KENYATTA UNIVERSITY

SCHOOL OF ENVIRONMENTAL STUDIES

DEPARTMENT OF ENVIRONMENTAL PLANNING AND MANAGEMENT

AN ASSESSMENT OF THE LEVEL OF COMPLIANCE WITH THE SOLID WASTE MANAGEMENT REGULATIONS (2006) IN STAREHE DISTRICT, NAIROBI COUNTY

BY

OCHIENG VICTOR A

N36/2767/2010

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR AWARD OF THE DEGREE IN BACHELOR OF ENVIRONMENTAL PLANNING AND MANAGEMENT

MAY, 2014
DECLARATION

I declare that this project is my original work and has not been presented for any degree in this or any other university.

……………………………………….. Date…………………………

Ochieng Victor A.

N36/2767/2010

DECLARATION BY THE SUPERVISOR

This project has been submitted for examination with my approval as the university supervisor

………………………………………….. Date…………………………

Allan C. Kurui

Department of Environmental Planning and Management
DEDICATION

This work is dedicated to Kenyatta University, Department of Environmental Planning and Nairobi County Government, Department of Environment, Solid Waste Management Section.
ACKNOWLEDGEMENT

I wish to express my sincere gratitude to Kenyatta University, School of Environment, Department of Environmental Planning and Management Staff for their assistance.

I am particularly grateful for the assistance offered by Dr. Allan C. Kurui as my University supervisor during the study. He consistently dedicated his time to guide me throughout the study.

I acknowledge the cooperation I received from the Nairobi County Government, Environment Department, Solid Waste Management Section. I am particularly thankful to Mr. Dancan Miheso for his permission, as the lead supervisor of the solid waste management section, to conduct the research through data collection.

To all who made the research successful, I am passionately grateful.
ABSTRACT

Globally, solid waste management is a serious challenge for cities in developing counties. The ever-increasing quantity of waste generated in cities in developing countries poses a risk to ecosystem and human health. The challenge is equally notable in regions such as Asia and Africa where there are less developed countries lacking modern waste management technologies. Kenyan cities are not exceptional. The country’s capital, Nairobi, faces a major environmental challenge of pollution from solid waste. Open dumping of waste presents a real threat to the environment and to human health and is commonplace in Nairobi. Constrained by budget pressures, the city county is struggling to deal with the proliferation of solid waste. While there are several justifications for the high level of pollution from solid waste in cities in developing countries, low level of compliance with relevant regulations is a causative factor. The case is true for Nairobi country as evident in the results of this research.

This study was prompted by the urge to find a lasting solution to solid waste pollution in developing countries through high level of compliance with regulations. The research was conducted through a comprehensive evaluation of the level of compliance with the provisions of Solid Waste Management Regulations (2006). The main objective was to establish the level of compliance with the Solid Waste Management Regulations (2006) among waste generators in Starehe District, Nairobi County. To achieve this, questionnaires were administered to various policy implementation officers in Starehe District. Data was analyzed and represented statistically, through use of graphs and tables. The findings show a low level of compliance with the Solid Waste Management Regulations (2006), in Starehe District, Nairobi County.
# TABLE OF CONTENTS

ACKNOWLEDGEMENT ........................................................................................................ iv

ABSTRACT .................................................................................................................................. v

LIST OF FIGURES ......................................................................................................................... x

ABBREVIATIONS ........................................................................................................................ xi

CHAPTER ONE: INTRODUCTION ................................................................................................. 1

1.1 Background of the problem ................................................................................................. 1

1.2 Statement of the problem ..................................................................................................... 2

1.3 Research Objectives ............................................................................................................ 2

1.4 Research questions .............................................................................................................. 3

1.5 Research premises ................................................................................................................ 3

1.6 Justification of the study ...................................................................................................... 3

1.7 Significance of the study ...................................................................................................... 4

1.8 Scope and limitation of the study ......................................................................................... 5

1.9 Operational terms ............................................................................................................... 6

CHAPTER TWO: LITERATURE REVIEW ...................................................................................... 7

2.1 Introduction .......................................................................................................................... 7

2.2 Status of compliance with environmental laws, regulations and policies ......................... 7

2.2.1 Factors affecting compliance with laws, regulations and policies ................................. 7

2.2.2 Socio-economic factors that influence compliance with laws, regulations and policies ........ 7
2.2.3 Public access to Information on the general environmental protection laws............................8

2.3 Compliance with the Waste Management Regulations 2006..................................................8

2.3.1 Important definitions according the Waste Management Regulations 2006 ..................8

2.3.2 Provisions governing solid waste management .............................................................9

2.4 Implications of compliance level with solid waste management regulations ..................10

2.4.1 Low compliance level with Solid Waste Management regulation in Kampala, Uganda....10

2.4.2 Best practices from other countries...............................................................................11

2.5 Applicable strategy to enhance compliance with solid waste management regulations .......12

2.5.1 Theoretical Framework .................................................................................................12

2.6 Gap identification.............................................................................................................15

3.0 CHAPTER THREE: AREA OF STUDY ..........................................................17

3.1 Introduction.....................................................................................................................17

3.2 The physical set up...........................................................................................................17

3.3 Location and extent.........................................................................................................17

3.4 The economic set up .......................................................................................................18

3.5 Population......................................................................................................................19

3.6 Administration ...............................................................................................................19

3.7 Tourism...........................................................................................................................20

3.7 Trade, Commerce and Industry.......................................................................................20

3.8 Transport and communication .......................................................................................20

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY.................................22
4.1 Introduction

4.2 Data Collection

4.2 Research design

4.3 Nature and sources of data

4.3.1 Primary Data

4.3.2 Secondary Data

4.4 Research Instruments

4.5 Population description

4.6 Sampling design and sampling frame

4.7 Use of the likert scale (part of questionnaire)

5.0 CHAPTER FIVE: DATA PRESENTATION, ANALYSIS AND DISCUSSION

5.1 Introduction

5.2 Socio-economic factors and compliance with the regulations

5.2.1 Public access to information on waste management regulations

5.2.2 Possible causes of low compliance level

5.3 Compliance with the Waste Management Regulations 2006

5.3.1 Solid waste transortation regulations

5.3.2 Waste Disposal and Segregation

5.3.3 Compliance with provisions on measures to monitor the product cycle

5.3.4 Regulations on Solid Waste disposal facilities

5.4 Enhancing compliance with solid waste management regulations
5.4.1 Effects of low level of compliance with solid waste regulations ........................................... 33
5.4.2 Illegal disposal of solid wastes ............................................................................................ 34
5.4.3 Penalties on offenses ........................................................................................................... 34
CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS ... 36
6.1 Summary of findings ............................................................................................................... 36
6.2 Conclusions ............................................................................................................................. 37
6.3 Recommendations .................................................................................................................. 37
6.3.1 Addressing challenges of regulatory compliance ............................................................... 37
6.3.2 Best practices to improve compliance with solid waste management regulations ........... 39
References ....................................................................................................................................... 42
Appendix ......................................................................................................................................... 45
LIST OF FIGURES

Figure 2.1: Theoretical Framework .............................................................. 14
Figure 2.2: Conceptual Framework ................................................................. 16
Figure 3.1: Area of study: Starehe District ....................................................... 18
Figure 3.2: Road Network in Starehe .............................................................. 21
Figure 5.1: The level of public access to information on waste management regulations... 28
Figure 5.2: Compliance among solid waste generators ............................... 29
Figure 5.3: Evaluation of compliance level, Based on the Likert scale ............ 30
Figure 5.4: Compliance with provisions on measures to monitor the product cycle ....... 31
Figure 5.5: Evaluation of compliance level by the authority............................. 31
Figure 5.6: Evaluation of compliance level, based on the Likert Scale.................. 32
Figure 5.7: Illegal disposal of solid wastes ................................................... 33
Figure 5.8: Effectiveness of existing mechanisms in promoting compliance .......... 34
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBOs</td>
<td>Community Based Organizations</td>
</tr>
<tr>
<td>DESA</td>
<td>United Nations Department of Economic and Social Affairs</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environmental Management and Coordination Act</td>
</tr>
<tr>
<td>ISWM</td>
<td>Integrated Solid Waste Management</td>
</tr>
<tr>
<td>NCC</td>
<td>Nairobi City County</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environment Management Authority</td>
</tr>
<tr>
<td>PSPs</td>
<td>Private Service Providers</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
</tbody>
</table>
CHAPTER ONE: INTRODUCTION

1.1 Background of the problem
High level of solid waste generation in most world cities poses serious challenges to protecting and promoting desirable human health conditions as envisioned in Chapter 6 of Agenda 21. The chapter focuses on five vital program areas (the necessity to meet primary health care needs, control communicable diseases, protecting vulnerable groups, satisfying urban health challenges and reducing the risk from pollution of the environment and its related hazards). Developed and developing nations, therefore, must focus on addressing the primary health needs of the increasing world population. The world human population is trending towards seven billion in by 2013 (Gilbert, 2006). Meeting the primary health demands of the ever-increasing world human population is essential to achieve the goals of sustainable development. This necessitates strategies to enhance proper solid waste management initiatives that are satisfactory against the high waste production rate.

The challenge of solid waste pollution is evident from a global perspective. In Asia, most countries such as India face a serious challenge of pollution from solid wastes. African countries still have diverse environmental problems including improper solid waste collection in most cities. In Uganda, for instance, poor solid waste management is a major challenge in its capital city, Kampala. Kenya’s cities are not exceptional concerning the challenge of poor solid waste management. Nairobi County, for instance, faces a grim challenge regarding compliance with waste management regulations among waste generators (Kenya, 2011). Waste generators’ level of compliance with solid waste management regulations has a mutual relationship with the level of pollution and environmental health in Nairobi County.

Since health and sustainable development have close interconnections, any challenge to public health, therefore, hinders progress towards sustainable development (UNEP, 2011). Considering the mutually supportive nature of the aspects of environmentally sound waste management, waste management regulations have a central role in promoting environmentally sound waste management, and consequently, sustainable development. Addressing the challenge of solid
waste management in Nairobi County requires a comprehensive study on the population’s level of compliance with relevant waste management regulations. It promotes compliance with the solid waste management regulations among the population of Nairobi County by proposing an action plan to enhance compliance among the population. It promotes high-quality human and environmental health as well attaining sustainable development goals.

1.2 Statement of the problem

By August 2009, the population of Nairobi was 3,138,369 people as envisioned in the 2009 population census results (Kenya, 2010). High level of human population has related implications including unprecedented increase in solid waste generation. Legal notice no. 121 of 2006, otherwise cited as the environmental management and co-ordination (waste management) regulations, 2006, is the key legislation used in Kenya to guide all waste management initiatives (Kenya, 2013). Despite the existence of relevant solid waste management regulations, there are unprecedented challenges to achieving the goals of environmentally sound solid waste management in Kenya.

Urban area residents and the business community operating in urban areas show an alarming trend regarding their level of compliance with the provisions of relevant waste management regulations. This hampers environmentally sound solid waste management initiatives and sustainable development. Low level of compliance with waste management regulations by waste generators is a potential probable cause of the problem of improper disposal of solid waste. Nairobi County faces an evident environmental problem of pollution from improper disposal of solid waste. Only 37% of the waste generated in Nairobi residential areas is collected and taken to designated dumpsites (Kenya, 2003). This study, therefore, intended to investigate level of compliance with Solid Waste Management Regulations (2006) by waste generators in Starehe District, Nairobi County.

1.3 Research Objectives

a) To determine the effect of selected socioeconomic factors on compliance with the waste management regulations 2006 among waste generators in Starehe District;
b) To determine the level of compliance with the Solid Waste Management Regulations (2006) among waste generators in Starehe District;

c) To examine the causes and implications the level of compliance with the Solid Waste Management Regulations (2006) among waste generators in Starehe district;

d) To recommend an action plan to ensure environmentally sound solid waste management based proper compliance with set regulations.

1.4 Research questions

a) Which socio-economic factors among waste generators affect their level of compliance with or violation of the Solid Waste Management Regulations (2006) in Starehe District?

b) To what level do waste generators comply with the Solid Waste Management Regulations (2006) among the population in Starehe District?

c) What are the causes and consequence of low level of compliance with the Solid Waste Management Regulations (2006) in Starehe district?

d) Which is the most applicable action plan for enhancing compliance with Solid Waste Management Regulations (2006) among the population of Starehe District?

1.5 Research premises

a) The population of Starehe district dwellers exhibits varied socio-economic status.

b) There is low level of compliance with waste management regulations (2006) among the population in Starehe District.

c) Continued low level of compliance with the waste management regulations (2006) has extensive negative implications on human and environmental health in Starehe District, Nairobi City County.

d) The management-based integrated perspective is most applicable to enhance compliance level with solid waste regulations among waste generators in Starehe District.

1.6 Justification of the study

Health and development are intimately interconnected (UNEP, 2010). Environmental sustainability, therefore, has close relationship with sound solid waste management policies and programs. The study is relevant in enhancing the implementation of millennium development goal seven of ensuring environmental sustainability by 2015. Key among the targets of the goal
is to achieve a significant improvement in the lives of at least 100 million slum dwellers, by 2020. This justifies the relevance of the subject of solid waste management.

Currently, the contribution of the rule of law on environmental concerns, in ensuring sustainability, is a serious debate that calls for extensive research. The study is greatly relevant to implementing the recommendations from the June 2012 UNEP’s World Congress on Justice, Governance and Law for Environmental Sustainability. Members at the congress reiterated the central role of the rule of law on environmental matters in promoting sustainable development. They stated that environmental sustainability is only achievable in the context of fair, effective and transparent governance arrangements and rule of law.

Under the Kenyan constitution (article 42), every person has the right to a clean and healthy environment, which includes the right—
(a) to have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69; and
(b) to have obligations relating to the environment fulfilled under Article 70 (Kenya, 2010).

In addition, the study contributes to the implementation of the environmental targets envisioned in Kenya’s vision 2030 social pillar. Kenya, according to the targets of Vision 2030, aims to attain a clean, secure and sustainable environment by 2030. Environmentally sound management of waste is vital to achieving the constitutional provisions and vision 2030’s targets.

Notably, Starehe is among the most polluted districts by illegal solid waste disposal in Nairobi County, therefore, its choice as the study area. Generally, the study enhances the strong linkage between the rule of law, environmental sustainability and sustainable development.

1.7 Significance of the study
The study is vital in the realization of the provisions of “The Future We Want”, the final document produced after the Rio+20 United Nations Conference on Sustainable Development. Participants at the conference recognized the important contribution made by the legal and auditing community worldwide to the enforcement of standards and safeguards for environmental sustainability. Participants noted that the judiciary, in particular, has been the
guarantor of the rule of law in the field of the environment worldwide and that judicial independence is indispensable for the dispensation of environmental justice.

The study contributes towards enhancing the Nairobi County Government agenda of ensuring a clean environment, through environmentally sound management of solid waste. It is imperative and helpful in the identification of a comprehensive and achievable approach to ensure compliance with the Solid Waste Management Regulations (2006) among waste generators in Starehe District. Findings and recommendations, if well implemented, will help ensure the achievement of sustainable development targets and various development agenda in Kenya and Nairobi County. The study will be useful in solving the challenges facing the implementation of integrated waste management programs in Nairobi County. Waste generators, transporters, private service providers and the authority will find the study useful to upgrade existing programs and improve compliance with the waste management regulations 2006.

The findings of the study will add to the existing knowledge and database available in the field of solid waste management. It would be important as a reference for research and field study on other related areas and topics. Findings of the study can be replicated, where applicable, and used to solve problems similar challenges of low level of compliance with waste management legislations in other areas of Nairobi County, Kenya or globally.

1.8 Scope and limitation of the study

The study covered Starehe district in Nairobi County. The research focused on an assessing the implementation of the waste management regulations (2006); the case of Starehe district, Nairobi city county. In addition to solid wastes, the waste management regulations (2006) have provisions for other types of wastes such as hazardous wastes and industrial effluents. However, this study only emphasized on the provisions on solid waste management.

The study investigates the level of compliance among both residential and commercial waste generators in Starehe District, Nairobi City County. The population of Sterehe District is 274,607 according to the 2009 population census.
Since the research investigated compliance with waste management regulation, policy implementers were best placed to respond to the questions administered during the study. Solid waste management officers at different levels provided information during the study.

The following limitations are possible limitations that can be experienced during data collection:

a) Insufficient/ inadequate time for data collection
b) Financial constraints
c) Lack of adequate cooperation from some respondents

1.9 Operational terms

- “Environmentally sound management of waste” means taking all practical steps to ensure that waste is managed in a manner that protects human health and the environment against the adverse effects, which may result from the waste.
- “Solid wastes” refers to all domestic refuse and non-hazardous wastes such as commercial and institutional wastes, street sweepings and construction debris.
- “Waste management” refers to the activities, administrative or operational, applied in handling, packaging, treatment, condition, storage and disposal of waste.
- “Integrated Solid Waste Management” refers to a systematic approach to the management of solid waste that entails and integrates source reduction, reuse, recycling, composting, energy recovery, and land filling as means of managing waste in a manner that protects human and environmental health.
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction
Although many countries, through different institutions and policy frameworks, target to address solid waste pollution challenges, attaining the goals of environmentally sound management of solid waste remains a key challenge. The approach to waste management in many developing countries has been rather ad hoc and unplanned – concentrating on physical aspects. Policy and legislative aspects of management-based integrated solid waste management, however, are rarely implemented. Notably, policy frameworks and legislative provisions are vital in the attainment of environmentally sound management of solid waste. Achieving the goals of environmentally sound management of solid waste, therefore, requires strategies to enhance compliance with relevant policy and legislative provisions.

2.2 Status of compliance with environmental laws, regulations and policies

2.2.1 Factors affecting compliance with laws, regulations and policies
Understanding compliance and noncompliance with laws entails the consideration of vital concepts social science. Generally, compliance with directives and laws is much defined by the extent of enforcement conducted by the relevant administration (Stover & Brown, 2007). There are prerequisite conditions, which administrations must ensure to promote the level of compliance with laws. Compliance is never absolute, however. One key factor that determines compliance with laws among citizens is their normative commitment. Normative commitment refers to personal morality that compels an individual to obey the law. It may also emanate from an individual’s feeling that the enforcement authority has the right to dictate behavior (Tyler, 2006).

2.2.2 Socio-economic factors that influence compliance with laws, regulations and policies
Diverse socio-economic factors influence compliance with laws, regulations and policies. Concerning environmental (waste management, for the purpose of this study) regulations, various factors such the waste generators knowledge of the regulations and their perception about formal enforcement levels by the relevant authority affect their level of compliance. Effective law enforcement requires extensive public awareness creation. Education and
awareness creation should inform the target population of the problem of solid waste pollution and reasons why compliance is a viable solution (McElreath et al., 2013). The media’s role in enhancing public awareness is appreciable. Relevant authorities should use the media to promote compliance with environmental (waste management) regulations. This serves to generate public support and eases enforcement mechanisms.

2.2.3 Public access to Information on the general environmental protection laws

The Rio Declaration outlines twenty-seven (27) principles that guide sustainable development. *Principle 10 of the Rio Declaration* recognizes that environmental issues are best handled with the participation of all relevant stakeholders at respective levels (DESA, 2000). Appropriate access to information concerning the environment by all stakeholders at different levels is imperative for the implementation of environmental laws and policies. The principle encourages states and authorities to facilitate public awareness and participation by ensuring wide accessibility to information. The right of access to information, public participation and justice on environmental issues is vital for the realization of sustainable development. The *Rio 2012 Summit* called for strong commitment by UN members to ensure that their legal structures on environmental concerns conform to the provisions of principle 10 of the Rio Declaration. The principle should also form part of all decision-making processes (Dodds, Laguna-Celis & Thompson, 2014). Participatory decision-making is imperative in enhancing the ability of governments to make prompt response to public concerns. It also helps to improve compliance with environmental laws and policies. Full implementation of the waste management regulations 2006, therefore, should involve strategies aimed at promoting public access to information. Environmental information access centers are important in enhancing public awareness and subsequent high compliance levels.

2.3 Compliance with the Waste Management Regulations 2006

2.3.1 Important definitions according the Waste Management Regulations 2006

The regulation, otherwise cited as legal notice no. 121 of 2006, is a key policy that governs waste management in Kenya. Part II of the Act provides the general provisions for environmentally sound solid management of waste. As defined in the Act, domestic waste implies all wastes generated from residences. Waste management, as provided in the Act, refers to an activity either
administrative or operational that aims to aid the processes of handling, packaging, treatment, conditioning, storage and disposal of waste. Environmentally sound management of waste refers to the practice of taking all practical steps to ensure that waste is managed through a strategy that protects human health as well as the environment against any negative implications that may result from the waste. A disposal site, as defined in the act, means any area of land designated for waste disposal. A disposal site is an area of land on which there are facilities for final waste discharge without the necessity for retrieval.

Waste recycling refers to the processing of waste material into a new product but that has similar chemical composition. Waste reprocessing refers to the practice of changing it in a new product that has different chemical composition. Waste reuse implies making it valuable with or without cleaning and/or repairing. Segregation is a process of separating waste materials for reprocessing. Proper storage means the placement of waste in a location that is suitable or appropriate with a facility where isolation, environmental, health protection and human control are available to ensure subsequent retrieval of waste for treatment or disposal. Treatment of waste refers to a process, method or technique applied that alters the chemical, biological and physical characteristics of waste to reduce the hazards that it may have. A waste generator refers to a person undertaking any activity that produces wastes (Kenya, 2013).

2.3.2 Provisions governing solid waste management
The regulation outlines guidelines for achieving environmentally sound solid waste management. It defines the roles of all stakeholders involved (from waste generation, management to final disposal and treatment).

Responsibilities of the waste generators
No person shall dispose of any waste in any public space except in designated locations for disposal and in waste receptacles. Every waste generator has the responsibility to collect, segregate and dispose the waste according to standards provided in the act. The regulation further recognizes the necessity for clean productions methods and processes. Every waste generator, therefore, must observe clean production methods. Waste generators should focus on the improvement of production process through diverse strategies. They should undertake
initiatives that promote conservation of raw materials and energy. Waste generators should eliminate the use of toxic raw materials and reduce toxic emissions and wastes. Waste generators should monitor the product cycle from the beginning to end through three key strategies. First, identification and elimination of potential adverse implications of the products. Secondly, ensuring recovery and re-use of products where possible. Third, ensuring reclamation and recycling throughout the product cycle. In addition to product cycle monitoring, the regulation provides that waste generators should incorporate environmental concerns in the design and disposal of a product. The regulation provides directions for waste segregation by the generator. A waste generator should separate hazardous from non-hazardous waste. Disposal of hazardous and non-hazardous wastes should be in facilities provided by the relevant local authority.

Responsibilities of waste transporters
All waste transporters should possess annual license approved by the relevant authority. No transporter is eligible for a transportation license unless when operating a vehicle approved by the issuing authority, after recommendation by relevant lead agency. Labeling of all waste transportation vehicles should be in such a manner as directed by the relevant authority. Licensed waste transporters should operate in designated geographical areas as directed by the relevant authority. Every licensed waste transporter shall use the routes designated by the licensing authority and stipulated in the license.

Responsibilities of the licensing authority
The licensing authority should indicate the disposal operations permitted and identified for the particular waste. The regulation provides for mandatory environmental audits for all disposal sites or plants by the authority (Kenya, 2013).

2.4 Implications of compliance level with solid waste management regulations

2.4.1 Low compliance level with Solid Waste Management regulation in Kampala, Uganda
The Kampala Capital City Authority is the main authority mandated to provide solid waste management services. The authority involves private service providers in enhancing the collection of wastes in the city. However, waste management condition in the city remains poor. According to reports by the Ugandan Auditor general, there is an evident failure by the authority
to provide adequate transportation service. Improper management of private waste collection services is a major shortcoming in Kampala (Oberlin, 2013). There is a high amount of accumulated solid waste in Kampala. Recommendations of the report highlight programs such as public education on modern waste management, ensuring adequate supervision, and monitoring and control mechanisms. Policy gaps and low level of compliance with the Solid Waste Management Ordinance, 2000 by various stakeholders is a cause of improper solid waste management in Kampala.

2.4.2 Best practices from other countries

Solid Waste Management in the City of Tacoma, Washington, USA

The City of Tacoma has a robust solid waste management program. The city has a solid waste utility that provides essential services including garbage, recycling and yard waste. The program covers single-family residential homes, multifamily units and commercial customers. The utility operates a landfill that provides full service in solid waste management. It has a solid waste recycling center. In addition, it has a facility for handling hazardous household wastes. Waste collection services in the city cover a commendable part of the city’s population. The facility operates a residential bulk item collection service (Tacoma City Council, 2013). The Tacoma City Council-operated solid waste management facility is designed to meet the need to ensure reduction and reuse of solid waste at source. There are personnel employed to offer environmental education and involvement programs to citizens.

Education and awareness programs aim at enhancing waste reduction and resource conservation initiatives among the residents of the city of Tacoma. The council has invested in solid waste collection facilities including tracks and inspection vehicles. The proper solid waste collection mechanisms in the City of Tacoma comply with the provisions of the Minimum Functional Standards for Solid Waste Handling regulations. The regulation has provisions for proper storage, collection, and disposal of discards, other management functions or operational activities including waste reduction, source separation, waste recycling, transportation, processing, treatment, resource recovery, energy recovery, incineration, and landfill operations (Washington State Legislature, 2013). Proper compliance with the legislation, therefore, enhances solid waste management services in the city of Tacoma, Washington.
2.5 Applicable strategy to enhance compliance with solid waste management regulations

2.5.1 Theoretical Framework

UNEP’s three perspectives of Integrated Solid Waste Management

The United Nations Environment Program highlights three perspectives of integrated solid waste management: Life cycle perspective, waste generation perspective, and management-based (UNEP, 2009). The life cycle perspective involves an assessment of the lifecycle of a product its production to consumption levels. Based on the life cycle system, reduced consumption and subsequent measures to utilized discarded materials in the production system, as valuable resources, constitutes an effective waste management system. Proper management of the production system leads to a highly reduced end-of-cycle generation of wastes. Hence, it forms an applicable framework for integrated solid waste management (UNEP, 2009).

The waste generation perspective of ISWM is based on management of wastes at the source. These include domestic, commercial, industrial and agricultural wastes. It involves classification of wastes as hazardous and non-hazardous. It reiterates the importance of segregation at source and further appropriate treatment before disposal at the most appropriate and designated sites. Disposal of waste must adhere to strict regulations set by the relevant government authority or government department. The 3R approach (Reuse, reduce and recycle) are equally to enhance collection, transportation and disposal of wastes.

The management-based perspective of integrated solid waste management

Management-based perspective of ISWM (Figure 2.1) forms the theoretical framework of this study. This perspective is based on an ISWM framework that includes regulations and laws, institutions, financial mechanisms, technology and infrastructure and the role of diverse stakeholders. Based on the framework, governments (local and national departments) should enact effective regulations. In addition, they should set proper financial mechanisms for waste generators, service providers and the business community. In turn, waste generators (residents, industries and waste from services or business) should comply with relevant waste disposal regulations (UNEP 2009). Waste generators should also consider the application of the 3Rs (reduce, reuse, recycle).
It is noteworthy that proper and effective regulations and regulatory process is a prerequisite for the management-based ISWM to function successfully. Waste generators should maintain high level of compliance with solid waste management regulations. The business community and waste service providers should also maintain high compliance levels. Therefore, the system is best applicable with the existence of two critical conditions:

1. Presence of waste disposal mechanisms as well as effective regulations and financial mechanisms for generators, service providers and businesses; and
2. High level of compliance with regulations concerning solid waste management, by all stakeholders in the entire ISWM process.

Five factors have central contributions in the proper implementation of the management-based framework of ISWM;

i. Policies- include laws, regulations, economic and enforcement tools
ii. Institutions- Include institutional frameworks, jurisdiction, resources and linkages
iii. Financial mechanisms- including taxes/fees, levies, subsidies and support/ aids
iv. Technology- including those applied in transportation, treatment, disposal, recycling and recovery
v. Stakeholder participation- Including waste generators, service providers, the private sector and government (UNEP, 2009).
Figure 2.1: Theoretical Framework

Management-Based perspective of Integrated Solid Waste Management


2.5.2 Conceptual Framework

Based on the theoretical framework (Figure 2.2), it is evident that regulations on solid waste management have a central contribution towards enhancing environmental sustainability and sustainable development. The conceptual framework improves on the management-based
perspective of ISWM. The conceptual framework strengthens the theoretical framework by placing it in the context of Kenyan. The conceptual framework, therefore, is applicable in study area Starehe District. It enhances the application of the waste management regulations 2006, in particular. It addresses the particular interest of waste generators in Starehe District, Nairobi County, regarding compliance with waste management regulations.

2.6 Gap identification

Based on the literature reviewed, approach to environmentally sound solid waste management in many developing countries has been rather unplanned and disintegrated – concentrating on certain aspects (mostly the manual: collection, transportation, disposal and treatment aspects) of waste management but ignoring other vital aspects such as policy and regulatory frameworks (UNEP, 2010). Based on the management-based perspective of integrated solid waste management, coined by UNEP regulations and laws are vital. To implement the management-based perspective of ISWM, governments (at the local, county and national levels) should enact effective regulations and monitor its compliance. This prompts the necessity to conduct a research and study on the efficiency of existing laws, their level of compliances and possible strategies to enhance their effectiveness. This study fills this research gap.
Figure 2.2: Conceptual Framework

Sustainable Development (Envisioned in Agenda 21)

Environmentally sound management of solids wastes (Agenda 21, Chapter 21)

Solid Waste Management Regulations
(Waste Management Regulations 2006)

Meeting urban solid waste management challenges

Four key program areas
- Minimizing wastes
- Maximizing environmentally sound waste reuse and recycling
- Promoting environmentally sound waste disposal and treatment
- Extending waste management services coverage

Key Stakeholders
- Responsibility of waste generators
- Clean production methods
- Waste transportation regulations
- Regulations on waste disposal facilities
- Enforcing penalties on cases of offenses
- Public access to information

Compliance with Solid waste management regulations

Environmental sustainability
- Proper public health

Creating public awareness on solid waste management regulations.

3.0 CHAPTER THREE: AREA OF STUDY

3.1 Introduction
Nairobi is among the commercial and business hubs in the East African region and a large and flourishing city with the settlement consisting mainly of low, middle and high-income individuals. Nairobi County constitutes eight (8) administrative units (Makadara, Kamukunji, Starehe, Lang’ata, Dagoretti, Westlands, Kasarani and Embakasi). Starehe forms the study area, being among the most populated and highly polluted districts in Nairobi County.

3.2 The physical set up
Starehe district has eleven (11) administrative wards; Ngara West, Ngara East, City Centre, City Square, Ziwani Kariokorr, Pangani, Mathare, Mlango Kubwa, Mabatini, Huruma and Kiamai. Administrative units, mainly wards, are important as planning units for solid waste management operations. CBOs mostly operate within specific wards. Monitoring of solid waste disposal also occurs through administrative units. Anti-dumping squads operating in Starehe mainly undertake their operations in different wards. Considerations of the area’s physical set-up and related aspects are vital considerations in planning for enhancing compliance with waste management regulations. The physical set-up of an area also influences the behavioral aspects of the population. The populations in highly populated areas show low level of compliance with solid waste management regulations, for instance. Further, an area’s physical set-up affects the communication and infrastructure set-up. These are important factors in monitoring the level of compliance with solid waste management regulations.

3.3 Location and extent
The study area is located in Nairobi County, Kenya (Figure 3.1). Because of its extensiveness and presence of informal settlements, the area requires deployment of a large population of staff to monitor compliance with waste management regulations. Anti-dumping units and inspectorate departments also need sufficient budgetary funding to execute their mandate given the extensive area of Starehe district.
3.4 The economic set up

The economic set-up of the area’s population consists of middle and low-income earners. There exists a direct relationship between income level and compliance with regulations. The economic set-up of an area influences the nature of business and industrial activities in an area. Illegal dumping is rampant in areas occupied by the low-class population compared to high-income population. Most instances and cases of low level of compliance to the regulations occur in highly populated regions where the population consists of low-income earners.
3.5 Population
The population of Starehe is approximately 274,607 (Kenya, 2014). As at 2009, August, there were 87,519 households in Starehe constituency. The population density, according to the 2009 census results is 3.137684389. Population density and settlement patterns differ among wards. Difference in population density and settlement patterns dictate the application of diverse mechanisms in enhancing compliance with waste management regulations. Density populated areas require high number of personnel and officers to monitor and enhance compliance with solid waste management regulations. In settlements areas such as East and West Ngara and Pangani, for instance, monitoring solid waste regulations compliance requires low number of officers. The production of these wastes is controllable, if an efficient and reliable refuse collection service is in operation. Continuous program of public education and strict legislation and enforcement procedures are equally applicable to control illegal solid waste disposal by the population.

3.6 Administration
The Nairobi City County government undertakes the mandate to provide social amenities to the population in all the eight districts including Starehe. The county government, through the department of environment, is responsible for the provision of essential services such as solid waste collection. The country government, through partnership with other stakeholders such as PSPs and CBOs, undertakes all solid waste management services in Starehe District. The department of environment’s core mandate is to carry out operations and activities aimed at creating a healthy, clean and aesthetically pleasant environment to the residents of Nairobi. It also focuses on the formulation and/or advocacy for formulation and implementation of suitable policies and tools for effective management of Nairobi’s environment. These include monitoring compliance with environmental regulations and by-laws. The department has an anti-dumping and inspectorate units that monitor the activities of the public, businesses and industries. The county government, licensing department, serves as the licensing authority for solid waste transporters in Starehe district.
3.7 Tourism
Tourism is not highly enhanced in Starehe. However, part of the city center and city square areas receives commercial or business tourists. Being the country’s capital city and a key commercial centre, Nairobi is a destination for many businesspersons and leisure tourists. Tourism activities do not highly influence the nature of solid waste generation in Starehe. Solid wastes generated by tourists contribute a negligible percentage of the overall solid waste generation in Starehe District.

3.7 Trade, Commerce and Industry
Trade is a major economic activity in the study area. Trade and industries are major sources of solid waste in the city center and city square parts of the study area. Three main categories include wastes generated by road traffic, and by the public (behavioral wastes). Wastes generated by natural causes or phenomena are difficult to avoid. They include dusts blown from unpaved areas, and leaves and flowers that fall from trees and plants in the community. Wastes generated by traffic such as motor vehicles constitute a relatively high proportion of street wastes.

The country government incurs high cost collecting solid waste from trade, commerce and industry because of several reasons. First, non-productive staff due to poor supervision, labor management and training on solid waste management is a cause of high solid waste collection cost. Second, inadequate education and awareness of the public and business operators who are the primary waste generators. Third, inappropriate type and size of the collection equipment also contribute to high solid waste collection cost. Unfavorable conditions at the disposal site. There is lack of sufficient numbers and appropriate types of storage containers at collection points. Existing equipment used are under low maintenance and servicing. Long distances to disposal sites and inadequate systematic collection routes cause inefficiency in collection.

3.8 Transport and communication
The area of study is well served with proper road network (Figure 3.2). The major road traversing Starehe is Juja road. Road network and infrastructure development are essential in enhancing proper solid waste management. Licensed solid waste transporters in Starehe do not have definite routes to follow during transportation from solid waste collection points to disposal site (Dandora dumpsite). Most licensed solid waste transporters in Starehe District use Juja road
towards the Dandora disposal site. Communication network in Starehe is efficient. Communication is vital for waste management stakeholders’ coordination. Efficient communication network in Starehe district supports the anti-dumping and inspectorate units duties of ensuring effective compliance with the solid waste management regulations.

**Figure 3.2: Road Network in Starehe**

![Road Network in Starehe](image)

**Source:** (Google Map Data, 2014, *Google Earth: Searchable Map and Satellite view of Nairobi, Kenya*. Cnes/Spot Image, Digital Globe, Landsat.)
CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction
This research evaluated how relative variables such as public knowledge of waste management regulations, the perception about the relevant authority’s laws implementation strategies, waste generators’ attitude about effectiveness of the regulations, and social/economic factors affect compliance with the waste management regulations 2006. The chapter focuses on research design and methodology. Data collection is important for analysis of and further statement of research findings. This chapter outlines the various method used in data collection. It outlines the various sources of data used in the research. Data analysis and presentation forms a central part of the research. It outlines the various limitations to data collection experienced during the research. It also outlines the target population used as a sample of the entire population.

4.2 Data Collection
To ascertain the level of compliance to Solid Waste Management Regulations (2006) in Starehe District, Nairobi County, data was gathered in cooperation with the Department of Environment, Nairobi County. Data collection involved administering questionnaires to staff members from the departments at different waste management offices in Starehe district. Departments included Ngara Offices (2 officers), CBD offices (2 officers), Pangani office (1 officer), and Mathare center (1 officer). Data was also collected from private waste collectors licensed to collect wastes at different estates. Five (5) private waste collectors operating in Ngara estate were interviewed during the study. Six (6) private waste collectors operating at the CBD were interviewed during the study.

Waste transportation officers were valuable source of data during the study. Data collection from transporters was conducted in two days (morning and midmorning) and covered ten (10) officers. The ten interviewed officers operated five waste collection vehicles (the driver and waste collection supervisor). Equally, data was collected from zone supervisors and sweepers mainly at the CBD with emphasis placed on Zone 1 (Kirinyaga Road area), where cases of non-compliance are widespread. Ten (10) zone supervisors and sweepers were interviewed during the study. Thirty-Seven (37) (calculated) questionnaires were conducted between February 21 2014 and
April 11 2014. There were no household questionnaires conducted during the study since the survey targeted policy implementers/ solid waste management stakeholders to ascertain the compliance levels of the population in Starehe District.

4.2 Research design
This research study was implemented through a survey research design. Survey research design is predominantly used in studies where individuals comprise the sample. It is perhaps the best method to collect original data to describe the characteristics of a large population (Rea & Parker, 2005). Survey research provides a method to evaluate the characteristics of a large population and allows the researcher to draw conclusions from study findings. Conclusions drawn from study findings are fundamental sources of information about the research problems. Survey research design was particularly relevant to this study to ascertain the level of compliance with solid waste management regulations.

The research used descriptive research methodology in analysis. In descriptive analysis, original data is from the field is transformed into a form that will make them easy to understand and interpret. It involves calculation of averages, pie charts, frequency distributions and percentages. Description shall be based on the conceptual framework.

4.3 Nature and sources of data
The research used both qualitative and quantitative data. The study utilized both primary and secondary data.

4.3.1 Primary Data
Primary data used in the research include original information collected from the field. The objective of using primary data in conducting the research was to ascertain the level of awareness of the regulation among the population. Primary data sources are useful in determining the level of compliance with the regulations among the population in Starehe. Information on the extent of public awareness is useful in determining the effectiveness of existing programs set by organizations involved in environmental education and awareness. Collection of primary was through survey research methods involving questionnaire administration.
Respondents include staff at the Nairobi City County Environment department, solid waste management section at different offices. Officers at the CBD, Ngara, Pangani and Mathate solid waste management departmental centers contributed towards the research. They are valuable source of information on the trend of pollution from solid waste in the study area. Licensed private waste collectors in Ngara Estates contributed to the provision if information during the study. Solid waste transporters (drivers and collection supervisors) were valuable sources of primary data. Zone supervisors and street sweepers also contributed to the study by providing information.

4.3.2 Secondary Data
Secondary sources of data from authentic literature were useful in the research. Literature used in the research includes previous research in solid waste management. Official national and county government report will be useful in the study. Nairobi county government development and strategic plans are also useful sources of secondary data used in the research.

4.4 Research Instruments
Questionnaires
This was the major research instrument applied during the study. Questionnaires consist of standardized target-specific questions for respondents. Responses recorded provide valuable information for analysis of the research questions. The questionnaire consists of open and close-ended questions. Questionnaires are self-monitored using the highest level of accuracy involved in the research. Questionnaires were useful to establish objectives one and two (Appendix I).

Recording of field data
Information relevant to the study were recorded and using notebooks. Observational guidelines were important to guide data recording during the field study. Trends in solid waste pollution were observed during the study. Observation was important to determine compliance by solid waste transporters. It also helped determine the level of compliance with regulations on proper disposal of solid wastes at designated receptacles.
4.5 Population description
The target population in the research was household and commercial solid waste generators in Starehe District. Household solid waste generation in Starehe District is high in Ngara East and West, Pangani, Mathare, Mlango Kubwa, Mabatini, Huruma and Kiamaiiko. Ngara East and West are medium density residential areas. Pangani, Mathare, Mlango Kubwa, Mabatini, Huruma and Kiamaiiko are high-density residential areas. Nairobi City Centre and City Square areas have high level of commercial activities.

4.6 Sampling design and sampling frame

Sampling, during data collection, involves the selection of a representative of the population under study. To achieve the objectives of the study, a target population was selected from five areas namely: City Square, City Centre, Ngara East, Ngara West, Ziwani Kariokor and Pangani. The sampled area is substantive to act as a representative of the entire research. The rationale of choice for the five areas is based on the study’s objectives. The study aims to assess the implementation of the waste management regulation in Starehe district. The scope of study is to investigate the level of implementation of the regulation among residents and commercial business waste generators. The sampled area meets the requirements since City Centre, City Square, Ngara West and Ziwani Kariokor have high commercial activities going on while Ngara East and Pangani have residential land use.

Individuals to provide information were selected by sampling. Systematic sampling is applicable in determining the areas, in Starehe District, to undertake the data collection based on administrative boundaries. The City centre, City Square and Ngara West were sampled purposefully because of their commercial and business activities that generate high amounts of solid wastes. Data obtained from the three estates would be useful to show the extent of implementation of solid waste regulations (2006) in commercial activity estates. Pangani and Ngara East have mixed residential and commercial land uses. The target population is the residential units. Information from the estates is useful in assessing the implementation of waste management regulations (2006) in residential areas. Simple random sampling will be applied in
choosing the respondents from the community based organizations and licensed solid waste transporters operating in Starehe District.

**Sample Size Calculation**

To calculate the sample size in the research the formula was adopted from Pfefferman and Rao (Pfefferman, D., & Rao, 2009, p. 547).

Formula: Sample Size (n) = \((Z\text{-score})^2 - \text{StdDev}^2(1-\text{StdDev}) / (\text{margin of error})^2\)

Where, \(E\) is the maximum error of estimate (in this case, 0.05)

Where, \(N\) is the population size

\(Z(c/100)\) is the critical value for the confidence level \(c\).

\(z = 1.96\) arises for a 95% confidence level

Allowing a +/-5% margin of error (+/-0.05)

Population size (N) is 274,607 (Population of Starehe according to the 2009 national census)

Assuming a 50% response distribution (normal distribution)

**Calculation**

Here is the sample size calculation for the study, assuming a 95% confidence level, 0.5 Standard Deviation, and a margin of error (confidence interval) of +/- 5%.

Sample Size (N) = \((Z\text{-score})^2 - \text{StdDev}^2(1-\text{StdDev}) / (\text{margin of error})^2\)

\(((1.96)^2 \times .5(.5)) / .05^2\)

\((3.8416 \times .25) / .0025\)

\(.9604 / .0025\)

384.16

385 respondents are needed

Note: This calculation is based on the Normal distribution, and assumes the data was collected from more than about 30 samples.

Because of resource constraints and limited time for the research thirty seven (37) respondents were chosen during the study.

4.7 Use of the likert scale (part of questionnaire)

A likert scale is an ordered scale from which respondents choose an option that they consent to or best aligns with their view. It measures respondents’ opinion and/or attitude on the subject of study. It shows the extent to which the respondent agrees of disagrees with a particular question or statement of study. A typical scale used in a likert scale can be “Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree”. For the purpose of objective two of the study, a likert scale is a perfect research tool for determining the level of compliance, as viewed by different stakeholders in the solid waste management sector. The likert scale used in the research will form part of the questionnaire conducted. Key stakeholders in solid waste management in Starehe District will provide their view on the level of compliance to the waste management regulations 2006.

4.8 Coding of regulations

To ease the study, regulations related to solid wastes transportation were coded in numerical (from regulation 1 to 9). This is only for the purpose of data analysis during the research. Coding were as follows:

Regulation 1: Operation under a license from the authority
Regulation 2: Proper labeling of vehicle as directed by the authority
Regulation 3: Operations in designated areas as per the transportation license

Regulation 4: Using vehicles that do not scatter of waste during transportation

Regulation 5: Using vehicles that ensure no emission of noxious smell

Regulation 6: Following scheduled routes approved by the authority

Regulation 7: Possession of dully filled tracking documents during transportation

Regulation 8: Collection of waste from designated areas of operations only

Regulation 9: Transporting wastes to designated disposal site of plant
5.0 CHAPTER FIVE: DATA PRESENTATION, ANALYSIS AND DISCUSSION

5.1 Introduction
The study intended to explore the level of compliance with the waste management regulations (2006) in Starehe district, Nairobi County. The purpose of this chapter is to analyze and discuss the findings that emerged from the data collection process. All the questionnaires used to collect, however, has not been analyzed in this chapter since two of them became ineffective after realization that the information provided were subject to distortion and, therefore, unreliable. Data analyzed represents information from thirty-five administered questionnaires.

In this chapter, there results of the present study will be discussed in order to address the four research questions outlined in Chapter One. Section 5.2 outlines and discusses results on selected socio-economic factors that influence compliance with the waste management regulations 2006. Section 5.3 outlines and discusses study results on the level of compliance with the regulations. Section 5.4 outlines and discusses results on the implications of compliance levels. Section 5.5 outlines and discusses results on enhancing compliance with solid waste management regulations through penalties.

5.2 Socio-economic factors and compliance with the regulations
Study results outlined in this section answer the first research question; which socio-economic factors among waste generators affect their level of compliance with or violation of the Solid Waste Management Regulations (2006) in Starehe District?

5.2.1 Public access to information on waste management regulations
The study shows that there is a commendable level of public access to information on waste management regulations. As shown in figure 5.1, sixty-nine percent of respondents have full access to information on waste management regulations. Only thirty-one percent of the respondents reported low access to information.
Figure 5.1: The level of public access to information on waste management regulations

Source: Author’s construct, 2014

5.2.2 Possible causes of low compliance level
Thirty out of the thirty-five respondents (86 percentage), acknowledged diverse causes of low compliance with the solid waste management regulations. These include overcrowded trading centers, high population density, few public awareness programs, policy gap, improper coordination, low number of vehicles for waste management services, inadequate monitoring, inadequate funding/ budgetary constraints, low number of employees, negligence among waste generators, poor access to information, poor state of dumpsite, poor access and infrastructure, poor maintenance of collection vehicles, flawed implementation system and inadequate collection bins.

5.3 Compliance with the Waste Management Regulations 2006
The study intended to determine the level of compliance with the waste management regulations. Data collected in relation to compliance level were varied. This section outlines the study results regarding compliance with different provisions of the regulation.
5.3.1 Solid waste transportation regulations

Figure 5.2 shows results on the level of compliance with regulations related to transportation of solid wastes. According to study results, licenced waste transporters show high compliance level with relevant transportation provisions outlined in the solid waste management regulations.

**Figure 5.2: Level of compliance with solid waste transportation regulations.**

Source: Author’s construct, 2014

5.3.2 Waste Disposal and Segregation

Figure 5.3 shows the results on the level of compliance among solid waste generators in Starehe district. From the results, most solid waste generators do not dispose at designated receptacles. However, most generators practice waste segregation.
Figure 5.3: Compliance among solid waste generators

Source: Author’s construct, 2014

5.3.3 Compliance with provisions on measures to monitor the product cycle

Figure 5.4 shows results on compliance with provisions on measures to monitor product cycle and reduce the level of solid wastes generation from industrial activities and production. Most respondents recorded low compliance with measures to identify and eliminate potential negative effects of products. Similarly, most solid waste generators in the production industry show low compliance with provisions that require them to incorporate environmental concerns in product design and disposal. However, most solid waste generators in the production industry show high compliance with provisions that encourage recovery and re-use of the product, where possible. They also show high compliance with provisions that require waste recycling.
Figure 5.4: Compliance with provisions on measures to monitor the product cycle

<table>
<thead>
<tr>
<th>Measure</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying and eliminating potential negative impacts of the product</td>
<td>12</td>
<td>23</td>
</tr>
<tr>
<td>Enabling the recovery and re-use of the product, where possible</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Waste recycling</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>Incorporating environmental concerns in the design and disposal of a product</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: Author’s construct, 2014

5.3.4 Regulations on Solid Waste disposal facilities

Figure 5.5 represents the results on the level of compliance with regulations on disposal facilities, by the authority. Based on results of the research, compliance level for sound management of disposal facility is at sixty percent, thirty-five for proper indication of disposal points permitted for particular types of wastes. The authority complies with provisions to ensure that the disposal site to not cause harm to humans and entire ecosystem, but partially at fifty percent. However, there is low compliance with provisions on proper indication of permitted disposal operations at designated points for different types of wastes.

Figure 5.5: Evaluation of compliance level by the authority

Source: Author’s construct, 2014

5.3.5 Evaluation of compliance level, based on the Likert Scale
Figure 5.6 shows results on the compliance level, based on the Likert Scale. The following stakeholders had different ratings on the likert scale. The public has a poor rating on their level of compliance with the solid waste regulations. The business community has a commendable rating on the level of solid waste regulation standards. The authority has a rating of good on compliance with solid waste regulations similar to private service providers. The business society has a commendable rating on the level of compliance with solid waste management regulations.

Figure 5.6: Evaluation of compliance level, based on the Likert Scale

![Evaluation of compliance level, Based on the Likert scale](image)

**Source:** Author’s construct, 2014

5.4 Enhancing compliance with solid waste management regulations

5.4.1 Effects of low level of compliance with solid waste regulations

There are diverse effects of low compliance with the regulations. The most prevalent negative implications are disease outbreaks, poor aesthetic quality, as well as water, land and air pollution as established during the study.
5.4.2 Illegal disposal of solid wastes
Based on the results of the study (Figure 5.7), streets are the most polluted public areas though illegal disposal of solid wastes. Other public areas such as highways, roads and recreational areas are equally subject prone to pollution from illegal disposal of solid wastes.

**Figure 5.7: Illegal disposal of solid wastes**

<table>
<thead>
<tr>
<th>Cases of illegal disposal</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Public Highways</td>
<td>32</td>
</tr>
<tr>
<td>Streets</td>
<td>34</td>
</tr>
<tr>
<td>Roads</td>
<td>33</td>
</tr>
<tr>
<td>Recreational areas</td>
<td>30</td>
</tr>
</tbody>
</table>

**Source:** Author’s construct, 2014

5.4.3 Penalties on offenses
The study showed that authority has penalties stipulated for violation of the regulations. The different mechanisms in existence include the solid waste management by-laws 2007, EMCA 1999 regulations, the Public health act Cap 265 and the city inspectorate units. The laws and inspectorate unit govern the management of environment concerning solid waste management. The existing mechanisms are effective based on the results of the study.

Results for the effectiveness of existing mechanisms in promoting compliance were as shown in the pie chart (Figure 5.8).
The authority faces notable challenges in implementing the existing mechanisms as determined during the research. The challenges highlighted include:

- Low number of employees to undertake monitoring of the implementation of existing laws (NCC, 2013).
- Budgetary constraints that hamper the implementation of the mechanisms.
- Inadequate cooperation from the public hence causing non-compliance.
- Inadequate enforcement capacity and equipment for enforcement.

Source: Author’s construct, 2014
CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS.

6.1 Summary of findings
Based on the first objective of the study, public access to information is a vital socio-economic factor that influences compliance with waste management regulations. The study reveals that public access to information among the waste generators Starehe district is high. Several factors cause low compliance level among waste generators in Starehe district as depicted by the study results. There is a generally high compliance level among licensed solid waste transporters. Compliance among solid waste generators depict varied results. First, most generators do not dispose wastes at designated areas. Contrary, most generators segregate their wastes. Waste segregation might be high because of demand for plastics by recycling companies or re-use by generators.

Solid waste generators in production industry show low level of compliance with provisions on identification and elimination of potential negative product impacts as well as incorporation of environmental concerns in product design and disposal. Compliance with solid waste management provisions that promote product recovery, re-use and recycling, however, is high. High compliance levels among waste generators in the production industry are because of high demand for plastic and recycled bottles. High level of solid waste disposal in public areas is high in Starehe. Inadequate public sensitization programs is a probable reason for the high
6.2 Conclusions
Based on the research, it is evident that there is uneven trend of compliance with the solid waste regulations (2006) among various stakeholders (generators, licensed transporters and the authority) in Starehe District. The research findings also depict low compliance with the regulation among waste generators compared to licensed solid waste transporters and the authority. With serious concerns of rising population of Starehe District and Nairobi county, at large, the problem is likely to escalate (Kenya, 2011). Low level of compliance with the waste management regulations is a central contributory factor to high level of pollution from solid waste in Nairobi County. The solution, in the first place, is the minimisation of waste. Where waste cannot be avoided, recovery of materials and energy from waste as well as remanufacturing and recycling waste into usable products should be the second option. Recycling leads to substantial resource savings. As a compliment to the aforementioned strategies, strict observation of regulations governing solid waste management is indispensable. All stakeholders should observe strict compliance with relevant provisions of the solid waste management regulations.

6.3 Recommendations

6.3.1 Addressing challenges of regulatory compliance
The Kenyan national and county governments undertake extensive efforts to enhance the development, organization, and policy direction of regulatory programs in the field of environment. A key determinant of government effectiveness is how well regulatory systems achieve their policy objectives. In most instances, regulatory failures tend to attract calls for more regulation by governments, with little assessment of the underlying reasons for failure. Although there is little hard evidence, a growing body of studies suggests that inadequate
compliance underlies many regulatory compliance failures. In recent years, governments have enhanced their efforts to examine how best to achieve policy objectives more cost-effectively through better regulation or different mixes of policy tools aimed at improving regulatory compliance.

National and county governments’ actions to promote regulatory compliance must consider the following three factors:

- **a)** The degree to which the target group knows of and comprehends the rules,
- **b)** The degree to which the target group is willing to comply – either because of economic incentives, positive attitudes arising from a sense of good citizenship, acceptance of the policy goals, or pressure from enforcement activities, and
- **c)** The degree to which the target group is able to comply with the rules

Based on the three considerations, national and county governments should employ the following mix of activities to ensure that environmental regulations take effect:

- **a)** Communication with the target group to inform it about duties and explain various provisions stipulated in the rules.
- **b)** Application of many kinds of policy instruments (taxes, prohibitions and subsidies for example) to influence the behaviour of the target group, backed up with a variety of enforcement activities (such as inspections and penalties).
- **c)** Adequate implementation to make the policy workable in practice, which means that governments have to ensure that the necessary information is provided to the target group and other technical facilities or mechanisms are taken.

To address challenges of compliance with environmental regulations, the following strategies would be effective:
a) All regulations need to be accompanied by information campaigns to ensure that they are brought to the notice of and made comprehensible to the target population. This would address the challenge of a common assumption that the target group will be aware of, and understand how to comply with a rule when it is published. The responsibility of policymakers does and implementing authority, therefore, does not end after publication of the regulation.

b) Strategies to support good compliance outcomes should be initiated at the regulatory design stage. Methods should be developed to help improve the likely level of future regulatory compliance.

c) Monitoring compliance trends among targeted population should also be a key part evaluation programs for existing regulations. Information and compliance data should help improve the effectiveness of enforcement activities.

d) Regulatory agencies need to shift from traditional performance measures, such as their own level of activity (i.e. measuring inputs). Instead, regulatory agencies need to shift towards output measures, such as environmental results, health effects, declines in injury rates, and behavioral outcomes that impact more directly on the population’s social welfare.

e) Regulatory drafting, implementation, monitoring, and enforcement should be designed to maximise the potential for target groups to achieve substantive policy goals (Bruch & Mrema, 2006).

6.3.2 Best practices to improve compliance with solid waste management regulations.
Results-oriented regulatory policy refers to regulatory development is designed to ensure maximum compliance with regulation and to accomplish substantive policy goals, at lowest cost.
The following best practices would promote compliance with waste management regulations among waste generators, the authority and licensed transporters in Starehe District.

a) Building institutional capacity for solid waste regulations enforcement:
   i. Prioritizing and strategically focusing on law enforcement efforts;
   ii. Promoting better interagency linkages at national and local levels;
   iii. Establishing partnerships with appropriate NGOs, civil society or private sector actors to support enforcement and/or monitoring;
   iv. Enabling citizens, supported where necessary by NGOs and government agents, to assist in monitoring and detecting solid waste non-compliance.

b) Improving data and knowledge

Accurate and up-to-date information is essential for prevention, detection, and monitoring, reporting, non-compliance with solid waste management regulations. Strategies to improve data and knowledge involve assessment and monitoring of compliance with waste management regulations. This is indispensable to provide baseline data on the state of pollution, which will in turn allow monitoring of changes over time.

c) Rationalizing the policy and legal environment

A number of steps can be taken in order to streamline and rationalize solid waste management policies and laws, including:

i. assessing underlying social, economic, cultural and political causes of non-compliance and modifying the policy and legal framework;
ii. increasing clarity, transparency and consistency of solid waste management legislation, by drafting legislation that is simple, unambiguous, based on tested approaches and
iii. ensuring cross-sectoral linkages and collaboration to guarantee a coherent and overarching approach to waste management issues.
Further Areas of Study

Based on the study, the following areas are recommended for further studies. Study should be conducted on the level of effectiveness of existing public awareness programs in enhancing compliance with the environmental regulations. Further research should be conducted on the extent of involvement of various stakeholders in solid waste management during the formulation of applicable environmental regulations. Study should be conducted on the best applicable mechanisms to enhance compliance with the waste management regulations.
References


42


Appendix

Research Questionnaire

Compliance with the general provisions of the law

Responsibility of waste generators

Respondents reported cases of illegal solid waste disposal in the following areas

Public Highways ☐ Streets ☐ Roads ☐ Recreational Areas ☐

Do waste generators show responsibility through the following practices?

Disposal at designated waste receptacles ☐
Waste segregation ☐

Clean production methods

Do waste generators (mostly businesses and companies) observe the following clean production methods?

a) Conserving raw materials and energy ☐ b) Elimination of toxic raw materials use ☐

c) Reduction of toxic emissions and wastes ☐

d) Monitoring the product cycle through the following measures:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Yes/ No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying and eliminating potential negative impacts of the product</td>
<td></td>
</tr>
<tr>
<td>Enabling the recovery and re-use of the product, where possible</td>
<td></td>
</tr>
<tr>
<td>Waste reclamation and recycling</td>
<td></td>
</tr>
<tr>
<td>Incorporating environmental concerns in the design and disposal of a</td>
<td></td>
</tr>
<tr>
<td>product</td>
<td></td>
</tr>
</tbody>
</table>

Waste transportation

Do waste transporters use vehicles approved by the authority, in accordance with the provisions?

Yes ☐ No ☐

Do licensed transporters conform to ALL the provisions of the regulation on waste transportation?

Yes ☐ No ☐

If No, which provisions of the regulations do waste transporters violate?

<table>
<thead>
<tr>
<th>Provision of the regulation</th>
<th>Yes/ No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation under a license from the authority</td>
<td></td>
</tr>
<tr>
<td>Proper labeling of vehicle as directed by the authority</td>
<td></td>
</tr>
<tr>
<td>Operations in designated areas as per the transportation license</td>
<td></td>
</tr>
<tr>
<td>Using vehicles that do not scatter of waste during transportation</td>
<td></td>
</tr>
</tbody>
</table>
Using vehicles that ensure no emission of noxious smell
Following scheduled routes approved by the authority
Possession of dully filled tracking documents during transportation
Collection of waste from designated areas of operations only
Transporting wastes to designated disposal site of plant

### Waste disposal facilities

Does the authority ensure that its waste disposal site operates in an environmentally sound manner?
Yes ☐ No ☐

Does the authority clearly indicate the disposal operation permitted and identified for the particular waste?
Yes ☐ No ☐

Does the authority apply the relevant provisions on waste treatment under the Local Government Act and Regulations to ensure that such waste does not present any imminent and substantial danger to the public health, the environment and natural resources?
Yes ☐ No ☐

Does the authority carry out annual environmental audits pursuant to the provisions of the Act/ regulations?
Yes ☐ No ☐

### Offenses and penalties

Note: Any person who violates the provisions of the Regulations commits an offence and is liable on conviction to imprisonment for such a term and such fine as provided for in the Act.

Does the authority have mechanisms to ensure that offenders get appropriate penalties for the offenses committed under the regulations?
Yes ☐ No ☐

If Yes, which mechanisms exist?

  i. 
  ii. 
  iii. 

How effective are the above stated mechanisms in promoting compliance?
Not Effective ☐ Effective ☐ Very Effective ☐

What challenges does the authority face in implementing the existing mechanisms?
Public access to information on waste management regulations

Are there Environmental information access centers set to improve public access to information on environmental waste management regulations?  

Full access ☐  Low access ☐

The Likert Scale of Evaluation

What is your opinion on the level of overall compliance with the waste management regulations 2006 by the following key stakeholders? (Using the following scales for evaluation)

<table>
<thead>
<tr>
<th>Poor</th>
<th>Commendable</th>
<th>Good</th>
<th>Very Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Waste generators: The Public ☐ Business Community ☐

Waste collectors: The Authority ☐ Private Service Providers (PSPs) ☐

Possible causes of low compliance level

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Yes/ No</th>
<th>Possible Cause</th>
<th>Yes/ No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcrowded trading centers</td>
<td></td>
<td>Low number of employees</td>
<td></td>
</tr>
<tr>
<td>High population density</td>
<td></td>
<td>Negligence among waste generators</td>
<td></td>
</tr>
<tr>
<td>Few public awareness programs</td>
<td></td>
<td>Poor access to information</td>
<td></td>
</tr>
<tr>
<td>Policy gap</td>
<td></td>
<td>Poor state of dumpsite</td>
<td></td>
</tr>
<tr>
<td>Improper coordination</td>
<td></td>
<td>Poor access and infrastructure</td>
<td></td>
</tr>
<tr>
<td>Low number of vehicles for collection</td>
<td></td>
<td>Poor maintenance of vehicles</td>
<td></td>
</tr>
<tr>
<td>Inadequate monitoring</td>
<td></td>
<td>Flawed implementation system</td>
<td></td>
</tr>
<tr>
<td>Inadequate funding/ budgetary constraints</td>
<td></td>
<td>Inadequate collection bins</td>
<td></td>
</tr>
</tbody>
</table>

Effects of low-level of compliance with solid waste management

<table>
<thead>
<tr>
<th>Possible Effect</th>
<th>Yes/ No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease outbreaks</td>
<td></td>
</tr>
<tr>
<td>Poor aesthetic quality</td>
<td></td>
</tr>
<tr>
<td>Water, land and air pollution</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>
Recommendations to improve environmentally sound management of waste

What recommendations do you propose to improve solid waste management in Starehe District?

i. 

ii. 

iii. 

What changes, if any, do you recommend for policies and laws governing solid waste management?

i. 

ii. 

iii. 

Any other information vital for the study

i. 

ii. 

iii.