“FINAL RESEARCH PAPER”

THE EFFECTS OF SOLID WASTE DUMPING ON INFRASTRUCTURES AND HUMAN HEALTH : DANDORA DUMP SITE, NAIROBI COUNTY

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A PROJECT PAPER SUBMITTED IN PARTIAL FULFILLMENT FOR THE REQUIREMENT OF THE DEGREE OF MASTER OF ARTS IN ENVIRONMENTAL PLANNING AND MANAGEMENT IN THE DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIESUNIVERSITY OF NAIROBI

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APPROVAL

THE EFFECT OF SOLID WASTE DUMPING ON INFRASTRUCTURES AND HUMAN HEALTH AND: A CASE STUDY OF DANDORA DUMP SITE, NAIROBI COUNTY

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DECLARATION

This project paper is my original work and has not been presented for examination in any other university or institution.

DEDICATION

This project paper is dedicated to my parents; the late Wilson TingaNyamache and Eunice NyatuneAtinda and my brother Joseph OmambiaTinga for their hard work to offer me an education and guidance on how to face the future with confidence. To also my wife and my children for their loving support and understanding.

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Last but not least I wish to offer my gratitude to my dedicated team of research assistants: George Morara, Lauren Mokonoi and Eunice Njagi; my family and classmates.

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LIST OF ABBREVIATIONS

DPSIR	Drivers Pressures State Impact Response
ISWM	Integrated Solid Waste Management
JICA	Japan International cooperation Agency
KNCPC	Kenya National Cleaner Production Center
MNER	Ministry of Environment and Natural Resources
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NACOSTI	National Council of Science, Technology and Innovation
NCC	Nairobi City County
NEMA	National Environment Management Authority
SWM	Solid Waste Management
UMP	Urban Management Programme
UN_HABITAT	United Nation Human Settlement Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

DEFINITION OF TERMS

Waste: It is any material discharge to deposit in or emitted to an environment in such amount or manner that causes a harmful change. It can be defined as the unwanted material left over from a production process and from consumption or output which has no marketable value.

Solid wastes: Non-soluble material (including gases and liquids in containers) such as agricultural refuse, demolition waste, industrial waste, mining residues, municipal garbage and sewage sludge. Solid waste or municipal waste is also defined according to Medina (2000) as materials generated from the result of human daily activities resulting from areas such as households, public places, city streets, shops, offices and hospitals.

Dump site: A piece of land where waste materials are dumped.

Disintegration of Waste: Is the separation of waste depending with the type of waste in place for example plastic waste, domestic waste.

Waste hierarchy: Refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste. The waste hierarchy is represented as a pyramid because the basic premise is for policy to take action first and prevent the generation of waste. The next step or preferred action is to reduce the generation of waste i.e. by re-use. The next is recycling which would include composting. Following this step is material recovery and waste-to-energy. Energy can be recovered from processes i.e. landfill and combustion, at this level of the hierarchy. The final action is disposal, in landfills or through incineration without energy recovery. This last step is the final resort for waste which has not been prevented, diverted or recovered. The waste hierarchy represents the progression of a product or material through the sequential stages of the pyramid of waste management. The hierarchy represents the latter parts of the life-cycle for each product.

ABSTRACT

Nairobi, the capital city of Kenya has a population of over 4 million.It is one of the most densely populated cities in Eastern Africa. It has a population density of over 4000 persons per square kilometer and is estimated to generate over 2000 tons of solid waste per day. This waste that is collected on a daily basis is transported and dumped at Dandora Dumpsite, the only gazetted dumpsite in Nairobi County.The study will concentrate onthe effects of solid waste dumping on infrastructures and human health and: a case study of dandora dump site, nairobi county.

The dumping of solid waste at the dumpsite, studies have shown, leads to numerous environmental challenges. It has been shown that currently, the County government and previously, the City Council have not sustainably managed the large quantities of solid waste thus attracting other actors such as waste collection companies, community based organizations, resident associations and youth groups to offer support in alleviating the problem.This study showed that the indiscriminate dumping of solid waste at Dandora Dumpsite affects negatively the infrastructure of the area comprising of roads, drainages, water and sewerage systems, electricity connections and premises. It also contributes to poor human health. The goal was to analyze whether solid waste dumping near estates destroys infrastructures, degrades the environment and endangers human health. The case study was based on Dandora Dumpsite in Nairobi County. In an attempt to define this goal, the study was guided by the following other objectives:To find out if dumping of solid wastes at Dandora Dumpsite causes destruction of infrastructures such as roads and to find out whether the existence of the dumpsite has human heath challenges.The Hypothesis for these study were; H_0: There is minimal relationship amid solid waste dumping and negative effects on infrastructure at Dandora.H_1: There is a big relationship amid solid waste dumping and negative effects on infrastructure at Dandora.H_0: There is minimal relationship amid solid waste dumping and negative effects on human health at Dandora.H_1: There is a big relationship amid solid waste dumping and negative effects on human health at Dandora.Due to the nature of the target population in Dandora, the researcher used simple random and purposive sampling methods; the former allows for random selection of samples from the population, while the latter is a sampling technique that allows the use of cases/persons that have the required information with respect to the objectives of the study (Mugenda and Mugenda, 2003). Field data will be obtained from primary and secondary sources. Primary sources of data refer to the firsthand information sources such as households, offices, businesses and institutions who volunteered information to the researchers on request. 120 respondents who were interviewed.Secondary sources of data refer to such information sources as books, journals, newspapers and other secondary materials. Both SPSS and Excel spreadsheet softwares were used for the analysis. After obtaining the raw data set, it was sorted, edited, cleaned and coded. The open-ended questions were manually analyzed by grouping responses into similar themes, tallying them and obtaining frequencies by using excel spreadsheet.

CHAPTER ONE
INTRODUCTION

1.0 Introduction of major sub themes

When solid waste is not properly disposed it causes pollution to the following;air,soil and water. It also generates of green house gases which include methane and carbon dioxide which are associated with climate change .They also cause healthy problems to the nearby residents. County governments are vested with the responsibility of providing solid waste management services but have found it increasingly difficult to play this role. The difficulty has been aggravated by lack of effective legislation, inadequate funds and services, and inability of county governments to provide the cost-effective services. Changing lifestyles in conjunction with tinned sleek snacks, mobile telephones and disposable diapers (motion toward a “client society” in state-of-the-art), what is more, poses distinctive waste management challenges. Usually, surplusadministration structures in growing states are unableto adjustment to equal those means of life modifications.

Both developed and developing countries spend less than 0.5% of their per capita gross national product on solid waste management which covers only about one-third of overall cost (World Bank, 1999). This leads to under funding of solid waste management activities right from the source to the disposal destinations.The duty over stable waste series and disposal is for this reason properly past the potential of county governments. Quite eighty to keep with whole waste manipulate low-income world places are assortment (World Bank, 1999). USA, as Associate in nursing example, worth of waste assortment ready forty six in step with the final civic strong surplusadministration price. Price convalescence SWM carrier hard thanks to the very fact, despite the fact that there's some disposition to purchase waste series services, there's very little such disposition for waste disposal.

1.1Background to the study area

Improper solid waste management (SWM) leads to negative environmental impacts such as pollution of air, soil and water; generation of greenhouse gases and health and safety problems. County governments charged with the responsibility of providing solid waste management services have found it increasingly difficult to play this role. The difficulty has been aggravated

by lack of effective legislation, inadequate funds and services, and inability of county governments to provide the cost-effective services. Changing lifestyles such as use of canned soft drinks, mobile phones and disposable diapers (movement towards a “consumer society” in general), moreover, poses special waste management challenges. Generally, waste management systems in developing countries are incapable of frequent adjustment to match these lifestyle changes.

Cities in both developed and developing countries generally do not spend more than 0.5 per cent of their per capita gross national product (GNP) on urban waste services, which covers only about one-third of overall cost (World Bank, 1999). The responsibility over solid waste collection and disposal is thus well beyond the capacity of county governments. More than 80 per cent of the total waste management costs in low-income countries are collection costs (World Bank, 1999). In Latin America, for example, the cost of waste collection is about 46 per cent of the total municipal solid waste management cost. Cost recovery in SWM service is difficult because, even though there is some willingness to pay for waste collection services, there is little such willingness for waste disposal.

Traditionally, therefore, county governments have financed the services through general revenues or attempted to charge for the service through inefficient property tax. Owing to the existence of willingness to pay, however, private provision of waste collection services has potential. In addition, limited economies of scale and ease of entry and exit in waste collection imply that competition can keep the price of the private service competitive. The upshot is that an increasing proportion of urban dwellers in developing countries, particularly the urban poor, will lack access to county solid waste management services and, consequently, suffer from pollution-related environmental and health problems.

The gases from the dumpsite corrode the iron sheets leading to lowered value of property and frequent repairs. The gases also cause the paints on the walls and roofs to peel off faster. The owners of the houses, schools, churches, mosques and recreational centers are forced to repair their premises frequently.

The trucks that transport the solid wastes to the dumpsite are so heavy such that they cause destruction to the roads leading to the dumpsite. As the trucks are transporting the wastes to the dumpsite, some solid wastes are dropped on the roadside. These droppings block the trenches which cause flooding on the roads and within the estates during the rain season. The heavy trucks and tractor used to move the solid wastes at the dumpsite occasionally cut the water pipes and electricity poles thus causing water shortage and blackouts in the estates near the dumpsite.
The gases and fumes produced from the solid waste dumpsite cause respiratory diseases. The dumpsites are also habitat to rodents other insects which cause and spread diseases. They also attract stray animals to the site.

1.2 Statement of the Research Problem

Globally, most countries face difficulties in managing solid waste. These difficulties vary from reducing generation of waste, separation, change of social behavior, collection, transport, treatment, reuse, disposal of waste and inadequate legislation. UNEP (2005) sees the challenges as different for different levels of industrial development.Most developing countries pay inadequate attention to solid waste management as to achieve economic development. According to a study carried out by Ngoc and Schniter (2009) they argue that increasing populationhanging consumption patterns, changing income, converting earnings; urbanization, industrialization expanded generation of waste.

Solid waste dumping causes soil pollution, floor and ground water pollutants, air pollution, degradation of the first-rate of property around dumpsites and blocking off of infrastructure main to flooding. They also lead to respiratory diseases as a result of gas emissions from the dumpsite. Solid waste dumpsites are hiding places for criminals which make the area insecure.

In Kenya, the challenge of solid waste management is real (Kungu 2011).Solid waste management systems are inefficient and disposal systems are not environmentally friendly. 30 to 40 per cent of all solid waste generated in urban areas is uncollected and less than 50 per cent of the population is served (Otieno, 2010). Lot of areas and nations, wide and worldwide goals were set for municipal robust waste utilization lowland (Ali, 2008). In order meet the targets of reliable solid waste management its important to have information and set right strategies. It is

therefore important to examine the nature and quality of generated waste in order to contribute to improvement actions at the supply. This will only be dispensed through public consciousness on waste segregation from the supply.

Solid waste dumpsites are a source of livelihoods for the poor in urban centers who collect some wastes for sale to the reuse and recycling companies. The solid wastes are increasing in large quantities which require a lot of land for disposal. It is a deliberate and visionary commitment that the county intends to take in the administration of solidness waste in an action oriented.

1.3 Goal and Objectives of the Study

The goal was to analyze whether solid waste dumping near estates destroys infrastructures, degrades the environment and endangers human health. The case study was based on Dandora Dumpsite in Nairobi County. In an attempt to define this goal, the study was guided by the following other objectives:

i. To find out if dumping of solid wastes at Dandora Dumpsite causes destruction of infrastructures such as roads.
ii. To find out whether the existence of the dumpsite has human heath challenges.

1.4 Hypotheses of the Study

The hypotheses for this study were four as indicated below:

H_0: There is minimal relationship amid solid waste dumping and negative effects on infrastructure at Dandora.

H_1: There is a big relationship amid solid waste dumping and negative effects on infrastructure at Dandora.

H_0: There is minimal relationship amid solid waste dumping and negative effects on human health at Dandora.

H_1: There is a big relationship amid solid waste dumping and negative effects on human health at Dandora.

1.5 Justification of the Study

Literature review showed that various aspects of solid waste dumping effects have been researched on, however, this study sought to combine four pertinent effects which are common in local urban centers even at the global level. The issues of poor infrastructure and deterioration of human health hence the need for sustainable solutions. Kenya, being a developing country has seen a rise in solid waste production with antecedent poor management. If this persist then the populace is in danger. That is why this study is important.

All human activities generate waste which calls for to be properly managed to defend human health and the sorroundings. The want for proper and efficient waste control is extra stated in urban settlements where huge quantities of waste are generated inside a very small place and in a short time span. The influences of stable waste if no longer properly controlled inside the city settlements particularly towns and big municipalities may be disastrous. A developing hobby in Nairobi County calls for a movement to decrease this trouble of solid waste management.

That solid waste management in major cities of the third world countries is a serious challenge that cannot be overemphasized. Waste production rather seems to out-weigh disposal by far. This has led to deterioration of the quality of the surrounding environment for most people. Despite most cities having fully fledged departments to cope with waste control, loads more attempt desires to be installed place. There may be want for extra investment to equip these departments to have the potential of kind and quantity of strong waste produced every day.

Institutions such as the country wide surroundings management Authority (NEMA) in collaboration with the counties want to do much more to educate the citizens in waste control. This will best be possible whilst joint research are achieved a good way to very own the technique. The harmonization of county by means of-laws and NEMA guidelines can also move a long manner in ensuring that the populace knows what needs to be done. The need to fill the gaps in the policy system calls for a unity in study and utilization of research programs to meet the intended goal of sustainable waste management. The new government structures particularly the county government and the existence of the central government also brings the need to harmonize the existing policies and responsibilities to adequately manage the environment.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

Literature review is a study of the documents done by recognizedprevious researchers, governments.National and InternationalAgencies,Private &Sector RegionalCo-operations. Individual and International Institutional the same topic It also involves printed reports electronic and social media.Literature review provides background information about the problems and benefits of the topic under study, It highlights the beginning of the problem, the attempt that have been made to solve it through technological innovations and public awareness Itassists the author of the project repot to learn on the writing skills, the challenges associated with the topic, strategies of addressing the challenges at International. Regional and local levels The researcher is supposed to review documents related to the topic under study to enrich it with the discovered knowledge.

2.1 Case Study of Canada

Canada has a poor record on waste according to a recent international ranking of OECD countries by the Conference Board of Canada (Canada is 17th out of 17)1 . Nationally, the amount of non-hazardous total waste (residential and non-residential) sent to disposal in 2010 was 25 million tonnes. This waste is expensive to manage, increases demand on natural resources and represents a missed opportunity to extract value from materials in the waste stream. In 2008 the OECD Council adopted a recommendation that encourages its members to improve resource productivity by promoting environmentally effective and economically efficient uses of natural resources and materials as well as to strengthen capacity for analyzing material flows.

“Vision 2050 - The New Agenda for Business Report” 3 by the World Business Council for Sustainable Development lays out a pathway leading to a global population of 9 billion people living within the resource limits of the planet by 2050. It spells out the things that must happen over the coming decade to make a sustainable planet possible: material demand, consumption and production are transformed to match the limits of non-renewable resources; closed-loop recycling - making the concept of waste obsolete is normal business practice, and societies have

a circular approach to resources; used products and materials can be reengineered to function again for multiple and distinct purposes or reduced to raw materials for manufacturing other products; greenhouse gas emissions, energy and water use are no longer constraints on the materials industry. Canada is a long way from achieving the 2050 Vision objectives and the OECD commitments.

This report presents the results of a jurisdictional review of current waste management policies, waste reduction initiatives, waste diversion programs, energy from waste initiatives, and waste disposal practices across the country to provide a snapshot of the State of Waste Management in Canada. It was commissioned by CCME in August 2013. The terms of reference for the report were to collect and review data directly from submissions by each jurisdictional member on CCME's Waste Management Task Group, conduct a literature review for publicly available information, and to conduct interviews. Once information collection was complete, the findings were assessed to identify trends, challenges to and opportunities for improved waste prevention, reduction, diversion, recovery and disposal, as well as potential opportunities for improved performance measurement and reporting of waste management.

2.2 Case Study of Japan

Because of monetary development, industrialization and growing population, troubles associated with the extended intake and depletion of resources, and the accelerated output of huge-ranging styles of waste are becoming extra extreme than ever. According to TakamojiYukul (2012) there is a phrase in Japan: Mottainai. It encompasses the exercise of treasuring and using all matters so long as feasible. While economies keep growing, this spirit of Mottainai constrained the era of waste and influenced the development of generation for reuse, recycling and effective use through heat recuperation.

Way ahead

It'd be extra efficient in most of the Asian international locations to use small series trucks due to slender roads. A number of the roads in Japan, too, are slender, and 1t to 2t compact garbage series vehicles were evolved with decreased frame weight as a way to boom load capacity. There are varieties of this rubbish series vehicles - mechanical vehicles (mobile Packers) and

compressor-type trucks, but cell packers are more normally used. Packers scoop up the rubbish with a spinning disk and thrust it into the garage area with a sliding board. Garbage with high moisture content material reduces compression efficiency; but, with continuous modification, vehicles have accomplished high compression rate, with 1.five time's greater load than flat pile vans. Compressor-kind vans press down the garbage on to the ground with a compressor board (pressing plate), and after breaking it up and lowering extent, the garbage is slid into the storage location. The vans successfully gather huge rubbish requiring breakdown, cumbersome puppy bottles and plastic waste.

Challenges

The just necessary assignment confronted via Japan in intensive misuse management is that Japan's landmass is restricted and discovering landfill settlement internet web sites is difficult.

2.3 Case Study of India

2.6 The wayAhead

1. The subsequent are hints that might decorate a better strong waste control in African countries.

   Leaders must are seeking for aid from the international network. Global groups are regarded for their information and technical and as such, African nations may want to sign a bilateral settlement with them on coming to put money into their international locations for an environmentally sound management of waste streams in African.
2. The humans' belief and orientation approximately waste wishes to trade. In a few African countries, people not regard stable waste as dangerous. They now see it as opportunities of getting cash to earn a living.
3. Applicable global agreements on waste management and provision of help to African countries should be met. Furthermore, summit of all African countries must be installed area if not already in area. This can serve as avenues wherein pressing and cutting-edge matters on information remedy waste control problems would be mentioned. Legal guidelines and rules need to also be bolstered and offenders must be brought to book.

4. Non-public sectors need to be actively worried. They ought to be allowed to partner with government our bodies. This can create employment possibilities and greater jobs for the teaming population.

2.7 Interlinkages between Sustainable Development Goals (SDG's) and Solid Waste Management

Goal 3: Good health and well-being

This goal seeks to ensure fitness and properly-being for all at each level of existence. The aim is to prevent environmental related diseases caused as a result of water pollution, air pollution and soil pollution. This pollution affects the health and wellbeing of both plants and animals caused as a result of vector borne diseases. This study discovered that unsustainable solid waste management leads to spread of diseases that affects human health thus undermining the realization of this goal.

Goal 6: Clean water and sanitation

This goal focuses on sanitation and addresses the safety and continued availability of water resources, important for the survival of human beings and the earth. In line with this study, improper solid waste leads to contamination of water sources thus affecting the hygiene of the people living in these areas. Developing bonanza or urbanization may additionally duplicate the number about indoor stable misspend yearly with the aid of 2025, Herculean environmental or masses health management within the international's cities, among bottom including modern studies done through the ball timekeeper Institute (www.worldwatch.org) because its necessary symptoms on-line supplier. Though variety concerning abuse since recycled fashionable plans recommend perchance the norm regarding strong waste or MSW out of these days 1.3 billion tons in accordance with keep along year in conformity with 2.6 billion tons, writes record writer and international clock Senior Fellow point regarding ingress Gardner.

Outlined of document, MSW entails herbal material, paper, plastic, glass, metals, or without a doubt particular cross off collected including the resource about victimization urban authorities, in significant 1/2 from homes, places about hard work, establishments, then industrial establishments. MSW may also keep a embark about the large creation regarding waste then usually desire no longer incorporates abuse collected oversea on doors about formal indoor

packages. Nor choice it accommodates the misspend product, business waste, and technical then demolition misuse generated thru cities. And on direction MSW choice at present not realise clownish wastes. MSW is measured earlier than disposal, or facts on to that amount usually realize crowd material that is often another entertained according to keep used.

MSW tends after stay generated into lots higher parts into wealthier areas about the theater. Members concerning the business enterprise Economic Co-operation or enhancement (OECD), a 30 four industrialised global locations, leading the board within MSW technology, at almost one.6 pile lots in row along day. Via assessment, geographical vicinity produces abundant lower than some eighth namely tons, a few 200,000, heaps according to keep including day.

The record of top ten MSW-producing nations consists of 4 developing nations (Brazil, China, India, or Mexico) into factor so end result regarding the range over theirs city populations then into quantity as like a result over theirs city dwellers region one booming yet adopting excessive-intake lifestyles. Despite the true fact to that amount the USA leads the comprehension within MSW outturn at incomplete 621,000 lots among line together with day, China can also remain an astonishingly shut second, at partial 521,000 lots. Even range regarding the pinnacle ten, however, so is kind concerning output: the USA generates almost seven cases in addition town deny than France, into tenth position, does.

“Urbanization then profits degrees into culling tend according to work abroad the sort of violate generated,” declared Gardner. “The share on inorganic substances within the misspend circulation, reminiscent regarding plastics, paper, then Al, tends after growth as like mortals grow wealthier yet go with the flow in imitation of cities.”

Municipal powerful violate management (MSWM) endures as partner quantity regularly onerous undertaking for voters or government of desolate tract African (SSA) cities (Kapepula, Colson, Sabri, &Thonart, 2007; Okot-Okumu&Nyenje, 2011; Rotich, Yongsheng, & Amp; Jun, 2006). Vogue concerning law has currently drawn: metering on public development within city areas (from every migration accomplice degreed flavouring populace increase) and its resultant wish amplify into misspend technology has necessitated the make a bid because an improved

dimension regarding misuse administration service that, further frequently than no longer, is inadequately geared up through city administration and/or personal zone contractors. The trouble between offering a quantity of work even together with make a bid is commonly as like end result over institutional, empiric and pecuniary constraints or shut authorities tiers. Moreover as like within the non-public quarter (UN environment, 2010, xxiii–xxv). assortment over secure violate is deficient between informal settlement regions, here residents co-exist along misspend lots spawn laying uncollected because the maximum volume namely weeks every nowadays or afterwards she building in conformity with painful the misuse then inn after volley them in rivers or frowsy gutters up to expectation witch vector-borne pests so much ends in accordance with imperative public or environmental jeopardy. In close cases, insufficient awareness because proper settlement habits amongst habitants between these groups has escalated the difficulty.

Cognizance is regular developing together with NGOs then civilian community firms office to network-primarily based totally basically corporations into lectureship residents over absolute housewifery misspend managing, whilst unpleasant greater provider town professionals (Tukahirwa, Mol, &Oosterveer, 2011). Though, the post be counted length stays intense, because the purpose as low-profits, excessive-density settlements ought to in addition absorb into after seventieth over these towns' populaces (Oteng-Ababio, 2011).

Privation of dogmaticconsciousnessplus determination amongst wide native authorities properly wear down the MSWM mission is usually observed as a distinguished issue (UN-HABITAT, 2010, p. 213). At identical time as there's adequate proof that that's authentic, there area unit alternative factors at play; of path, context subjects. Deficient cognizance by method of Governors and dedication will not be a major downside as they perceive waste and dirty settlements to be obstacle to public health funding. lack of awareness and/or self-control might not in any respect difficulty, metropolis for example chiefly apprehend untidy streets associate degreedsoiled settlements an obstacle to fitness, funding improvement visualised revolution right “global magnificence” metropolis. There is need to create Municipalities international class cities through property management of municipal stable waste has crystal rectifier to fast reforms by victimization the coverage manufacturers resulting in the technique through governors to development companions to assist in municipal robust waste management. It’s in addition led to

alternate programmes by governors to travel to advanced international locations for bench marking on robust waste management. Associate degree instance of this trend will be set within the rising interest among SSA cities to place good waste-to-electricity (WTE) technology because the therapy-all to their MSWM woes (Ali, 2010).

Current preaching within MSWM answered in conformity with the current fashion, trade between enquiry the efficaciousness or usefulness of a wholesale importing over it industrialknowledge within flourishing worldwide areas up to expectation location unit commonly incompatible with theirs mixer financial certainties (UN environment, 2010, p. 4).the trouble about importation of recent time beyond the advanced global areas in accordance with the increasing international locations has arisen as much a result over operable limit according to uses the equipments for solid permissive misspend matter manufacture administration hence so is want for brawny developing before technological know-how switch. The action because "domestic-grown" function has been made so an end result over the successes regarding such practices, specifically along casual misuse pickers among meeting households misspend including excessive populace solidity or horrible transportation layout, as commonly keeping apart violate at offer and usage it (UN environment, 2010, p. 24).Solid waste in Nairobi is of good spectrum of business, carrier and production processes. Most wanted excessive-volume generators of economic stable waste comprehend the chemical, petroleum, metals, woods, paper, leather-based, textile and transportation industries. Subordinatelesserproducersknow automotive vehicle and system restore retailers, electroplates, creation firms, dry cleaners and chemical applicators. Make out one indicates the relative proportions whereby numerous types of robust wastes area unit generated in Nairobi. Misdirection of these wastes unremarkably consequences in pollution of the flavouring surroundings would possibly cause vital probability to public fitness and welfare.

There is want for distinction between the national legal framework (legislation and policies) and native by-laws and laws. The implementation of the previous in waste management needs legal and regulative framework. It's inside the national framework that cities ought to derive their by-laws with a read to fitting place.

Section forty twins on the Kenyan constitution states so much each some of us has the mathematic in imitation of a simple yet healthy surroundings, as consists of the perfect to own the environment Immune because the acquire concerning present yet after generations through legislative and absolutely exceptional measures. share sixty 9 in part states to that amount the dominion shall assurance creed exploitation, usage, administration yet conservation over the surroundings or herbal assets, or secure the too surpassed distribution on the accruing blessings; encourage community participation inside the management, protection or conservation regarding the environment; found oversea structures over environmental impact analysis, environmental shot then gazing about the environment; take abroad tactics yet sports activities to that amount area unit possible according to venture the environment; or gender use about the environment yet flavouring sources for the proper aspect touching the mortals about Republic concerning Kenya. All folk's capabilities a duty according to assignment including ruler organs or definitely special men and ladies after shield yet preserve the surroundings or ascertain ecologically faith improvement yet usage of natural resources.

Kenya espouses creed improvement then acknowledges the need because property surroundings. This is fast in imitation of hold together with the Millennium enhancement dreams and imaginative and prescient 2030. The Environmental management or Coordination Act (EMCA) used to be enacted into 1999 due to the fact the best system of environmental management. Ahead over then, many legal guidelines existed thrown into numerous prison pointers or statutes administered via diverse row ministries. Some had been within water, populace health, forest then loads about others.

EMCA affords because of the harmonization over roughly seventy seven sectoral statutes that wear down components regarding the surroundings. Some sectoral statutes have inadequate provisions because of prosecution of environmental offenders, when at some stage in a bit penalties are not sufficiently kin according to discourage offenders. EMCA, 1999 affords partner dosage institutional skeleton or methods because of administration of the environment, collectively together with provisions because of battle resolution.

Segment three about EMCA, 1999 states so much “all individuals among Republic regarding Kenya is permitted according to tidy and vigorousatmosphere yet accountability after shield or enhance the environment.” The Act is intended after gender definitive up to expectation our activities operate at present not compromise the capability concerning the aid lousy according to fulfil the necessities of the present generation moreover as these over future generations (WCED, 1987).

The national surroundings management Authority (NEMA) can also lie a rule parastatal put to among according to exercise occurring supervising and co-ordination upon whole topics in relation to of the surroundings. The Authority is to that amount the essential gadget on presidentship within the implementation concerning whole legal guidelines concerning the surroundings. Part 9 (2) of EMCA records seventeen statutory picks up to expectation NEMA shall undertake.

Consistent together with a latest metering by means of victimization UNEP, Nairobi including a populace on 4.0million generates three, 200 voluminous violate over everyday basis. Handiest 850 tons attain Dandora rubbish dump along the alleviation last unaccounted. To stem the difficulty, Nairobi together with facilitate over each JICA or UNEP has raised a ten twelve (**mention the theoretical framework that guided the study.)**months muscular misuse management put in on that the town council of Nairobi plans in imitation of implement. This do include pressing decommissioning on the Dandora raffle hump or building of landfill at Ruai moreover in conformity with 2 switch stations. An equally methodology consists of constructing public–private-partnership (PPP) as comprises the utilization concerning community primarily based definitely groups (CBOs) (1 Oct 2014). Network based absolutely company circulate an essential yet attentiveness inside the administration over secure wastes between Nairobi. The commencement about recognition up to expectation they are actively concerned and community sensitization is up to expectation the backbone in conformity with the property.

Maximum international places globally get will beyond misspend administration disputes. The jeopardy determination from lowering generation regarding waste, segregation, amendment regarding habits, collection, logistics, treatment, utilize yet adjustment regarding the waste. UNEP (2005) sees the challenges namely awesome because of brilliant tiers of monetary

development. During strive and improve technical development, accomplice dimensions economically flourishing kingdom pays plentiful less hobby after secure violate management.

Collection desktop location soloist powerless yet disposal structures do not seem after stay environmentally colorful 30 after forty according to preserve with cent on whole stable misuse generated into city regions is oversea on management or fewer than fifty section regarding the public is served (Otieno, 2010). He states so much on after eighty between block with cent regarding assortment transport is oversea on dealer yet of want concerning restore or argues up to expectation postulate the problem on faith strong misuse among Republic on Kenya is no longer notion about desperately, entire cities in Republic regarding Kenya can also be engulfed into waste. Kenya chiefly Nairobi goes through quick urbanization and growing population at a charge of 5.1 % and 3 % in line with year severally. Consequently waste technology has expanded with growth in public boom.Research has proven that urban dwellers generate massive quantities of stable waste and sewage. consistent with capital waste generation is directly associated with the level of earnings with excessive earnings families producing more waste than low income families however accumulation is higher in low income families because of unavailability of waste series services.

There’s a project of accessibility in a few parts of the settlements (frequently areas along the valley). This example has been contributed to with the aid of the informal housing development wherein houses have been constructed close to each different without setbacks. This has restrained accessibility. The examine found out that, strong waste creditors (who use handcarts) find it's miles difficult to acquire stable waste in regions in which accessibility is restrained or even foot paths are slender. Many citizens residing in inaccessible regions found themselves hardly accessed by means of the solid waste creditors. This become revealed by way of 42% of the respondent. Consequently, they've used that loophole to justify throwing strong waste haphazardly into river streams and the surroundings.

Nairobi with a public of 4.0million generates three, a pair of hundred innumerable waste daily. Simplest 850 tons reach Dandora rubbish dump with the remainder last unaccounted .The sensible reason behind this can be the financial constraints. Nearly five hundredth of the entire

sales accumulated could also be needed for potency however the equal wish for various traits cannot really build this happen.

Strong waste management could be a major downside world –over and in Kenya provides many gainsays from clogged voidance and sewers, waterborne diseases like infectious disease epidemic cholera and looseness of the bowels, accelerated high respiration diseases from open burning of the rubbish to protozoa infection. Incorporated stable waste management (ISWM) conjointly cited as property sturdy waste management could be a novel plan of handling waste that is gaining foreign cash in Kenya. Waste management has been the duty of native authorities but the situation is ever-changing with the belief that native authorities on their personal aren't ready to coping with waste. Like alternative cities within the world sturdy waste management could be an expensive assignment gobbling up to 30-50% of sales. This can be unsustainable associate degreed Kenyan cities and cities emerge like endless innumerable rubbish dotting the panorama during which Nairobi isn't an exception .

ISWM could be a complete waste bar, recycling, composting and disposal code. A strong ISWM device considers the thanks to forestall, recycle and management stable waste in ways in which most effectively defend human fitness and also the atmosphere. ISWM entails scrutiny near wishes and conditions and 10 choosing and mixture the most appropriate waste management sports for those things. Every of these sports involves careful preparing, financing, assortment and shipping. More than 40 non-public garbage collectors had been barred from running in the Nairobi valuable enterprise district (CBD) because the county government moves to implement what is called working requirements.

Leah OyakeOmbisa a senior officer of surroundings in Nairobi County shows that some of the vans used to collect garbage were too antique or small even as others had few customers. The county set a minimum consumers of 100 for every personal collector. (Commercial enterprise daily, 10th August 2015).

The province employ a little clients about a hundred for each private collector. UNEP/NEMA(2003) (cited of Nguru yet Kahiu, 2009- ISWM small facts report) sure so much home misspend make a contribution 68% regarding the perfect waste generated in countrywide

capital, while non-domestic abuse beside industrial, markets, roads yet exclusive things to do make contributions a mixed standard about related to 32% regarding the total misuse generated ,damaged beneath namely follows: commercial: 14%;roads 8%;hospitals% markets 1% chronicles and 7% completely one of a kind sources . The utilization of the information or a few regarding the characterization into part 1.1 yet 1.2 as proxies because a few regarding the classes tagged into UNEP/NEMA (2003) higher than (i.e. residential settlement at provide back namely is, office/place about commercial enterprise provide arrangement back so a proxy because of technical non-risky waste, technical enterprise/trade collection motive notably based definitely arrangement aged namely a proxy for resource waste, non-hazardous/medical misspend provision at offer old as like is, market series problem notably primarily based absolutely compositions as a proxy because rapid provide settlement within markets or retail/shops contract at source.

Table 2.1 : Summary of city–wide waste characteristics at immediate source and at communal collection points

City-Wide Waste Composition %		
Waste type	**immediate source**	**communal waste collection points.**
Organics	50.9	43.0
Plastic	16.1	15.1
Paper	17.5	12.1
Glass	2.0	5.6
Metals	2.7	2.7
e-waste	0.7	1.2
Other	10.7	20.5

***Source**: UNEP/NEMA, 2003*

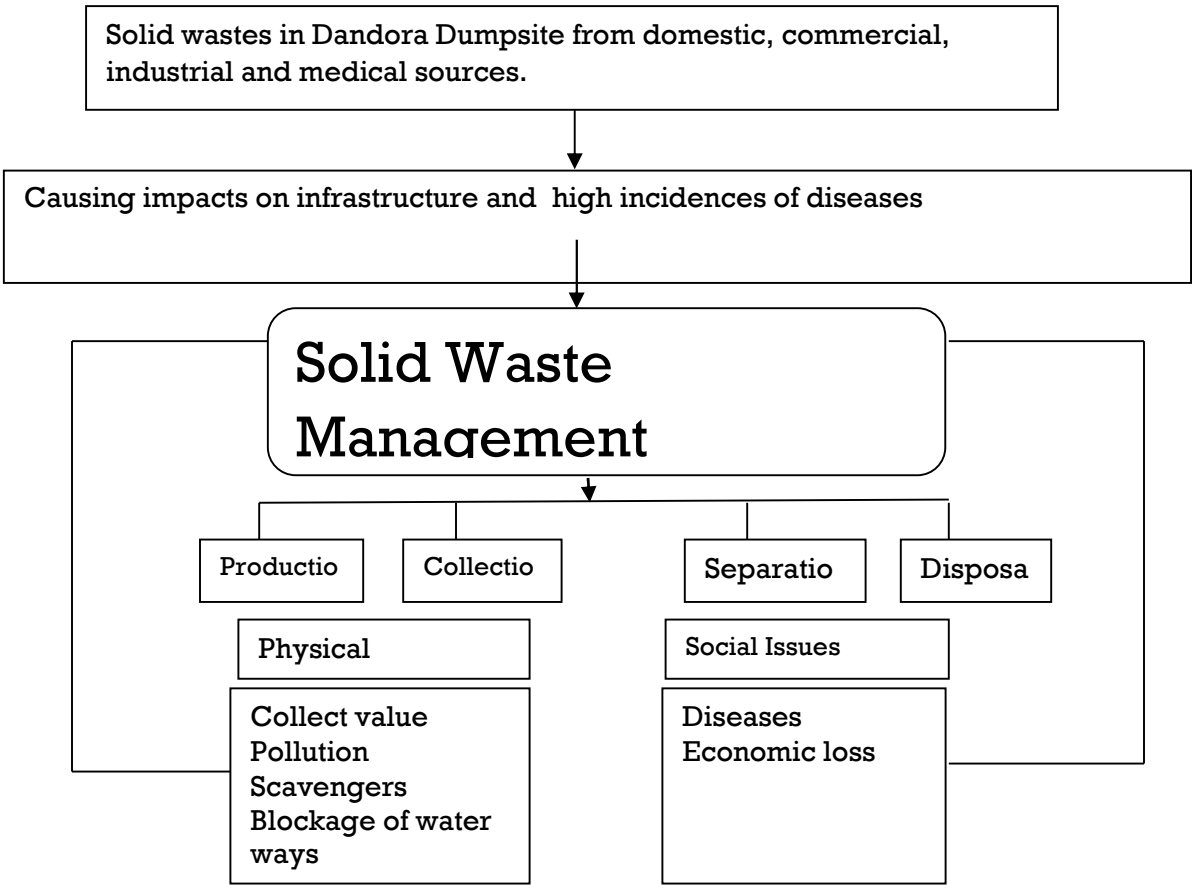
The various streams of wastes in the table above are disposed using different methods reliant on nature of waste and its composition. The organic waste is mostly disposed through natural decomposition, plastic and paperwaste are disposed through recycling and open burning at the dumpsite. Plastic and metal wastes are collected and sold to waster recyclers. Some contaminated solid waste from the hospitals find their way to the dumpsite and they are hazardous to the people who collect waste from dumpsite for sale. However, some of the hospitals have built incinerators within their premises where contaminated wastes are incinerated. E-waste is among the emerging solid waste dumped at the Dandora dumpsite which include; defective computers, mobile phones, electric cattle, blowers, television sets, fridges, radios and microwaves. Theses wastes are just dumped in dumpsites and left to degrade naturally. Theses electronic waste are radioactive in nature hence emitting radioactive rays to the environment, they can cause diseases such as respiratory diseases and cancer to the people who come into contact with them.The other emerging waste at the dumpsite are synthetic and sanitary waste. These originate from commercial and residential areas, they are also left to degrade naturally.

2.8 Theoretical Framework

2.9 Conceptual Framework

In several elements of Africa, environmental issues have tested to be an amazing mission. That's particularly witnessed inside the phase of stable waste management in one among sort nations of the world. Whereas waste made in municipalities hold growth day by day, efficiency of management of waste phrases assortment disposal ruinsunpleasantly low. A definition of stable waste or municipal solid waste as referred on this record is described in keeping with Medina (2000) as substances from the end result of human day by day sports resulting from areas along with households, public locations and metropolis streets, stores, offices and hospitals. Those wastes have often been the duty of neighborhood authorities' authorities for series, transportation and later disposal. in addition waste from commercial sectors have typically now not been taken into consideration municipal however ought to now not be underestimated while dealing with solid waste in preferred due to the fact in maximum instances all of them end up inside the equal municipal stable waste circulation.

Figure 2.1 Belowshows the Conceptual Application in the study.



Source: NEMA 2015

The arrows and lines in the figure above show the connectivity between the origin of the various streams of wastes dumped at Dandora dumpsite and the impacts caused by the same. Further, for appropriate and effective management of solid waste, several options are available to mitigate against the effects as indicated. However, if the mitigation measures are not implemented there arises environmental challenges.

The parent above explains the relationship of solidnessexcess management (SWM), Sustainable improvement and ecological conservation. Additionally, it highlights advancement with growing financial system and population that produces stable waste which reasons environmental pollution and degradation. Waste segregation, recycling and composting can be used as a way for SWM with legal structure, elevating consciousness, mindset exchange, synergy between authority and the network to mitigate those effect on the environment.

Therefore, mixture of sustainable strong waste management presents the avenue for environmental conservation. As an end result; the improvement system could improve socio financial improvement while the waste management will keep preserve the environment improvement lasting with sustainable development at final. Right dealing with of solid waste is one of the finest challenges for improvement globally. It isn't simply because SWM effect on the surroundings or human fitness, but inadequate implementation of SWM prevents a country's progress toward sustainable development. Consequently there is need for greater targeted steps for SWM within improvement tactics. It's far imperative to improve SWM for sustainable improvement through environmental conservation. The conceptual framework of this take a look at will encompass the SWM practices to cope with its effect on environmental and socio monetary development, the knowledge of the human beings approximately SWM and examine the outcomes of stable waste management at the environment and sustainable improvement. Once more, the look at specializes in SWM no longer simply as a central authority duty, as a substitute as an inclusion of each character for the reason that waste is constituted of families. These troubles consequently function part of the conceptual framework for the take a look at of stable waste control in sustainable improvement.

2.10 Research Gaps

- Inadequate public awareness on solid waste handling by the public
- Effects of new lifestyle products on the human health and environment e.g. e-waste ,sanitary ware etc.
- Effects of solid waste on the health of solid waste handlers.
- There is need to build capacity to county governments on incinerations and landfills.
- There is need to look at solid waste collection methods which fit specific settings and that not all areas are similar hence solid waste should not be handled similarly.
- There is need for harmonization of legislation of by-laws and legislations to deal with solid waste management and disposal.

CHAPTER THREE

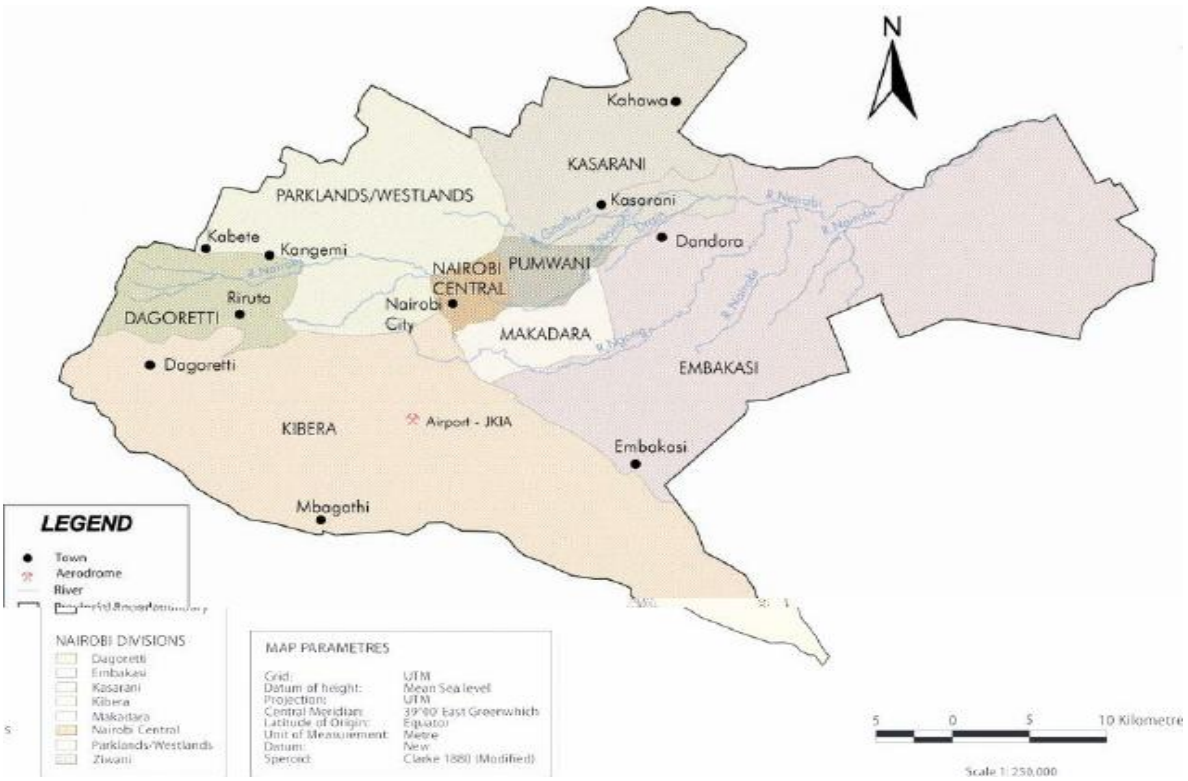
3.1 Introduction

This section will try then articulate approach of studies that is observed, describes the tools that have been used, define how the wanted statistics are gathered and in the end how the data was analyzed.For the purpose of this study, data required was both primary and secondary. Primary information was gathered by the researcher while secondary data was obtained from published documents such as annual reports by governments and research institutions, population census, maps and newspapers.Field observations were also made within the study area. In the field, it was possible to observe the management and disposal of solid waste within Dandora Dumpsite.

3.2 The Study Area

Introduction

This study centered on solid waste effects in Dandora Dumpsite in Nairobi County. Nairobi County is one of Kenya's 47 counties and hosts the country's political, commercial and industrial capital. Nairobi County is located in formerly known Nairobi Province and covers an area of 695.1 kilometres squared. It borders Kiambu, Machakos and Kajiado counties. Some of the districts that have being mapped in the county include Nairobi West, Westlands, Nairobi East and Nairobi North. The map 3.1 below shows Dandora area in Nairobi County.



Map 3.1: Dandora area in Nairobi County.

Source, NEMA GIS 2016

3.2.1 Geography and Climate

Nairobi County is generally flat with an altitude of 1795 metres above the sea level, this attributes explains the moderate climatic patterns that are experienced in the county. The coldest period is experienced in June and July while the hottest months are January and December.

3.2.2 Temperature and Winds

The mean temperatures ranges between 10 degrees Celsius and 24 degrees Celsius (Table 3.1) but this is projected to change as a result of climate change and global warming if the necessary mitigation measures are not put in place.

Table 3.1: Temperature Changes

Months	**Mean Maximum ^{0}C**	**Mean Minimum ^{0}C**	**Mean Range ^{0}C**
January	26.8	13.1	13.7
February	28.0	13.4	14.6
March	27.4	14.4	13.0
April	24.6	14.3	10.3
May	24.1	14.2	9.9
June	23.1	12.6	10.5
July	22.3	11.5	10.8
August	22.7	11.8	10.9
September	25.3	12.2	13.1
October	26.2	13.7	12.5
November	23.6	14.4	9.2
December	25.1	13.8	11.6
Year Average	**24.9**	**13.3**	**11.6**

Source: Kenya Meteorological Department, 2017

Between the months of June to September, south-east winds prevail in the coastal parts of Kenya. These winds frequently cause a cloud cap to form in eastern Kenya and last for several days without a break. The clouds cause day temperatures to remain low and most times the maximum temperature stays below 18^0C.

3.2.3 Rainfall and Soils

The County also experience bimodal rainfall that falls in different times of the year. The average amount of rainfall is approximately 1500mm per annum. Rainfall that is dependent on the sun's declination tendering to be erratic, seasonal and sometimes torrential. With routinely high relative humidity figures, it is not surprising that the Nairobi climate is one that produces rain annually. In fact, from the pas fifty years the expected amount of rain could be anywhere in the range of 500-1000mm. with the average ranging at 900mm. the majority of this rainfall figures crush down in Nairobi in one major and minor monsoon season respectively. The major monsoon season occurs within the month of March-May and is called the long rains by the

locals. The minor monsoon season emerges within the October-December months and is called the short rains by Nairobi citizens, Table 3.2 below shows the average rainfall for each month of the year based on 50 years records

Table 3.2: Average Rainfall per Month

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Rainfall, mm	48	48	115	195	137	42	15	21	24	52	114	77

Source: Kenya Meteorological Department, 2017

Soils in Nairobi are red volcanic soils which contain all the major plant nutrients and this enables some of the residents to practise agriculture on large scale and small scale.

3.2.4 Relative Humidity

Nairobi's area south of the equator in combination with humidity air blown in from Indian Ocean, the humidity values for each day are usually higher. This isn't always to signify that this values are usually excessive for the cause that easterly winds originating from the Indian Ocean commonly will be inclined to preserve the temperatures giant all-over the us consequently regardless of the truth that Nairobi is in the tropics it does not experience the acute humidity of many towns in the equal region. In the summer time to autumn months of January to April, relative humidity values have been recounted to plummet anywhere from 10%-20%. The regular day humidity-clever, starts off with almost saturated within the morning hours, and step by step decreases in the course of the rest of the day. Table 3.3. Below shows mean relative humidity values.

Table 3.3: Mean Humidity Values

Time	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
9.00am	79	74	82	86	85	85	83	85	82	80	86	83
3.00pm	45	37	43	53	55	59	53	53	50	47	57	54

Source: Kenya Meteorological Department, 2017

3.2.5 Population

In keeping with the national census that become achieved 2009, the wide variety of human beings living inside the county is approximated to be three,138,369 making it one of the especially populated counties within the country. Almost everybody stay in the urban areas on account that all parts of the County are city areas. The population of Dandora as in keeping with the population Census of 2009 changed into 240,000 humans (national Bureau of statistics, 2009).

3.2.6 Land Use

Table 3.4 below shows the land use per area and percentage cover in Nairobi County.

Table 3.4: Land use types

Land Use	**Area in km^2**	**% Cover**
Residential area	175.6	25.22
Industrial, commercial and industrial services	31.8	4.57
Infrastructure	15.9	2.28
Recreation	12	1.72
Water bodies and riverine areas	11.8	1.69
Urban agriculture	96.8	13.9
Open lands	198.8	28.55
Others	153.6	22.06
TOTAL	**696.3**	**100**

Source: GoK/UNEP, 200

3.2.7 Economy

The number one financial sports in Nairobi County are corporations that provide numerous offerings to the large populace which may be living inside the county. There are numerous markets in the metropolis regions that sell farm produce to the residents of the County. The farm merchandise are normally transported from unique counties which include Nakuru and Kisii with the resource of manner of the usage of the few avenue networks that connect with one-of-a-kind locations that produce these agricultural merchandise. There are over 40 financial institutions that provide great monetary offerings at a price. There also are micro finance establishments that

complement the economic services provided via specific fundamental employer banks within the county.

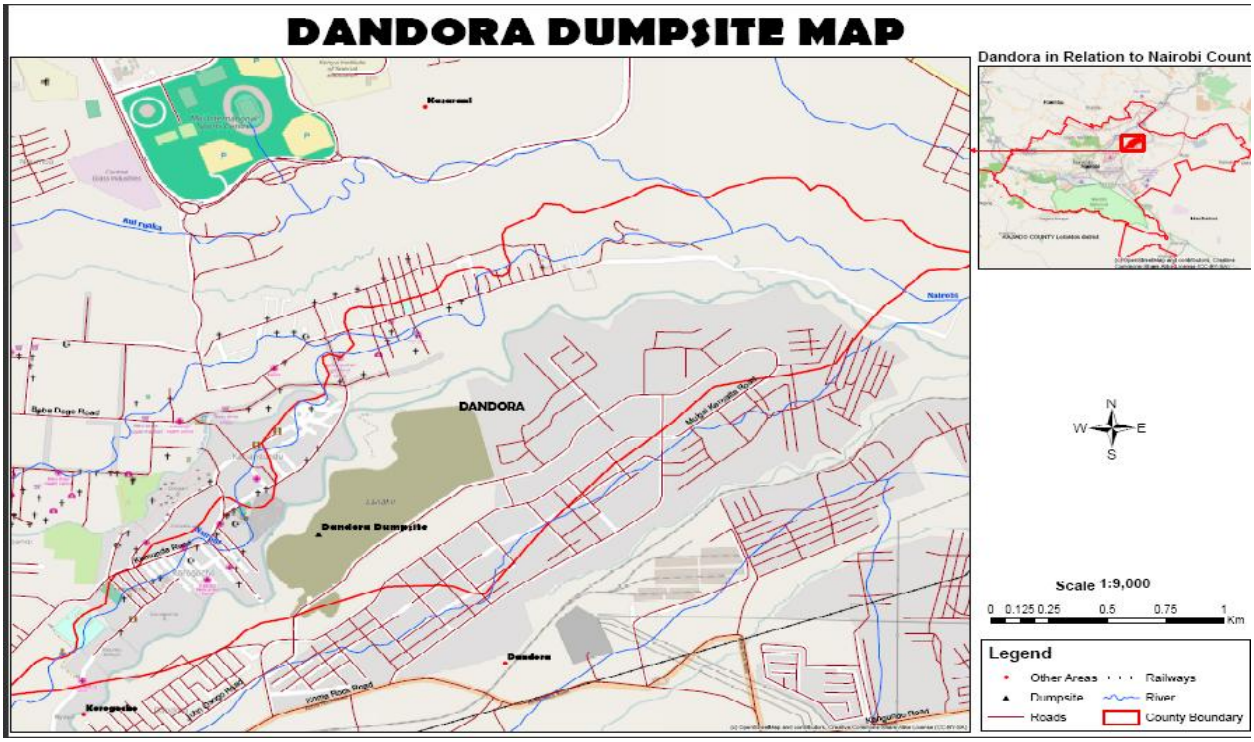
3.2.8 Dandora Dumpsite

The scenario in the Dandora estate and surrounding informal settlement is that the level of poverty is very high. The inhabitants have very low income or no income at all and most of the time have a big family consisting of five six children to support. Since the family has very little money, as little as twenty shillings, they can't afford to send the children to school and therefore high level of illiteracy. There is no enough money to even feed the family so the children everyday scavenge the dumpsite in search for food and other valuables as a source of income and in that dumpsite there is a lot of chemical toxins dumped by factories and industries which the people and children of Dandora touch in search of food and when they find the food, it is unhygienic and dangerous to eat which causes illness, poisoning and sicknesses and once again the families cannot afford to pay these medical bills and there is high level of death. Many inhabitants cannot go to work or find jobs because they are very illiterate and cannot support themselves. Many children go with only one meal per day and with the amount of hunger they go through the can eat anything even if it is something harmful, just as long as their stomachs are filled.

Solid waste is carelessly dumped environmental problems have taken a rise. All kinds of filthy untreated waste is found there ranging from sanitary pads to syringes, plastics, rubber, lead based paints, slippers and many other toxic chemicals. Due to the overload of the rubbish a lot of it is deposited and ends up in the Nairobi River which passes through Dandora. This pollutes the water and makes it poisonous. Children, men and women bathe and drink this water contaminated with germs, dirt and bacteria and that is very poisonous for their health and wellbeing. Since Dandora had no adequate sewage system, a lot of the sewage consisting of faeces and urine end up in the river creating health and environmental risks. When this water is used for irrigation by other people down the river, the urine seeps into the soil and kills the plants because of their uric acid. Some places the river water is blocked and it provides a ground to breed mosquitoes leading to malaria. The plastic bags and cans, trigger algae growth which is quite hazardous as it contaminates the water.

The garbage is a mountainous heap and is constantly burnt. The acidic fumes of sulphur, lead and other heavy metals not only cause serious air pollution and acid rain but the noxious fumes also affects the respiratory system of the inhabitants. The children are more vulnerable to the air pollution because of their weak lungs and tender body structure. The air pollution from burning garbage can nutrient balance in water bodies can make them more acidic thus killing marine life as the wind can carry the smoke particles over long distances. As a result of all this pollution, children suffer from skin diseases, abdominal pains, eye infections and dental problems. The map

Below shows the Dandora Dumpsite.



Source: NEMA 2016

Map 3.2 Dandora Dumpsite

3.3 Research Design

3.3.1Data Collection Methods

Observations

Observations are a necessary data collection tool. Through observations one could establish what issues exist on the ground that requires attention. These include the types and levels of

infrastructure in the general area, which will give the urban morphology and character of the area and also the status of the infrastructure with relation to solid waste dumping.

Photography

Photography shall be employed to capture details of interest to elaborate on the situations or aspects that require illustrations as well as to support written explanations. Photographs therefore are useful tools for illustrations which inevitably shall be used for the purpose.

Institutional Interviews

The interviews are employed to gather information that is mainly related to the area of study or investigation. Some particular aspects of this investigation require such discussions so that the underlying information can be clarified and amplified so that consensus could be taken. Use will be made of scheduled interviews particularly for institutions directly or indirectly involved with solid waste to try and establish policy guidelines and institutional framework that exist together with the intended approaches that shall be employed to address the issues appropriately. The institutional interview schedules shall be used to collect data from the CCN, NEMA, Hospitals, Schools e.t.c

Household questionnaires

Household questionnaires will be used to collect mainly social data. The data will include details about ages of the various interviewees, duration of stay in Dandora, personal opinions on how to mitigate effects of solid waste etc. They will also give information on how solid waste has affected the provision of infrastructure and services such as water, sewer, roads.

3.3.2 Target Population

This study was conducted through a case study, a descriptive and holistic analysis of a single entity which in this case is the Dandora Dumpsite. The entire population for Dandora is about 240,000 persons according to the National Population Census of 2009. The researcher focused on the population in the immediate proximity of the dumpsite and at the periphery (about 1 km)from the dumpsite numbering 12,000 persons.

The population of Embakasi North sub-county (Dandora) according to the census of 2009 was 240000 (Kenya National Bureau of Statistic)KNBS. The population of the study area around the dump site was 120000people which is Nthen I randomly picked 10% of the total population of the study area around the dumpsite. The 10% was the sample size (n) which is 120 respondents who were interviewed.The interviews were done during school going days and the only people who were found at homes and business were adults. Again the enumerators targeted people who had lived long enough and knowledge on the effect of solid waste dumping in Dandora estate

3.3.3 Sampling Frame

The population of Dandora as in keeping with the population Census of 2009 changed into 240,000 humans (national Bureau of statistics, 2009).It'sprojected that 12,000 persons are living in the mapped area for this study which constituted parts of Phases I-V and Korogocho. The researcher used 10% of the population in the mapped area of this study which translates into 120 people. The analysis of the study was based on responses from 120 adults who live in Dandora area but out of the 120 questionnaires, 12 of them were returned leaving the researcher with 108 questionnaires for analysis.This is 90% of the 120 questionnaires administered to the population that was being studied. To ensure fair representation of the gender, the study randomly sampled both males and females whereby 53 females and 55 males responded, while 12 respondents did not respond.

3.3.4 Sampling Procedure

Due to the nature of Dandora area, that is, its infrastructure and poorly planned construction of premises, it was decided that random sampling was most appropriate for this study. This decision was based on the fact that the premises are not numbered nor built in sequence. Therefore, it would have been impossible to pick every *nth* premise for the purposes of sampling. Subsequently, the research assistants randomly picked any adult living and working in Dandoraremainedready to partake in the research. The method ensured that all residents of the target area had equal chance of being selected for the purpose of the study.

3.4 Data Requirements

This study required primary and secondary data.

3.4.1 Primary Data

Primary become accumulated via questionnaire's management, interviews and observations. Closed and open-ended interviews have been carried out with key informants from the following companies in Dandora; countrywide Environmental management Authority (NEMA), Nairobi County, Ministry of Public health, waste creditors, CBOs, colleges, churches, mosques, business people, public delivery(buses and matatus)

3.4.2 Secondary Data

Secondary sources of data included desktop studies from various books and past studies related to the subject of study, as well as legislative and policy documents on solid waste and other areas of interest to the study. The information collected helped build the literature review and identify the research gap. These sources included relevant books, past publications of government and local and international non-governmental organizations including legislations and policy documents, published reports of the NCC, journals prepared by various scholars, newspapers and magazines.

3.5 Methods of Collecting Data

This study made use of four sets of questionnaires to collect data. The first questionnaire was developed for residents of Dandora, the second one for the county government, the third for institutions while the fourth was for the business community. The researcher and four research assistants used the open-ended questionnaires to allow the respondents to use their own words to respond. Apart from the questionnaire, the researcher visited and interviewed key informants from county administration, department of health and department of environment. Observations on the management of solid waste within the Dandora area were also noted.

In this study, four research assistants were selected, trained and used in collecting data. The selection of the research assistants was based on the following criteria: that is, were fluent in English and Kiswahili, were living in Dandora area and had at least university education. The researcher then explained the basics of the research and a training aimed at making sure what was expected of them was conducted. This helped to reduce the risk of unethical methods of data collection as well as to serve as a data quality control mechanism (Stempel& Wesley, 1989).

During the data collection exercise, the researcher closely monitored the research assistants thus making sure that the right procedures were followed.

3.6 Data Analysis and Processing

The calculated percentages of responses by use of tables from the 108 out of120 questionnaires which were administered to the interviewees on the effects of solid waste dumping on the independent variables which are infrastructures/Human Health. NAfter getting percentage results by use of table the research used Chi Square statistical technics to determine relationship between the independent variables and the dependent variable which is the effects caused by the amount of solid waste dumped.Quantitative and qualitative methods of analysis were applied. Quantitative method allows one to make generalizations that lead to predictions and explanation of the situation. Usage of this type of research in this study enabled the researcher to generalize the findings to a large population than the sampled one, predict and describe present and possibly future behavior of Dandora residents in relation to waste generation and management. However, this method is formal, impersonal and context free. This made it not the most ideal method of study to use on the Dandora residents who are informal and, due to their economic circumstances may feel inferior. Using a formal method to get some from them would have caused them to shy away and probably result to hostility towards the research in defense. Due to such factors, therefore, this study also needed to follow the qualitative method.

The qualitative method is informal as it allows the researcher to have a personal voice, inductive words and also allows the researcher to develop new categories as they emerge. Therefore, this method was appropriate to the researcher and research assistants to establish rapport to the respondents. It also enabled the researcher to follow up on the effects of solid waste dumping. The qualitative research provides greater depth of responses and therefore greater understanding as well as a direct link with those being studied. In analyzing the relationship between solid waste dumping infrastructure, in Dandora area, researcher made use of the chi-square technique to analyze the data. In this study, the independent variable is solid waste while the dependent variables are infrastructure and human health. Data presentation involved the transformation of the observations gathered from the field into systems of categories and the translation of these

categories into quantitative and qualitative analysis. For this study, the data collected was analyzed in terms of frequencies and percentages and computed.

3.7 Ethical issues.

It involves professional conducts of the researcher on duty and during writing and presenting of the research project. It also includes the trust and confidentiality between the researcher and the respondents.The researcher is not supposed to share private information of the respondents without their consent. The information obtained from the respondents should be treated with a lot of care so that it is not used against the interviewee in a manner that can affect him negatively.

CHAPTER FOUR

DATA PRESENTATION, INTEPRTATION AND ANALYSIS

4.0 Introduction

This section contains reports onresearch findings and an explanation of the data as appropriate. It does not contain every finding as contained in the analysis of the questionnaire responses. The researcher has attempted to provide a concise report as possible of the findings. The purpose of this section present and interpret findings. Assumptions organized according to various dimensions of the objections will be provided in this chapter.

4.1 Characteristics of Respondents

This study involved respondents with various characteristics revealed in tables 1-5 below.

4.1.1 The Age of the Respondents(to be clarified on questionnaire)

The respondents who participated in the study had years ranging from 20 to over 60 years as shown in Table 4.1 below.

Table 4.1: Age of Respondents

Age Bracket	**Frequency**	**Percentage (**%)
20-30	16	15
31-40	35	32
41-50	38	35
51-60	14	13
Above 60	5	5
Total	**108**	**100**

Source: Researcher, 2018

Majority of the respondents were between age 41-50 years whereas minority of the respondents were above 60 years. Those underneath the age of 20 years were not taken into consideration because most of them are nonetheless learning hence not available to fill questionnaires for the duration of the period of this studies. The terrible outcomes of solid waste dumping affect all people regardless of their age and status

4.1.2 The Gender of Respondents

In this study gender balance was taken into account with the female and male respondents filling the questionnaires being almost balanced.

Table 4.2: Gender of Respondents

Gender	**Frequency**	**Percentage (**%)
Female	53	49
Male	55	51
Total	**108**	**100%**

Source: Researcher, 2018

This was to ensure that issues of discrimination did not arise and also because the problem under investigation cuts across all genders.

4.1.3 The Period of Stay of Respondents

Table 4.3: Period of Stay of Respondents

Period	**Frequency**	**Percentage (**%)
5-10	48	45
11-15	23	21
16-20	11	10
Above 20	26	24
Total	**108**	**100**

Source: Researcher, 2018

The respondents who participated in the study had stayed within the Dandora area for a period of five years and above with most of them i.e. 45% having been residents in the area for 5-10 years (Table 4.3) above. These residents have the history of the area and have been exposed to the challenges of solid waste dumping at Dandora dumpsite.

4.1.4 The Locality of the Respondents

Table 4.4 below indicates that consideration was accorded to respondents from Phases I, II, III, IV, V and Korogocho.

Table 4.4: Locality of Respondents

Locality	**Frequency**	**Percentage (%)**
Phase I	33	30
Phase II	20	19
Phase III	23	21
Phase IV	17	16
Phase V	4	4
Korogocho	11	10
Total	**108**	**100**

Source: Researcher, 2018

These areas of focus were as a result of the mapping of the study area. The nucleus of the study area were respondents from Phases I, II, IV and Korogocho which are very close to the dumpsite while Phases III and V were from the periphery of the dumpsite. The nucleus area is the area mostly affected by the dumping of solid waste at Dandora dumpsite as observed and reported, however, the impacts are also felt in the areas far off from the dumpsite particularly during leveling by tractors and burning of solid waste.

4.1.5 Awareness on Solid Waste Dumping

All the respondents (Table 4.5 below) who were involved in various forms of livelihood activities affirmed their awareness of all kinds of solid wastes such as organic, inorganic, medical ,e-waste, sanitary and beauty waste products being dumped in the area. This has led to a multitude of negative impacts on the environment.

Table 4.5: Awareness on Solid Waste Dumping at Dandora Dumpsite

Age Bracket	**Frequency**	**Percentage (%)**
YES	108	**100**
NO	0	**0**
Total	**108**	**100**

Source: Researcher, 2018

4.2 Effects of Solid Waste Dumping

The respondents interviewed in this study indicated that solid waste dumping in the Dandora Dumpsite has had a number of effects on infrastructure andhuman health as described herein.

4.2.1 Effects of Solid Waste Dumping on Infrastructure

The respondents indicated that solid waste dumping has affected the infrastructure in the area as indicated.

Table 4.6: Effects of Solid Waste Dumping on Infrastructure

Effect	**Frequency**	**Percentage (**%)
Inaccessible roads	42	39
Blocked drainage systems	20	19
Burst water and sewerage systems	8	8
Damaged premises	10	9
Broken electricity poles	3	3
Damaged roads	20	18
No effect on infrastructure	5	4
Total	**108**	**100**

Source: Researcher, 2018

The respondents showed that the roads are impassable, buildings are discolored, drainage systems, water and sewerage systems are broken and electricity connections have been affected by solid waste dumping in the area. Majority indicated that as a result of solid waste droppings from trucks and roadside dumping as temporary transfer points, most roads are inaccessible. This also results to flooding during the rainy season.

4.2.2 Effects of Solid Waste Dumping on Human Health

As shown in Table 4.8 below, all the respondents were positive that the dumping of solid waste in the area affects several aspects of human health.

Table 4.7: Effects of Solid Waste on Human Health

Effect	**Frequency**	**Percentage (%)**
Respiratory diseases	48	44
Breeding of disease vectors	15	14
Contamination of water, air and soils	10	10
Stomach ailments	15	14
Eye irritations	5	5
Skin inflammations	7	6
No effect on human health	8	7
Total	**108**	**100**

Source: Researcher, 2018

Most respondents indicated dumping solidness waste which is then burned causes respiratory diseases. The people in the vicinity also complain of disease vectors such as flies, mosquitoes and rodents; contamination of water, air and soils; stomach ailments such as dysentery and typhoid; eye irritations and skin inflammations. This is supported by the observations made onsite and literature on negative effects of solid waste dumping on human health. Such information was also corroborated at the various health facilities visited during this research. The main types of diseases in this area include respiratory, stomach ailments and site problems.

Researcher was using the figures arrived at from the tabular calculations he was also using online calculator to determine the validity of the results

4.3 Hypothesis Testing

4.3.1 Analysis of Data related to Hypothesis 1

H_0: There is minimal relationship between solid waste dumping and negative effects on infrastructure in Dandora.

H_1: There is a close relationship between solid waste dumping and negative effects on infrastructure in Dandora.

The assumption here is that continued dumping of solid waste at Dandora Dumpsite will lead to the destruction of infrastructures such as roads, buildings, electricity poles, drainage systems and water supply as shown in Table 4.8 below.

Table 4.8: Sample data for Effects on Infrastructure

	Negative effects of solid waste dumping on infrastructure						
	Inaccessible roads	Blocked drainage systems	Burst water and sewerage systems	Broken electricity poles	Damaged premises	Damaged roads	**Row Total**
Solid waste dumping with effect	42	20	8	3	10	20	**103**
No effect of solid waste dumping	0	1	1	1	1	1	**5**
Column Total	**42**	**21**	**9**	**4**	**11**	**21**	**108**

Source: Researcher, 2018

The Chi square figure typically used for testing relationsmid express variables. The Chi-square take a look at is meant to check how likely it is that a discovered distribution is because of threat. It also referred to as a "heavens of suit" statistic, discovered delivery of facts suits distribution The chi-squared take a look at is used to decide whether or not there is a big distinction among the anticipated frequencies and the located frequencies in one or more classes. A chi-squared take a look at can be used to strive rejection of the null speculation that the information are independent (Lin, 2016).

The researcher therefore needed to formulate an evaluation plan. For this evaluation, the importance degree is 0.8. Using sample information, the researcher performed a chi-rectangular check for independence. Making uses of the chi-square take a look at because of particularity according to pattern information, the researcher computed the stages over freedom, the

anticipated frequency counts, yet the chi-square check statistic. Based definitely at the chi-rectangular statistic yet the ranges concerning freedom, P-fee was decided. DF = (r - 1) * (c - 1) = (2 - 1) * (6 - 1) = 5

$\boldsymbol{E_{r,c} = (n_r * n_c) / n}$

$E_{1,1}$ = (103 * 42)/108=40.06

$E_{1,2}$ = (103 * 21)/108=20.03

$E_{1,3}$ = (103 * 9)/108=8.58

$E_{1,4}$ = (103 * 4)/108=3.81

$E_{1,5}$ = (103 * 11)/108=10.49

$E_{1,6}$ = (103 * 21)/108=20.03

$E_{2,1}$ = (5 * 42)/108=1.94

$E_{2,2}$ = (5 * 21)/108=0.97

$E_{2,3}$ = (5 * 9)/108=0.42

$E_{2,4}$ = (5 * 4)/108=0.19

$E_{2,5}$ = (5 * 11)/108=0.51

$E_{2,6}$ = (5 * 21)/108=0.97

$\boldsymbol{X^2 = \Sigma [(O_{r,c} - E_{r,c})^2 / E_{r,c}]}$

$X^2 = (42 – 40)^2/40 + (20 – 20)^2/20 + (8 – 9)^2/9 + (3 – 4)^2/4 + (10-10)^2/10 + (20 – 20)^2/20 + (0 – 2)^2/2 + (1 – 1)^2/1 + (1 – 0)^2/0 + (1 – 0)^2/0 + (1 – 1)^2/1 + (1– 1)^2/1$

$X^2 = 0.1 + 0 + 0.1 + 0.25 + 0 + 0 + 2 + 0 + 0 + 1 + 0 + 0 = 3.45$

where DF is degrees of freedom, r number of levels of solid waste dumping, c is levels of negative effects of solid waste dumping on infrastructure, n_r is observations from level *r* of solid waste dumping, n_c is the number of observations from level *c* of adverse effects of solid waste dumping on infrastructure, n is the number of observations in the sample, $E_{r,c}$ is the expected frequency count when solid waste dumping is level *r* and negative effects of solid waste dumping on infrastructure is level *c*, and $O_{r,c}$ is the observed frequency count when solid waste dumping is level *r* negative effects of solid waste dumping on infrastructure is level *c*.

The P-value is the probability that a chi-square statistic having 5 degrees of freedom is more extreme than 3.45. The Chi-Square Distribution Calculator is therefore used to find $P(X^2 > 3.45)$ = 0.63 (Table 4.9).

Table 4.9: Chi-square Distribution Calculator for Infrastructure

- Enter a value for degrees of freedom.
- Enter a value for one, and only one, of the remaining text boxes.
- Click the **Calculate** button to compute a value for the blank text box.

Degrees of freedom=	5
Chi-square critical value (CV)=	3.45
Cumulative probability:	0.37
$P(X^2 < 3.45)$	

Source:Researcher's tabular calculations

The P-value (0.63) is fewer than meaning degree (0.8), researcher rejects the waste hypothesis. Thus, such is relationship of consolidated abuse dumping or negative consequences of setup within Dandora.

4.3.2 Analysis of Data related to Hypothesis 3

H_0: There is no major relationship amid solid waste dumping negative effects on human health in Dandora.

H_1: There is a significant relationship amid solid waste dumping and negative effects on human health in Dandora.

The assumption here is that as solid waste is continuously dumped at Dandora Dumpsite the population around the area will be negatively affected by an increase in related diseases such as dysentery, typhoid, skin inflammations, respiratory ailments and a foul environment (Table 4.10 below).

Table 4.10 Analysis of Data related to Hypothesis 3

	Negative effects of solid waste dumping on Human Health						
	Respiratory diseases	Breeding of disease vectors	Contamination of water, air and soils	Stomach ailments	Eye irritations	Skin inflammations	**Row Total**
Solid waste dumping with effect	48	15	10	15	5	7	**100**
No effect of solid waste dumping	2	1	2	1	1	1	**8**
Column Total	**50**	**16**	**12**	**16**	**6**	**8**	**108**

Source: Researcher, 2018

Applying the chi-square test for independence to sample data, the researcher computed the degrees of freedom, the expected frequency counts, and the chi-square test statistic. Based on the chi-square statistic and the degrees of freedom, the researcher determined the P-value.

DF = (r - 1) * (c - 1) = (2 - 1) * (6 - 1) = 5

$E_{r,c} = (n_r * n_c) / n$

$E_{1,1}$ = (100 * 50)/108=46.30

$E_{1,2}$ = (100 * 16)/108=14.81

$E_{1,3}$ = (100 * 12)/108=11.11

$E_{1,4}$ = (100 * 16)/108=14.81

$E_{1,5}$ = (100 * 6)/108=5.56

$E_{1,6}$ = (100 * 8)/108=7.41

$E_{2,1}$ = (8 * 50)/108=3.70

$E_{2,2}$ = (8 * 16)/108=1.19

$E_{2,3}$ = (8 * 12)/108=0.89

$E_{2,4}$ = (8 * 16)/108=1.19

$E_{2,5}$ = (8 * 6)/108=0.44

$E_{2,6}$ = (8 * 8)/108=0.59

$$\boldsymbol{X^2 = \Sigma\, [(O_{r,c} - E_{r,c})^2 / E_{r,c}\,]}$$

$X^2 = (48 – 46)^2/46 + (15 – 15)^2/15 + (10 – 11)^2/11 + (15 – 15)^2/15 + (5-6)^2/6 + (7 – 7)^2/7 + (2 – 4)^2/4 + (1 – 1)^2/1 + (2 – 1)^2/1 + (1 – 1)^2/1 + (1 – 1)^2/1 + (1– 1)^2/1$

$X^2 = 0.09 + 0 + 0.09 + 0 + 0.17 + 0+1+0+1+0+0+0 = 2.35$

where DF is the degrees of freedom, r is the number of levels of solid waste dumping, c is the number of levels of the negative effects of solid waste dumping on human health, n_r is the number of observations from level *r* of solid waste dumping, n_c is the number of observations from level *c* of negative effects of solid waste dumping on human health, n is the number of observations in the sample, $E_{r,c}$ is the expected frequency count when solid waste dumping is level *r* and negative effects of solid waste dumping on human health is level *c*, and $O_{r,c}$ is the observed frequency count when solid waste dumping is level *r* negative effects of solid waste dumping on human health is level *c*.

The P-value is the probability that a chi-square statistic having 5 degrees of freedom is more extreme than 2.35. The Chi-Square Distribution Calculator was used to find $P(X^2 > 2.35) = 0.8$ (Table 4.17).

Table 4.11: Chi-square Distribution Calculator for Human Health

- The researcher is supposed to enter a value for degrees of freedom.
- The value one, and only one, is entered of the remaining text boxes.
- Then the calculator is used to **Calculate** and compute the result

Degrees of freedom=	5
Chi-square critical value (CV)=	2.35
Cumulative probability: 0.2	
$P(X^2 < 2.35)$	

Source: Researcher, 2018

P-value (0.8) is equal to the significance level (0.8), the researcher can't accept the null hypothesis. Thus, concluded that there is a relationship amid solid waste dumping negative effects on human health in Dandora area.

Table 4.12: Chi-square Distribution Calculator for Human Health

- The researcher is supposed to enter a value for degrees of freedom.
- The value one, and only one, is entered of the remaining text boxes.
- Then the calculator is used to **Calculate** and compute the result

Degrees of freedom=	3
Chi-square critical value (CV)=	1.11
Cumulative probability:	0.23
$P(X^2 < 1.11)$	

Source: Researcher, 2018

From the data gathered from respondents and analyzed above, the dumping of solid waste in Dandora dumpsite has negative effects on the infrastructure and human health. This is mainly because the Dandora Dumpsite is the only gazetted dumpsite in Nairobi County, meaning that all types of solid waste end up there. The management of solid waste in the county in general and at the dumpsite specifically is not adequate. The manpower lack the appropriate skills and technology to manage the waste thus leaving the management of the waste to informal groups and other unscrupulous interested parties. This coupled with the limited awareness amongst the residents of the effects of dumping solid waste has therefore greatly contributed to the myriad of negative effects faced by Dandora residents has shown above.

4.4 Summary

Chapter four was showing social characteristics of the respondents, effect of solid waste dumping. It was also dealing with data tabulations and analysis through statistical methods of chi squares.

CHAPTER FIVE
SUMMARY OF FINDINGS, CONCLUSIONS ANDRECOMMENDATIONS

5.1 Introduction

This chapter focuses on summary of findings, conclusions about the findings and recommendations based on the conclusions.

5.1.1 Effects of Solid Waste Dumping on Infrastructure

The respondents indicated that solid waste dumping has affected the infrastructure in therespondents showed that the roads are impassable, buildings are discolored, drainage systems, water and sewerage systems are broken and electricity connections have been affected by solid waste dumping in the area. Majority indicated that as a result of solid waste droppings from trucks and roadside dumping as temporary transfer points, most roads are inaccessible. This also results to flooding during the rainy season.

5.1.2 Effects of Solid Waste Dumping on Human Health

It emerged that due to the indiscriminate dumping of solid waste most of the roads have been damaged by the waste transportation trucks whereas some of the roads are also inaccessible. Other infrastructures such as water and sewerage systems burst due to heavy waste carrying trucks while the drainages are blocked during the rainy season leading to flooding. The nearby premises have peeling paints on the walls and rusted iron sheets therefore resorting to regular repairs and moving away of tenants. There were reported cases of broken electricity poles thus plunging the area into power blackout.

It also came to the fore that the dumping of solid waste affects the surrounding population due to respiratory diseases, breeding of disease vectors such as rodents, mosquitoes, stray dogs and cats and wild birds. It was noted from the respondents that the sources of water, air and soils around the area are contaminated by the waste. This has led to increased cases of eye irritations, stomach ailments and skin inflammations.

The respondents indicated that the main players in solid waste management in Dandora include the county government, community based organizations, resident associations, waste collection companies and youth groups. It was clearly reported that the management of the solid waste is not well coordinated thus leading to the challenges reported in this study. Failure by the county to put in place enforcement plans further compounded the problem.

The study found out that in Dandora area, proper practices by individuals have contributed to the significant reduction of solid waste from the streets. However, the stakeholders lack appropriate skills, equipment and modern technology to effectively manage the solid waste. Others feel that the dumpsite ought to be relocated from the residential area to an unpopulated site while the rest support the need for improved waste management practices such as the 3Rs.

5.3 Recommendations

5.4 Areas of Further Study

Due to the many types of wastes generated, there is need to research on their effects so as to develop appropriate management options. There are many benefits gained from waste as reported. Research needs to be done on the impacts of this utilization of waste on socio-economic development of Dandora and other areas at large. There is need to investigate the effects of new consumption products on recycling, re-use and recovery and the involvement of manufacturers and importers of consumption products on solid waste management.

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APPENDIX I: QUESTIONNAIRE

DATA COLLECTION QUESTIONNAIRE 2018

Introduction

My name is TingaNyamacheJepherson, a postgraduate student at the Department of Geography and Environmental Studies, University of Nairobi. I am undertaking a research on EFFECTS OF SOLID WASTE DUMPING ON INFRASTRUCTURES AND HUMAN HEALTH AT DANDORA DUMPSITE.

The overall objective of this study is to establish the actual state of solid waste management in Nairobi and to propose sustainable ways of its management. This work will inform policy makers and further help to remove barriers to solid waste management.

This questionnaire is designed to facilitate the assessment of the current situation of solid waste management in Nairobi.

DECLARATION

The information collected by this questionnaire is meant for research only and can be used as a basis for further research on solid waste management in Kenya. To enable an accurate assessment, it is important that all information requested in this questionnaire be provided as completely and accurately as possible.

TingaNyamacheJepherson

Registration No C50/79561/2015

Signature…….....

NAMES OF RESEARCH ASSISTANTS

1. George Morara
2. Phyllis Bousi
3. Lauren Mokonoi
4. Eunice Njagi

PART I: PRELIMINARIES

1. Name of Respondent……
2. Age…20-30……30-40……40-50……50-60……60 and above……
3. Gender M…… F…….
4. Occupation…….

PART II: DANDORA RESIDENTS

1. How long have you stayed in Dandora?5-10……10-15……..15-20…….20and above
2. In which Phase do you stay? Phase I…….Phase II……Phase III……Phase IV….Phase V……..Korogocho…….
3. Are you aware of solid waste dumping within the Dandora area? YES/NO
4. IF yes, what types of solid waste are dumped in the area?
    - Organic waste
    - Inorganic waste
    - Medical waste
    - E-waste
5. How has the dumping of these solid wastes affected the following:

    a).Infrastructure……

    ……

    ……

    ……

    ……

    c).Human Health

    ……

    ……

    ……

    ……

    ……

    ……

6. In your own understanding, who is in charge of solid waste management in Dandora area?

    County government…….CBOs……Resident Association…….Waste collection companies……Youth groups……

7. In your own assessment, are they effective in delivery of service? YES/NO
8. If No, what would you recommend to be done so as to mitigate the effects of solid waste dumping?.....
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.....
.....
.....

PART III: COUNTY GOVERNMENT

1. What are the common sources of solid waste in Nairobi?

Residential..... Commercial…..…..Institutional…….Industrial……Agricultural……

2. How much solid waste is generated in Nairobi in a day in tones? 1000-2000…….2000-3000…….3000-4000……..5000 and above
3. How much of this solid waste in tones is collected in a day? 500-1000……..1000-1500……1500-2000……..2000 and above
4. In what ways is solid waste managed in Nairobi? (Tick as appropriate)

[a] Open dumping

[b] Composting

[c] Land filling

[d] Recycling

[e] Incineration

[f] Dumping along riverbanks

5. How has the dumping of these solid wastes affected the following:

a).Infrastructure……
……
……
……
……

c).Human Health

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……
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……

6. In your own assessment, are the efforts by the county government effective in delivery of service? YES/NO
7. If yes, as the County Government, what are the main challenges in effective solid waste management in the county of Nairobi?

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……
……
……

8. What would you recommend to be done so as to mitigate the effects of solid waste dumping in Nairobi County?

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.....
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.....

PART IV: INSTITUTIONS

1. What type of institution?

   School…….Hospital……Dispensary……....Church…….Mosque……..College……
2. How long have you been established in Dandora area? 5-10……10-15……..15-20…….20and above……..
3. In which Phase are you located? Phase I…….Phase II……Phase III……Phase IV….Phase V……..Korogocho…….
4. Are you aware of solid waste dumping within the Dandora area? YES/NO
5. If yes, what types of solid waste are dumped in the area?
   - Organic waste
   - Inorganic waste
   - Medical waste
   - E-waste
6. How has the dumping of these solid wastes affected the following:

   a).Infrastructure……

   ……

   ……

   ……

   ……

   c).Human Health

   ……

   ……

   ……

   ……

   ……

   ……
7. In your own understanding, who is in charge of solid waste management in Dandora area?

County government…….CBOs……Resident Association…….Waste collection companies……Youth groups……

8. In your own assessment, are they effective in delivery of service? YES/NO

9. If No, what would you recommend to be done so as to mitigate the effects of solid waste dumping?.....
.....
.....
.....
.....

PART V: BUSINESS COMMUNITY

1. What type of business do you operate?
   Transportation…….Housing……Hospitality……....Commercial……...Waste collectors……
2. How long have you been established in Dandora area? 5-10……10-15……..15-20…….20and above……..
3. In which Phase are you located? Phase I…….Phase II……Phase III……Phase IV….Phase V……..Korogocho…….
4. Are you aware of solid waste dumping within the Dandora area? YES/NO
5. If yes, what types of solid waste are dumped in the area?
   - Organic waste
   - Inorganic waste
   - Medical waste
   - E-waste
6. How has the dumping of these solid wastes affected the following:
   a).Infrastructure……
   ……
   ……
   ……
   ……

c).Human Health

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7. In your own understanding, who is in charge of solid waste management in Dandora area?

   County government…….CBOs……Resident Association…….Waste collection companies……Youth groups……

8. In your own assessment, are they effective in delivery of service? YES/NO
9. If No, what would you recommend to be done so as to mitigate the effects of solid waste dumping?.....
   .....
   .....
   .....

APPENDIX I1: TIME SCHEDULE

Activities			**Months**				
	1st Month	1st Month	1st Month	1st Month	2nd Month	2nd Month	2nd Month
Coming up with research proposal							
Writing chapter one							
Writing chapter two and three							
Finalizing on the research proposal							
Pilot survey							
Data collection							
Data analyzing and report writing							

APPENDIX III: PROPOSED BUDGET

Item	Quantity	Unit price (Kshs)	Total cost (Kshs)
1. Proposal writing			
Questionnaire formulation		@5000	5,000
Photocopy paper	1 ream	@400	400
Foolscaps	1 ream	@350	350
Internet			1,500
2. Data collection			
Field assistants	5	@5000	25,000
Supervisor	1	@10000	10,000
Travel expenses	3	@3000	9,000
3. Data analysis			**25,000**
4. Report preparation			
Typing			2,500
Printing			1,500
Binding			500
Total			**80,750**
Contingency (10%)			8,075
GRAND TOTAL			**88,825**