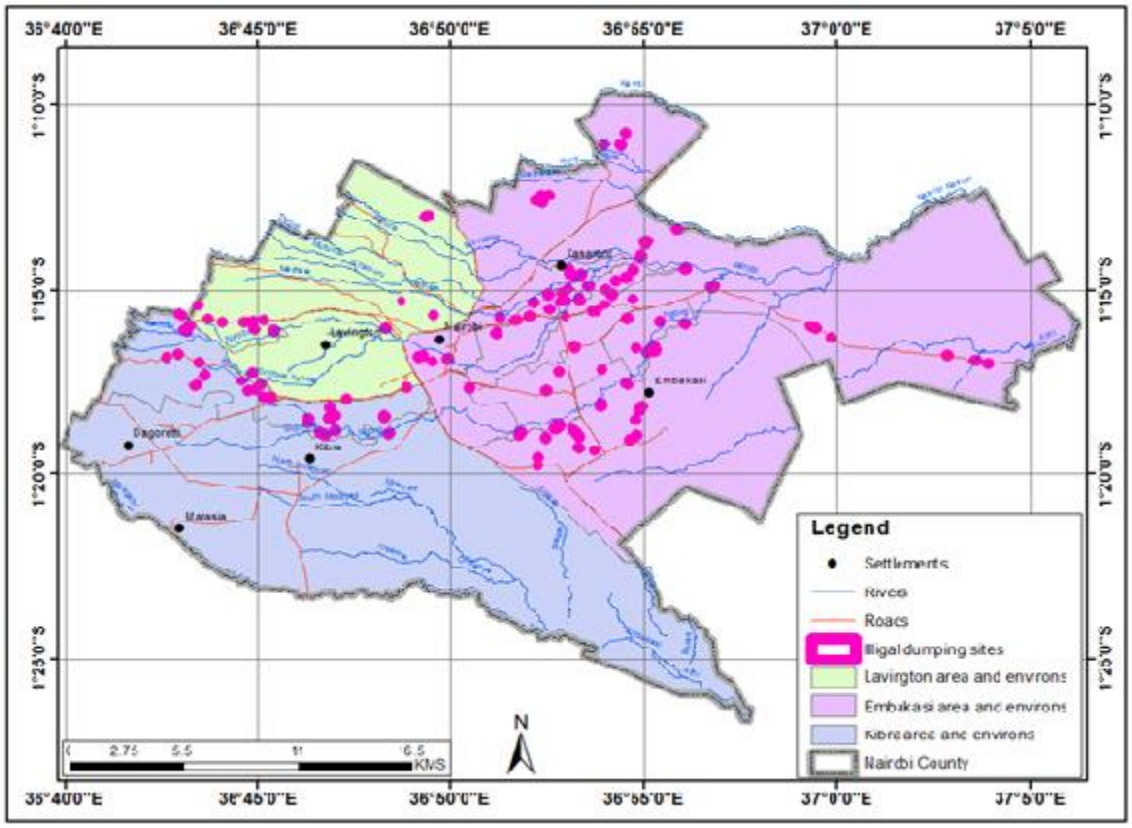

Figure 5.4: Distributional of illegal dumpsites in Lavington, Embakasi and Kibra in 2013

This spatial analysis of the illegal dumpsites in Nairobi County was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2013. The number of illegal dumpsites has increased from the initial number of dumpsites as illustrated above.

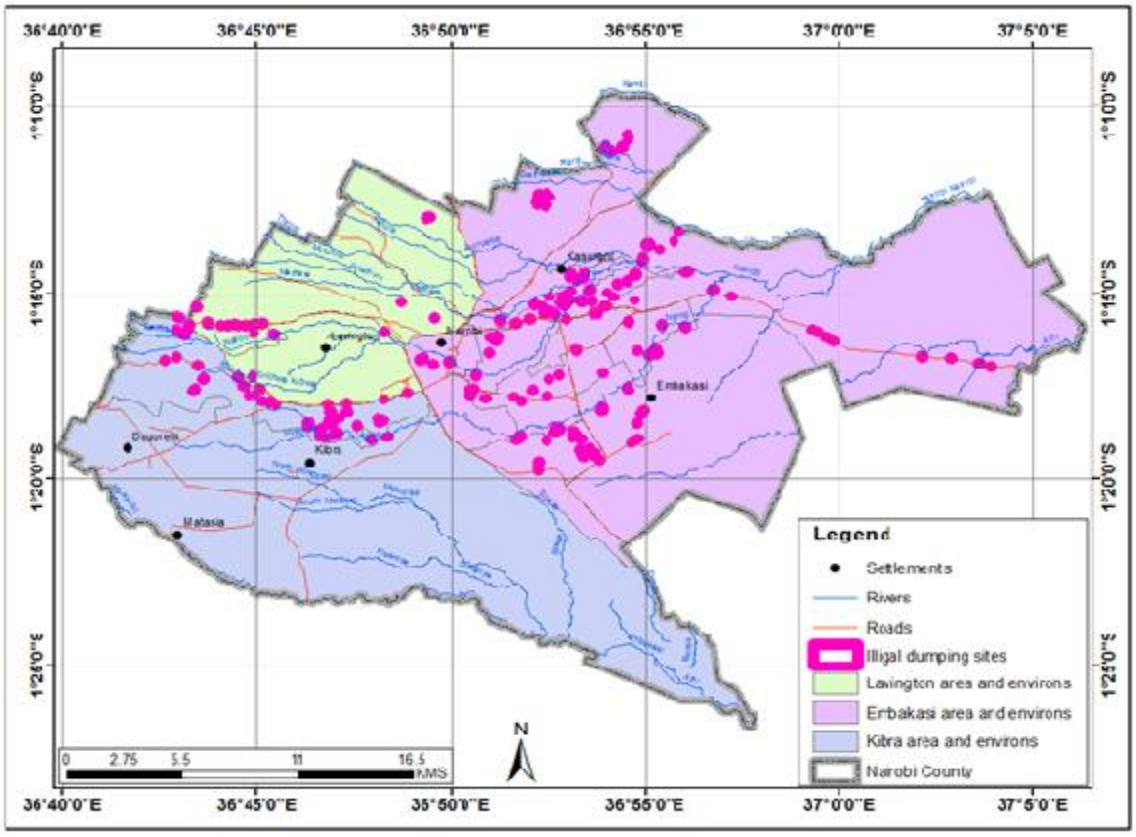

Figure 5.5: Distribution of unplanned dumping sites in Lavington, Embakasi and Kibra in 2017

Figure 5.5 illustrates the latest images of illegal dumpsites in Nairobi County which was conducted in three Sub-counties of Nairobi County namely Lavington, Embakasi and Kibra in the year 2017.

5.4.3 Unplanned dumping sites patterns in Lavington, Embakasi, Kibra and their Environs

The illegal dumping sites' spatial coverage in Nairobi between 2003 and 2017 was 7.35 ha, 7.96 ha, 11.03 ha and 16.94 ha in 2003, 2007, 2013 and 2017 respectively. From the study findings, the spatial area was determined by the extent of the unplanned dumpsites which was calculated in hectares. Embakasi had a larger spatial area of 6.55ha in 2003 to 15.04ha in 2017, thus had more unplanned dumpsites unlike Lavington (0.25 ha, in 2003 to 0.53 ha in 2017). Kibra on the other hand had (0.55ha, in 2003 to 1.37 ha in 2017) with the least number of dumpsites respectively.

5.4.4 Discussion

Nairobi County is one of the smallest Counties in Kenya and yet is the most populous County in terms of its population. The rapid population growth has been due to a number of reasons such as employment opportunities, business opportunities and other factors that attract residents to the city (Satterthwaite, 2009). Just as the population of the city increases, so are the environmental challenges (Allison, 2010). Solid waste management in the city has been a menace and the amount of solid waste generation has been on the increase to levels that have caused global attention. Nairobi's status is largely characterized by low coverage of solid waste collection, pollution from uncontrolled dumping of waste, inefficient public services, unregulated and uncoordinated private sector and lack of key solid waste management infrastructure (JICA, 2010). The change in organic waste in these city locations and an increase in plastic and other non-biodegradable wastes can be attributed mainly to the residents changing lifestyle (UNEP, 2016).

The analysis results from very high resolution satellite images show that the spatial coverage of unplanned dumping sites in the entire City of Nairobi was on the increase and this was attributed to the increase in population. According to Census reports of 2009, the population of Nairobi County stood at 4 million residents. This automatically would result to an increase in solid waste generation. Other major sources of solid waste were generated by the numerous economic activities and industrialization (Muniafu and Otiato, 2010). In addition, Nairobi City has limited number of legal dumpsites and this meant that the existing sites were over time getting overwhelmed by the increase in waste generated. The Dandora dumpsite for instance, is the main dumpsite that serves the entire City and some of the wastes generated in other metropolitan towns

like Kajiado, Kiambu and Machakos find their way in the same dumpsite (Henry, Yongsheng and Jun, 2006). In a report by UNEP (2016), studies conducted by different urban planning experts recommended that the dumpsite be relocated to the nearby Ruai area. This was because the area had plenty of space to supplement the increasing waste generated by the City residents. Unplanned dumpsites are as a result of an overstretched legal dumpsite and management challenges (UNEP, 2005, KNBS, 2015).

Failure to effectively implement policies and regulations on solid waste management with institutions dealing with solid waste management lack synergy resulting to lack of coordination and inefficiency (Troschinetz and Mihelcic, 2009). Additionally, Policies and regulations on solid waste management are inclined towards collection, transportation and disposal, with least emphasis on recycling and re-use. Public attitude towards waste management and lack of empowerment on environmental values and ethics by the relevant institutions, thus waste is viewed as mere waste and not resources that can be harnessed to create wealth (Lesley and Frankline, 2017).

5.4.5 Conclusion

The spatial analysis of the illegal dumpsites in Nairobi County clearly brought out the essence of ensuring proper environmental governance structures that control emergence of illegal dumpsites within Nairobi City. This paper clearly bring out how the governance process operates in the local context with regards to managing Solid Waste and hence emergence of illegal dumpsites in an Urban setting. Good governance promotes equity, participation, pluralism, transparency, accountability and the rule of law done in a manner that is effective, efficient and enduring that can help overcome the challenges of solid waste management in urban cities like Nairobi County

This paper documents that lack of good governance is the main problem in waste management in Nairobi City County, thus waste management institutionalization of good governance by bridging the gap between different stakeholders in solid waste management through inclusiveness and participation.

Solid Waste Management in Urban settings such as Nairobi City continues to be a challenge and relevant agencies and stakeholders must devise ways to curb the challenges that come with it. Before governments and relevant local and global institutions implement sustainable solid waste management plans and strategies, it is necessary for all stakeholders to first of all encourage basic Solid Waste Management practices such as: ensuring they use sustainable waste dumping methods, proper recycling methods, sustainable collection and transportation of solid waste that suits the type of waste generated and creation of awareness and education among all stakeholders in their areas of jurisdiction

CHAPTER SIX

THE ROLE OF INSTITUTIONS IN SWM IN NAIROBI COUNTY USING ENVIRONMENTAL SWM POLICY FRAMEWORKS FOR SUSTAINABLE WASTE MANAGEMENT

(International Academic Journal of Social Sciences and Education 2(1), (Ogutu, F.A., Kimata. D and Kweyu, R (2018)

6 .1 Abstract

Inadequate solid waste management mechanisms in many cities are a major drain on the economy with many health problems and environmental impacts experienced. Institutions such as municipal authorities and policymakers need to create synergy to upscale their efforts in SWM in cities. Sustainable waste management provides a comprehensive inter-disciplinary framework for addressing the problems of managing urban solid waste, in the resource constrained Nairobi City Council which will provide a network for remedial actions and enhance the quality of services being rendered. Despite many SWM policies in place, institutions lack the capacity, financial and technology to handle the increasing waste generation in Nairobi city. The study was guided by this objective; to analyse the existing policy framework on solid waste management and its effectiveness in addressing SWM in Nairobi City County. The study adopted a descriptive research design, interrogating the SWM policy frameworks in place and how the institutions mandated integrated to yield sustainable management of solid waste. This paper highlights the role of institutions and effective SWM policies where involvement and participation of all the stakeholders such as the waste generators, waste processors, formal and informal agencies, non-governmental organizations and financing institutions are pivotal to the sustainable waste management.

Key Words: Solid waste, Environmental policies, Policy frameworks, Institutions, Nairobi

6.2 Introduction

In Kenya, the challenge of Solid Waste Management is an increasing hard reality to deal with (Gakungu, 2011). The SWM collection systems are inefficient and disposal systems have least environmental friendliness where 30 to 40 per cent of all solid waste generated in urban areas is uncollected and less than half of the population being served (Otieno, 2010). With the urban population in Kenya estimated to be growing at a rate higher than that of the country's general population growth rate, waste generation shall be a major challenge (Ngoc and Schnitzer, 2009; NEMA, 2014). Kenya's waste generation has been accelerating due to the rapid urbanization the current amount (about 4 million tones/year) generated is expected to double by 2030 (Njoroge, *et al.*, 2014). However, the rise in waste generation has not been accompanied by an equivalent increase in the capacity of the relevant urban authorities to deal with this challenge of Solid Waste Management (SWM) (Gakungu, 2012).

A country's development agenda should focus on the needs of present generations should be met without compromising the ability of the future generations to meet their needs which is also applicable to SWM (UNEP, 2010). This can be attained by providing an avenue for integrating SWM with the environment through socioeconomic planning and management which ultimately is increasing environmental concerns and the emphasis on material and energy recovery are gradually changing the orientation of solid waste management and planning (Marshall and Farahbakhsh, 2013).

In general, solid waste management policies are broad and looks more integrating than specific ones, the institutional and implementation mechanism proposed by these policies are more centralized (Asase, *et al*., 2009). Consequently, in response to the consistently increasing challenge

of solid waste management, several policy frameworks are formulated and enacted to address it (Murad, *et al*., 2012). Solid waste management and its effects is cross cutting and multi-sectoral therefore, to effectively address the challenge of solid waste management, policy integration among and within the various sectors and stakeholders is essential (Marshall and Farahbakhsh, 2013). Policy integration concerns the management of cross-cutting issues in policy-making that transcend the boundaries of established policy fields, and which do not correspond to the institutional responsibilities of individual departments (Persson, 2004). Policy integration also refers to management of policy responsibility within a single organization or sector where integration encompasses both horizontal sectoral integration (between different departments and/or professions in public authorities) and vertical inter-governmental integration in policy-making (between different tiers of government), or combinations of both (Persson, 2004; Tilahun, *et al.*, 2016). Notably the sector-specific and embedded solid waste management policies are coherent with the overall policy document, but they lack mechanisms of implementation within the same SWM policy framework. Major gaps exist in stipulating clear policy strategies and implementation mechanisms (Gakungu, 2011; Njoroge, *et al.*, 2014). Corresponding to the Constitution of Kenya, the National Environment Policy outlines responsibilities of what the government entail and what the government will do in relation to creating a favorable ground for protecting the environment (NEP, 2013). The intention of National Solid Waste Management strategy is to address a core area of the National environment policy, which aims to establish a platform for action between stakeholders to systematically improve SWM (NEMA, 2014). In retrospect the integration between the Environment Policy and the Solid Waste Management Strategy is a vertical one where the policy outlines the core issues and the strategy formulated however, the national SWM strategy has a national scope focused on flagship SWM projects in

five main cities in Kenya. Despite the presence of legislative and institutional frameworks governing solid waste management, there is so much waste as a result of indiscriminate littering and illegal dumpsites, illustrating lack of coordination and enforcement of the various laws (Njoroge, *et al.*, 2014).

The role of various SWM institutions in most countries lie in local authority and devolved units responsible for waste collection, resource recovery, recycling and disposal within their jurisdiction in Kenya (AfDB, 2015). The institutions are therefore in a position to introduce the concepts of clean environment by ensuring good practices, strive to conduct their activities and use of resources in a manner that develops environmental awareness and fosters responsible solid waste management (Marshall and Farahbakhsh, 2013; Ngau, 2009). Environmental awareness and knowledge about SWM had a positive effect on recycling attitude though knowledge of recycling still lacking the required depth (Aini, *et al*., 2002). Thus, waste managers need to take steps to help align the information on SWM presented to the public to ensure sustainability. Growing costs, shortage of funds, institutional deficiencies, indiscipline among the work force, lack of trained personnel and political pressure are making the situation worse as time goes by (Asnani, 1996; Joseph, 2006). A study by (Kasozi and Von Blottnitz, 2010) on solid waste management in Nairobi (2010) found that there were no monitoring mechanisms on the enforcement of the environmental Laws which include SWM policies which emphasized on the need for sanctions and penalties of waste mismanagement. This paper seeks to illustrate the critical role of institutions and effective SWM environmental policies have an effect on sustainable solid waste management in Nairobi County.

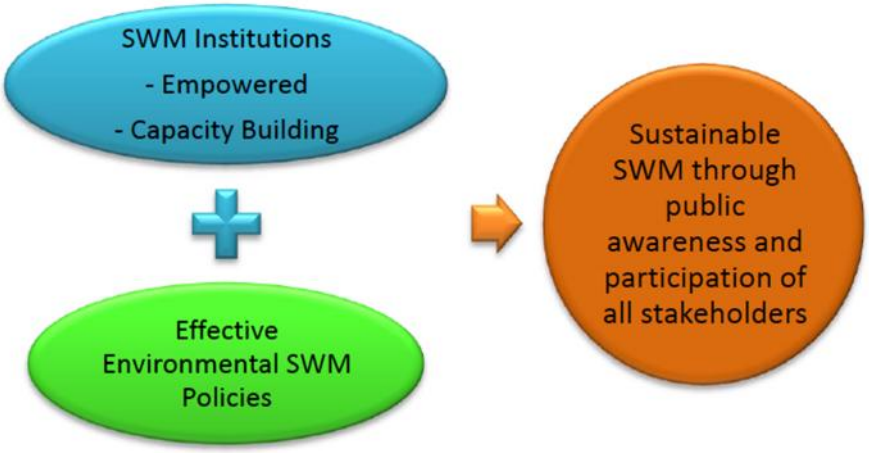

Figure 6.1: Conceptual Framework

6.3 Materials and Methods

The study approach was based on the theoretical framework of institutional analysis and capacity building theories where analytical and prescriptive benefits are crucial in empowering the society in complying with environmental policies in solid waste management (Cord, 2009). A conceptual framework (Fig. 1) was utilized to design the study where empowered SWM institutions and effective SWM environmental policies are dependent on creating a sustainable SWM through public awareness and stakeholders' participation and engagement.

Data was collected in Nairobi being the capital city of Kenya where concerned Ministries, Ministry of Environment and Natural Resources and NEMA, who formulates policies on SWM for the entire country, where policy regulators and implementers are also domiciled. Surveys were conducted using semi structured questionnaires and key informant interviews. The study adopted a mixed design approach with a target population of 385 households derived from a sampling formula that give equal representation of the samples. Data was collected by administration of

questionnaires supplemented by interviews and Focus Group Discussions. Data was analyzed quantitatively using SPSS and qualitatively based on the emerging themes (Agarwal, 1991).

6.4 Results

6.5 Effectiveness Environmental policies in Solid Waste Management

Table 6. 1: The enforcement of environmental policies on solid waste management in Nairobi City County

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
Agree	9	0	9	60	12	72	38	11	49
Disagree	26	4	30	47	4	51	61	24	85
Strongly Agree	0	1	1	6	3	9	1	1	2
Strongly Disagree	16	2	18	6	0	6	34	18	49
Total	51	7	58	119	19	138	134	54	188

62% of the respondents disagreed that enforcement of environmental policies on SWM in NCC has not been carried out properly, as opposed to 36% who agreed illustrating a gap in the implementation of the set policies. Most of the respondents who disagreed that there has been effective implementation are members of the lower-class zone – Kibra, at 35% unlike Lavington and Embakasi. The focus group discussions with University of Nairobi Chiromo campus students and CBOs at Kibra, key informant interviews with private service providers, hotel institutions of middle and upper categories and Resident Associations of Lavington agreed that implementation of policies is not effective as stipulated.

Table 6. 2: Impact of SWM policies on the environmental and personal health

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
Strongly disagree	0	0	0	0	0	0	1	1	2
Disagree	1	0	1	1	0	1	6	3	9
Agree	9	0	9	83	13	96	75	32	107
Strongly agree	41	7	48	35	6	41	52	18	71
Total	51	7	58	119	19	138	134	54	188

Majority of the respondents at 55% agreed that the environmental conditions predisposed to proper SWM affect people's health as opposed to 42% who disagreed. This implies that the effectiveness of the policies is in enforcement and implementation mechanisms that should be consistently adhered to.

6.6 Effectiveness of institutions in SWM policies implementation in Nairobi County

Table 6.3: Nairobi City County as an institution has conducted SWM Public Awareness

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
No	11	0	11	74	13	87	105	51	156
Yes	40	7	47	45	6	51	29	3	32
Total	51	7	58	119	19	138	134	54	188

65.9% of the respondents concur that public awareness needs to be conducted more on SWM as a result of lack of capacity, corruption and negligent NCC officers unlike 34.1% who expressed satisfaction with the Nairobi City County's public awareness

.

Table 6.4: Respondent's attitudes to SWM from Public Awareness

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
No	6	0	6	69	13	82	88	29	117
Yes	45	7	52	50	6	56	46	25	71
Total	51	7	58	119	19	138	134	54	188

53% of the respondents agreed that would not keep waste until they find a litter bin since the NCC has no clearly labelled litter bins at the right places while 46% indicated that they would keep the litter and disposed it at the right place where they would find a litter bin.

6. 7 Impacts of implementation of SWM policies in Nairobi County

Table 6.5: The impacts of the SWM Policies implementation

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
No problem	0	0	0	0	0	0	3	2	5
Problem	5	0	5	30	7	37	32	17	49
Slight Problem	0	0	0	6	1	7	3	1	4
Serious Problem	46	7	53	83	11	94	96	34	130
Total	51	7	58	119	19	138	134	54	188

Majority of the respondents, at 72% were concerned about an overloaded waste disposal truck scattering waste on the road where they agreed that it was a serious impact of lack of implementation of the SWM policies. While 28% of the respondents stated they would be bothered with waste disposal truck littering because NCC should have policies measures to deal with them.

Table 6.6: Respondents perceived benefits of effective SWM Policies

Response	Male	Female	Total	Male	Female	Total	Male	Female	Total
Strongly disagree	0	0	0	0	0	0	3	1	4
Disagree	0	0	0	1	0	1	6	4	10
Agree	36	2	38	61	11	72	78	37	115
Strongly agree	15	5	20	57	8	65	47	12	59
Total	51	7	58	119	19	138	134	54	188

58% of the respondents concurred that waste is a resource that can be harnessed to create wealth, employment, and reduce pollution of the environment, with effective implementation of SWM policies unlike the 42% of the respondents who indicated that there was no wealth creation from waste generated. The perceived benefits ranged from a clean environment to employment opportunities for the growing number of youth populations in the city.

6.8 Discussion

The data from the results supports the respondent's views that institutions on SWM are enhanced by effective implementation of environmental policies on SWM (Gakungu, 2012; Ngau, 2009). The data illustrates the critical role institutions have in terms of public awareness on SWM (UNEP, 2015; Marshall and Farahbakhsh, 2013, Njoroge, *et al.*, 2014)

Majority of the respondents seemed to be aware of the existence of Solid Waste Management regulations and policies but are neither empowered to enforce the policies and regulations using SWM Policy frameworks. This data, as supported by other previous authors also suggests that SWM policies when implemented and combined with strong enforcement measures through empowered institutions and stakeholders becomes sustainable and profitable (Aini, *et al.*, 2002;

Joseph, 2006; UNEP, 2015). These SWM policy frameworks in Kenya when implemented strategically could strengthen the weak links between various stakeholders and enhance the public awareness on SWM as is supported by the data that shows respondents agreed there were benefits attributed to it (Aini, *et al*., 2002). Consequently, majority of the respondents agreed that empowered institutions are vital in successful implementation of SWM policies which would enhance waste free and clean environment. The data is suggestive of the fact that once institutions/policies put in place can upscale the SWM sustainability and strengthening the public awareness as a holistic approach towards solid waste management, the same will result in wealth creation and education on Solid Waste Management.

The data however elucidates optimism in empowered SWM institutions and effective SWM environmental policies application in Nairobi County which can be replicated in other counties too thereby ensuring sustainable management of solid waste (Troschinetz, 2009; Gakungu, 2012).

6.9 Conclusion and Recommendation

The study explicates an analysis of integration of SWM policies in Kenya which shows that the extent of integration differs across different dimensions of policy development, implementation and enforcement where at macro-level, integration of SWM policies look sound and practical. However, coordination mechanism for implementation are not comprehensive. The study recommends that there is need for a clear coordination mechanism of policy making, implementation and evaluation and create synergy among the stakeholders in their implementation as well as enhancing institutional capacity (infrastructural, financial and human resources) of key stakeholders in SWM for effective implementation of policies.

CHAPTER SEVEN

7.0 GENERAL DISCUSSION, CONCLUSION AND RECOMMENDATIONS

7.1 Discussion

The Kenyan 2010 constitution guarantees clean and healthy environment which seems to be threatened daily by the increased solid waste generation and mushrooming of dumpsites. This is tied to the policy framework on Solid Waste Management and its effectiveness is made up of four elements; institutional arrangements, technical, financial and regulatory. This study highlights significant weakness in the effectiveness of the existing policy framework on Solid Waste Management in Nairobi City County. The study used concurrent transformative mode (CTM), suitable for mixed study design where the researcher examines phenomena on severally different levels in a bid to explain the findings (Creswell, 2013).

Data was collected by administering questionnaire from the three different stratums (residential areas): One representing an urban informal settlement (Kibra); middle income setting (Embakasi) and high income setting (Lavington). This was collaborated through spatial representation mapping (satellite image data acquisition) and key informant interviews made up of policy community (NEMA, NCC, WRA), hotel institutions made up of lower categories (kiosk, lower, restaurant, middle and upper). Lavington resident association, private service providers (PSP) and focus group discussions (FGD) included University of Nairobi Chiromo campus students, CBO,s from Kibra and waste pickers from Dandora dumpsite. Figure 7.1 and Table 7.1 below shows household heads in their respective socio-economic zones, who can influence the effectiveness of the policy framework on Solid Waste Management.

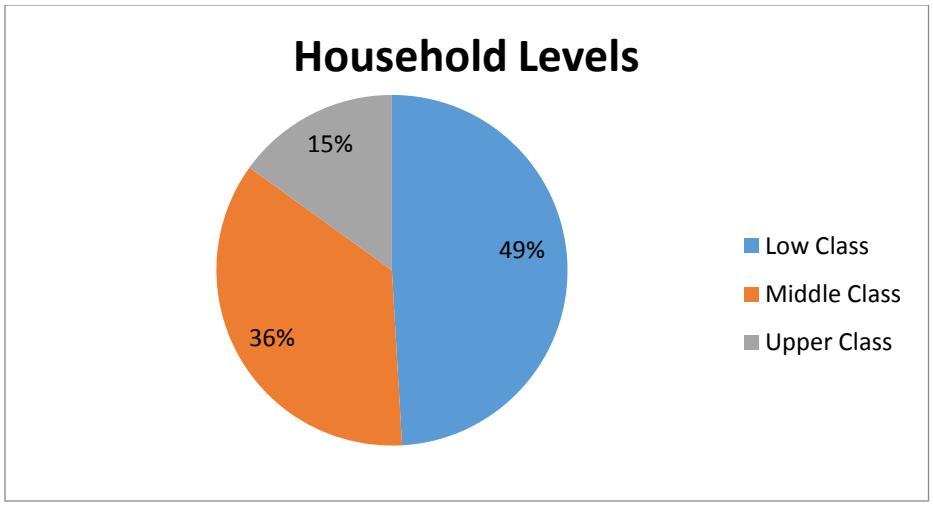

Figure 7.1: Household Levels

Table 7.1: Household Zones

Zones	Male	Female	Total
Informal settlement (kibra)	153	54	207
Apartments (Embakasi)	95	19	114
Gated community (Lavington)	57	7	64
Total	305	80	385

7.2 Demographics

The demographics characteristics of respondents who enhanced the general objectives of the study were between ages 18 to 36 years which is classified as youth according to the United Nations and the African Youth charter. This age group are economically very active and are the consumers who generate most waste, thus the policies and regulations on solid waste management heavily impacts on their lives (UN, 2010).

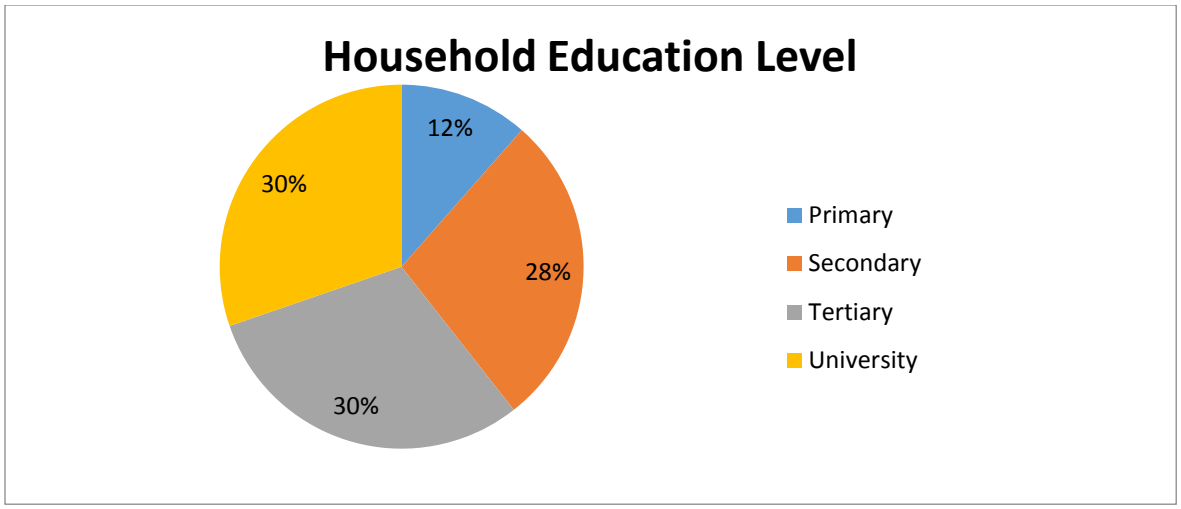

Figure 7.2: Household Education Level

On education level the data represents a tie between those in tertiary and university education level at 65%, followed by secondary at 29% (figure 7.2) which indicated that the respondents had basic literacy levels. They could understand the questions asked on the policy framework on solid waste management. This is confirmed by Kenya literacy level at age 15 years.

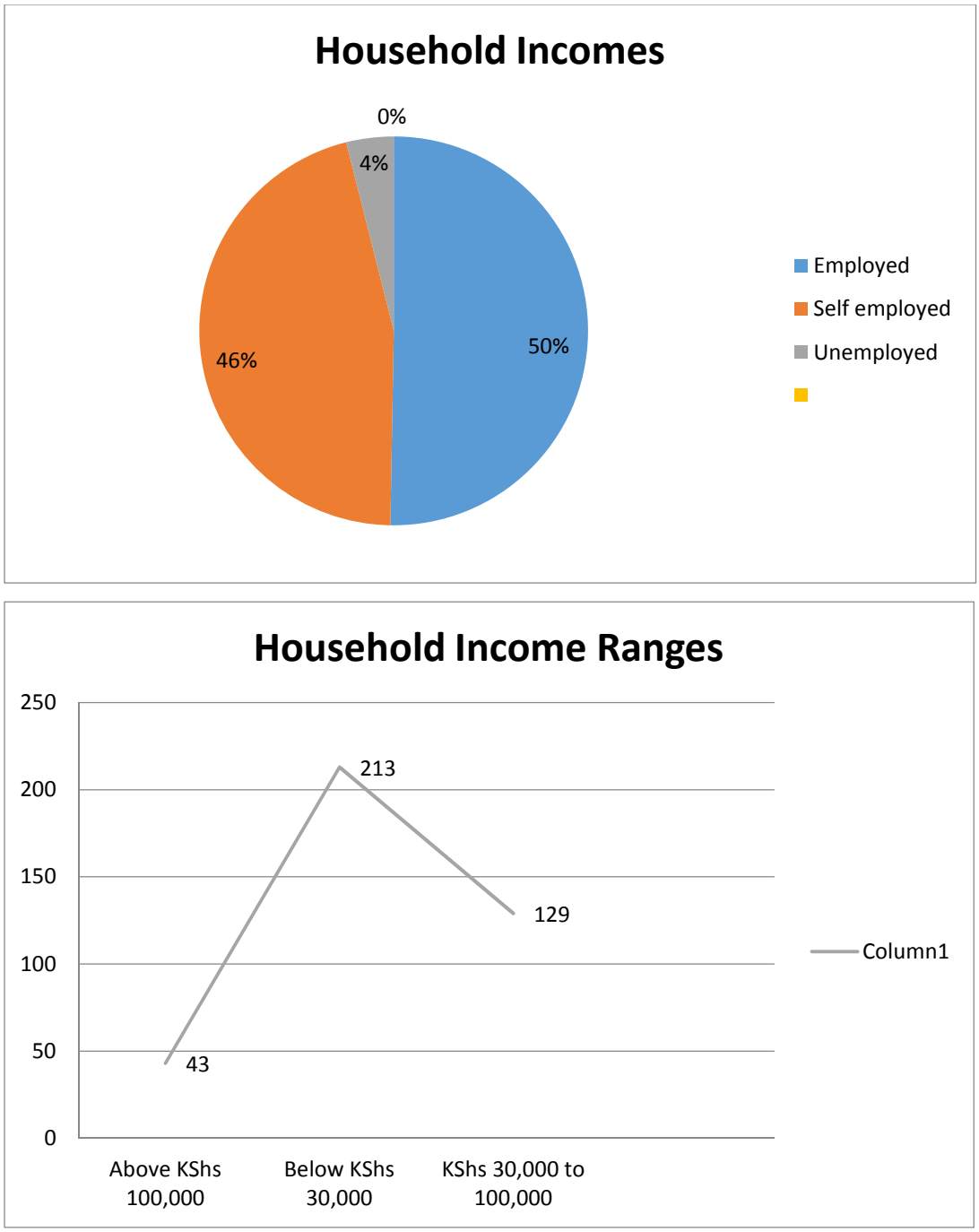

Figure 7.3: Household Incomes

On household incomes, the data represented a balanced representation of the respondents in terms of sources of incomes where there was a balance between self – employed and employed and significantly the unemployed at 29% of the respondents (Figure 7.3) therefore this implies that

there was no relationship between income and the behavior of people when handling waste. This similar observation was reported by (Henry, *et al.,* 2006) on municipal solid waste management challenges in developing countries.

Policies and regulations on solid waste management in NCC on paper, are well outlined but reality as exposed by the study findings through household survey, that public awareness and environmental values and ethics are lacking leading to unsustainable solid waste management disposal practices. Satellite imagery and GIS analysis on how the unplanned dumpsites have been growing with time shows lack of good governance is the main problem of SWM in NCC. Key informant interviews and focus group discussions shows that the capacity of the elements of the policy framework are weak in terms of institutional, infrastructural, financial and human resources, hence contributing to the biggest challenge of SWM in NCC (Ogutu Florence, 2017).

This study found out that there was knowledge gap on policies and regulations on SWM which was significant and that the level of knowledge had no relationship between social classes since residents of the upper class (60.3%) were less knowledgeable compared to those of middle and lower class zones respectively. Additionally, they were aware of existing policies on SWM but it was in the least of their priorities. Knowledge is important variable affecting environmental action and higher levels of environmentally relevant knowledge can play a significant role in instilling pro- environmental behaviour regarding waste management in relation to compliance to policies and regulations on SWM. Absence of this result to underperformance in SWM service delivery. This agrees with the findings of a study done in Indonesia on community participation in household SW reduction, assessing knowledge in modifying behaviour (Dhokhikah, *et al*., 2015).

The study reports that the respondents were aware of the policies and regulations on solid waste management that can influence their behavior on the way they handled their generated waste, meant to impact on their behavior which was geared towards a waste free environment. The Kenyan Constitution (2010) emphasizes that everyone has a right to a clean and healthy environment for the benefit of present and future generations and the responsibility to safe guide it is with the people (UNEP, 2010). However, it was in the least of their priorities and very few knew about legislation governing proper solid waste management disposal practices of which many of them did not comply with (Gakungu, 2012).

This was confirmed by key informant interviews with sub-county environment officers and officers in the department of monitoring, compliance and enforcement, Ministries of Environment, Water and Natural Resources at City hall, observed that enforcement of existing legislation on SWM was a challenge; which has encouraged people to continue using poor waste disposal methods that were not environment- friendly. This was also revealed by the satellite imagery and GIS analysis of how unplanned dumpsites have been increasing over the years (Otieno, 2010; Ogutu Florence, 2017).

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Focus group discussions with waste pickers at Dandora dumpsite and GBOs in Kibra revealed that majority of the population were not aware of laws governing proper waste management. They did not know that waste should be classified into organic and inorganic to ease the work of the sorters which perpetuated the situation of poor SWM in NCC. In addition, the waste pickers at Dandora observed that those policies were meant for CBD areas, middle and higher class zones, ‘not mtaani’

(meaning lowest social caliber like themselves) thus compliance was a challenge. In addition, they were never consulted on the plastic ban and yet this was going to affect their business in a negative way since recycled plastic has very high value in terms of monetary returns, unlike the alternative packaging bags, which is expensive with low value. The waste pickers felt that NEMA should have consulted them first before imposing the rule on Kenyans since they were better placed to give relevant advice on policy content. This reflects poor coordination between parties involved in WM. This research was carried prior to plastic ban implementation. (Ogutu, 2017).

The study findings revealed that majority of the respondents, 62%, felt that there was poor implementation and enforcement of environmental policies on SWM in NCC. Out of this, 35% were members of the lower class zone (kibra). Being a vulnerable group, they encountered more severe environmental problems associated with poor waste management which impacted on their well-being, health and environment at large (Mwangi, 2011). This was revealed during the focus group discussions with University of Nairobi Chiromo campus students and CBOs in Kibra, key informant interviews with private service providers, hotel institutions of middle and upper categories and Resident Associations of Lavington.

This was also reported during the key informant interview with the sub-county environment officer (SCOE) at Kibra. The seriousness of SWM and action to be taken depended on the socio - economic zone and it is skewed. According to (SCEO) areas like Woodley and Upper Hill, residents reported any illegally dumped waste immediately and they harassed the NCC officer concerned with phone calls until he sends someone to collect the waste. On the other hand, residents of Kibra can stay for two years with illegally dumped waste **(no one cares)** without

reporting. This finding concur with Mwangi (2011) study done in Makina village in Kibra where SWM services are hardly provided (Mwangi, 2011).

According to sub-county environment officer at Lavington, which falls under kileleshwa ward waste collection was not very challenging because the residents managed their own waste through PSPs. However, food kiosks have encroached the area and they generate too much waste from the eateries and disposed of it discriminately along the road, around James Gichuru road and Lavington mall. Additionally, in the recent past, the severe drought that hit the entire nation made the Maasai community to invade Lavington ward with their cattle to feed on the green grass leaving a lot of solid waste droppings. Since the residents in this area are categorical that they do not want to see waste littered anywhere, NCC still has to come and fix the problem and this reflected challenges in implementation of the policies on SWM (NCC, 2017).

Kibra area suffer from pollution from Ngong River since all the waste from Kawangare is dumped into Ngong River after every three weeks. It was observed that this affected the health of children in Kibra as every month there was outbreak of cholera which the health officer in one of the dispensaries attested to. Interesting, the authorities were aware of this and were doing absolutely nothing to stop the disposal. They received bribe from the operators in form of a stipend every week and allowed the trucks to operate. This finding concurs with study findings on challenges of solid waste management in developing countries (Gulis, *et al.*, 2004).

Interviews with key informant respondents from the environment department at City hall, Water Resource Authority (WRA), hotels and focus group discussion with University of Nairobi Chiromo campus expressed the same feeling. University of Nairobi students reported that SWM

policy frameworks has good policies but there were poor implementation strategies and the state of corruption in the county has further slowed down the enforcement of the policies. This agrees with the findings of Okot-Okumu, *et al.,* 2012 on SWM in East African cities.

One of the officers at the department of monitoring, compliance and enforcement at NCC, observed that the lack of enforcement was to do with lack of enough supporting legal framework that is existing which cannot accommodate the challenges of SWM. This is coupled with lack of coordinating mechanism and political interference where politicians abet with cartels and illegal dumpers to strengthen their political space together with threats from city cartels and lack of proper integrated SWM system. Others added that there was a gap between capacity (staff) and existing gap between the community and sub-county environment officers. This has been observed as a trend in many developing countries who are faced with challenges when it comes to enforcing and implementing environmental policies and regulations on solid waste management (Stella, 2014; Taiwo, 2015; Ogutu, 2017).

According to the NEMA officer in charge of SWM, enforcement on the ground was a challenge because the sector was controlled by cartels, who operate an anarchist regime outside the legal and institutional frameworks and are dangerous and armed. They are rife especially where the NCC and authorities in the management of SW have been weak in playing their role as they come in to fill in the vacuum. However, they have been entrenched in the system and are hard to eliminate. Additionally, one of the respondent from the upper category hotels, in his own words said, 'NCC must be more professional in their approach to work and be more objective, not extortionist on intent and purpose". They suggested good environmental governance in SWM, that there should

be cohesion and coordination between the institutions responsible for SWM and hotels management team so as to streamline service delivery in collection of waste to avoid accumulation of food waste which created bad odour, resulting to breeding sites for worms and rodents which leads to outbreak of diseases, for example, last year there was an outbreak of cholera in Nairobi (NCC, 2017).

Results of current study (2018) shows that majority of respondent's at 77% wanted the set policies and regulations on SWM be implemented effectively and people empowered on proper waste disposal. This would yield desired result of a clean and safe environment and would affect their health in a positive way. This was observed during the key informant interviews and focus group discussions. This feeling was also shared by respondents from focus group discussion in Kibra, University of Nairobi students Chiromo campus, private service providers and hotel institutions. This correlated with the findings of Njoroge, *et al*., 2014 on review of MSWM, a case of Nairobi.

According to UNEP (2015), Sub – Saharan Africa is continuously faced with major challenges in providing universal access to waste collection services and dysfunctional policies and regulations on SWM which are a challenge to implement (UNEP, 2015).

The University of Nairobi Chiromo campus student's focus group discussion revealed that; Institutions like the University of Nairobi have been on the forefront when it comes to solid waste management and compliance to the policy framework on SWM. The University has an Environmental Policy statement aligned with environmental laws in Kenya. One of its objectives

is to encourage use of no papers in its operations and have embraced the 3Rs concept (reduce, reuse and recycle). The University encourages the use of soft copy notes, online submission of assignments and one line relay of information to the students and on line registration of courses. There is also an unwritten rule where outgoing students leave their class notes for ongoing students hence reducing the amount of paper used as the new students do not have to photocopy the notes afresh.

Chiromo campus medical school which generates biomedical waste which was classified as hazardous by EMCA 1999, has tried its best to properly dispose of the waste. The school has a functional drainage system, taps and sinks for disposal of chemical solutions and waste water and burn waste and dead bodies through incinerators. Allocation of dustbins at various spots within the campus that caters for both organic and inorganic wastes, leads to desired results. This shows that effective implementation of policies and regulations on solid waste management is achievable through participation and inclusivity of all stakeholders. This agrees with the findings of effective solid waste management policies and regulations in Cape Town which is inclusive and participatory (UON, 2010; Lisa, *et al* 2010).

The upper level hotels were aware of the existing laws on solid waste management and acknowledged that compliance was mandatory and the hotel management were doing their best to operate within the stipulated laws regarding prompt collections, segregation and disposal by licensed waste handlers. Once in a while they train their staffs on SWM and even have surveillance cameras to monitor the same.

These hotels preferred to work with private firms in collection of waste as compared to NCC which they termed as inefficient. They don't mind paying the average of Ksh 60,000 per month to the PSP because at least the waste is collected on a daily basis, sorted within the hotel premises and disposed of accordingly. They felt that NCC should put in place an infrastructure that is functional in terms of waste collection and handling so that institutions like hotels don't have to resort to more expensive solutions for food waste collection, reflecting institutional structures challenges, which is contrary to institutional theory, which emphasizes multi- tier structure where each entity work together for a common goal (Scott, 1995., Delbridge and Edwards, 2013., Ogutu Florence, 2017)

The CBOs at Kibra, noted that there were no designated places for dumping waste which they have collected from the residents and they get stranded and result to indiscriminate disposal. They observed that NCC was not doing enough when it comes to the implementation of the policies on SWM as evident by the state of the environment in NCC, especially informal settlements like Kibra, Kwa Reuben, Kwa Njenga and Muthaiga dumpsite among others. This finding was observed by Simelane and Mohee (2012) on SWM ineffectiveness in developing countries.

Impact of poor implementation of the set policies on SWM was further noted by NEMA officer, NCC environment officers at sub- county levels, Dumpsite manager and Deputy Director of environment at NCC is as a result of limited funding, lack of key SWM infrastructure, manpower, machinery and implementation mechanism which are obstacles for SWM stakeholders to be compliant to the set policies (Njoroge, *et al.,* 2014).

Global waste management outlook (GWMO, 2015) focus has shifted from waste disposal to addressing the problem from the source through preventing its generation, adopting 3Rs concept. This concept was aligned to the WMR 2006, focus is on waste segregation, recycling and reuse, no indiscriminate littering and responsibility of waste management is with the generator (GWMO, 2015). This is revealed by the study where majority of the respondents at 88% were willing to comply with governance instruments for sustainable waste disposal practices and management system through waste segregation, recycling and reusing.

They also acknowledged that waste is a resource that can be exploited to create wealth, employment and reduce pollution of the environment. They felt that if proper structures are put in place in terms of institutional, technical, financial and regulatory structures are put in place, it would have a great impact in waste disposal practices and would reduce significantly the amount of waste in the city. This would effectively address the challenge of SWM in the city. This shows that effective implementation of the policies and regulations on solid waste management to attain a sustainable system is achievable through good environmental governance. This data as suggested by other previous authors seems to suggest that empowered institutions are important in successful implementation of SWM policies (Marshall and Farahbaksh, 2013).

However, they pointed out that, there were no proper structures in place for implementation and there is lack of capacity, limited funding, weak institutional mechanism, low technical know-how, poor planning and inadequate infrastructure as revealed by CBOs in Kibra, sub- county environment officers, NEMA officer, private service providers (PSP) and dumpsite manager at Dandora. This was also observed by the CBOs in kibra that proper structures to facilitate their operations was lacking. They operate in very difficult conditions the public is not cooperative,

working with them is impossible which is worsened by the culture of littering, corrupt NCC officers, harassment by cartels and limited funds and infrastructure, suggesting lack of implementation of the SWM policies (Njoroge, *et al*., 2014)

The CBOs further noted that the sorters who are basically looking for valuables, scatter the waste which has been deposited by the roadside awaiting collection by the NCC trucks. This inconvenient them since they have to pay someone again to recollect and put it in a heap. These were observed by Cheserek, *et al.*, (2013) as impediments faced by County Government to implement policies and regulations on SWM. The NCC has realized the role the CBOs play in waste management and are given recognition letters.

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According to NEMA (2014), SWM system at NCC lack waste minimization and waste is not seen as a resource of value which can be exploited, thus reuse, recycling, composting and sanitary landfilling hardly takes place and Recycling is at 8% and resource recovery at 3%

(NEMA, 2014).

Findings of current study indicate that environmental governance in SWM in NCC is faced with great challenges as a result of public attitude and public responsibility and environmental ethics and values which are significantly low, at 47%. Focus group discussion by CBOs indicated that most members of the public were not very conscious when it came to waste management. Most people dump waste on the roadside or throw them out of windows of cars and still complain of poor sanitation in the area. Those assigned to create public awareness have not done a good job as they assume that people already know what they should be doing which was not always the case.

Sometimes they don't reach out to people at the grass root level. When they do, they provide the information but not the relevant facilities required to effectively manage waste. Thus poor enforcement of policies and regulations on SWM has led to environmental degradation (Ogutu, 2017)

Public awareness and attitude on SWM can affect the entire SWM system and is key to the success or failure of a SWM system. According to the officer at NEMA, it is almost impossible to charge someone with illegal dumping as you have to do risk assessment before you take action.

The officer from NEMA further noted that, the National solid waste management strategy (NSWMS, 2015) is a strategy that is not enforceable. It is a guideline unless it is anchored into the existing law. On paper, the policies and regulations on SWM are good but implementation is a big challenge. This is worsened by the state of corruption in the County which has further slowed down the enforcement of SWM policies as funds meant to support such programs have continuously been embezzled. This data, as suggested by other previous authors shows that implementation of SWM policies and regulations required strong enforcement measures through greater management capacity (Jacobi and Besen, 2011).

It was observed that the private service providers (PSP) and CBOs from Kibra, face operational challenges due to the public attitude towards SWM, making it difficult to be compliant with the set regulations and policies on SWM.

According to the officer in charge of SWM from water resource authority (WRA), there has been increased dumping of SW along water sources over the years and Nairobi and Ngong Rivers are heavily polluted by waste. He observed that the problem is due to lack of proper SWM plan and poor public attitude to SWM. The public do not care for their environment leading to poor waste disposal practices and the culture of indiscriminate littering. He also felt that there were conflicting legislations with overlapping of mandates which slowed down the implementation process and poor coordination between parties. Additionally, as revealed by key informant interview at city hall, poor institutional structure in waste management has led to poor coordination for example National Youth Service (NYS) is under different authority and thus NCC can't control their activities of solid waste management (WRM, 2017; Ogutu, 2017; NCC, 2017)

This study found that the generator of waste is not responsible for the waste they generated. This is enhanced by attitudes such as; out of my backyard syndrome, 'so long as waste is removed from my neighbourhood the rest is not important, even if it ends up being disposed illegally.' This data concur with Njoroge, *et al. (2014),* findings of illegal dumpsites scattered throughout the NCC and the researcher findings from the satellite data GIS analysis confirmed this scenario (Njoroge, *et al.,* 2014; Ogutu Florence, 2017).

The respondents acknowledged that the Nairobi City County was not doing enough public awareness and they observed that the poor state of the environment clearly shows not much of awareness has been done. According to focus group discussions by CBOs and University of Nairobi Chiromo Campus students, they noted that NCC lack capacity, has no proper strategies for WM in place, NCC officers are corrupt and negligent in WM, they are discouraged since people

ask for money during such clean – up events and it was done by NGOs. However, they agreed that NCC hold awareness events with the youths, they have conducted environmental clean-ups and put up posters and messages written in litter bins to enhanced awareness efforts, among others, though it is not sustainable (Ogutu, 2017).

The dumpsite manager blamed the public on the current state of WM in NCC. The clean ups the NCC organises in collaboration with other stakeholders is never sustainable since the public always viewed it as a program for NCC which they do not own. This is in agreement with previous authors like the late Maathai (2009); “You cannot protect the environment unless you empower people, you inform them, and you help them understand that these resources are their own, that they must protect them”

Respondents from the middle class hotels, concur that NCC is not effective in addressing the issue of public attitude towards SWM and the public lacks environmental values and ethics. At times they appear in these hotels for inspection early in the morning and ask for environment licence, which is paid monthly and they end up arresting workers who have not worn uniforms. When they are taken to NCC court, they are charged as follows; ‘found littering the streets ‘, and the fines range from ksh 1,500 to 3,000. This reflects their inefficiency and poor institutional structure and this is the more reason for the public attitude towards SWM. This data, as suggested by other previous authors reveals that public awareness applied to SWM will require strong enforcement measures through empowered institutions and stakeholders (Onibokun and Kimuyi, 1999).

University of Nairobi Chiromo campus students reported that their campus is totally complaint to all the set policies and they even promote public awareness on SWM. Within the University there are clubs like Chiromo Environmental Awareness Club (CEAC), Biological Association of Nairobi University (BANUS) and Chiromo Campus Peer Educators (CCPE) that have worked tirelessly in creating awareness on solid waste management at the campus. Allocation of dustbins at various spots within the campus has further helped reduce careless dumping of waste

It is of critical importance to ensure that the policies and regulations on SWM are implemented so as to promote sustainable solid waste management system. Thus University students can be used as environmental stewards to promote public awareness amongst the public in NCC on solid waste management.

However, all is not lost and there is a ray of hope as policy regulators like NEMA and NCC have come up with various ways of dealing with this menace. In 2017 for instance, there was a gazette notice No. 2356 on plastic bag ban which was reinforced hence reducing the amount of plastic waste in the city. There has also been allocation of litter bins in the CBD and this has reduced careless dumping of waste by the public, though it is skewed whereby down town litter bins are hardly found. The enactment of Polluters Pay Policy by NCC has reduced aimless littering for fear of penalties (NCC, 2017).

Different organizations and media houses have stepped up campaigns in creating public awareness on solid waste management. These organizations sometimes even organize clean-ups within the county in a bid to reduce the amount of solid waste in the city though it's not sustainable (NCC, 2017; Ogutu, 2017).

7.3 Conclusion

The following conclusions could be drawn from this study

- The residents of Nairobi City County lack public awareness and environmental values and ethics in solid waste management, thus poor SWM disposal practices
- Nairobi City County structures in relation to institutional, technical, financial and regulatory are unable to cope with increased generation of waste brought about by increased population growth
- The study brought out the essence of proper environmental governance and how its process works and lack of good governance is the main problem of SWM in NCC

7.4 Recommendations

Based on the observed conclusions, this study recommends the following:

- Public awareness and environmental values and ethics be enforced through inclusiveness, involvement and participation of all stakeholders in managing solid waste effectively and efficiently.
- There is need for a clear coordination mechanism of policy making implementation and evaluation so as to create synergy among all the stakeholders and enhance institutional capacity, regulatory, infrastructural, human resources and financial for effective implementation of policies.
- There is need of institutionalization of good governance in solid waste management through bridging the gap between different stakeholders by inclusiveness and participation.

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APPENDICES

APPENDIX I: Logical framework operationalization of variables table

Objective	Variables	Target Pop &Sample Size (Why?)	Indicators	Data Collection	Measurement	Data Analysis	Anticipated Output
1. Analyse the existing policy framework on SWM and its effectiveness in addressing SWM in NCC	Provisions of the framework, overlaps, grey areas, strengths	County boundary shape-file, Kenya rivers shape-file, Kenya roads shape-file and Kenya settlements shape-file from Survey of Kenya databases	Environmental Governance. Implementation and enforcement mechanism weak. Population growth trend	Remote sensed images, Secondary data on economic and population growth, Solid waste collections	Examine current conditions, trends and status of events in SWM. Spatial analysis of unplanned dumpsite. Ground coordinates	Thematising. Codes and content analysis/ frequency distribution tables. Maps and satellite images	Satellite images. Maps of unplanned dumpsites in Kibra, Embakasi and Lavington. Trend of events in SWM, 2003, 2007, 2013 and 2017.
2. Evaluate the implementation level in SWM and its impacts in NCC. This includes legal and institutional arrangement	Solid waste dynamics &Economic growth trends. Weak implementation and enforcement mechanisms	Residents Association – 2, Hotels; lower, middle and upper class hotels 9, NCC -6, NEMA-3, Environment ministry WRMA-3,NCC - 7, UNEP-3, University of Nairobi students. Target study area residents: kibra, Embakasi	SWM trend/ coverage, government officials reports, Implementation compliance.	Primary data-Key informant interviews and FGD, Secondary data- documents from the ministry of Environment, NEMA, reports, journals, University theses	Nominal and interval	Content analyses and thematic codes	Documentation of the SWOT analysis of the SWM policy
3To examine the public attitude and	Awareness of SWM &	Target study area – kibra, Embakasi & Lavington -385	Compliance level,	Questionnaire – Likert scale, FGD	Tables, pie charts,	Content analysis, check list	Documentation of the questionnaire analysis, content

environmental ethics and its impact on SWM in NCC	roles of stakeholders		empowerment	& key informant interview.	nominal & interview		analysis and descriptive statistics

APPENDIX 2: Photographs / plates

Researcher with CBOs from Kibera during a FGD.

Researcher with University of Nairobi Chiromo Campus Students During a FGD Session

Researcher with waste pickers at Dandora dumpsite during an FGD session.

A trench at Lavington upper class zone, not clogged with waste

A trench in Kibra clogged with waste.

Ngong River polluted with waste.

Nairobi River polluted with waste, a bridge in Dandora, leading to the dumpsite

River through Kibera polluted with waste

Ngong River polluted with waste.

Kibra informal settlement (lower class zone) surrounded by waste.

One of the residential areas in Embakasi (middle class zone), waste free

One of the residential areas in Lavington (upper class zone) waste free.

CBOs at Kibra transporting waste with handcarts, reflect the difficult conditions they faced in their operations.

Uncompliant waste transporter

A waste transporter vehicle carrying waste from Lavington area (upper class zone)

Part of the perimeter wall, only 200 metres has been constructed so far, to meet NEMA ten minimum requirements of a good landfill, to control dumping and spread of waste outside.

Open dumpsite at Dandora, contravenes the ten minimum requirements of National solid waste management Strategy of 2015, set by NEMA of a good landfill

The rest of the dumpsite, open dumpsite, against NEMA ten minimum requirements of a good landfill.

APPENDIX 3: Household research questionnaire

This questionnaire is designed to assess the effectiveness of policy framework on solid waste management in Nairobi City County, Kenya. As a resident of this city, you have been selected to participate in the survey as a respondent and your confidentiality is guaranteed. Kindly give honest and elaborate responses which is very important to the success of this study.

Thank you in advance.

SECTION A.

(a) Background information.

(1) **Physical Location: GPS**

Zone	
Estate	
Nearest street.	

(2) Gender of Respondents [a] Male [b] Female.

(3) Age categories (years). Tick appropriately.

15 - 20	21 - 25	26 - 30	31 - 35	36 and above.

(4) Indicate / tick your current marital status.

Married	Single	Divorced	Widow / widower.

SECTION B.

(5) Socio – economic characteristics of Household.

I Education level. Indicate your highest level of education.

Primary.	Secondary	Tertiary	University

2 Income category / sources of incomes.

Unemployed	Employed	Self employed	Profession

(iii) Socio – economic status. (Income).

Lower class Below ksh 30,000	Middle class Ksh 30, 000 – 100,000.	Upper class Above Ksh 100,000.	Others

6 (a) How long have you lived in this estate?

[1] Less than 12 months.

[2] 1 – 5 years

[3] Over 5 years.

(b) How long have you lived in this Nairobi City County?

[1] Less than 12 months.

[2] 1 – 5 years.

[3] Over 5 years.

7 Is your house accessible from the Main Street / road?

[1] Yes [No]

8 How can you describe your house from the following?

[1] Informal settlement.

[2] Apartments.

[3] Gated community

[4] Others.

SECTION C: INFORMATION ON TOPIC

PUBLIC INFLUENCE / AWARENESS AND ATTITUDE (ENVIRONMENTAL VALUES) ON SOLID WASTE MANAGEMENT

1 Do you know what makes an environment clean or dirty?

[1] I know a lot.

[2] I know little.

[3] Neutral.

. [4] l do not know.

2 There are legislation / regulation on solid waste management in Nairobi City County that is meant to influence your behaviour on the way you handle your generated waste?

[l] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

3 Do you agree that the policies and regulations on solid waste management in Nairobi City County has affected people's attitude and behavior on the way they handle waste?

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree

4 Do you think the enforcement of environmental policies and regulations in Nairobi City County has been properly carried out?

[1] Strongly agree.

[2] Agree

[3] Disagree.

[4] Strongly disagree.

5 Do you consider environmental issues like solid waste management to have any relevance to your daily life?

[l] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

6 Identify your choice of what is important to you as an individual in the following:

[1] Clean environment.

[2] Profits / income / business.

[3] Education.

[4] Employment.

[5] Insurance

7 Do you agree with the statement that, the conditions of your environment influences your health?

[1] Strongly agree

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

8 What is your opinion of the statement that, it is okay for a licensed waste transporter to dispose waste anywhere, instead of a designated waste disposal facility?

[I]Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

9 What is your opinion of the sugarcane vendor in your neighbourhood who operates without a dustbin to dispose of the sugarcane waste? Does this affect you?

[1] Affects me so much.

[2] Affects me a little.

[3] Neutral.

[4] Doesn't affect me at all.

10 Do you think segregating waste at the source is an important environmental requirement which should be applied by everyone generating waste in Nairobi City County?

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

11 We have the responsibility to reduce the amount of waste generated through recycling / reuse and everyone should adhere to this practice?

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

12 How does it concerned you as an individual if you see waste scattered anywhere in the Nairobi City County?

[1] Very concerned.

[2] Concerned.

[3 Neutral.

[4] Unconcerned

13 If you see people dumping waste in your residential area / public place, what influence do you have to hinder this illegal practice?

[1] Strong influence.

[2] Little influence.

[3] Neutral

[4] No influence

14 What influence would you have on your neighbour to make them segregate waste from the source?

[1] Strong influence.

[2] Little influence.

[3] Neutral

[4] None.

15 What is your opinion of an overloaded and licensed waste transporter vehicle scattering waste on the road.

[1] Serious problem.

[2] Problem.

[3]Slight problem.

[4] No problem.

16 On a scale of 1-5, how would you rate the following?

[1] Any person generating waste shall collect, segregate and dispose.

[2] Every person in Nairobi City County has a duty to cooperate with Nairobi City Council in solid waste management, a pathway to a clean and healthy environment

[3] Waste is not just waste, but a resource that can be harnessed to create wealth, employment and reduce pollution of the environment

[4] People in Nairobi City County have become tolerant living in a dirty environment.

[5] 20 People should have the responsibility to manage the waste they generate.

17 Throw away culture of disposing solid waste reflects how the Nairobians value their natural environment.

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

18 Every person in Nairobi City County has the right to a clean and healthy environment for the benefit of present and future generations.

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree.

19 I always care about the hygiene in a hotel where food is served.

[1] Strongly agree.

[2] Agree.

[3] Disagree.

[4] Strongly disagree

20 (a) If you generate waste and there is no litter bin, would you keep it until you get a dustbin or throw it?

A Yes B No.

[b] Explain your response.

……

……

21 (a) Have you ever inquired from your waste collector where he dispose of the waste?

A Yes B No.

[b] If yes, why did you enquire, explain.

……

……

If No, why didn't, you enquire, explain.

……

……

22 Is it appropriate for the Nairobi City County police to arrest a person who is littering the street?

A Yes B No

Explain your response.

……

……

23 Do you think the Nairobi City County is doing enough about public awareness on the issue of waste handling?

A Yes B No.

If yes, how are they doing it?

……

……

If No, why? Explain.

……

……

24 Do you have clean – up programs in your area?

(A) Yes (B) No.

If yes, does it have impact on the way people handle their generated waste?

……

……

If No, why? Explain.

……

……

(b) How can these clean – up programs be improved to make people change their attitude on the way they handle their generated waste? Explain

……

……

Thank you for your cooperation

APPENDIX 4: Key informant interview guide for hotels/ food kiosk

Serial No…….

This key informant interview guide is meant to collect information on the policy framework on solid waste management in Nairobi County, Kenya. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as applicable. The information provided will be considered confidential and no instances will your name be mentioned in this research. This research is intended for an academic purpose only.

SECTION I: DEMOGRAPHIC INFORMATION

1. Gender Male □ Female□

2. Age □ below 30 years □ 30-39 years □ 40-49years □ 50-59 years

3. Name of Hotel / Restaurant / Institutions.....

4 Specify the category of hotel in terms of its service.

i Kiosk (lower class) ii Restaurant (Middle class) iii Full – service hotel (Upper class).

5 For how long have you worked with this Hotel/ Restaurant / institution?

i. Less than a year ii. Between 1-5 years

iii. Between 6-10 years IV. Over 10 years

5. What is your highest level of education? (Please tick one)

I. Secondary iii. Tertiary College

ii. Undergraduate iv. Postgraduate

v other (specify) ……

SECTION II: INFORMATION ON TOPIC

A: SOLID WASTE MANAGEMENT IN KENYA

1 Which legislation / policies / laws are there in Kenya in relation to the way people are supposed to manage their generated waste?

……

……

……

2 What are the provisions (clauses) of the policy framework on solid waste identified above?

……

……

3 How do you operate within the provisions of these policies to manage the waste your hotel generate on a daily basis?

……

……

4 Has Nairobi City County sensitise your staff on issues related with the way waste is meant to be handled?

……

B. IMPLEMENTATION LEVEL OF POLCIY FRAMEWORK ON SOLID WASTE MANAGEMENT

5 How do you manage your waste on a daily basis?

……

……

6 There are polices on the way waste is meant to be stored, collected, treated and finally disposal. How is your hotel operating within these policies?

……

……

7 Does your service provider (NCC) collect your waste on a daily basis?

……

……

8 How much do you pay for service delivery for waste collection and is it efficient?

……

……

9 In what way is the Nairobi City County effective in its waste collection and disposal?

……

……

10 What is the most important challenges faced by your hotel regarding the way you handle your generated waste?

……

……

12 What do you think has contributed to these challenges in relation to the way you handle your generated waste?

……

……

13 How can these challenges be dealt with?

……

……

C. LEGAL AND INSTUTUTIONAL ARRANGEMENT FOR SWM IN NCC

(a) LEGAL

14 Does your hotel know of any legal instruments that is meant to guide the operations of waste handling?

……

……

15 How do you implement these legal instruments in relation to waste handling in your hotel?

……

……

16 What challenges do you experience in the implementation of the legal instruments for waste handling in your hotel?

……

……

17 There are institutions that deal with policies in relation to the way the hotels are meant to handle their generated waste. Can you identify them?

……

……

18 Comment on their performance as far as waste handling in hotels is concerned?

……

……

19 Give suggestions on how these institutions dealing with waste management can be improved?

……

……

20 Please recommend actions that should be taken by NCC to improve waste management system in hotels in Nairobi City County?

……

……

THANK YOU

APPENDIX 5: Key Informant Interview Guide for Residents Association

Serial No…….

This key informant interview guide is meant to collect information on the policy framework on solid waste management in Nairobi County, Kenya. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as applicable. The information provided will be considered confidential and no instances will your name be mentioned in this research. This research is intended for an academic purpose only.

SECTION I: DEMOGRAPHIC INFORMATION

1. Gender Male □ Female□

2. Age □ below 30 years □ 30-39 years □ 40-49years □ 50-59 years

3. Name of the Residents Association

……

4 Specify the area / zones. ……..

5 For how long has the Resident Association been in operation?

i. Less than a year ii. Between 1-5 years

iii. Between 6-10 years IV. Over 10 years

5. What is your highest level of education? (Please tick one)

I. Secondary iii. Tertiary College

ii. Undergraduate iv. Postgraduate

v other (specify) ……

SECTION II: INFORMATION ON TOPIC

A: SOLID WASTE MANAGEMENT IN KENYA

1 Which legislation / policies / laws are there in Kenya in relation to the way people are supposed to manage their generated waste?

……

……

……

2 What are the provisions (clauses) of the policy framework on solid waste identified above?

……

……

3 How do you implement these provisions of the policy framework on solid waste management in your residential areas?

……

……

4 Has the Nairobi County Government given any training to members of your Association (residents) on solid waste collection and management according to policies?

……

……

B IMPLEMENTATION LEVEL OF SOLID WASTE MANAGEMENT.

5 Does your Resident Association have a system of household disposal mechanism which operate according to the policy / regulations on solid waste management?

……

……

……

6 Does the Nairobi City County have a structure of operation with Residents Association in relation to solid waste management in the residential areas?

……

……

7 In what way is NCC effective in overseeing the operations of Resident Associations regarding the policies of waste management?

……

……

8 Comment on the implementation of the policy framework on solid waste management in Nairobi City County.

……

……

9 What challenges does your Resident Association face in relation to solid waste collection and disposal?

……

……

10 What do you think has contributed to these challenges of solid waste collection and disposal?

……

……

11 How can these challenges be dealt with?

……

……

C LEGAL AND INSTUTUTIONAL ARRANGEMENT FOR SWM IN NCC

12 Does your Resident Association know of any legal instruments that is meant to guide the operations of waste handling in the residential areas?

……

……

13 How do you implement these legal instruments in relation to the operations of waste collection and disposal?

……

……

14 Is there coordination between your Resident Association with NEMA, NCC in terms of encouraging environmental sustainability in solid waste management in the residential areas?

……

……

15 There are institutions that deal with policies in relation to solid waste management in NCC. . Identify them?

……

……

16 Comment on their performance as far as solid waste management in NCC is concerned?

……

……

17 How can these institutions deal with the growth trend of the impact of economic and population growth on solid waste management in Nairobi City County?

……

……

18 The problem of cabbage (solid waste) is a menace in NCC and over the years it has become worse. What role can Resident Association play to find a more sustainable solutions to it?

……

……

……

THANK YOU

APPENDIX 6: Key informant interview guide for waste collectors

Serial No…….

This key informant interview guide is meant to collect information on the policy framework on solid waste management in Nairobi County, Kenya. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as applicable. The information provided will be considered confidential and no instances will your name be mentioned in this research. This research is intended for an academic purpose only.

SECTION I: DEMOGRAPHIC INFORMATION

1. Gender Male □ Female□

2. Age □ below 30 years □ 30-39 years □ 40-49years □ 50- 65 years

3. Name of the service provider…. ……..

4 Specify the area of operation / zones. …….

5 For how long has the service provider / company been in operation?

i. Less than a year ii. Between 1-5 years

iii. Between 6-10 years IV. Over 10 years

6 What is your highest level of education? (Please tick one)

I. Secondary iii. Tertiary College

ii. Undergraduate iv. Postgraduate

v other (specify) ……

SECTION II: INFORMATION ON TOPIC

A: SOLID WASTE MANAGEMENT IN KENYA

1 Which legislation / policies / laws are there in Kenya in relation to the way people are supposed to manage their generated waste?

……

……

……

2 What are the provisions (clauses) of the policy framework on solid waste identified above?

……

……

3 How do you implement these provisions of the policy framework on solid waste management in your daily operations of collecting waste?

……

……

4 Has the Nairobi County Government given any training to members of your service provider (company) on solid waste collection and management according to policies?

……

……

B IMPLEMENTATION LEVEL OF SOLID WASTE MANAGEMENT

5 There are policies for private service providers for collection, segregation, storage, transportation and disposal of waste. Does your company operate within these policies?

……

……

……

6 Does the Nairobi City County have a structure of operation with private service providers in relation to disposal of waste at the dumpsite in Dandora?

……

……

7 In what way is NCC effective in overseeing the operations of private service providers regarding the policies of waste management?

……

……

8 Comment on the implementation of the policy framework on solid waste management in Nairobi City County (NCC).

……

……

9 What challenges does your company face in relation to the waste management operations of solid waste collection and disposal in Nairobi City County?

……

……

10 What do you think has contributed to these challenges of solid waste collection and disposal?

……

……

11 How can these challenges be dealt with?

……

……

C. LEGAL AND INSTUTUTIONAL ARRANGEMENT FOR SWM IN NCC

12 Does your company know of any legal instruments that is meant to guide the operations of waste handling?

……

……

13 How do you implement these legal instruments in relation to the operations of waste collection and disposal?

……

……

14 What challenges do your company experience in the implementation of the legal instruments for waste handling and management?

……

……

15 There are institutions that deal with policies in relation to the way your company is meant to operate. Identify them?

……

……

16 Comment on their performance as far as your operations of waste handling is concerned?

……

……

17 How can these institutions deal with the growth trend of the impact of economic and population growth on solid waste management in Nairobi City County?

……

……

18 Any other comment on solid waste management policy framework (policies / regulations / by laws in Nairobi City County?

……

……

……

THANK YOU

APPENDIX 7: Focus group discussion

Serial No .....

This Focus group discussion (FGD) guide is meant to collect information on the solid waste management policy framework in Nairobi City County, Kenya.

Kindly discuss the questions and answer by writing brief notes. Choose a secretary among the group. The information provided will be treated as confidential and not divulged to anyone not involved in the study. This research is intended for an academic purpose only.

Knowledge of solid waste management

1 What do solid waste management policy framework provide for?

……

……

2 what is your general view of solid waste management policy framework in Kenya?

……

……

3 How effective is the policy framework on solid waste management in Nairobi City County?

……

……

4 What can you say about public awareness on the issue of WM, especially on waste handling in Nairobi City County?

……

……

B Implementation of solid waste management policy framework in NCC.

5 How effective is the collection and disposal of solid waste in Nairobi City County?

……

……....……

6 Name officers who are responsible for the implementation of solid waste management policy framework in Nairobi City County?

……

……

7 How is the Nairobi City County service of solid waste management in relation to economic and population growth?

……

……

8 Comment on the implementation of the policy framework on SWM in NCC.

……..

……..

SWOT ANALYSIS

LAW/PIF	Strength	Weakness	Opportunity	Threats
EMCA 1999				
SWM Regulations 2006				
SWM Strategy 2014				
Water Act 2006/WRMA				
Constitution 8 Kenya 2010				
Vision 2030 county government Act 2012				
NCC by-laws on SWM 2007				
NCC integrated SWM plan (2010-2020)				
NCC SWM Act 2015				
100 days RRI on SWM 2016				

C Legal and Institutional Arrangement on solid waste management in NCC

(a) **Legal**

9 What are the legal instruments that guide solid waste management in Nairobi City County?

……..

……..

10 How do you implement the legal instruments for policy framework on solid waste management in NCC?

……

……

11What are the strengths and weakness of the legal framework on solid waste management in NCC?

……..

……

12 What improvement should be made on the legal framework for solid waste management in NCC?

……

……

13 Any other comments on solid waste management policy framework in NCC?

……

…….

D Institutional

14 Which institutions deal with solid waste management policy framework in NCC?

…….

…….

15 What are their mandates in relation to solid waste management policy framework in NCC?

……

16 How do they implement these mandates in solid waste management policy framework in NCC?

…….

……

17 In what ways are these institutions effective in dealing with solid waste management?

……

18 How can the performance of these institutions be improved in NCC?

……

……

19 Is there anything being done to improve these institutions in solid waste management in NCC?

……

……

20 Any other comments for improvement of solid waste management policy framework and knowledge Awareness in NCC?

……

…….

Thank You

APPENDIX 8: Key informant interview for Nairobi City County

Serial No…….

This key informant interview guide is meant to collect information on the policy framework on solid waste management in Nairobi County, Kenya. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as applicable. The information provided will be considered confidential and no instances will your name be mentioned in this research. This research is intended for an academic purpose only.

SECTION I: DEMOGRAPHIC INFORMATION

1. Gender Male □ Female □
2. Age □ below 30 years □ 30-39 years □ 40-49years □ 50-59 years
3. Name of Ministry/Organization……
4. For how long have you worked with this Ministry/organization?

   i. Less than a year ☐ ii. Between 1-5 years ☐

   iii. Between 6-10 years ☐ iv.Over 10 years ☐
5. What is your highest level of education? (Please tick one)

   i. Secondary ☐ iii. Tertiary College ☐

   ii. Undergraduate ☐ iv. Postgraduate ☐

   v other (specify) .....

SECTION II: INFORMATION ON TOPIC

A: SOLID WASTE MANAGEMENT IN KENYA

1 Which legislation are there in Kenya in relation to solid waste management?

……

……

2 What are the provisions of the policy framework on solid waste management identified above?

……

……

……

3 How do you implement these provisions of the policy framework on solid waste management?

……

……

4 How is the current status of solid waste management impacted by your interaction with Nairobi City County?

……

……

B: IMPLEMENTATION LEVEL OF SOLID WASTE MANAGEMENT

5What is the growth trend of solid waste management in Nairobi City County?

……

……

6 What do you think is your level of involvement in solid waste management?

……

7 How has this changed over time?

……

……

8 Why has this happened? Explain your response.

…….

……..

9 In what way is the Nairobi City County effective in its waste collection and disposal?

……

……

10 Comment on the implementation of the policy framework on solid waste management in Nairobi City County.

……

……

11 What is the existing weakness in the implementation of the policy framework on Solid Waste management in Nairobi City County?

……

……

12 What do you think has contributed to this weakness in the implementation of the policy framework for solid waste management?

……

……

13 How can this weakness in the implementation of the policy framework for solid waste management dealt with?

……

……

C: LEGAL AND INSTITUTIONAL ARRANGEMENT FOR SWM IN NCC

(a) LEGAL

14 What are the legal instruments that guide solid waste management in your institutions?

……

……

15 How do you implement the legal instruments for policy framework on solid waste management in your institutions?

……

……

16 What challenges do you experience in the implementation of the legal instruments for policy framework on solid waste management in Nairobi City County?

……

……

17 What do you think brings about these challenges in the legal framework for solid waste management?

……

……

18 How can these challenges in the legal framework for solid waste management policy framework be dealt with?

……

……

19 What is being done at the moment to address these challenges of the legal framework on solid waste management policy framework?

……

……

(b**) INSTUTUTIONAL ARRANGEMENT**

20 What is the institutional arrangement in regard to solid waste management?

……

……

21 Which institutions deal with policy framework for solid waste management?

…….

……..

22 What is your general view of these institutions dealing with solid waste management?

……..

……..

23 In what ways are these institutions effective in dealing with solid waste management?

……..

……..

24 What weaknesses do exist in these institutions dealing with solid waste management?

……

……

25 How can the performance of these institutions dealing with solid waste management be improved?

……

……

26 What is being done to improve these institutions dealing with solid waste management?

……

……

27 Do you keep records of solid waste management and which ones?

……

……

28 How are you managing waste at the dumpsite?

……

……

29 What are the challenges faced by NCC in the management of the dump site?

……

……

30 What do you think has contributed to these challenges in the management of the dumpsite?

……

……

31 What is being done to address these challenges in the management of the dumpsite in Nairobi City County?

……

……

32 What is the impact of economic and population growth trend in relation to SWM in NCC?

……

……

33 How can these institutions address the impact of economic and population growth trend on solid waste management policy framework in Nairobi City County?

……

……

APPENDIX 9: Key informant interview for waste regulator (Nema)

Serial No

This key informant interview guide is meant to collect information on the policy framework on solid waste management in Nairobi County, Kenya. Kindly answer the questions by writing a brief statement or ticking in the boxes provided as applicable. The information provided will be considered confidential and no instances will your name be mentioned in this research. This research is intended for an academic purpose only.

SECTION I: DEMOGRAPHIC INFORMATION

1. Gender Male □ Female□

2. Age □ below 30 years □ 30-39 years □ 40-49years □ 50-59 years

3. Name of Ministry/Organization / Institutions

……

4. For how long have you worked with this Ministry/organization / institution?

i Less than a year ☐ Between 1-5 years ☐

iii. Between 6-10 years ☐ V. Over 10 years ☐

5. What is your highest level of education? (Please tick one)

i. Secondary ☐ ii. Tertiary College ☐

ii. Undergraduate ☐ IV. Postgraduate ☐

V other (specify)……

SECTION 11: INFORMATION ON TOPIC.

A: SOLID WASTE MANAGEMENT IN KENYA

1 What are the existing policy framework in solid waste management?

……

……

2 How effective are the policy framework in managing solid waste?

……

……

3 As a regulator, how do you implement these policy framework in solid waste management?

……

……

4 What are the impacts? Are you achieving the results?

……

……

……

……

B LEGAL AND INSTUTUTIONAL ARRANGEMENT FOR SWM

5 What legal tools are there used to manage solid waste management both at the national and county level?

……

……

6 How do you implement the legal instruments for policy framework on soil waste management?

6 What is the institutional arrangements for solid waste management?

……

……

7 How is the interaction of NEMA and these institutions?

……

8 How is the interaction between NEMA and Nairobi City County as far as solid waste management is concerned?

……

9 What is NEMA action plan as far as the status of solid waste management in Nairobi City County is concerned?

……

……

10 From NEMA perspectives, how do you address the impact of economic and population growth trend in relation to solid waste management in Nairobi City County?

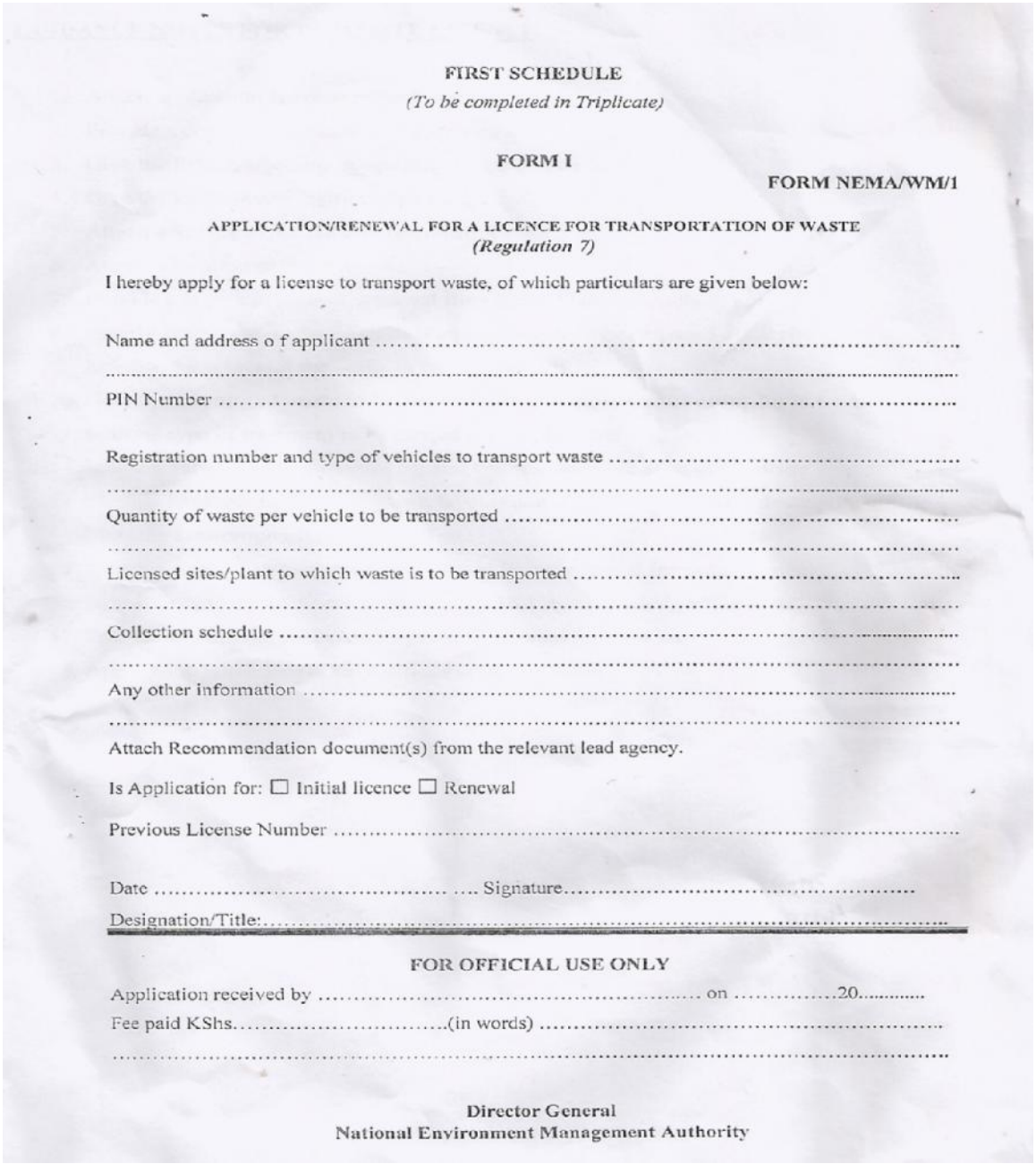
……

……

11 The generator of waste (the public) are not responsible for the waste they generate in Nairobi County and public awareness on solid waste management is lacking. As the regulator, how are you addressing this challenge?

APPENDIX 10: Renewal of licence

REQUIREMENT FOR RENEWAL OF LICENCE



FIRST SCHEDULE

(To be completed in Triplicate)

FORM I

FORM NEMA/WM/1

APPLICATION/RENEWAL FOR A LICENCE FOR TRANSPORTATION OF WASTE

(Regulation 7)

I hereby apply for a license to transport waste, of which particulars are given below:

Name and address o f applicant .....

.....

PIN Number .....

Registration number and type of vehicles to transport waste .....

.....

Quantity of waste per vehicle to be transported .....

.....

Licensed sites/plant to which waste is to be transported .....

.....

Collection schedule .....

.....

Any other information .....

.....

Attach Recommendation document(s) from the relevant lead agency.

Is Application for: ☐ Initial licence ☐ Renewal

Previous License Number .....

Date .... Signature.....

Designation/Title:.....

FOR OFFICIAL USE ONLY

Application received by ..... on .....20.....

Fee paid KShs.....(in words) .....

.....

Director General

National Environment Management Authority

APPENDIX 11: Requirements for waste transporters.

	Initial Transport Application Checklist	Yes	No
1	Attach application fee receipt/bank slip		
2	Provide copy of certification of registration		
3	Give PIN number and attach the PIN certificate		
4	Provide copy of Logbook		
5	State type of vehicle		
6	Provide two photographs of vehicle front view and side/rear view showing vehicle is appropriately labelled		
7	Submit copy of valid Insurance certificate		
8	Submit copy of Vehicle Inspection unit report		
9	Submit a valid copy of driver's licence		
10	Indicate amount of waste to be transported		
11	State type of waste to be transported		
12	Indicate whether the disposal site licenced by NEMA		
13	Attach copy of contract/Authority with the waste disposal site operator		
14	Provide a sample tracking document with company logo in NEMA prescribed format		
15	Provide name, designation and signature of contact person		
16	Put official company stamp on application form		

Points to consider

1. Is the type of vehicle appropriately labelled for the type of waste?
2. Is the disposal point appropriate for the waste
3. Reviewer.....
4. Date.....

APPENDIX 12: REQUIREMENTS FOR DUMPSITE OPERATOR

GUIDANCE NOTES FOR DUMPSITE LICENCE

1. Attach application fee receipt/bank slip
2. Provide a copy of certificate of registration of company
3. Give the PIN number and attach the PIN certificate
4. Give the location and district of plant/site
5. Attach a Survey of Kenya grid reference A4 site plan
6. Attach a location plan for the site
7. Provide a copy a licence of approval from Local Planning Authority
8. Clearly describe the type of waste/Nature of waste to be disposed off at site
9. Indicate the source of the waste to be disposed off
10. Give the quantity of waste to be disposed off; daily and annual estimates in tonnes or Kgs
11. Indicate type of treatment to be carried out on plant/site
12. Indicate the year of commissioning and the estimated life span of plant/site
13. Provide Engineering designs, plans, layouts and sketch and boundary description of site
14. State the area/proposed hectarage of site
15. Attach a copy of an executive summary of Environmental Impact statement
16. Attach a copy of EIA licence/copy of NEMA EA acknowledgement letter
17. Provide name, designation and signature of contact person
18. Application letter should have official company stamp

APPENDIX 13: Requirements for license for NCC for waste collectors

Requirements by NCCG to Give License for Waste Collection

- Single business permit for garbage collection
- Physical address
- Capacity to conduct waste collection Roadworthy well labeled trucks that are covered (trucks are inspected)
- List of clientele
- Waste transportation permit from NEMA
- Certificate of corporation
- For youth groups and CBO'S they must have a registration certificate, constitution showing waste management is their main activity and a recommendation letter from the sub county environment officer in their area of operation