# SOLID WASTE MANAGEMENT AND HEALTH EFFECTS IN NAIROBI COUNTY, KENYA.

## BY

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# DECLARATION

This research is my original work developed as a requirement for the partial fulfillment of Master of Arts in Business Administration and has not been presented before for a Degree in any other University.

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This research project has been presented for examination with my approval as the University Supervisor

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# DEDICATION

This project is dedicated to my family and colleagues who gave me invaluable moral support throughout the period.

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# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF CHARTS

# LIST OF APPENDICES

# ABBREVIATIONS AND ACRONYMS

**4Rs:**        Reduce, Recycle, Re-use and Repair

**APHRC:**      African Population and Health Research Center

**ARK:**        Africa Risk Knowledge

**DoE:**        Department of Environment

**EMCA:**      Environmental Management and Coordination Act

**JICA:**      Japan International Cooperation Agency

**MEAs:**      Multi- lateral Environmental Agreements

**NCC:**        Nairobi City Council

**NEMA:**      National Environmental Management Agency

**SWM:**       Solid Waste Management

**TTIs:**       Technical Training Institutions

**UNEP:**      United Nations Environmental Program

**WHO:**       World Health Organization

# ABSTRACT

Solid waste management is important to Nairobi County because it ensures a healthy working environment for Nairobi residents thus increase productivity of the county hence the need of this study which was titled solid waste management and health effects in Nairobi County. The purpose of this study was to establish how solid waste are managed in Nairobi county, what was the impacts of SWMM on health in Nairobi county and what were the challenges faced in managing solid waste in Nairobi county, the study was guided by waste minimization theory, the research was descriptive survey where questionnaires were used to gather data from respondents who were environmental officers and residents of Nairobi county, data was analyzed using descriptive statistics, the findings of the study was that the dominant method used to manage waste in Nairobi county was controlled dumping to which 93.5 % of the respondents argued that was responsible for increase in incident counts of respiratory ailments in Nairobi county, the main challenge of SWM was illegal dump sites in Nairobi county. From the study I conclude that the methods put in place to manage waste in Nairobi county has adverse effects on the residents of Nairobi and thus I recommend that the county government to invest in technological ways of managing waste. The key limitation of the study was limited resources. Further research should be done on how to adopt technology to manage solid waste in Nairobi County.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

Many nations worldwide experience various challenges in the management of solid waste. Such challenges vary from reducing waste generation, separation, collection, change of habits, reuse, transport, disposal and treatment of the same waste. According to UNEP (2005), the challenges are mainly diverse for dissimilar levels of industrial growth in the country. In a trial to quicken the speed of its industrial development, a nation that is trying to develop its economy might pay insufficient attention to the solid waste management issue affecting the country. Ngoc and Schnitzer (2009) claim that a growing population, different changing patterns of consumption, economic development, varying income, industrialization and urbanization lead to increased waste generation. The known fact remains that solid waste generation will continue to rise yearly if not efficiently managed, and thus it interferes with the service delivery of a county or country (Karanja & Okoth, 2003).

In Kenya, the challenges facing of Solid Waste Management is actually existent (Gakungu, 2011). Thus, the collection systems of the country are unproductive and disposal systems are not ecologically welcoming. Approximately 40% of every solid waste produced in different urban zones such as Nairobi County is often not collected and less than 50% of the entire urban population is offered the services (KNBS, 2010). Approximately 80% of collection transport of the country is considered to be out of service or require repair and maintenance, thus if the subject of workable solid waste management in country is not well thought-out straightaway, all the counties in Kenya including Nairobi will continue to be overwhelmed with waste.

A study on how people, such institutions and various industries manage the waste will actually help in guiding good practices that can lead to lowered amount of municipal waste in Nairobi County and in effect reduced environmental pollution (Mariera, 1996). Regardless of where everyone lives, works, or plays, people do generate trash. From the beginning of manhood, human beings have always produced waste. Nevertheless, disposal of waste was not an issues when there was nomadic life; different persons just moved away leaving their generated waste behind. During the 10,000 BC, people started to leave their nomadic life and live in societies as

groups of people. With the arrival of non-transient group of people came garbage and waste that were released on the ground where human beings existed. Alternative methods of waste disposal were not established till waste started put at risk the life of people in the city and its environs (Khan & Ghouri, 2011).

### 1.1.1 Solid Waste Management

Adeniran, Nubi and Adelopo (2017) defined solid waste as the range of trash and rubbish that arise from the activities of human beings and animals, which are thrown away as undesirable and unusable. Solid waste is mainly produced from residential, commercial and industrial activities in a particular region, and might be controlled in various means. Thus, landfills are characteristically categorized as municipal, sanitary, construction and industrial or demolition waste sites. Solid waste can be characterized centered on material, like plastic, glass, paper, organic and metal waste. Classification might similarly be centered on hazard potential, which include radioactive, flammable, toxic, non-toxic or infectious waste. Classifications may perhaps relate to the waste origin, like industrial, commercial, domestic, demolition and institutional or construction.

According to ARIJ (2009), waste that is produced on the streets build unfriendly smells and is mainly form the breeding sites for insects and vermin that results to diseases; hazardous resources from aimlessly and erroneously discarded waste can leak into and contaminate resources of water, which include groundwater or any main drinking water source.  Thus polluted earth as well as water get into the body of human beings, through drinking water, animal products and vegetables, whereas burning the solid left-overs contaminates the air, leading to severe health issues, which include respiratory diseases, cancer, and other diseases. Irrespective of the starting point, hazard or content potential, every solid waste needs to be systematically controlled to guarantee ecological best practices. Since solid waste management is a life-threatening feature of environmental sanitation, it must be assimilated into the environmental planning agenda.

Municipal solid waste management creates one of the highest critical service delivery challenges that face the African cities and towns (Achankeng, 2003). Thus, various economic melt-down

that Zimbabwe underwent throughout the 10 years, between 2000 and 2010 led to several challenges being influenced against all-encompassing urban operational Solid Waste Management. Such challenges comprised of the incapability of the municipalities to source for non-toxic water to the inhabitants, incapacity to dispose off sewage as well as the breakdown of service delivery and infrastructure in Solid Waste Management (SWM) activities from production of waste, storage, collection, and similarly safe disposal of the same waste. SWM is well-defined as the activity related to control of production of solid waste materials, collection, storage, transfer or transport, processing as well as disposal of the same waste in various means, which best address the issue of public health, economics, conservation, engineering, aesthetic and other environmentally friendly concerns.

### 1.1.2 Health Effects

Using the WHO definition of health as "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" gives a baseline for connecting health effects and waste (WHO, 2012). Though this definition has not been modernized from 1948 and many other commonly accepted definitions exists currently (WHO, 2012), this study will stay with WHO's definition for a recognized evidence. According to Onibokun and Kumuyi (1999), the rapid urbanization in the developing countries of Africa, uncontrolled and unplanned, has brought a serious environmental degradation. One of its most pressing matters is the management of solid-, liquid- and hazardous waste. A visit to any African city will be the evidence of this situation where litter lays besides the roads, streams blocked with junk and toxic waste polluting the environment and threatening human health. A total of 80 percent of all diseases spread within a community in a developing country are believed to be connected to the poor waste management in small towns or cities (Public Health Officer, 2012). This in itself is an unnecessary and additional problem for people in these countries who often already struggle with inadequate drinking water and lack of food.

Poor management of solid waste is a general problem in Kenya. Literature is generally lacking on solid waste management (SWM) in this country, with the exception for some reports from Nairobi (UNEP, 2005). Kenya, which is one of the most populated countries on the African continent, formulated a Waste Management Regulation Plan in 2006. This plan was meant to

streamline the handling, transportation and disposal of various types of waste, aiming to protect human health and the environment. The waste regulations focus on waste minimization, minimization of future possible waste and cleaner production. Despite of this regulation plan, different kinds of waste are still dumped in an uncontrolled manner with hazardous waste seriously poisoning the environment which endangers the health of both humans and animals (NEMA, 2012). Plastic bags left in nature have been connected to spread malaria because they provide ideal breeding habitats for the malaria-carrying mosquitoes when the plastic has collected rainwater. Then during burning of the plastic toxic gases like furan and dioxin will be released and unhealthy residues including lead and cadmium remain on the ground (Njeru, 2006).

### 1.1.3   Nairobi County

According to Mwenda, Ingham and Ominde (2018), Nairobi is considered as the main industrial Centre in Kenya. The railways are the principal distinct industrial employer. Various light-manufacturing industries also help in the production of beverages, processed food and cigarettes. Tourism is likewise significant. Nairobi City is situated near the agricultural heartland of Eastern Africa, and various primary goods are channeled via Nairobi prior to being exported through Mombasa. Nairobi thus plays a vital role in the communities of Eastern African nations since it is the head office and center of operations of significant regional railways, airways and harbors corporations.

Nairobi is among of the fastest rising municipalities in Africa, rapidly becoming the second leading city of the African Great Lakes region (Nairobi Population, 2017). The city is rising at a rate of more than 4% yearly, chiefly for the reason that there is high birth rates and various immigrants that come to the city in search for employment openings (Urban ARK and APHRC, 2017). It is projected that Nairobi City will progress to be on its skyward trajectory in terms of population, approaching 5 million by 2025. Nairobi City is the site of one of the biggest slums around the world, and roughly 22% of its inhabitants live in poverty.

According to UNEP/NEMA (2003) report, domestic waste results to 68% of the total waste produced in Nairobi; whereas various non-domestic waste that come from industrial, roads,

4

markets and other activities have led to a collective total of approximately 32% of the total waste produced, which is sub-divided in the following ways: Industrial activities at 14 %; roads activities at 8 %; hospitals activities at 2 %; markets activities at 1 %; and other sources at 7 % (Ngau & Kahiu, 2009). In different cities around Africa, just like other developing areas, quick growth of population and expansion of manufacturing sectors and services have resulted to the rise in the quantity of solid waste generated, whereas its management has continued to be highly poor. This is particularly the circumstance in poor regions like slums in which limited or actually no waste collection happens. If waste is uncollected, it is thus inappropriately disposed off, characteristically in open landfills or dumpsites, which are normally located in close vicinity to urban informal residential sites. The impacts of poor SWM in the cities as well as big municipalities in connection to environment and public health, and eventual adverse influences on the quality of life of every resident of a country, are well acknowledged in the collected literature works (Urban ARK & APHRC, 2017).

## 1.2 Research Problem

Efficient waste management systems are essentials in order to withstand economic as well as social development. However, most countries around the world are unable to maintain adequate management systems capable of handling the continuously growing mountain of waste that is generated. This is due to inefficient collection systems. Without collection, waste cannot be disposed off, treated or reused. On the other hand, failing to collect waste leads to environmental and social-economic repercussions (Regassa, Sundaraa & Seboka, 2011).

Generation of waste has been rising in Kenya because of the rapid urbanization process. The quantity of solid waste produced yearly is at present 4 million tonnes, and is projected to increase by double the number by 2030. However, this increase in number has not essentially been tracked by an "increase in the capacity of the relevant urban authorities to deal with this challenge of Solid Waste Management (SWM)" (Regassa, Sundaraa & Seboka, 2011). For instance, in Nairobi approximately half (1500 tonnes per day) of the generated solid waste is not often collected. In accordance with a working paper issued by the Urban Ark institute (2017), such insufficiency is largely because of scarcity of delivery of policy tactics as well as key gaps in the mechanisms of implementation.

Numerous researches have been conducted on waste management. At the global scene, Wilson, Rodic, Scheinberg, Velis and Alabaster (2012) deduced that majority of dump sites were not subject to any control or monitoring by the Ministry of Health as well as other ministries. Hoornweg and Bhada-Tata (2012) reasoned that municipal solid waste management is the greatest significant service any city can offer both in low income countries and various middle-income countries. Guerrero, Maas, and Hogland (2013) and Zerbock (2003) did some studies to find out ways of disposing wastes in urban regions. They discovered that in urban centers all over African countries, approximately half of the solid waste produced is mostly collected, and 95% of that quantity of waste generated is either comprehensively thrown away at different dumpsites on the outside edges of the urban centers, or at various purported temporary spots, normally empty lots spread all through the city.

Locally, Kukreja (2009) investigated the cause of flooding in Nairobi County. One of the reasons he came up with is that the dumpsites which are not controlled causes obstruction of the drainage systems therefore leading to flooding. Purvis (2015) investigated the presence of licensed dumpsites in Nairobi, and he found out that Nairobi County does not have licensed or selected dumpsites therefore, it is very common to see animals like cows, chicken, pigs and goats feeding at such dumping sites. The sites are usually littered and are thus breeding places for various disease causing bacteria and viruses. APHRC (2017) lately examined the various integration levels of SWM in Kenya, and ways in which such policies chiefly address issues of health amongst urban inhabitants in Mombasa and Nairobi. They nevertheless did not look at the social changing aspects of SWM. The authors contend that there are comparatively good provisions for SWM put in place in Kenya. For instance, in relation to macro-level incorporation, the authors reason that the National Environment Policy that plans tasks for the state, is well incorporated with the National SWM policy, which is highly considered to be policy for action amid various stakeholders.

The above studies concentrated on the theoretical approach on SWM in Kenya overlooking the practical section of SWM and its impact on Health in Nairobi, Kenya. This research was done to bridge the existing knowledge gap on SWM in Nairobi County through replying to the following research queries: how is solid waste managed in Nairobi County? What is the impact of SWM on Health in Nairobi County? And, what are the challenges faced on SWM in Nairobi County?

**1.3 Research Objectives**

The objectives of the study were:

i.   To determine the methods of solid waste management in Nairobi County
ii.  To establish the impact of solid waste management on Health in Nairobi county
iii. To establish the challenges faced in solid waste management in Nairobi county

**1.4 Value of the Study**

The study was important to Nairobi County because it discussed the work of the agencies responsible for waste management in Nairobi City and its environs, which resulted into detecting key challenges of SWM as well as proposing possible solution. This research also helped in determining how Health is influenced by waste management as well as suggesting areas of development for a Healthy Environment in the county.

To other counties and regions, this research study was significant because it contributed to policy formulation on how waste should be managed to minimize its effects on Health. As a result of this study the policy makers in other counties can utilize the findings as well as recommendations to achieve better ways of managing wastes in their respective counties in Kenya.

To future researchers and academicians, the study findings acted as a reservoir for knowledge and provided the basis for further research on impact of SWM on Health.

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

This chapter centers on key questions on SWM and its effect on service delivery in Nairobi County, Kenya as well as the global world. The key areas discussed include: Theoretical Literature Review, SWM Methods, Empirical Literature Review, Challenges in Solid Waste Management and Summary of Literature Review and Research Gaps.

## 2.2 Theoretical Literature Review

To be able to understand the concept of SWM and service delivery, the theories that were used were the top-down bottom-up theory and conflict theory. These are discussed below.

### 2.2.2 Conflict Theory

The theory was recommended by Karl Marx in 2008 and it claims that the society is in a continuous conflict state due to competition for scarce resources. It embraces that the social order is upheld by power and domination, instead of conformity and consensus. In accordance to the conflict theory, the individuals with power and riches attempt to hold on to it through any possible way, primarily by overpowering the powerless and poor. For example, the economically rich and political elites make use of their monetary strength in channeling benefits from both the national government and local government to their well-developed regions. This is what leaves the less privileged persons struggling with various issues, which include SWM. This typically creates helps in creating conflict amid the two groups since the policy as well as legislation that are developed have a tendency of favoring the rich people (Cairns & Sears, 2015).

In case of any technological implementation on SWM, the parts which are occupied by the wealthy people are often provided first priority, thus leaving the poverty-affected-people in the shanty town where a lot of the waste is generated suffocating in loads of trash. Most of the employees of NCC provide favored treatment to the areas in which political as well as economic elite live. This theory thus proves that every variables specifically capacity policy as well as legislation, urbanization and technology favors particular class of persons therefore poor waste

management in semi structured regions compromise of more than 70% of the population of the population of the city.

### 2.2.1 Waste Minimization – Resources Use OptimizationTheory

Prevention of waste creation is the main priority of waste management, which corresponds to the principal goal of waste management: conservation of resources. Moving toward waste minimization requires that the firm commits itself to increasing the proportion of non-waste leaving the process. It has been argued that, it follows from the laws of thermodynamics, that producing by-products is concomitant of a main product (Baumgärtner & de Swaan Arons, 2003). For this reason, industrial firms have to look beyond their factory walls, and seek for external utilization of their waste, in accordance with the principles of Industrial Ecology (IE). If we accept that waste minimization and resources use optimization is the most important objective of waste management (Pongrácz, 2002).

The Theory of Waste Management is based on the considerations that waste management is to prevent waste causing harm to human health and the environment, and application of waste management leads to conservation of resources. However, Industrial Ecology successfully combines waste minimization and resources use optimization measures, and ensures that resources are effectively circulated within ecosystems (Pongrácz, 2002).

### 2.3 Solid Waste Management Methods

A number of the techniques used to manage wastes are: waste separation and composting, controlled dumping, the 4R's and by use of technology. The methods are discussed below:

Waste separation and Composting is one of the methods commonly practiced in developed countries. Martin and Gershuny (1992) has defined Composting as a sustainable waste management activity that transforms any volume of accrued organic waste into a practical and useful product. Whenever the organic wastes undergoes biodegradation by microorganisms in a warmth-generating surroundings, the volume of waste is reduced, various dangerous organisms are killed, and a valuable, hypothetically merchandisable product is created (Golueke, 1973).

Organic wastes mainly comprise of manure from animal bedding, livestock operations, yard wastes like grass clippings and leaves as well as kitchen scraps.

Inorganic materials cannot be composted hence the need of Controlled Dumping. For example, plastics have to be disposed off in any landfill or recycled. Controlled Dumping advocates for efficient waste management system where wastes are picked from collection points at regular intervals, preferably daily especially in tropical weather to avoid decomposition of waste and of the resultant bad odors (UNEP, 2015). This is, however, one of the areas of the systems of waste management in the cities of developing nations have failed. It is not uncommon to find waste accumulated in collection points for too long, which results in bad odors, damage to the aesthetics of neighborhoods as well as the hatching of flies. On the disposal end, it is ideal that solid garbage is disposed off in a clean land fill; however, even where open dumping is practiced, it is important that all collected waste is disposed off in the designated site. This ensures that waste is contained in one defined area as opposed to being indiscriminately dumped in any available open space.

The 4Rs, which include waste reduction, waste reuse, waste recycling as well as waste recovery, is being encouraged as a means of lowering the dumping costs, thus decreasing the burden on landfills as well as lowering environmental effects. The ecological advantages of using the 4Rs comprise of decrease in the release of greenhouse gases, reduction of air pollution as well as water and land population, water conservation, energy conservation, resources conservation, and reduction of the quantity of waste that require dumping.

Resource utilization is one of the greatest operational and ecological ways of managing the waste and extract the best use of it. Instead of discarding all the waste into landfills, a large quantity of biodegradable organic and recyclable waste is considered as a valuable source of alternative energy, raw materials, and byproducts. As such, it is essential to manage waste with appropriate technologies for greater management outcomes and more rigorous in monitoring and evaluating SWM system. An example of SWM by technology is incineration, which involves the burning of different solid wastes at very high temperatures till they are changed to ashes. Waste can be also be reduced by application of more efficient production technologies (Lohani & Thanh, 1978; Lardinois & van de Klundert, 1995).

## 2.4 Empirical Literature Review

Many studies have been undertaken on SWM. Dowson (1991) sought to quantify the household generated wastes in Greater Hobart. A survey of 356 households in Greater Hobart was conducted. The objective was to quantify and to determine the character of household produced wastes in the city of Hobart, and it was reasoned that the mean household waste produced for collection purposes was 9.1 kg weekly or 472.5 kg yearly. Whereas the survey offers a valuable baseline research, it is significant that present studies are carried out to help in better understanding of the changes in the household waste generation patterns.

ARIJ (2009) tried to find out the challenges of SWM in Nablus city. He basically did a case study of stressing on the literature works of waste management unit of the Palestinian City of Nablus's Joint Council for Services for the determination of detecting key challenges as well as proposing thinkable solutions. The arguments and data were presented by the Nablus people and the Municipality officers throughout a special workshop, which was planned by Applied Research Institute-Jerusalem (ARIJ) as part of the *Pro-Poor Integrity Program* executed by TIRI and sponsored by the Department for International Development (DFID) in the UK. The author discovered that many of the significant urban solid waste tools had been impaired all through the Intifada. Thus, the employees in the Health and Environment Division was decreased and some linked development projects as well as actions have been frozen. The medicinal waste incinerator of the city had been removed and some exceptional medical containers had been decreased from 16 to around 10. A number of solid waste compressing Lorries had been out of use and there existed no substitute. The other significant figure is the quantity of waste collection employees that reduced from 420 to 248, even though the city is increasing in population and buildings (Arafat, Al-Khatib & Zahra, 2006). The research gap is that the study was only based on the Palestinian city and hence the result may not be applicable to African countries.

Kasozi and von Blottnitz (2010) wanted to determine the Domestic or Residential Waste Characterization. The authors collected a total of 568 samples, which was spread over one week and were directly collected from the family unit in three different areas specifically; Makadara, Westlands and Starehe for characterization of wastes at their immediate source, whereas a sum total of 163 collection points for communal waste situated in residential areas that are spread

across Nairobi City were experimented for waste characterization at their collection points. The outcome for the residential/domestic waste characterizations done at the communal waste as well as immediate source collection points were not the same. Whereas it maybe be projected that there ought to be resemblance in the waste characterizations at the collection points and the source as hypothetically the waste produced at source often goes to the collection points, this was not the reality in this case. The limitation of the study was that the variance between the collection points and immediate source based characterization of waste was not evidently clarified.

Regassa, Sundaraa and Seboka, (2011) investigated if there were capacity to manage increasing Waste generation in Kenya due to rapid urbanization. They carried out a survey in Nairobi and Mombasa and assumed that the quantity of solid waste produced yearly is at present 4 million tonnes, and is projected to double by approximately 2030. However, this increase has not essentially been followed by a rise in the capacity of the significant urban authorities who are capable of dealing with this challenge of SWM. For example, in Nairobi, approximately half of the solid wastes generated are not always collected. Ultimately, the authors did not investigate how this affects service delivery in Nairobi County.

Emma Selin, (2013) Investigated if there was public awareness on possible health effects due to improper disposal of waste within Mutomo community, Kenya. The used method was qualitative and for data collection in-depth interviews were conducted with help of an interpreter, interviewing guide, and a recording device. The result shows that all participants were aware of the health risks connected to waste. Much concern was raised amongst the community members, especially for the children's health.

Urban Ark institute (2017) sought to determine SWM practices such as storage, collection and disposal in Kenya. They did a sample of households both in Nairobi and Mombasa, and the results showed differences in waste storage practices between communities in the two cities. Majority of households in Nairobi at 85 % and 52 % of those in Mombasa used plastic bags to store their waste. Open containers were the second most common forms of waste storage in both cities. There were also differences in the use of common collection points, with more households in Mombasa (15 %) than Nairobi (0.7 %) using such points. Results also indicate that majority of

households in the study sites had their garbage collected between 4-6 times in a month, although the proportion was substantially higher in Nairobi (92 %) than Mombasa (49 %). Majority of the households are reported to be disposing waste together with toxic waste, with the proportion being higher in Nairobi (87 %) than Mombasa (76 %). Although most respondents had heard about recycling and composting, waste reduction practices through these methods were very low. This presents an opportunity for community sensitization to raise wakefulness amidst the citizens on the significance of waste reduction.

APHRC (2017) examined the diverse integration levels of SWM in Kenya, and the ways in which such policies chiefly handle health issues amid urban inhabitants in Mombasa and Nairobi. The authors did a survey in both cities where they argued that there are comparatively good provisions for SWM put in place in the nation. For example, in relation to macro-level integration, the authors realized that the National Environment Policy that plans tasks for the state management is well incorporated with the strategy for the National SWM, which is generally comparable to a stage for action amongst shareholders. Nevertheless, they did not research on the social dynamics of SWM.

### 2.5 Challenges in Solid Waste Management

SWM face various challenges when it comes to implementation. According to ARIJ (2009), these challenges comprise of critical funding shortages, and thus the international community has always given the provisions of major facilities and equipment. In the city of Nablus, every new infrastructure as well as major tools has been funded via either grant help or infrequent sponsoring from financial institutions such as the European Commission, and the donor nations. Although such financial support has made significant helps to the unit of waste management at Municipality of Nablus, still the unit is observed to lack various equipment and facilities, which include various types of containers having different functions, colors and sizes. Correspondingly, many present machineries are obsolete and old.

Lack of public awareness and participation can hinder proper solid waste management. When it comes to the general ecological issues as well as SWM practices to be specific, the continuing challenge facing the whole Palestinian community remains to be insufficient awareness and

similarly public ignorance, which result from negative behaviors that concern the disposal and collection of waste. These behaviors include casually throwing away trash in the street or close to an unused vegetation, disposing of garbage right next to the required waste container rather than putting it inside the container, disposing of loose waste inside the waste container rather than disposing it in a firmly closed bag, physically changing the position of the waste container to a new place as well as burning produced waste either out in the open or inside the waste container (ARIJ, 2009).

The absence of any concrete recruitment policy licenses for the recruitment of unqualified employees and therefore it involves not placing the right individual in the correct place, the gender effect, age and similarly educational status on operational SWM and reasons for not making use of a suitable waste collection service (WCS) in Nigeria's customary cities. This is considered in Abeokuta case study. Educational status, amount charged and age for WCS had been recognized as key factors that influence effective SWM in extremely populated cities such as Lagos and Ibadan (Babayemi & Dauda, 2009; Sridhar, Bammeke & Ademola Omishakin, 1985).

Absence of advanced technological capacity for separation of waste at the immediate source is considered as one of the main factors that help in hindering effective SWM. Waste recycling is costly. Even though current years have had a rise in various waste recycling amenities, the recycling economics is still unfavorable. In several cases, waste recycling is costly when compared to purchasing the product. Thus, the support of the government in terms of inexpensive land for landfills and grants are usually essential for profitable practicality. There is also underdeveloped market for the products developed through recycling process. Inadequate demand for the recycled goods in the local market is an additional reason that has hindered the development of the waste recycling business. Therefore, there exists some units taking part in recycling waste plastics, paper and paperboard (Ajani, 2008). Unreachability due to the urban and geographical structure, deficiency of appropriately planned collection time schedule and route system, malfunctioning and inadequate operation equipment, open garbage burning, poor final dump site condition and dropping litter at the corner around the waste containers are activities that promote illegal dumping, thus they are the chief technical issue that faces many cities (Sridhar *et al.* 1985).

## 2.6 Summary of Literature Review and Research Gaps

Table 2.1 below shows the summary of literature review. It contains the scholar(s), the study done, the objectives of the study, findings and research gaps on SWM.

**Table 2.1: Summary of Literature Review and Research Gaps**

| Scholar(s) | Study | Objectives | Findings | Research Gaps |
|---|---|---|---|---|
| Dowson (1991) | Quantify the household generated wastes in Greater Hobart | To quantify household generated wastes in Greater Hobart | The average waste produced by the household for collection was 9.1 kg weekly or 472.5 kg annually | Its baseline study explains that it is significant that present studies are carried out to better recognize and know the changing household waste generation patterns |
| Arij (2009) | To find out the challenges of SWM in the city of Nablus | To establish the challenges faced in SWM in the city of Nablus | Some solid waste compressing trucks had been out of use with no substitute | Did not explain how this affects sanitary services, and the result could not be applied in African countries |
| Allison Kasozi and Harro von Blottnitz (2010) | To determine Residential/Domestic Waste Characterization in Nairobi. | To establish the impact of solid waste in Nairobi county | There is a difference in waste characterizations at the source and at the collection points | The dissimilarity between collection points and immediate source based waste characteristics was not clearly explained |

| | | | | |
|---|---|---|---|---|
| Regassa, Sundaraa and Seboka (2011) | Investigated if there were capacity to manage increasing Waste generation in Kenya due to rapid urbanization | To establish the effects of urbanization on solid waste management in Kenya | There is an increase in waste generation with no increase in capacity to manage the waste | Failure to bring out the effects of this on Health in Kenya |
| Emma Selin(2013) | Investigated if there was public awareness on possible health effects due to improper disposal of waste within Mutomo community, Kenya | To establish the degree of awareness of effects of solid waste on public health in Mutomo, kenya | The result shows that all participants were aware of the health risks connected to waste | The health risk associated with solid wastes were not Stated |
| Urban Ark institute (2017) | To determine SWM practices such as storage, collection and disposal in Kenya | To determine the SWM practices in Kenya | Majority of households in Nairobi (85%) and 52% of those in Mombasa used plastic bags to store their waste. | Did not explain how this affects Housing service delivery |
| Paul and APHRC (2017) | Investigated the different levels of integration of SWM in Kenya | To investigate if policies on SWM are integrated in Kenya | there are relatively good SWM provisions in place in the country | Did not check whether the SWM provisions and policies are put into actions |

From the above summary, it's clear that the literature and empirical studies covered above shows that though researchers have gone to great length to establish why managing solid waste is important, limited studies have been done to investigate how SWM affects Health in Nairobi County.

## 2.7 Conceptual Framework

The framework outlined below indicates the influence of solid waste management on health service in Nairobi County. The independent variable is solid waste management methods which are waste separation and composting, controlled dumping, the 4R's, and technology. The dependent variable is health effects whose indicators are incident counts on respiratory ailments and cholera.

**Independent Variable**

**Dependent Variable**

**Solid Waste Management**

Waste Separation and Composting

Controlled Dumping

The 4R's

Technology

.

**Health Effects**

- Incidence counts on:
  - ➢ Respiratory ailments
  - ➢ Cholera
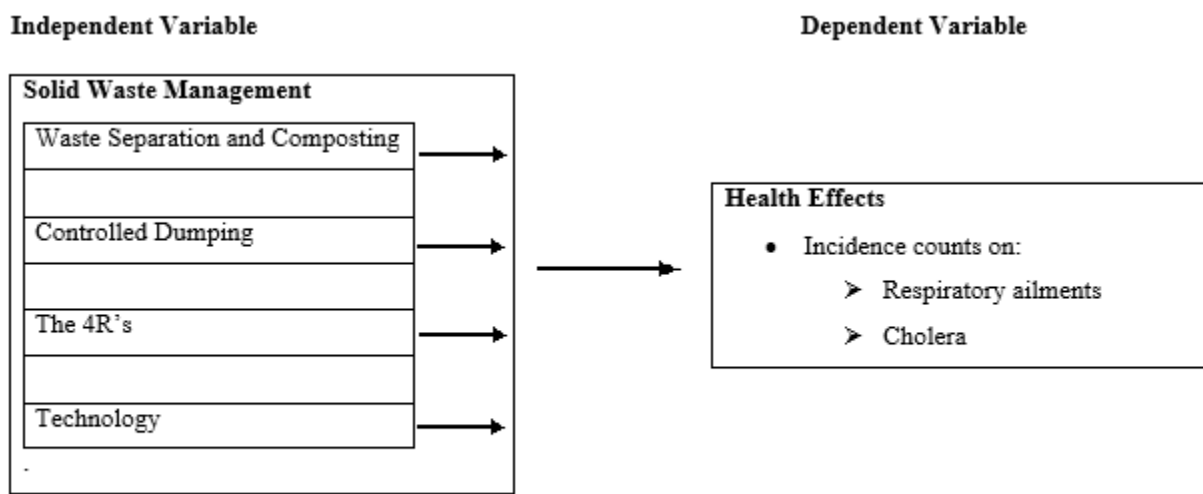
Source: Researcher (2018)

**Figure 2.1: Conceptual model**

Null Hypothesis, Ho: There is no relationship between solid waste management (SWM) and Health effects in Nairobi County. Alternative Hypothesis, H1: There is a relationship between solid waste management (SWM) and Health effects in Nairobi County.

# CHAPTER THREE: RESEARCH METHODOLOGY

## 3.1 Introduction

This chapter mainly presents the research methods that was utilized in carrying out the study. It comprises of: research design, sampling procedures and sample size, target population, research tools, data collection procedures as well as data analysis techniques.

## 3.2 Research Design

The research design which was adopted for this study was descriptive cross-sectional study involving both quantitative and qualitative data collection approaches. Descriptive survey research is a research method involving the use of questionnaires and/or statistical surveys to gather data about people and their thoughts and behaviors. Yin (1984) argues in favor of the use of descriptive surveys in fact-finding because they provide a great deal of accurate information. The intention of survey research is to gather data at a particular point in time and to use it to describe existing conditions.

## 3.3 Target Population of the Study

The research was a case study to be conducted in Nairobi County targeting representatives of the residents of Nairobi county, health care providers (KEMRI) and environmental agency staff within Nairobi County.

## 3.4 Sampling Design

The sampling procedure was guided by the general rule in most social science research which suggested that the use of the largest sample will facilitate generalization (Kline 1980). This study used Random sampling for quantitative research. Random sampling allows the researcher to use cases that have the required characteristics with respect to the objectives of the study (Mugenda & Mugenda, 1999). Random sampling was applied to pick 20 employees of environmental agencies and 20 Residents of Nairobi county therefore the sample of 40 respondents was used for the study.

### 3.5 Data Collection

Primary and secondary data was used in this research. Secondary data was gathered from published data and journals whereas primary data was gathered using the research instruments which was questionnaires and interview schedules. The questionnaire as a tool was used because it is familiar to most people (Berdie, Anderson & Niebuhr, 1986). The structured (closed-ended) was used so as to get the responses from respondents with the following sections, section A gave the demographic characteristics of Respondents, section B dealt with solid waste management methods (SWM) in Nairobi county, section C entailed SWM and health effects in Nairobi and section D gave out the challenges of SWM in Nairobi county.

The structured questionnaires were accompanied by a list of all possible alternatives from which respondents select the suitable answer that describes their situation by simply ticking (Mugenda & Mugenda, 2003), Interview schedule was used since it provides face-to-face interaction with respondents and enables the researcher to adapt the questions as necessary, clarify doubts and ensure that the responses are properly understood, by repeating or rephrasing the questions.

### 3.6 Data Analysis

Data Analysis methods was dictated by the objective of the study, methods of data collection and challenges faced. For the analysis of the demographic characteristics of respondents and the analysis of solid waste management methods (SWM) in Nairobi county descriptive statistics was used, SWMM and Health effects in Nairobi county was analyzed using Descriptive statistics and The analysis of the challenges of SWM in Nairobi county was also done using descriptive statistics. The data analysis methods are summarized in table 3.1 below.

**Table 3.1: Summary of Data Collection and Data Analysis Methods**

| Objective | Data collection | Data analysis |
|---|---|---|
| To determine the Demographic characteristics of the Respondents | Section A of the questionnaire | Use of descriptive statistics |
| To determine the methods of solid waste management in Nairobi County | Section B of the questionnaire | Use of descriptive statistics |
| To establish the relationship between solid waste management and Health effects in Nairobi county | Section C of the questionnaire | Use of descriptive statistics |
| To establish the challenges faced in solid waste management in Nairobi county | Section D of the questionnaire | Use of descriptive statistics |

**Source: Researcher (2018)**

# CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSIONS

## 4.1 Introduction

This section covers the presentation, interpretation as well as discussion of findings. The objectives of the study were to determine the methods of solid waste management in Nairobi County, to establish the impact of solid waste management on Health in Nairobi County, to establish the challenges faced in solid waste management in Nairobi County.

## 4.2 Response Rate

The target population was 20 employees of environmental staff agencies, 20 representatives of Nairobi county residents totaling to 40 respondents, 31 responses were obtained. This gives a response rate of 78% due to the fact that some of the questionnaires were not fully filled and some had some inconsistent information. However, Fryrear (2015) argued that a response rate of 50% and above is sufficient for analysis and making inferences and hence this was the case for this study.

## 4.3 General information

The general information comprised of the age bracket of the respondents, gender, years of employment in an organization and educational level of respondents. The results are discussed below.

### 4.3.1 Age bracket of the respondents

The Respondents were required to specify their age bracket and the findings were as shown in table 4.1 below.

**Table 4.1: Age bracket of the respondents**

| Age bracket | Frequency | Percentage |
|---|---|---|
| 21-30 years | 15 | 48.4 |
| 31-40 years | 9 | 29.0 |
| 41-50 years | 5 | 16.1 |
| Above 50 years | 2 | 6.5 |
| **Total** | 31 | 100 |

**Source: Research Data (2018)**

As indicated in table 4.1, Above 40 years were 22.5%, (31-40) years age bracket was 29%, Most of Respondents were of the age bracket (21-30) years which are the people who are likely to be most affected by the management of Solid wastes.

### 4.3.2 Gender of the respondents

The respondents were required to show their Gender. The results were as presented in table 4.2 below

**Table 4.2: Gender of the respondents**

| Gender | Frequency | Percentage |
|---|---|---|
| Male | 22 | 71 |
| Female | 9 | 29 |
| **Total** | **31** | **100** |

**Source: Research Data (2018)**

From the findings of table 4.2 female correspondents were 29% while the majority were male (71%), a third gender rule was obeyed in getting the opinion on SWM in Nairobi county.

### 4.3.3 Level of Education of the Respondents

The respondents were required to show their level of education as an indicator of familiarity with solid waste management. The results were as presented in table 4.3 below.

**Table 4.3: Level of Education of the respondents**

| Level of Education | Frequency | Percentage |
|---|---|---|
| Certificate | 5 | ,16.1 |
| Diploma | 6 | 19.4 |
| Degree | 12 | 38.7 |
| Masters | 8 | 25.8 |
| Phd | 0 | 0 |
| Other | 0 | 0 |
| **Total** | 31 | 100 |

**Source: Research Data (2018).**

As per the findings in Table 4.3 over 80 % of the respondents had at least attained a diploma certificate and hence had a knowledge in solid waste management in Nairobi County.

### 4.4 Solid Waste Management Methods (SWM) in Nairobi County

The study sought to find out solid waste management methods put in place and the level to which they are being used to manage wastes in Nairobi County. Some of the methods considered to be in place were: Waste separation and composting, Controlled dumping, The 4R's i.e. waste reduction, waste reuse, waste recycling and waste recovery and management of waste by technology.

The respondents were required to affirm whether the methods were in place then rate the SWM. A Likert scale was used where 5 signified mostly used method, 4= moderately used, 3= least used, 2= unfamiliar with, 1= undecided. The results were as presented in table 4.4 below

**Table 4.4: SWM Methods in Nairobi county Descriptive Statistics**

| SWMM IN NAIROBI COUNTY | MEAN | STD |
|---|---|---|
| CONTROLLED DUMPING | 4.3 | 0.593 |
| THE 4R's | 4.0 | 0.611 |
| WASTE SEPARATION AND COMPOSTING | 3.7 | 0.714 |
| USE OF TECHNOLOGY | 3 | 0.903 |

**Source: Research Data (2018)**

The findings from table 4.4 above revealed SWM methods are in place in Nairobi County. Controlled dumping came first in the ranking, the 4Rs are moderately used while waste separation & composting and technology are least used in the management of solid waste in Nairobi county as illustrated in the Box and Whisker Chart (4.1) below.

**Chart 4.1: SWMM Ranking in Nairobi County**
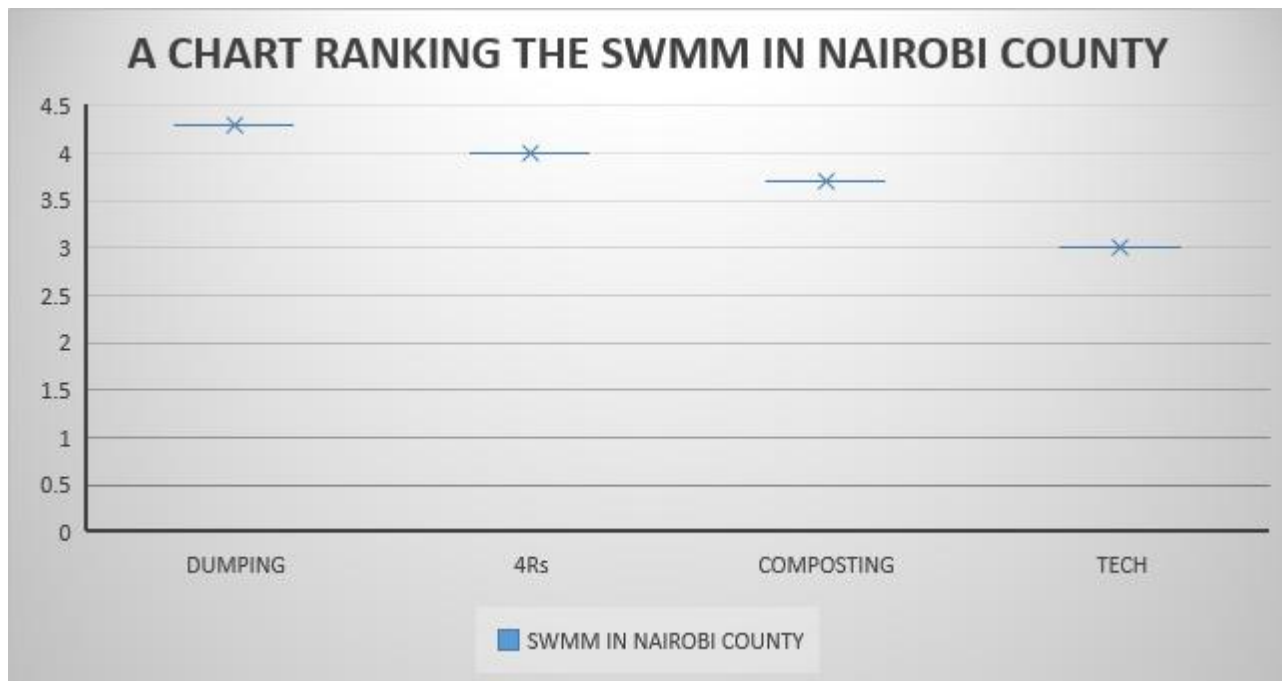


**Source: Research Data (2018)**

The findings correspond to the literature review on research done by Urban Ark institute (2017) who sought to determine SWM practices such as storage, collection and disposal in Kenya, which concluded that that majority of households in the study sites had their garbage collected between 4-6 times in a month,

Although the proportion was substantially higher in Nairobi (92 %) than Mombasa (49 %). Majority of the households are reported to be disposing waste together with toxic waste, with the proportion being higher in Nairobi (87 %) than Mombasa (76 %). Although most respondents had heard about recycling and composting, waste reduction practices through these methods were very low.

### 4.5 Impacts of Solid Waste Management Methods (SWMM) on Health in Nairobi County

The second objective looked to find out if the methods used to manage waste in Nairobi County had an impact on health of the residents of Nairobi County. Two diseases were used as indicators for health i.e. respiratory ailments and cholera. A Likert scale was used where 1 signified greatly reduces, 2= small extent reduces, 3=greatly increases, 4= small extent increases and 5= do not affect the two named health indicators, the results were as follows

**Table 4.5: SWM Methods Impacts on Respiratory Ailments in Nairobi county Descriptive Statistics**

| SWMM | mean | greatly increases % | greatly reduces % | other categories % |
|---|---|---|---|---|
| SEPARATION & COMP | 3.4 | 32.3 | 9.7 | 58 |
| DUMPING | 3 | 93.5 | 6.5 | 0 |
| THE 4R'S | 2.8 | 16.1 | 19.4 | 64.5 |
| USE OF TECHNOLOGY | 1.3 | 0 | 67.7 | 32.3 |

**Source: Research Data (2018)**

The findings from table 4.5 above revealed that 93.5 % of respondents indicated that Dumping greatly increases the incident counts of Respiratory ailments in Nairobi county, while 67.7 % of respondents believed that if technology can be used to manage waste in Nairobi county then incidents counts on respiratory ailments will significantly reduce.

**Table 4.6: SWM Methods Impacts on Cholera in Nairobi county Descriptive Statistics**

| SWMM | mean | greatly increases % | greatly reduces % | other categories % |
|------|------|---------------------|-------------------|--------------------|
| DUMPING | 3.3 | 74.2 | 0 | 25.8 |
| THE 4R's | 3 | 12.9 | 16.1 | 71 |
| SEPARATION $ COMP. | 2.8 | 25.8 | 13 | 61.2 |
| USE OF TECHNOLOGY | 1.7 | 0 | 71 | 29 |

**Source: Research Data (2018)**

The findings from table 4.6 above revealed that 74.2 % of respondents indicated that Dumping greatly increases the incident counts of Cholera in Nairobi county, while 71 % of respondents believed that if technology can be used to manage waste in Nairobi county then incidents counts on Cholera will significantly reduce.

The result above corresponds to the secondary data provided by the UNEP through a research initiated by UNEP's Urban Environmental Unit and Njoroge G. Kimani on environmental pollutants and the impacts of public health at the Dandora municipal dumping site, Nairobi, linked environmental pollution to public health. As shown in table 4.7 below

**Table 4.7: Health risks associated with Dandora Waste-Dumping site**

| DANDORA WASTE-DUMPING SITE |
|---|
| • Industrial Waste e.g., falloff or unused chemicals and raw materials, expired products and substandard goods<br>• Agricultural Waste e.g., pesticides (herbicides and fungicides)<br>• Hospital Waste e.g., packaging materials and containers, used syringes and sharps, biological waste and pharmaceuticals |
| **ENVIRONMENTAL POLLUTANTS** |
| • Heavy Metals e.g., lead, mercury, cadmium, arsenic, chromium, zinc, nickel and copper<br>• Persistent Organic Pollutants e.g., aldrin, dieldrin, dichlorodiphenyl-trichloroethane (DDT), endrin, heptachlor, toxaphene, chlordane, hexachlorobenzene, mirex (organochlorines, organophosphates, carbamates) and polychlorinated biphenyls (PCBs) |
| **ROUTES OF EXPOSURE** |
| These toxicants can be found in air, water and soil and could find their way into the human body through:<br>• Inhalation – movement of air from the external environment through the airways during breathing<br>• Ingestion – the consumption of a substance by an organism either man or animals<br>• Absorption – the movement and uptake of substances into cells or across tissues such as skin by way of diffusion or osmosis |
| **PUBLIC HEALTH EFFECTS** |
| • Skin Disorders – fungal infection, allergic dermatitis, pruritis and skin cancer<br>• Respiratory Abnormalities – bacterial upper respiratory tract infections (pharyngitis, laryngitis and rhinitis), chronic bronchitis and asthma<br>• Abdominal and Intestinal Problems – bacterial enteritis, helminthiasis, amoebiasis, liver cancer, kidney and renal failure<br>• Dental Disorders – dental carries and dental pain<br>• Ear Infections – otitis media and bacterial infections<br>• Skeletal Muscular Systems – back pain<br>• Central Nervous System – impairment of neurological development, peripheral nerve damage and headaches<br>• Eye Infections – allergic conjunctivitis, bacterial eye infections<br>• Blood Disorders – Iron deficiency anemia<br>• Others – malaria, chicken pox, septic wounds and congenital abnormalities, cardiovascular diseases and lung cancer |

**Source: UNEP (2007)**

According to the study by UNEP, medical records obtained from the Catholic Church dispensary at Kariobangi showed that 9,121 people were treated for respiratory tract-related problems in 2003-2006. Cases of skin disorders, abdominal problems and eye infections are also common among those tested. Malaria could be another threat since blocked drains collected water and become breeding grounds for mosquitoes.

### 4.6 Challenges of Solid Waste Management (SWM) in Nairobi County

The Third objective looked to find out the challenges faced in managing solid waste in Nairobi County. A Likert scale was used where respondents were asked to tick in the suitable box the extent to which they consider the named challenge to be relevant to Nairobi county, 1 signified Not at all, 2= small extent, 3= Moderate extent, 4= Large extent and 5= very large extent, the results were as follows in table 4.8.

**Table 4.8: SWM Challenges in Nairobi county Descriptive Statistics**

| THE CHALLENGES | MEAN |
|---|---|
| There is illegal dumping of solid waste in Nairobi county. | 4.83 |
| There is inherent corruption in the council that makes it difficult to follow the specified environmental rules by NEMA. | 4.81 |
| There is lack of reinforcement from agencies towards SWM | 4.64 |
| There is insufficient of funds for promotion of waste reduction, recycling and recovery. | 4.32 |
| There is poor accessibility to the dumping sites | 4.29 |
| Waste workers have poor working conditions | 4.26 |
| Dumping sites construction are not done according to stipulated regulation | 4.23 |
| The Nairobi city council lack a policy on waste reduction at the source. | 3.42 |
| Municipality lacks clear authorities and sanitation rules | 3.42 |
| There is excessive strain on existing facilities and underinvestment in new ones creating a big challenge on management of SWM | 3.32 |
| Nairobi county Residents lacks public awareness on SWM | 3.10 |
| Personnel involved in SWM have inadequate qualifications and skills | 2.94 |

**Source: Research Data (2018)**

Result in table 4.8 above reveals that the leading challenge in managing solid waste in Nairobi County is illegal dumping of solid waste (M=4.83) followed by inherent corruption in the council that makes it difficult to follow the specified environmental rules by NEMA (M=4.81). The least challenge faced inadequate qualification to manage waste (M=2.94) this because the environmental agencies do train their employees after recruitment.

## 4.7 Discussion of the Findings

One of the theories that this research was based on was Resources Use Optimization Theory (waste minimization Theory) which states that Prevention of waste creation is the main priority of waste management, which corresponds to the principal goal of waste management: conservation of resources. Moving toward waste minimization requires that the firm commits itself to increasing the proportion of non-waste leaving the process according to this study results this can only be achieved when Nairobi County employs technology as their chief waste management method.

Solid waste management especially in Nairobi and Mombasa and in other major urban centers in Kenya has received attention due to the deplorable condition of dumpsites in these cities and the attendant environmental and human health effects (Kimani, 2007). The country has always relied on open dumps as waste disposal sites and in many of the urban centers. This study by Kimani corresponds with this my research study which also deduced that dumping is the key SWM method being deployed to manage waste in Nairobi County and it was also the method with adverse health effects in the county.

Study by Urban Ark institute (2017) sought to determine SWM practices such as storage, collection and disposal in Kenya. And from the study it was deduced that dump Sites are being used as the repositories of waste from cities, dumpsites are important facilities with far-reaching public health implications in Nairobi county this was in line with the study by UNEP (2007). This outcome also reinforced this study research results.

*"... when you embrace technology, when you embrace safe measures, when you move forward like cities in Japan... you live with it, you know everything is used other than of course the e-waste. The ones that cannot be converted are the only ones they destroy. Plastic is the one that makes tires, whatever, it's the one that makes clothes that they wear. It can be applied in Kenya, but I think we need to do a lot of community mobilization, citizen knowledge, citizens need a lot of knowledge."* *[KII County officer, Nairobi],* This was in line with this study result which outlined that one of the key challenges in managing waste was insufficient funds for promotion of waste reduction, recycling and recovery.

The major challenge of SWM in Nairobi county as deduced from the study was illegal dumpsites this corresponds to Purvis (2015) who argued that the municipal dumpsites in both Nairobi and Mombasa are inaccessible especially during the rainy season. This is because in Nairobi, the Dandora dumpsite is full and vehicles delivering waste do not venture into the interior of the site due to unstable waste that poses the risk of vehicles sinking. Waste transporters therefore resort to dumping garbage on the access roads, making it hard for vehicles to access the dumpsite. Participants expressed need for the access roads to be cleared of garbage that has been dumped there to avoid the proliferation of illegal dumpsites all over the city.

# CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMEDATIONS

## 5.1 Introduction

This section covers the summary of findings, the conclusion, limitation and recommendation in line with the topic of the study which is solid waste management and health effects in Nairobi County. The objectives of the study were to determine the methods of solid waste management in Nairobi County, to establish the impact of solid waste management on Health in Nairobi County, to establish the challenges faced in solid waste management in Nairobi County.

## 5.2 Summary of Findings

The result of this study research shows that solid waste is managed through the following methods controlled dumping, waste composting, recycling and reuse and by use of technology, the dominant method in solid waste management is controlled dumping which I have deduced from the research that it has a very adverse effect on health i.e. it increases respiratory ailments and cholera incident counts in Nairobi county.

Waste management by technology in Nairobi County is minimal but from the research is it's the healthiest method of managing waste. The greatest challenge in managing waste in Nairobi County is illegal dump sites and the least challenge inadequate skills in managing waste as deduced from the research results.

## 5.3 Conclusion

Solid waste management is key in the county to enable create a healthy conducive working environment for the residents of the county. Nairobi County should adopt the SWMM which have least or zero health impacts on Nairobi residents. Basing on the findings of the study technology should be the leading solid waste management method in Nairobi County i.e. before the garbage is

dumped in the dumpsite, they should separate the garbage into recyclable products, biodegradable products and non-biodegradable products. The recyclable products should be separated and be taken to recycling plants, the biodegradable should be kept together to form a massive compost heap and the non-recyclable or biodegradable products should be burnt in an incinerator and this way the dumpsite will be cleared and the amount of air pollution will be much more less

## 5.4 Recommendations

The health effects connected to improper waste disposal are many to habitants living close to illegal dumpsites, the study established that one of the greatest challenges of SWM in Nairobi county is illegal dumping sites hence the study recommends that the NCC comes up with a policy of eliminating dumping as waste control mechanism and develop technological measures of managing waste in Nairobi county.

The study established that recycling and reuse of solid waste is practiced not to its potential in Nairobi county thus the study recommends that awareness campaign of 4R's as a method of solid waste management should be done in Nairobi county, the government should also be able to provide workshops for the illiterate and teach them how to look after the environment and their own personal health. The government should also sensitize the inhabitants about the mental, physical, and health effects of the dumpsite.

## 5.5 Limitations of the Study

There were some difficulties faced by the researcher during the course of this research. One is the challenge of resources which limited the collection of information particularly where the respondents demanded the physical presence of the researcher leading to increase of travelling expenses.

Incidents counts on some diseases are considered confidential thus it was difficult to get the whole data but this was bridged by getting data from secondary sources. This study was being undertaken within a limited period of time which meant that the feedback from the respondents was required in within this short period this affected the response rate. Lastly, the results of this research largely relied on the respondent's opinion, there was no direct control of accuracy of information on the part

of the researcher, and this challenge was countered through seeking clarifications from the respondents on any ambiguities found on the responses.

## 5.6 Suggestions for Further Research

This study concentrated efforts on establishing how solid waste are managed in Nairobi County and the impacts of SWMM on health of the residents of Nairobi county, the research also explored the challenges faced in managing waste in Nairobi county. The forms the ground work for more researches to be conducted on the same subject for more information to be generated.

The research did not use longitudinal data to establish incident counts on diseases arising from solid waste, future research can be done using the data to establish and analyze the quantitate aspects of the named phenomena. Further research needs to be done to investigate the possible solutions to the challenges faced. Finally, the research was based in Nairobi County and there is need to undertake similar studies in the whole parts of country Kenya.

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**APPENDICES**

**APPENDIX I: QUESTIONNAIRE**

**Questionnaire No…………. Date ……………………..**

**"SOLID WASTE MANAGEMENT (SWM) AND HEALTH EFFECTS IN NAIROBI COUNTY"**

**Section A: The Demographic Characteristics of Respondents**

Put across (x) or a tick (√) against the appropriate option

1. Name of the organization…………………………………………………

2. Designation……………………………………………………………….

3. Please indicate your age bracket?

21-30 years [ ]

31-40 years [ ]

41-50 years [ ]

Above 50 years [ ]

4. Please indicate your gender

Male ( )

Female ( )

5. State the number of years you have been employed by the organization.

Less than 5 years [ ]

5-10 years [ ]

10-15 years [ ]

15-20 years [ ]

Above 20 years [ ]

6. Please indicate the level of your education

Certificate ( )      Diploma [ ]

Bachelor's degree [ ]

Masters [ ]   PhD   [ ]   Other (specify)……………………

**Section B: Solid Waste Management (SWM) Methods in Nairobi County**

7. In this section kindly tick (√) the most used SWM to the least used method using the following criteria: Mostly used (5), moderately used (4), least used (3), unfamiliar with (2) and undecided (1)

| METHOD | SHORT DESCRIPTION | 5 | 4 | 3 | 2 | 1 |
|--------|------------------|---|---|---|---|---|
| M1 | **Waste separation and Composting** | | | | | |
| M2 | **Controlled Dumping** | | | | | |
| M3 | **The 4R'S i.e.** Waste reduction, Waste reuse, Waste recycling and Waste recovery. | | | | | |
| M4 | **Use of Technology** e.g. Industrial processing of waste, incineration and any other technological method. | | | | | |

**Section C: The relationship of SWM on Health Effects in Nairobi County**

8. Please indicate if SWM Indicated below do increase or reduce the incidences of the named diseases. Tick appropriately using the following criteria. Use 1- Greatly reduces, 2- Small extent reduces, 3-Greatly increases, 4-small extent increases and 5- do not affect

| D1 | Respiratory Ailments | 5 | 4 | 3 | 2 | 1 |
|----|---------------------|---|---|---|---|---|
| M1 | Dumping | | | | | |
| M2 | The 4Rs | | | | | |
| M3 | Use of technology | | | | | |
| M4 | Waste separation and composting | | | | | |
| | | | | | | |
| D2 | **Cholera** | | | | | |
| M1 | Dumping | | | | | |
| M2 | The 4Rs | | | | | |
| M3 | Use of technology | | | | | |
| M4 | Waste separation and composting | | | | | |

**Section D: The Challenges of SWM in Nairobi County**

9. Please indicate the challenges of solid waste management (SWM) in Nairobi County. Rank by a tick in the suitable box the extent and nature to which you consider this characteristic important. Use 1- Not at all, 2- Small extent, 3-Modarate extent, 4-Large extent and 5-Very large extent.

| Q | | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|
| 1 | The Nairobi city council lack a policy on waste reduction at the source. | | | | | |
| 2 | There is poor accessibility to the dumping sites | | | | | |
| 3 | Municipality lacks clear authorities and sanitation rules | | | | | |
| 4 | Dumping sites construction are not done according to stipulated regulation | | | | | |
| 5 | There is lack of reinforcement from agencies towards SWM | | | | | |
| 6 | There is inherent corruption in the council that makes it difficult to follow the specified environmental rules by NEMA | | | | | |
| 7 | There is excessive strain on existing facilities and underinvestment in new ones creating a big challenge on management of SWM | | | | | |
| 8 | There is illegal dumping of solid waste | | | | | |
| 9 | Waste workers have poor working conditions | | | | | |
| 10 | Nairobi county Residents lacks public awareness on SWM | | | | | |
| 11 | Personnel involved in SWM have inadequate qualifications and skills | | | | | |
| 12 | There is insufficient of funds for promotion of waste reduction, recycling and recovery | | | | | |

**THANK YOU SO MUCH FOR YOUR TIME**