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Urban solid waste management, environmental governance, and private sector initiatives. A case from Nairobi, Kenya

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Declaration

I, Ingrid Øilo Marcussen, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature……..

Date……

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Abstract

Managing solid waste is one of the greatest challenges a city of any size faces regardless of its development level. Waste management in Nairobi has been a well-known problem for many years, stated by international organizations, the government, and its people. A combination of rapid population growth, urbanization and economic development is causing increased waste generation, putting further pressure on weak systems. This study aims to find out what the previous efforts in securing a stable and functioning waste management system in Nairobi have been, and thorough using a resource regime framework try to pinpoint the main reasons why the efforts have failed. Additionally, it is looking at the private sector's role in securing sustainable waste management in Nairobi, using the integrated sustainable waste management framework. The data was found through a combination of analyzing secondary and primary sources. First, to analyze the efforts made by the government in Kenya and the current waste regime, research and analysis on secondary sources was carried out on waste generation, collection, content, and practices in Nairobi, in addition to official legal documents, strategies, and plans for waste management. Then interviews with respondents from four companies working with waste, as well as two individuals with vast waste management knowledge were held, to understand the role of the private sector. The study finds that Kenya and Nairobi have a large body of legislation on waste management, and one of the strictest bans in the world on plastic bags. However, except for the ban on plastic bags, there is generally low levels of implementation and enforcement of the relevant legislation. The private sector plays an important role in managing waste in Nairobi, however a clear strategy and relationship between the public and private sector is needed to ensure the best possible outcomes are experienced for all areas of the city. Awareness on waste and its consequences seems to be on the rise, which is promising for the future waste management in Nairobi, however concrete action is needed for things to improve in the Green City in the Sun.

Table of Contents

Acronyms

AU – African Union
CBD – Central Business District
CBO – Community Based Organization
EAC – East African Community
EPR – Extended Producer Responsibility
GDP – Gross Domestic Product
GHG – Green House Gases
ISWM – Integrated Sustainable (solid) Waste Management
JICA – Japan International Cooperation Agency
MCM – Municipal Council of Mombasa
NCC – Nairobi City County (formerly Nairobi City Council, changed its name in 2010)
NCCSWMA – Nairobi City County Solid Waste Management Act
NEMA – National Environment Management Authority
NGO – Non-Governmental Organization
NMS – Nairobi Metropolitan Services
PBC – Polychlorinated Biphenyls
POP – Persistent Organic Pollutants
PPP – Public-Private Partnerships
SWM – Solid Waste Management
SWMB – Sustainable Waste Management Bill
TISA – The Institute for Social Accountability
UN – The United Nations
WEEE – Waste of Electrical and Electronic Equipment
WHO – World Health Organization
WWF – World Wildlife Fund

1.0 Introduction

Managing (municipal) solid waste is one of the greatest challenges a city of any size faces regardless of its development level. However, less attention is given to this problem compared to many other city management issues (UN-Habitat, 2010). The negative implications of mismanaged solid waste are many and of growing concern in developing countries and their big cities (Njoroge, Kimani, & Ndunge, 2014). Despite the growing concerns, it often seems like the solutions await while the waste is piling up and the problems keep growing.

In the industrialized world, waste collection and management services are often satisfactory, while sustainable disposal opportunities are still lacking. In many countries, waste is generally landfilled instead of being used as a resource. In developing countries, challenges are both related to management, collection, transportation, and disposal. Low collection rates leave a lot of wastes on the streets, while illegal dumping on overfilled, unregulated dumpsites cause many problems for those living nearby the dumping sites. Many African countries, especially in sub-Saharan Africa, are experiencing critical situations where the public sector and local governments fail to deliver functional systems, and waste remains uncollected or improperly disposed. Although the responsibility of management is formally established, those in charge are struggling to fulfill their roles and find long-term solutions to the problems. Because of this, many African countries are facing growing waste management crises (Godfrey et al., 2019). Problems like environmental degradation and severe health issues are common, and it also represents lost economic opportunities (Njoroge et al., 2014; UNEP, 2018). Nairobi, Kenya, is no exception, with a waste management system that does not keep up with its economic development and population growth, causing problems for many of its inhabitants and the environment. Estimates say that as little as 33% of solid waste is collected, leaving the remaining 66% on the street or scattered around the city (Haregu et al., 2017). Of the solid waste that is collected, a majority of it ends up on the Dandora dumpsite, an open, overflowing dumpsite located on 30 acres surrounded by poor areas and slums, causing issues like contaminated water, polluted air, landslides, and degraded environment.

Increased urbanization and population growth coupled with economic growth and more consumption-based lifestyles are recognized as some of the primary sources for the increases in waste generation (UNEP, 2018a). This means that the peak waste generation in the

developing world is still ahead of us, and systems already under pressure will have to tackle much larger amounts of waste in the near future (Godfrey et al., 2019; Hoornweg, Bhada-Tata, & Kennedy, 2015). To avoid a potential full-blown crisis, the issues cannot be ignored any longer and concrete measures must be made and actions enforced.

For this study, I aim to find out what the previous efforts in securing a stable and functioning waste management system in Nairobi have been, and by using a resource regime framework, I will try to pinpoint the main reasons why the efforts have failed. Additionally, I will look at the private sector's role in securing waste management in Nairobi, using the integrated sustainable waste management framework, and which policies and regulations are covering their work and the relationship with the public sector. To answer my questions, I will study secondary sources combined with interviewing some waste companies and waste specialists.

The remaining part of chapter 1 covers the background of waste as a problem and resource, the continental and regional waste outlooks, before the thesis justification, the problem statement, and the objectives and research questions. Chapter 2 and 3 cover the conceptual frameworks and methodology used for the research, while chapters 4, 5, and 6 cover the secondary and primary data results on the three objectives. Chapter 7 is the discussion, and finally, there is the concluding remarks and recommendations for further study.

1.1 Background

For more than a century, we have seen the consequences of our lifestyles in the form of massive waste generation, and our need to handle it has increased (Lovejoy, 1912). Waste is an inevitable result of living, whether it is the food scraps we cannot eat, used equipment from hospitals, or the plastic bag that neatly keeps our lettuce fresh. As human beings live further and further away from nature, our needs can no longer be covered without generating a certain amount of waste. The solutions to handle our waste are essential to protect humans and the environment.

Although waste has been generated for centuries, the composition has changed drastically following economic growth and global development. Going back a few hundred years, human waste consisted mostly of animal and human excrements, soil, water, and other organic matter (Wilson, 2007). Poverty was more prevalent, even for the rich, the resources were scarce, and items were typically repaired when broken. Fast forward to today's developed world, the

population is high, and convenience has taken over. Food items are often individually wrapped in plastic, paper, metal, and mixed materials, and resources are abundant enough for items to be replaced when broken or out of style. This has led to increased waste generation levels, putting pressure on waste management services to keep up with the growing amounts of waste.

Waste as a resource is common in the developed world. Many people work as scavengers on dumpsites, collecting valuable waste to sell to recyclers or others who can reuse the materials (Wilson, 2007). In the developed world, waste is often thought of as garbage or trash, something lacking value, rather than seen as a resource. Although many industrialized countries have established adequate systems for waste management, many countries are still struggling, and the levels of mismanaged waste are high all over the globe. Misplaced or mismanaged waste only contributes to the image of waste as negative or something useless or problematic, and it often represents a lost economic opportunity.

Although many developing countries struggle to manage the increasing amounts of waste, solid waste management (SWM) is often overlooked in tight budgets, and governments prioritize health, education, and clean water before waste management (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018). Local authorities are often in charge of the waste management in their areas, but with lacking public funds, expertise, and capacity, private companies, community groups or individuals are often in charge of removing waste from certain areas, paid by the inhabitants using the service. Poorer parts of the cities are disproportionately affected by this, not being able to pay for waste removal and often involuntarily living in areas surrounded by open dumpsites (Kaza et al., 2018). Open dumpsites cause many problems for people and the environment, yet they are the primary way to 'get rid of' waste in Sub-Saharan Africa. In addition to harming people and the environment, the economic benefits of recycling or reuse are not taken advantage of.

The waste management hierarchy (Figure 1) is commonly used within SWM strategies to establish the preferred order of treatment (UNEP, 2011). The hierarchy was created in the 1970s when the idea of waste as a resource became more central than it previously had been (Wilson, 2007). Ideally, waste is prevented by not creating something that eventually will become waste, which reduces the number of resources needed for both manufacturing of the product and handling of the waste (UNEP, 2011). If it is not possible to prevent waste completely, which often is the case, one should reduce the amount that has to be made through

optimizing the use of resources in order to avoid wasting them. For instance, hospitals, laboratories, and health care facilities are some industries that are dependent on sterile single-use items for safety. On the contrary, items like uncut fruit and vegetables in supermarkets do not need single-use plastics to be safe; hence this waste could be reduced. However, a challenge is that the ones in charge of waste management are rarely in charge of the materials production, and therefore have little power in reducing and preventing waste (Gertsakis & Lewis, 2003). Therefore, to withdraw from the current view that recycling is the best option, there has to be collaboration between different industries, one being the waste management industry and another being the design and production industry, to prevent waste from being created in the first place and to have recycling or material recovery as a solution to the waste that must be generated (ibid). Additionally, legal regulations such as Extended Producer Responsibility laws can aid in reducing waste at its source. Recycling and recovery mean either breaking down an item into its components and using the components as the material in other products instead of using virgin resources, or using the item as it is for a new purpose (UNEP, 2011). E.g., reusing the good parts of obsolete buildings in the construction of new buildings (Kralj & Markič, 2008). Incineration is also a recovery solution, especially if the energy created during the incineration can be used as a replacement for other energy sources like coal or kerosene. Only items that cannot be recycled, reused, incinerated with energy recovery, or otherwise recovered should be disposed of. This could be items that there is no technology to take care of (yet), such as asbestos or other materials with components making them impossible to recycle, incinerate, or otherwise treat.

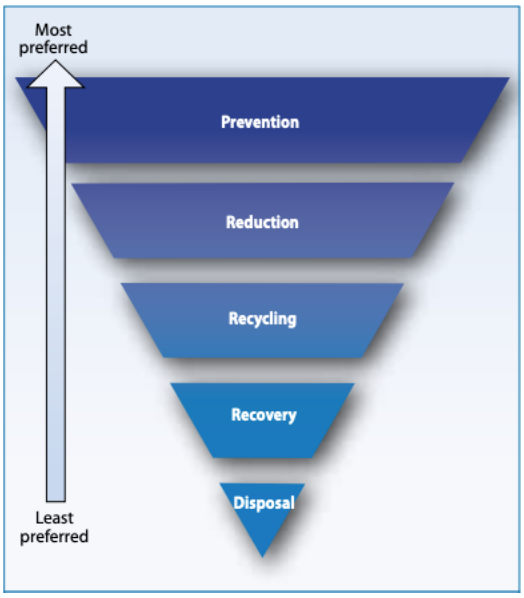


Figure 1. The waste management hierarchy (UNEP, 2011).

Although waste prevention and reduction are the ideal, history shows us that the more economically developed a country gets, the more waste it produces (UNEP, 2018a). Thus, as countries worldwide are improving their development status through increased uses of goods and services, systems have to be put in place to cope with the increasing amounts of waste generated, ideally still using the waste hierarchy as a framework for good waste management solutions.

A significant challenge in finding good systems that are appropriate for their specific location is the lack of data on waste generation and composition. This is an issue in many developing countries, where there is a significant lack of data on waste (UNEP, 2018a). This contributes to inadequate waste management systems since simply copying a system that works in one country will not necessarily contribute to solving the problems in another country. Research and data collection are being carried out, but establishing an extensive database with the relevant data takes time, technology, expertise, and funding; therefore, large databases are still lacking many places.

Waste is not only a local issue in terms of causes and effects, although solutions are often best if sourced locally (Kaza et al., 2018). Mismanaged waste can travel far, causing problems far away from its source. Our rivers, oceans and seas are often the final destination for mismanaged waste, and estimates say there will be more plastic than fish in the ocean by 2050 if measures are not taken (UNEP, 2018b). Waste in the ocean does not solely come from direct dumping in the ocean, but a large part of it comes from waste that is not taken care of on land, either dumped in rivers or waterways or being carried there by wind and rain, eventually ending up in the ocean. Furthermore, large amounts of organic waste accumulated in piles such as landfills emit methane, a greenhouse gas almost 20 times as potent as CO_2, contributing to climate change globally (Kumar, Gaikwad, Shekdar, Kshirsagar, & Singh, 2004). Locally, waste emits toxins harmful to both people and the environment, especially those living near landfills and dumpsites. Groundwater and air get contaminated, directly affecting people in need of the natural resources surrounding dumpsites (ENVILEAD, 2005). Burning of non-organic waste creates toxic smoke harmful if inhaled yet is used by many as an energy source in the home or for cooking (Muindi, Egondi, Kimani-Murage, Rocklov, & Ng, 2014). The complexity of waste and its management combined with the urgency of the problems it causes underline the fundamental need for good governance systems, improved collaboration between national, local, and private initiatives to tackle the issues.

1.2 Definitions

In the literature, the term *waste* is used both widely and narrowly depending on the context. An example of a wide definition is given by Vatn (2015): "… all 'losses' including emissions from combusting engines, factories, mining sites and so on. … [A]ll resources we introduce into the economy, all new compounds that we create from these, become waste at some point" (p. 18). A narrower definition is that *waste* refers to something, an object, a thing, item, or substance that the holder intends to or must discard or dispose of (Pongrácz & Pohjola, 2004; Pongrácz, Phillips, & Keiski, 2004; Stanbury & Thompson, 1995). Some examples of waste are given by the European Communities (1991):

> Q3 Products whose date for appropriate use has expired, Q4 Materials spilled, lost or having undergone other mishap, Q6 Unusable parts, Q7 Substances which no longer perform satisfactorily, Q14 Products for which the holder has no further use (e.g. agricultural, household, office, commercial and shop discards, etc.)" (No L 78/36).

Covered by these definitions and examples are most of the items discarded from households, shops, industries, hospitals, etc. that we think of as either *waste, garbage, trash,* or *refuse* today.

Municipal solid waste is defined by (UN-Habitat, 2010) as:

> … wastes generated by households, and wastes of a similar nature generated by commercial and industrial premises, by institutions such as schools, hospitals, care homes and prisons, from public spaces such as streets, markets, slaughter houses, public toilets, bus stops, parks, and gardens (p. 6).

However, wastes of hazardous or chemical nature stemming from some of the sources mentioned above, such as hospitals, care homes, and industries, are not defined as municipal solid waste. Depending on the city or country, municipal solid waste can include hazardous waste from households, such as batteries, paints, lightbulbs, etc. Although a definition by UN-Habitat is suggested, many cities, counties, or municipalities might have their own definitions of municipal solid waste according to the systems they have for handling the waste. In Nairobi, the *Nairobi City County Solid Waste Management Act* (2015) clarifies the different definitions of waste according to their management systems. *Municipal waste* is defined as "everyday waste items generated by commercial establishments and households" (p. 4), *solid waste* is

defined as "any waste in solid forms which is deposited in the environment in such volumes or composition likely to cause an alteration of that environment" (p. 5), and *solid waste management* is all "the activities, administrative and operational, that are used in the handling, packaging, treatment, conditioning, reducing, recycling, reuse, storage and disposal of the solid waste to protect the environment against the possible resultant adverse effects" (p. 5). Industrial solid waste, junk waste, market waste, hazardous waste, e-waste, biomedical waste, clinical waste, and agricultural waste are defined as different types of waste in the Act. For this paper, I will be looking at municipal solid waste, which matches the definitions by UN-Habitat and the Nairobi City County Solid Waste Management Act, of general waste from households and public spaces, not including hazardous or chemical wastes.

1.3 Global and continental conventions, treaties, and declarations

In 2013, the African Union presented a 50-year plan for a prosperous and developed continent, *Agenda 2063: The Africa We Want* (2015), ratified by all Union members[1]. Agenda 2063 is the plan that will guarantee sustainable development on the African continent, ensuring that its role as a 'powerhouse' will be established by 2063. Waste management and lack of recycling are recognized as problems in the First Ten Year Implementation Plan; therefore, it presents a goal of at least 50% recycling in cities across Africa to be included in the agenda.

Agenda 2063 builds on several other declarations, conventions, and treaties. Beginning with the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, 1989[2] (UNEP, 2018c) that came into force as a result of the discovery that many African countries were the final destination for toxic items from the western world, causing problems for humans and the environment. In the 1970s and 80s, environmental awareness started spreading across the Western world, and disposal of toxic and hazardous waste became more difficult. As a result of this, countries in Africa and Eastern Europe where environmental awareness and policies were not yet well-established, regulations were not as strict, and costs of dumping low became the 'dumpsite' for hazardous waste from the industrialized world. The Basel Convention intended to end this "toxic trade" (Basel Convention, n.d., p. 1), but it turned out to be difficult. The Basel Convention did not manage to altogether prohibit the export and import of hazardous waste to less developed countries, and many countries kept trading these

[1] The 55 Member States: 54 African countries plus Western Sahara (Sahrawi Republic) (African Union, 2020).
[2] Starting from January 1st, 2021, some types of plastic will also be included in the Basel Convention (Basel Convention, 2019).

goods, causing severe problems in the countries where the waste ended up. As a result of this, the *Bamako Convention on the Ban of the Import into Africa and Control of Transboundary Movement and Management of Hazardous Wastes within Africa* was negotiated by 12 African Union nations and came into force in 1998 (UNEP, n.d.). The Bamako Convention had a much stricter prohibition of trade and import than the Basel Convention, not allowing for exceptions to certain wastes and specific agreements[3] as the Basel Convention did. The countries signing the Bamako Convention had to prohibit the import of hazardous and radioactive waste, as well as dumping of waste in bodies of water and incineration of hazardous waste. Furthermore, in 2001, *The Stockholm Convention on Persistent Organic Pollutants* was adopted to protect humans and the environment against pollution from chemicals that were improperly disposed of (UNEP, 2017). Similar to the Basel and Bamako conventions, the Stockholm Convention prohibited import and export of chemical waste, as well as the production and use of Persistent Organic Pollutants (POPs) and the sound management of waste contaminated with POPs. The trade of chemical waste had reached a point where it was recognized as a global problem that required effort from governments around the world to be managed (UNEP, 2019).

Despite the claims that the Basel Convention did not manage to prevent the import and trade of hazardous waste, the parties of the Basel Convention met in Bali in 2008 and signed the *Bali Declaration on Waste Management for Human Health and Livelihood*, reaffirming the commitments to the Basel Convention, sustainable development, and the Stockholm Convention. The Bali Convention aimed to gain support and enhanced implementation in preventing the trade of hazardous waste, seeing as the challenges related to waste and the environment kept increasing despite previous conventions, treaties, and protocols.

Also in 2008, the *Libreville Declaration on Health and Environment in Africa* was signed by all 53 African countries[4] reaffirming their commitment to all former declarations, conventions, and treaties concerning environmental and health-related issues, such as the Bamako Convention, Stockholm Convention, Bali Declaration, as well as the UN Millennium Development Goals, among others (WHO African Regional Office, 2008). Simultaneously, the declaration calls for support to the African countries in implementing the Libreville Declaration

[3] Article 11 of the Basel Convention encouraged countries to make agreements, bilateral or multilateral, on hazardous waste, something that allowed the trade of waste to continue.
[4] In 2008, Africa consisted of 53 countries, as South Sudan officially became the 54th country in 2011 (Central Intelligence Agency, 2020b).

both from the UN, donors, and partners to secure the development needed to implement the declaration.

Furthermore, the East African Community[5] (EAC) launches its *East African Community Development Strategy* every five years, mapping out the plans for development in the region. The strategies outline goals and targets on different development indicators to secure development of the region. Already in the early strategies, actions regarding waste were considered required, recognizing the problems caused by the trade of toxic waste (East African Community, 2001). This was after the Basel and the Bamako Conventions were ratified, underlining the fact that the conventions had little effect in reducing the trade of waste. This focus on the challenges lasted through the Third Development Strategy from 2006. However, in the Fourth Development Strategy, environment and natural resource management received its own section, and the focus on waste management here exceeded illegal trade of waste. Waste management is recognized as being underfunded, lacking priority, generally offering poor services and insufficient facilities to handle waste in a sanitary way, causing development problems in East Africa (East African Community, 2011). The fourth strategy includes priority interventions for the following period, with the goal of "harmonization of policy interventions on the management of plastics and plastic waste and establishment of an electronic waste management framework" (East African Community, 2011, p. 65). The targets for this goal are to put in place a "regional policy on management of plastic and plastic waste" by 2014 and to develop "an EAC electronic waste management framework" by 2014 (East African Community, 2011, p. 148). However, in the fifth development strategy, it is stated that some of the main challenges within the environment and natural resource goals have been the "lack of supportive policies and institutional frameworks" (East African Community, 2018, p. 44). Despite the lack of support, a bill (pushed for by Rwanda) was passed by the East African Legislative Assembly in 2011, regulating the use of polythene[6] materials in the East African Region. The bill caused a frenzy in some of the EAC countries, especially Kenya, as stopping the production of polythene materials would negatively affect people working within the industry. Kenya did, however, ban plastic bags in 2017 (NEMA, 2017), but as all countries in the region have not signed the bill yet, it is currently not a law for the entire region.

[5] An intergovernmental organization consisting of Burundi, South Sudan, Uganda, Tanzania, Kenya and Rwanda (East African Community, 2020).
[6] A certain type of plastic often used to make plastic bags and food wrapping (Grover, Gupta, Chandra, Kumari, & Khurana, 2015).

Although there are many treaties, conventions, and declarations mainly focusing on the negative implications following the trade of waste, the waste problems are not yet under control. During the past couple of decades, the generation of Waste of Electrical and Electronic Equipment (WEEE), also known as e-waste, has increased at alarming levels (Shamim, Mursheda, & Rafiq, 2015). Technological innovations and items have become essential parts of our lives, and with the rapid development of technological items, they equally fast become obsolete and need to be disposed of. Although we do not know the exact numbers on how much e-waste is generated, estimates reported around 50 million tons in 2015, and that up to 80% of the e-waste generated globally is sent to developing nations to be 'recycled'. Some of the countries in sub-Saharan Africa identified as locations for e-waste are Ghana, Nigeria, and Kenya, where the systems for handling hazardous waste are generally inadequate or even non-existent (Gibbs, McGarrell, & Axelrod, 2010; Shamim et al., 2015). Despite being illegal under the Basel Convention, the trade is highly profitable, causing many to participate and consequently leaving the major environmental and health impacts to the people who are not responsible for this waste generation (Gibbs et al., 2010). Additionally, many of the people that exploit the possibilities of profit within the waste trade sector take advantage of the difficulties concerning regulating transnational trade. Lack of proper infrastructure to handle illegal actions is combined with cases where the officials in charge of preventing the illegal activities are, in fact, those allowing and facilitating the activities. Therefore, the globalized trade system is effectively contributing to this trend by creating several incentives for those who want to participate in illegal activities (Gibbs et al., 2010).

1.4 Continental and Regional outlooks

The *Africa Waste Management Outlook* (2018), a report by UNEP and *What a waste 2.0* (2018) by the World Bank, present some of the most recent data on waste in Africa, although data is still limited for the continent. There are large variations within the continent from waste generation per capita to waste collection rates. The main similarities within the continent are that the average waste generated per person is way lower than for other parts of the world, the majority of waste created is disposed of in open, unregulated landfills or dumps, the composition differs from industrialized countries, and the large informal sector. The use of open, unregulated landfills is one element that contributes to the lacking data from the continent. As waste is dumped without regulations, no registration is in place to monitor *how much* waste is actually being dumped and what it consists of.

1.4.1 Waste generation

As data on the subject differs depending on methods, population, time frames, etc., numbers on how much waste was generated on the continent also differ. In 2012, estimates say that sub-Saharan Africa generated somewhere between 62.0 and 81.0 million tons, while the whole African continent in total generated around 125.0 million tons of municipal solid waste (Hoornweg & Bhada-Tata, 2012; UNEP, 2018a). As the African continent is generally divided into North-Africa and the Middle East, and sub-Saharan Africa, exact numbers for the whole continent can be hard to pin down. For this chapter, I look at sub-Saharan Africa only.

Globally, each person generates 0.74 kg of waste per day on average, while in sub-Saharan Africa, the average is at 0.46 kg/capita/day (in comparison, Europe is at 1.18 kg/capita/day and North America at 2.21 kg/capita/day). The total waste differences waste within sub-Saharan Africa are large, ranging from 0.11 kg in Lesotho to 1.57 in the Seychelles (Kaza et al., 2018). The different consumption patterns and types of waste between countries can be explained by factors like tourism, culture, attitudes, economic and political situations, income levels and distribution, and how much data can be gathered and how well research is carried out. The differences can also be large within a country, with lower amounts of waste generated in rural than urban areas. In 2016, sub-Saharan Africa generated 174 million tons of waste, an increase of nearly 100 million tons since 2012 (Kaza et al., 2018). The large growth can be explained by different methodologies and more data availability and actual increases in waste generation. The amount of waste generated per capita remains the lowest in the world, at less than one kg/capita/day, with lower waste amounts in rural areas and higher in urban areas.

1.4.2 Waste composition

The composition of the waste generated in Africa also differs from the global averages. In 2012, the amount of organic waste was the largest of all components at 57%, something that is common in countries at a development stage (UNEP, 2018a). The other fractions are relatively low, with plastics and other at 13% each and paper at 9%. In 2016, the largest component of the municipal solid waste generated in sub-Saharan Africa was still organic wastes, at an average of 40%, according to Kaza et al. (2018). The decrease can be explained by an actual decrease caused by changing consumption patterns as a consequence of economic development and by differences in data collection and methods. The category ‘other’ has grown to 30%, paper to 10%, and plastic reduced to 8.6%. ‘Other’ consists largely of inert waste, which is non-biodegradable, non-chemical, and non-recyclable, e.g., concrete and other building

materials. Organic waste is the largest component, and despite being both biodegradable and 'natural', it causes problems when it is not appropriately handled. A high share of organic waste left to degrade in an unregulated dumpsite causes high emissions of methane, a greenhouse gas created when organic materials decompose (Kaza et al., 2018; Niskanen, Värri, Havukainen, Uusitalo, & Horttanainen, 2013). Like the other fractions, organic waste should be used as a resource through recovery, such as composting or creating biogas, contributing to improved soil and farm output, and increased wealth (Cerda et al., 2018; Wei et al., 2017).

1.4.3 Waste collection and disposal

Regardless of how "easy" something is to recycle or reuse, lacking waste management services is common on the African continent. The responsibility of waste management services is often the local governments or municipalities, still, a lack of finances and expertise on the subject leads to low collection rates and even lower recycling rates. In 2012, it was estimated that 55% was collected on the African continent, and only around 44% of waste was collected in sub-Saharan Africa, of which approximately 4% was recycled (UNEP, 2018a). In 2018 the collection rate estimate was still about 44%, but the recycling rate increased to 7% (Kaza et al., 2018). The rest of the waste was left on the streets, dumped illegally, dumped on open dumps, sanitary landfills, or burned openly (Hoornweg & Bhada-Tata, 2012). Waste management is commonly a large part of a governmental budget, and for low-income countries, as much as 20% to 50% of the budget can go to waste management solutions but without the results to speak for the budget share (Kaza et al., 2018; UNEP, 2018a). The lack of results often leads to private companies working to collect waste in areas where the inhabitants can afford to pay for the collection. Therefore, waste collection is contributing to creating further strain on poor neighborhoods and people by forcing them to live side by side with waste. Youth groups, community-based organizations or individuals often take matters into their own hands, by cleaning up dumpsites or scavenging for valuables, without proper protective gear, exposing themselves to hazard. Having no adequate collection systems also forces people to find their own ways to dispose of waste, such as in rivers and streams. As the waste composition is increasingly consisting of less organic material and more plastic and other non-biodegradable items, pollution as a consequence of this dumping are very high both in the form of chemicals from the waste and from the waste itself as it clogs rivers and streams and eventually ends up in the ocean. Improving waste collection systems is an important step in securing people's health and reducing pollution (Kaza et al., 2018).

Globally, around 70% of waste ends up in landfills or open dumpsites (Kaza et al., 2018). Some landfills are regulated, have gas collection, and are covered both underneath the waste and above it. Yet the majority is not controlled or sanitary, leaving it to cause significant consequences for nature, the environment, and those living close to the landfills. In sub-Saharan Africa, 69% is disposed of on open dumps and around 24% on landfills (ibid.). There are variations between countries and cities, where cities, in general, have better systems than rural areas, and higher-income countries have better systems than lower-income countries. Still, the general overview is bleak regarding sustainable waste management.

1.4.4 Future waste and population estimates

In sub-Saharan Africa, economies are developing, consumption patterns are changing in size and composition (becoming more modern), and populations are growing. The World Bank estimates that "more than half of the world's population growth" (Kaza et al., 2018, p. 76) until 2050 will occur in sub-Saharan Africa, while the peak will occur around the year 2100. The waste generation is estimated to quadruple in the same period, reaching its peak generation at the same time as the population peaks, the year 2100 (Hoornweg et al., 2015). A potential consequence of this growth is that the crises that are now just starting to develop and evolve will become major disasters if they are not dealt with promptly.

1.5 Justification for thesis

The population growth in Kenya and especially in Nairobi, is high, at 3.88%, which is more than three times the average global population growth (World Population Review, 2020). According to the World Population Review's estimates, Nairobi will be home to a population of 5.7 million in 2025 and 8.5 million in 2035, creating enormous pressures on resources, space, and the already struggling waste management systems (ibid.). This population growth will cause a corresponding growth in waste generation with the estimated waste peak in the year 2100, and to avoid further health and environmental problems; the SWM systems should be to be improved. Waste management in Nairobi has been a well-known problem for many years, stated by international organizations, the government, and its people, and by personally having spent time in Nairobi, I can say the problems of mismanaged waste are clearly visible. Kenya has both signed multiple agreements, agendas, conventions, and strategies over the past few years, as well as developed their own large body of legislation on the matter. Yet, visible progress on the situation is missing. Some of the SWM targets set in the *Integrated Solid Waste Management Plan for Nairobi* in 2009 were a 95% collection rate and full closure of all illegal

dumpsites by 2020 (Blottnitz, Kasozi, & Cohen, 2010). Additionally, in 2014, *The National Solid Waste Management Strategy* was published with goals such as following the Zero Waste Principle, have an 80% material recovery rate, and only leave 20% to landfills by 2030 (National Environment Management Authority, 2015). Despite the clear goals, physical action to reach them has been missing, and therefore, none of the above-mentioned goals were achieved by 2020.

Kenya in general and Nairobi specifically are far behind on their own plans on improving the SWM systems, and there is a striking inconsistency between goals, plans, and actual action taken. Furthermore, there seems to be a lack of legal consequences for continuously not following plans or reaching goals. Various research has carried out on the situation and how it affects the environment and people's health, underlining the urgency of the situation. Studies have been done by organizations such as Japan International Cooperation Agency, UNEP, UN-Habitat, as well as scientists and students. Issues have been pointed out, and ways forward have been created. In 2015, Kenya signed both the SDGs and the Paris Agreement, in which issues related to waste management are also covered as targets to work towards. There is therefore no doubt that there is knowledge and awareness of the problem, and given the strategies and plans being made, there are likely some expectations of results.

The national government did pass a plastic bag ban in 2017 and has ensured it is being enforced throughout the country. Additionally, a new Act on waste management was enacted in 2019, creating a clear framework for the way forward. The recent efforts put in place have the potential to be the beginning of reversing the waste crisis. Furthermore, the latest governor in Nairobi (inaugurated in 2017) made some new efforts to engage the public in cleaning up Nairobi, e.g., through monthly clean-up events, as well as making SWM more of a priority for the local government (NCC, nd).

Furthermore, as the private sector is a large part of Nairobi's waste management system, evaluating their role and possibility to scale up is important, considering their potential to help solve the waste management problems in the long term. The private sector is growing, from being only informal around the early 2000s to being registered companies having contracts with the government now. In 2013, the Public-Private Partnerships Act was enacted to promote Public-Private-Partnerships (PPPs) in Kenya, where private companies perform a public service based on a contract between the two parties (Ombaba, Arogo, Murey, & Kipngetich,

2014). This should have allowed for more companies to formalize within the waste management business, as there is still room for multiple companies to handle waste in Nairobi.

This research aims to use a resource regime framework to look at why the current waste regime is not effectively solving the recognized waste problems. This is combined with looking at the role of the private sector through an integrated sustainable waste management framework to understand the importance of their contribution to SWM in Nairobi and to see if they are potentially the solution to the many waste-related problems.

Nairobi is a good example of a city in a less developed country that is likely to see a large growth in the coming years, with all the challenges that follow. It is experiencing many of the typical issues developing countries face relating to improving SWM systems, such as lack of concrete action taken, low oversight of the current situation, lack of funding, and a large private and informal sector taking matters into their own hands. Analyzing the situation through a resource regime framework can potentially point out some critical problems hindering the progress, which can contribute to a larger research base on solid waste management problems in developing countries.

1.6 Problem statement

In this thesis, I aim to present an analysis of the so-called waste regime in Nairobi, Kenya. Waste is the resource, and the regime is how the resource is being managed. Though using a resource regime framework, I aim to demonstrate that the current waste regime is not effectively improving the waste management situation in Nairobi, instead it is consolidating the current, problematic situation, and consequently, waste as a resource is still unexploited. I will look at factors like attributes of waste, agents of the waste regime, institutions, patterns of interaction that all lead to the outcomes of the current regime: health problems, untapped economic resource, and a degraded environment. All of which are contributing to Nairobi's reputation as the "the Green City in the Sun" (UN-Habitat, 2010, p. 73) to slowly diminish.

In this study, I aim to firstly analyze the previous governmental efforts on establishing a well-functioning waste management regime for municipal solid waste and look at why they have not worked out. Secondly, I will examine the role of the private sector in ensuring their success, and finally, I will assess the most likely future scenarios for household waste management in Nairobi.

1.7 Objectives and research questions

Objective 1. Analyze the Solid Waste Management initiatives for household waste management implemented by the national and local government.

RQ 1: What are the attributes of the waste resource and which technologies are available for its utilization in Nairobi?

RQ 2: Which agents are involved in planning and enforcing waste management systems and what are their motivations?

RQ 3: Which institutions are established to ensure household waste is collected and disposed of in a way that does not harm humans and the environment?

RQ 4: What are the outcomes of the initiatives, caused by the patterns of interaction, and how do they affect choices concerning politics and the economy?

Objective 2. Examine the role of the private sector in currently managing and recycling the household waste in Nairobi, and in solving the growing problem of mismanaged waste.

RQ 1: How are the private companies included in the SWM system, and what are their prospects for expanding?

RQ 2: Which of the Waste System Elements do the private sector handle, and are there any regulations protecting the health of the workers and the environment?

RQ 3: What are some of the main issues the private sector experiences in performing their work?

Objective 3. Investigate which solutions are most likely going to solve Nairobi's problems with household solid waste management.

RQ 1: Which issues are currently the main challenges in ensuring a well-functioning waste management system in Nairobi?

RQ 2: Which recommendations are there for solving Nairobi's waste management problems?

RQ 3: Which future scenarios are currently most likely for Nairobi?

2.0 Conceptual frameworks and literature

2.1 Environmental governance and the resource regime framework

Analyzing the waste management initiatives in Nairobi and the role of the private sector demands a conceptual framework to better understand how different aspects of waste management relate to each other. As established above, waste can be seen as an important resource that should be used at increasing rates instead of using virgin raw materials, it is therefore beneficial to use a resource regime framework for analysis. Although waste should not be characterized as a natural resource, it is a valuable economic resource that should be managed properly both to minimize the negative effects it causes and to maximize the potential use of waste as a resource adding to the welfare of the nation.

To understand how the resource regime framework fits into a larger system of environmental governance, it is relevant to very briefly look at what environmental governance entails. Governance refers to how something is managed, coordinated, or controlled and how priorities and goals are formulated (Vatn, 2015). Environmental governance is the "use, management and protection of environmental resources and processes" (Vatn, 2015, p. 134). As there are many different interests regarding using and protecting natural resources, the issue of environmental governance can lead to conflicts concerning whose interests to protect, what values to create and protect, who can use the resource, how can the resource be used, - in short: all assets and outcomes. Many different actors can be involved, making the issues of environmental governance complex and decision-making more difficult.

Below is the model for analyzing resource regimes (Figure 2). Waste is not like a natural resource that is likely to be depleted any time soon, but it is an economic resource that affects humans and nature. If it is managed well, it can provide economic outputs in the form of job generation and materials to be used in production, and it can have limited negative environmental and human impacts. Furthermore, the fact that the resource is unintentionally unused when it could provide a useful resource, indicates an inefficient regime for the type of resource and an analysis of the resource regime currently in place is sensible (Vatn, 2005).

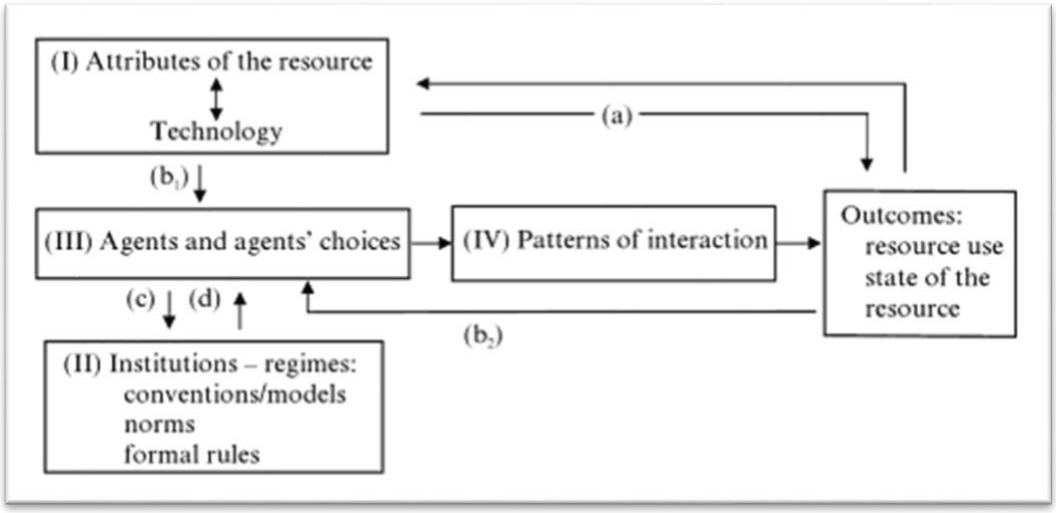


Figure 2: Resource regime model. (Vatn, 2005, p. 283).

Looking at the model, there are four elements in play regarding the resource and how human interaction affects the resource (Vatn, 2005, p. 283). Firstly, the attributes of the resource (I) and the existing technology for using the resource have to be established. This step means looking at the components, scarcity or abundance of the resource, and the human capacity and competence for utilization. A vast resource might not need regulation for its use and access, but in the case of waste, although it is a vast resource, access regulation is still important because the components of the waste are many and potentially dangerous and should therefore not be freely accessed by those who do not have the appropriate technology to handle it. Regulations are therefore needed for the result to be economically sound and environmentally sustainable.

Secondly, the institutions or regimes (II) relevant to the resource should be outlined. Institutions, according to Vatn (2015), are constructed by humans and define how we interact with each other. He defines institutions as "the conventions, norms, and formally sanctioned rules of a society. They provide expectations, stability, and meaning essential to human existence and coordination. Institutions support certain values and produce and protect specific interests" (Vatn, 2015, p. 78). Therefore, conventions, norms, and formally sanctioned rules (laws) regarding waste and its management have to be outlined, to understand how they affect decisions made at higher levels regarding waste management and also by people and their actions regarding waste. Concerning the rules and regulations, these are different depending on the resource in question, as the different attributes of the resources define which rules and regulations are relevant. Some rules of relevance to waste management are property and use

rights. These define access, withdrawal, management, exclusion and alienation rights of the resource. The first two concern who can enter a specific property and who can take and use the resource (e.g., recyclable plastic). The next two concern who *decides* who has access and how the use is regulated, and the last aspect covers who is entitled to sell or lease the rights. In the case of SWM in a developing country this narrow definition of who has physical access and who defines this access is relevant because of the role of the private and informal sector in SWM, where especially the informal sector is based on scavenging waste piles for valuables to sell. This also ties into the types of property that exist. The four main types of property are private, common, state and open access, and are normally defined legally (Vatn, 2015). This can determine who can use the resources on the property and how, based on which outcomes follow the different types of property.

Thirdly, we have agents and agents' choices (III). This factor concerns agents' motivations, which are affected by several factors such as institutional structures, technology, the resource itself, costs, interests, profits, and values. Under this element, all factors affecting choices have to be considered, as a regime might be correct for the resource, but if agents can break the rules because the costs of doing so are lower than the benefits, then the regime has to be reconsidered. A regime where the rules are broken often has low validity causing it to not function in the long term. One especially relevant factor to consider regarding agents' choices, is bad governance issues such as corruption and power misuse (Vatn, 2015). The problem with corruption is and has been pervading governments and authorities of developing countries for years, effectively preventing policies from functioning despite proper planning.

Fourthly, there are patterns of interaction (IV). These can cause issues based on the choices made by the different agents, the attributes of the resource, or the institutions. If " … the regime is not able to motivate coordinated action in accordance with what is demanded given resource characteristics, technology and the number of agents" (Vatn, 2005, p. 285) problems will present themselves, eventually causing the regime to fail and the resource to not be managed properly. A new regime may be established to manage the resource, but if the issues with the different elements of the regime are not analyzed and problems solved, the regime will continue to fail.

Finally, we have the outcomes of the model. The outcomes are the state and use of the resource in the regime and their development, the distribution of income, and the economic output,

which are likely to affect choices concerning politics and economy. The desired outcomes should be the baseline for establishing the proper institutions, however the actual outcomes might still not match desired outcomes. This can be because the characteristics of the resource and the problems it creates are not correctly considered when establishing the institutions. It could be related to the general economic situation and that it promotes economic growth and thereby the environmental consequences that naturally follow economic growth. It could also be related to lacking capacity to change or adapt to new institutions, in which new actors might have to be introduced.

When evaluating the effects of policies implemented to make a change, it is useful to look at certain criteria for evaluating the outcomes. According to Vatn (2015), legitimacy is a useful baseline for evaluating governance structures and can, therefore, be useful for evaluating policies. The criteria he uses for evaluation of the outputs are distributive justice – how total costs and benefits are produced and distributed, effectiveness – if the policy is effective in reaching the goal, and efficiency – the goal is reached through the lowest cost possible.

If the outcomes are not as expected or not accepted, agents can try to influence or change the structures of the institutions on any level, norms, conventions, or formal rules. However, for changes to happen the problems have to be recognized from the inside, and the correct causes for the problem have to be identified, such as if it originates at the institutional level (Vatn, 2015). The urgency of the problem and the need to solve it is also related to power and who the problems affect, and change is likely to be influenced by who the negative outcomes affect the most. If the powerful (this could for instance be the rich) are those suffering the negative (or unacceptable) consequences it is likely that the change will seem more urgent than if it is the powerless (e.g., poor) that are affected.

“Environmental problems are, to a large extent, the result of institutional structures that motivate choices that are bad for our environments” (Vatn, 2015, p. 187). Changing these structures demands a lot of difficult work and is challenging how the current systems are protecting certain interests in their development path. Therefore, although changes in institutions can be helpful, it is time consuming and if not approached with the pursuit of actually achieving an outcome that is positive for both humans and the environment, the same issues might resurface in any new regime.

2.2 Integrated Sustainable (Solid) Waste Management framework

In addition to the Resource Regime framework, I will use the Integrated Sustainable Waste Management framework to look at the role of the private and informal sectors in managing waste in Nairobi. The private sector is one of several actors within waste management in Nairobi, therefore, by using this framework as a complementing framework, the elements and aspects of the waste collected and treated in Nairobi by private companies can be analyzed in more detail, helping explain the importance of their function in managing waste in Nairobi.

The Integrated Sustainable (solid) Waste Management (ISWM) framework was created by the Dutch NGO "WASTE" as a solution to the endless process of external consultants from industrialized countries trying to fix the waste management issues in developing countries without notable success (Anschütz, IJgosse, & Scheinberg, 2004). ISWM is intended to assess the SWM situation in urban areas but can also be used in other areas that have waste management as a central problem. When using the framework and assessing the situation in a city, the focus should be on all aspects of the current situation and the conditions of each situation that can make them very different from industrialized countries. The solutions presented have to be technologically, economically, and socially appropriate, acceptable, and possible for the city in question. Different from many other SWM assessments, is the role of the stakeholders in the ISWM approach. In the ISWM approach, the stakeholders play an important role in evaluating the current system, making decisions regarding the actions needed to improve the system, and then implement the changes and put them into action (Anschütz et al., 2004).

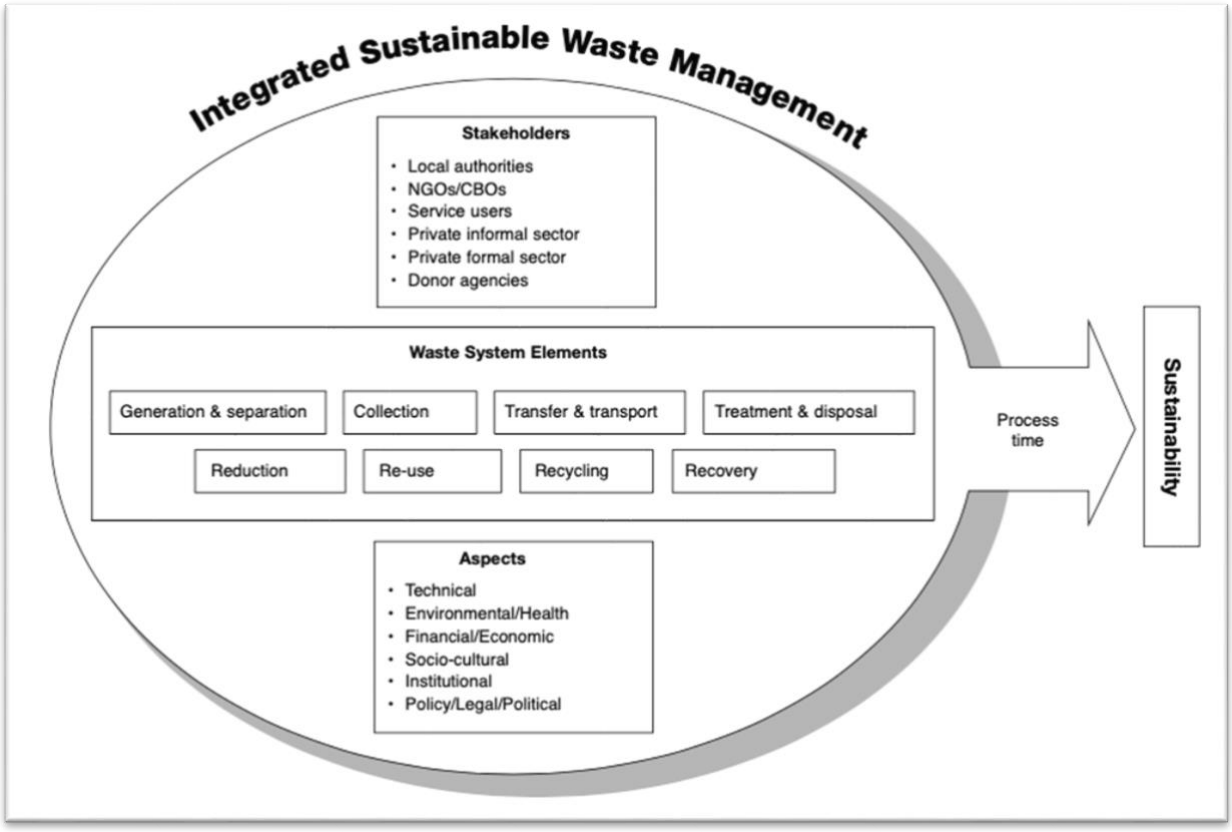


Figure 3: Integrated Sustainable Waste Management model (Anschütz et al., 2004).

The ISWM framework identifies three core dimensions in SWM (Figure 3), namely the *stakeholders*, the *waste system elements*, and the *aspects* of the local context (Anschütz et al., 2004). The stakeholders are both those who are involved in performing waste management tasks and those who are affected by the waste management services in place. As each local system is different, the stakeholders involved have to be identified for each new assessment. The goal for the stakeholders is to agree on a shared purpose and to collaborate in order to achieve it. The waste system elements are the technical and practical elements of the waste system itself, the final steps in material life cycles. These elements describe the steps of handling waste, from collection to disposal. The waste management hierarchy (Figure 1) is an integrated part of the ISWM framework under the waste system elements dimension, where the prevention and reuse of waste are preferred, and disposal of the pure waste is only used when nothing else is available. Although desired, it is rarely put in practice. The third dimension is the sustainability aspects of waste management, where each aspect represents a lens to assess the current waste management system and plan a new system through. The aspects include the factors that affect solid waste activities and combined they make up and affect the entire system's sustainability.

The outcomes of an ISWM assessment can be used for different purposes depending on who is carrying out the assessment. E.g., issues relating to political decisions on waste management can be pointed out, a project and its results can be evaluated, a strategic planning process can be started from the results of the assessment, data can create a base for future research and projects, etc.

2.3 Empirical literature on SWM in Kenya

Some studies on waste mismanagement in Nairobi have been done, such as one by Henry, Yongsheng and Jun (2006), looking at the challenges with waste management in Kenya. Through analysis of secondary sources and interviews with key informants from different public administrations they found that one of the main reasons why waste management in Nairobi is not working well, is that local authorities have an imbalance in workers, funding, and training, with too many workers, no funding left for SWM, and poor training of the workers hired. This causes low capacity for implementing the legislation on SWM, a lack of capability to handle issues adequately when they arise, and a lack of consideration of environmental and social impacts in choosing dumpsites (Henry et al., 2006). E.g., they found that problems such as a flat tire in one of the collection vehicles could take that vehicle out of business for several weeks due to lack of funding and without being able to replace it with another vehicle in the waiting period. Rapid population growth enhances the problems that already exist by putting more strains on an already stretched capacity while at the same time contributing to the increasing generation of waste. They also found that the higher-income areas and the Central Business District (CBD) have the best collection rates, while the poor areas, shanties, and slums are the ones suffering from both the lowest collection rates and the highest negative impacts from waste such as polluted groundwater (Henry et al., 2006).

This is supported by a study on contamination of chicken eggs carried out near the Dandora dumpsite in Kenya (ENVILEAD, 2005). Dandora is a poor area in Nairobi, and the inhabitants there are suffering the consequences of the unregulated landfill. The study found that the eggs had six times higher levels of dioxins than the limit set by the European Union, and polychlorinated biphenyls (PBCs) four times the limit. Dioxins and PBCs are persistent organic pollutants (POPs) that should be regulated under the Stockholm Convention, but that can still be found in many places where waste dumping and burning are unregulated. The egg example is one of several examples that underline how problems caused by waste often hit the poor disproportionately hard.

Pollution caused by mismanaged waste is a fairly researched topic in Kenya in general and Nairobi specifically, especially looking at its effect on the poorest people in the city. A study on the effects of air pollution on the people living in the Kibera slum in Nairobi found that there was varied knowledge about both the sources and the consequences of air pollution, and the potential to do something about it (Muindi et al., 2014). Even those who knew about the consequences of air pollution would keep working as scavengers on dumpsites or other polluted areas and keep cooking with kerosene without ventilation because of other factors more important to them than the air pollution. This is similar to the results of a study by Egondi et al. (2013), finding that awareness of air pollution was in general low in the slum areas, despite being the areas with the highest levels of air pollution. Lack of education was the main reason for the low awareness, a common trait among the inhabitants in the slum areas.

Another study on the consequences of lacking SWM in Kenya has for instance found high levels of pollution in the Nairobi River caused by illegal dumping of waste and wastewater near or directly in the river (Ngumba, Gachanja, & Tuhkanen, 2016; Njuguna, Yan, Gituru, Wang, & Wang, 2017). The river meets with other water bodies that are important sources of irrigation and domestic water for many people living in Nairobi, mainly poor people, despite not being within the limits of drinking water set by WHO (Ngumba et al., 2016). The dumping is a result of rapid population growth and rural-urban migration combined with poor infrastructure development, where especially the informal settlements suffer from the negative consequences.

Some studies that have been done on the state of the SWM situation in other cities in Kenya find the same issues as in Nairobi, poor collection opportunities, illegal dumping, and unregulated dumpsites and incineration. A study from Kisumu finds that uncollected waste is an increasing problem in the city, but that little is done by the local authorities to reduce it (Munala & Moirongo, 2017). Additionally, there is little knowledge among the citizens about waste, its negative consequences when improperly handled, and its potential as an economic resource. A master thesis study from Mombasa finds that around 60% of waste is being collected, while the recycling levels are insufficient (Maloba, 2012). Dumping is commonly done on illegal dumpsites or unregulated landfills. The citizens expect the Municipal Council of Mombasa (MCM) to provide collection services, while the MCM is denied the opportunity to choose their own strategies for SWM because of national government legislation (ibid.). A study from Eldoret found that lack of resource capacities such as ICT, finance, and logistics

combined with a lack of human resources caused the SWM situation in Eldoret to not function (Ombaba et al., 2014). Their suggested solution is to engage in Public-Private Partnerships (PPP) with companies that have strong resource capacities.

Several of these studies on SWM systems in Kenya mention the fact that the poorest people often are those experiencing most of the negative effects of mismanaged waste, such as polluted water, air, and food, as well as the general issue of living next to a landfill. Additionally, the poorer areas are generally underserved when it comes to collection services, forcing them to live side by side with waste or take action themselves. Waste pickers or scavengers are in general people from poor families and neighborhoods, making a living from picking waste that can be sold to brokers or middlemen but is by many seen as nothing but a nuisance making problems rather than helping to solve them (Amugsi et al., 2016). Furthermore, they are, in general, looked down upon by many and even seen as dirty because of their job, despite their contribution to increased recycling. One study on the economic impact on families relying on waste picking found that the income generated from waste picking and recycling was very important to the families and helped provide money for education, food, housing, and health expenses (Wangatia, 2014). However, as mentioned by a respondent in Amugsi (2016), if it were possible, they would prefer to change their job. It is well known that there are health risks involved with handling waste, especially waste that includes both hazardous, chemical, and other types of waste. This is also more likely to affect poor people as they live closer to dumpsites, experience more waste on the streets, and are more likely to work within informal, unregulated waste management (Egondi et al., 2013; Muindi et al., 2014).

Common for all the studies is the lack of functioning SWM systems, issues related to pollution from waste dumping and burning, growing problems with the amount of waste generated and illegally dumped, and little progress in solving any of the problems. In general, they give an overview of a poor waste management situation across the country, where despite legal frameworks and initiatives, little progress is actually made. Additionally, they emphasize the fact that poor people are those suffering the majority of the consequences.

3.0 Methodology

3.1 Study Location

Kenya is located in East Africa, bordering the Indian Ocean in the east, Ethiopia, and Somalia in the north, Tanzania in the south, and Uganda and South Sudan in the west (Central Intelligence Agency, 2020a). Its land area measures 580,367 km^2, placing it as the 50th biggest country in the world measured in area. Kenya has a population of just over 50 million, with the majority still living in rural areas, but with a rural-urban migration rate at 4.23%, indicating rapid growth in the urban population. Kenya had a GDP of around USD163 billion in 2017, which is categorized as a lower-middle-income country. The country passed the threshold set by the World Bank from low income to lower-middle-income in 2014 (Central Intelligence Agency, 2020a). The GDP growth is high, at around 5%, which is higher than the global average of 3.1%. The backbone of the Kenyan economy is agriculture, with around 75% of the population being somehow involved with agriculture, and agricultural products are the main export sources (Central Intelligence Agency, 2020a). Additionally, Kenya has a rich natural resource base from sandy beaches in the east to wildlife and mountains in the mainland and to lakes in the west and arid land in the north. Tourism covers a large part of the Kenyan economy (8.8% of GDP), and despite setbacks in the form of terrorist attacks, the growth within the sector is still significant (Knoema, 2020).

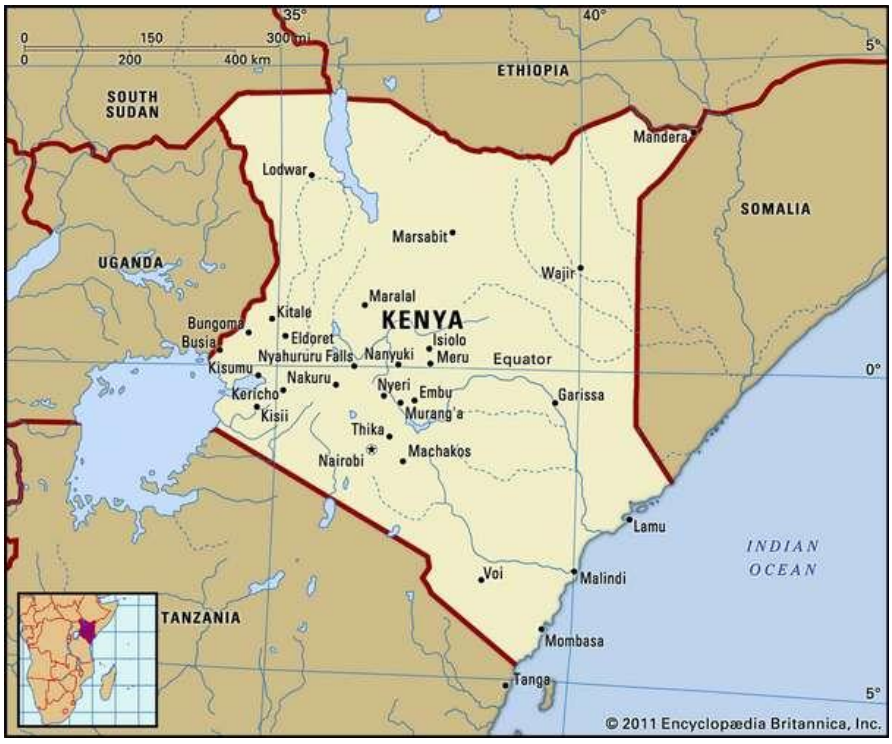


Image 1. Map of Kenya.

The political landscape in Kenya is continuously developing, and currently the country has a multi-party system where the elected president is the head of state and government (Nyadera, Agwanda, & Maulani, 2020). The country's 47 counties each have their governor, with their elected executive and county assembly. Kenya became independent from Great Britain in 1963 and promulgated its constitution in 2010. Until then, the political system in Kenya resembled the colonial system, with the majority of the power remaining with one person. The constitution was approved by a majority of Kenyans (68.7%) and was seen as a steppingstone for achieving democracy in the country. The division of power is strengthened, and Kenya's status as democratic and free is increasing, being "partly free" in 2019 according to Freedom House, with the main struggles preventing democracy being corruption and low protection against physical force from security officers (Freedom House, 2020).

Kenya struggles with widespread poverty and malnutrition and a high unemployment rate. Some of the issues preventing development in Kenya are weak infrastructure, weak governance, and corruption. Sub-Saharan Africa is the lowest ranking region on the Corruption Perceptions Index presented by Transparency International, scoring an average of 32/100 (Transparency International, 2019). Kenya is below the average, scoring 28 in 2019, up from 25 in 2015, ranked number 137 out of 180 countries. Sub-Saharan Africa is affected by undemocratic regimes and weak institutions, undermining the few efforts put in place, causing little to no progress in reducing corruption. In Kenya, corruption saturates the judicial system, the police, politicians, and public services and administration. Bribery, fraud, illicit trade, embezzling of money, un-official payments in exchange for benefits, and lack of transparency are some of the main governance problems seen in Kenya (Gan Business Anti-Corruption Portal, 2017). High levels of corruption in a country prevent sound economic development and can stop initiatives and efforts put in place to solve national and local problems (Gan Business Anti-Corruption Portal, 2017; Harrington & Manji, 2013; Transparency International, 2019). Several laws, bodies, and processes are in place to stop corruption in Kenya, and the problems are well-known, yet little progress is seen as corruption is entrenched in all levels of the economy and the political system (Hope Sr, 2014).

Nairobi is the capital of Kenya, the most populous city in East Africa, home to around 4.7 million people. Nairobi is located south in Kenya in the highlands and far away from the coast (Central Intelligence Agency, 2020a). The city is also one of the 47 counties in Kenya, with a governor whose main role is to implement county and national legislation (Constitution of

Kenya, 2010, § 183). Several large international organizations and agencies have offices located in the city, such as the UN, Red Cross, USAID, Oxfam, CARE International, etc. UN Environment and UN-Habitat have their headquarters located in Nairobi. The city is also home to multiple slums, of which the Kibera slum is one of the largest slums in the world. Thus, both demographically and financially, Nairobi is a very heterogeneous city (World Population Review, 2020). Nairobi represents about 21% of Kenya's GDP, the largest share of any county, where a key growth driver is industrial activity, especially manufacturing and services (Kenya National Bureau of Statistics, 2019). In Nairobi, the Gross County Product (GCP) per capita per year is over KSh 200,000 (approx. USD 1800), compared to the national GDP per capita at KSh 96,779. Nairobi is therefore an important city and county contributing to the national economy, and it has an average higher level of income than the other counties. However, in terms of income distribution and fairness, the differences between rich and poor are extreme and growing.

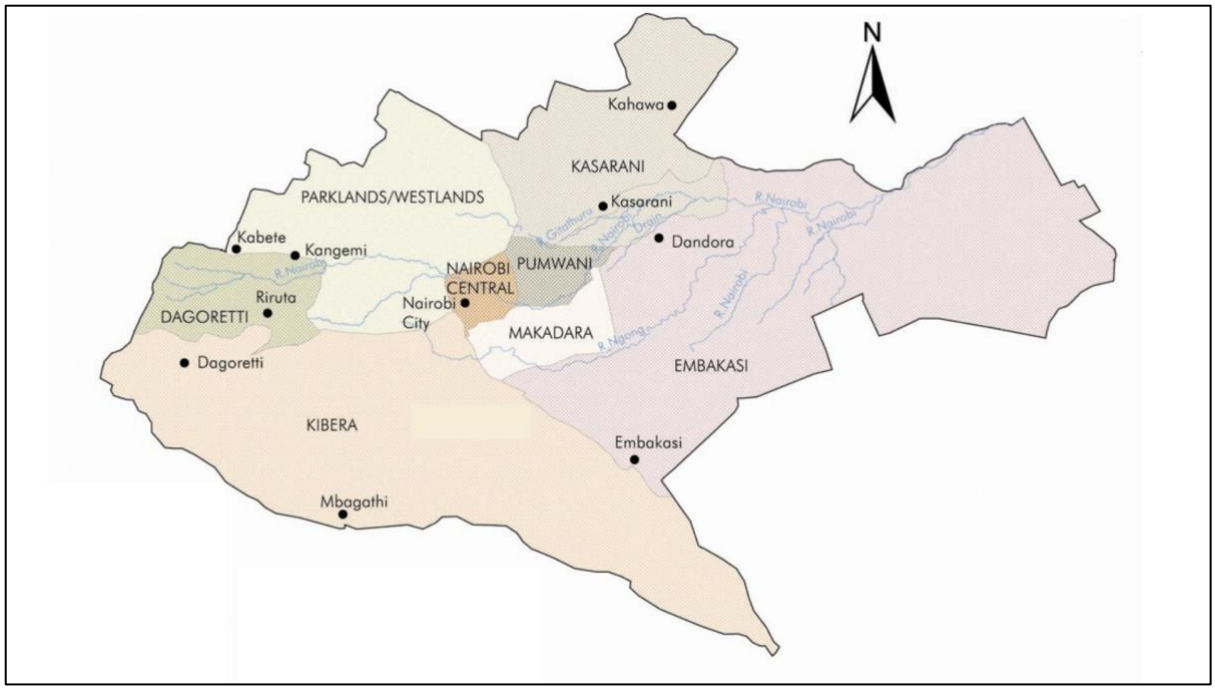


Image 2. Map of Nairobi. Demographically, Parklands/Westlands, as well as an area west of Dagoretti, inhabit the wealthiest people in Nairobi. The east side of the city is home to the poor, including some slums and the main dumpsite in Nairobi, Dandora.

Image 3. Dandora dumping site and its surroundings, including Nairobi and Mathare River, as well as multiple schools, churches, and households.

3.2 Data collection and methods related to the objectives

For this study, I will use secondary data sources, combined with primary data sources through interviews of private waste companies. The data for chapter 4 is secondary sources on waste as a resource, including statistics about waste generation, collection, and content in Kenya, in addition to official documents such as laws, regulations, acts, policies, and reports to analyze the efforts made by the government in Kenya, what regimes that are in place for handling waste and how the private sector is included.

Data for chapters 5 and 6 was found through conversations with respondents from four companies working with waste in different ways, as well as two individuals with vast waste management knowledge. This will be supplemented and cross-checked with data from secondary sources, such as legal regulations on private sector involvement in the waste management sector, as far as the secondary data is available. Using multiple data sources, also known as triangulation, can contribute to strengthening the findings of social research (Bryman, 2016). The key informants were found through online research on private waste management companies, SWM projects initiated by individuals, organizations, or groups working with waste in Kenya and contacted by email.

Table 1. Methods and theory related to objectives and research questions.

Objectives and RQs		Theory	Methods
Objective 1: Solid Waste Management initiatives implemented by the national and local governments			
RQ 1	What are the attributes of the waste resource and which technologies are available for its utilization in Nairobi?	Resource regime	Literature analysis
RQ 2	Which agents are involved in planning and enforcing waste management systems and what are their motivations?	Resource regime	Literature analysis
RQ 3	Which institutions are established to ensure household waste is collected and disposed of in a way that does not harm humans and the environment?	Resource regime	Literature analysis
RQ 4	What are the outcomes of the initiatives, caused by the patterns of interaction, and how do they affect choices concerning politics and the economy?	Resource Regime	Literature analysis
Objective 2: The role of the private sector			
RQ 1	How are the private companies included in the SWM system, and what are their prospects for expanding?	Integrated Sustainable Solid Waste Management	Literature analysis Interviews
RQ 2	Which of the Waste System Elements does the private sector handle, and are there any regulations protecting the health of the workers and the environment?	Integrated Sustainable Solid Waste Management	Interviews
RQ 3	What are some of the main issues the private sector experiences in performing their work?	Integrated Sustainable Solid Waste Management	Interviews
Objective 3: Future waste management scenarios			
RQ 1	Which issues are currently the main challenges in ensuring a well-functioning waste management system in Nairobi?	Resource regime	Interviews
RQ 2	Which recommendations are there for solving Nairobi's waste management problems?	Resource regime	Literature analysis Interviews
RQ 3	Which future scenarios are currently most likely for Nairobi?	Resource regime	Literature analysis Interviews

3.3 Study design, reliability and validity

The study design resembles that of a case study, where solid waste management in a developing country is the problem and solid waste management in Nairobi is the case. However, there are no observations of any participants or on the location for the study.

Regarding reliability and validity of the study, it can be argued that the terms are more relevant for quantitative studies since replication of a social setting at a point in time is difficult and because the sample is very small, and therefore it is more difficult to generalize the findings to a larger population (Bryman, 2016). However, following some of the criteria set by Lincoln and Guba in Bryman (2016) of trustworthiness is more relevant for this study.

3.3.1 Trustworthiness

The first criterion within trustworthiness is credibility, which is used instead of internal validity. For this study, I am offering the respondents to read the paper after it is finished to allow them to see how their information is presented.

Lincoln and Guba in Bryman (2016) argue that confirmability is an important criterion for research, meaning that personal values and ideas do not affect the findings of the research. My personal opinion on waste is that it should be reduced and prevented, and that in the cases where it *must* be produced, the resource should be utilized to its full potential, and that those in charge should put absolutely all efforts in place to avoid waste mismanagement and to constantly work to improve the systems. I am therefore aware that my personal opinion might somehow affect the presentation of the findings, although I attempt to present the findings objectively and back up statements and recommendations with theory. I aim to present the findings objectively, but acknowledge the possibility that my personal view might, in some ways, affect the presentation of the findings.

Transferability is used instead of external validity, which concerns whether the findings can be generalized to other settings or contexts (Bryman, 2016). For this study, the findings might be possible to generalize to, for instance, other towns or cities in Kenya, which experience many of the same issues regarding SWM. However, Nairobi differs from other Kenyan cities in multiple ways, such as the large population, level of wealth, and the big differences between rich and poor, something that makes generalization more difficult. Using thick description, as argued by Lincoln and Guba in Bryman (2016), can contribute to a larger database of which

others can use to look for possible transferability, or generalization, to other settings and contexts.

3.4 Limitations and challenges

These are some of the main limitations and challenges I have met during the research process.

Data gaps: lack of data is an important issue in research because it can prevent the best solutions to be made because a large knowledge base allows decision-makers to make choices based on the actual situation in question. Lack of data makes it difficult to properly analyze the situation and find the problems as it does not give a proper overview of a situation. For instance, in order to find a new location for a sanitary landfill, one very important thing to have knowledge about is how much waste is being generated to be able to know how large of an area is needed for the new landfill. Furthermore, knowledge about the composition of waste is useful when establishing recycling and recovery facilities to know which types of waste should be prioritized in the process. These are just some examples of the importance of a large database.

Lack of access to data/transparency: In some cases, I read a news story related to waste management in which there is an indication of data on waste, or one document refers to the next document in the series that will be published by the same entity. E.g., weighbridges in Dandora Dumpsite, or reports or reviews of strategies and policies. However, when I try to locate the source of the news, it remains impossible. The websites of NCC or NEMA, which are in charge of waste management, often have just one report from a series of reports available for downloading, and there is no trace of the rest. Another example is the Integrated Waste Management Plan for Nairobi that does not have any follow-up paper to document any progress. Thus, in some cases, there are traces (from the news or other articles) that the data does exist somewhere but is challenging to find, while in other cases, it would be natural to have accompanying documents, but they seem to not exist or are not available to the public.

Differences in data: another challenge I have met is that in the data that does exist, there can be large differences in the numbers presented, such as in estimates on how much waste is generated each day, collection rates, and recycling rates. Additionally, the data can sometimes be very old, and the newer numbers are estimates based on the old data.

Covid 19: Due to Covid 19, many offices in Kenya are closed; thus, receiving answers from potential respondents was difficult. This was especially relevant for public administration offices, where receiving a positive answer from someone was impossible, something that may be caused by the fact that they are not in the office and have limited access to emails from home. Furthermore, in general, getting responses to my emails was very difficult despite trying to contact companies multiple times through multiple channels, the majority did not come back to me with a response at all. This means I have not been able to talk to any company that collects waste directly from households, for example.

Initially, I also wanted to look into the informal sector in waste management but looking at this in-depth is a very large topic with many issues, and the fact that I could not get in touch with any informal waste agents limited the opportunity to look at the informal sector from their own perspective. Therefore, I had to narrow it down to the private sector; however still mentioning the informal sector from the point of view of the private sector because of its large involvement in SWM in Nairobi.

4.0 Solid Waste Management in Kenya and Nairobi from the 1940s until today

In this chapter, I present data from secondary sources on the waste regime evolution in Kenya, from the 1940s until the 2010s. The relevance of a historical description is to understand how institutional changes were made to address and solve the problems of the time, which actors have been and are key elements in the regimes, and how it has affected the current regime. Firstly, I will go through the regime from the 1940s until the 1990s. The 1940s represent the earliest time of data on waste management in Kenya, while the 1990s represent the time of a major shift in the waste management system in Nairobi. This part of the chapter is fairly short because of limited data on the time period, but it presents an interesting backdrop to the current regime. Secondly, I present the waste management regime from the 1990s until today. There are data limitations for this time period as well, something that is common in many developing nations, where technology, capacity, or funding to collect data is missing and much therefore is based on estimates. In this chapter, I address the following research questions:

1. What are the attributes of the waste resource and which technologies are available for its utilization in Nairobi?
2. Which agents are involved in planning and enforcing waste management systems and what are their motivations?
3. Which institutions are established to ensure household waste is collected and disposed of in a way that does not harm humans and the environment?
4. What are the outcomes of the initiatives, caused by the patterns of interaction, and how do they affect choices concerning politics and the economy?

4.1 The waste management regime in Nairobi from the 1940s until the 1990s

4.1.1 Institutions and agents of the waste regime

The early systems of waste management in Kenya were established under British colonial rule and followed the traditional steps of collection, transportation, and disposal of the waste (Oyake-Ombis, 2012). The *Penal Code* of 1948 is the first legal document in Kenya to address pollution of air and water as a criminal act in the country. Although waste is not specified as the source of pollution, those who purposely pollute the water or air, making it unfit for its intended purpose or damaging for humans, are found guilty of a misdemeanor (Penal Code, 1948). In 1963, Kenya became independent from Britain and inherited a Nairobi with both its positives in the form of resources and infrastructure, but also the negatives such as urban planning and immense population growth (around 12% in the 1960s) (Owuor & Mbatia, 2008). The *Local Government Act* of 1963 Cap. 265, giving the municipal councils the responsibility of the sanitary services, including "[…] the removal and destruction of, or otherwise dealing with, all kinds of refuse and effluent […]" (Local Government Act, 1963, § 160 a). Until the late 1970s, Nairobi City Council, under the cleansing section in the Department of Environment, collected up to 90% of the waste generated in Nairobi, leaving behind only a small fraction of the total amount of waste generated in the city (Njoroge et al., 2014; Oyake-Ombis, 2012). The system until the 1990s did not differentiate between rich and poor, collecting waste from all areas of the city, including slums and poor neighborhoods. During this period, the main driver for waste management was the protection of human health. This led to rapid removal of waste from private properties and other waste-producing areas. Although the national level was formulating policies, supervising the waste collection, and assisting with technical issues, the local governments held the main share of the responsibility regarding the practicalities of waste management. In 1986, the *Public Health Act* was put in place to secure national health (Haregu et al., 2017; Public Health Act, 1986). The Act defined

waste as a nuisance with the potential to create harm to human health. Therefore, the Act states that no person shall create such a nuisance through disposing of waste, among other things, in a way that will cause issues to human health (Haregu et al., 2017; Oyake-Ombis, 2012; Public Health Act, 1986). The services were generally paid through taxation, city fees, and charges on containers, but the fees were fixed and did not depend on types or amounts of waste, and therefore proved insufficient as the source of funds for the overall SWM services.

Despite a well-functioning collection system, there was a lack of proper disposal facilities for decades, forcing those collecting the waste to dispose of it in locations of momentarily convenience (Oyake-Ombis, 2012). In 1977, Dandora Dumpsite opened as the first official dumpsite in Nairobi, with funding from the World Bank (ISWA, 2017). Its location is 7.5 km east of the city center, far away from rich neighborhoods. Already in 1998, when Japan International Cooperation Agency (JICA) assessed the waste management system in Nairobi, the Dandora dumpsite was declared full for its estimated capacity, and the report stated a need for its closure and opening of new facilities (JICA, 1998). However, 22 years after the first need for closure was expressed, Dandora, the eyesore of Nairobi, is still active as the main landfill in the city.

4.1.2 Waste composition and generation

Data on waste generation and composition for Kenya in the time period before the 1990s is very limited. Therefore, what can be assumed is that the composition and generation resemble that of other countries in a developing stage, with a low population growth, namely ash being the largest fraction, followed by organic waste and some paper. The amount generated per day was also much lower than today based on fewer large urban centers, lower income, and a smaller population (Bello, bin Ismail, & Kabbashi, 2016; Walsh, 2002; Wilson, 2007). Food waste was likely fed to animals or left on private property to be used as part of the soil in agriculture.

4.1.3 Patterns of interaction and outcomes

In this regime, the use of waste as a resource was reserved for private use rather than a large-scale resource, which has been common throughout history when resources are scarce (Wilson, 2007). Waste collected by local authorities was left unused, with no technology in place to take advantage of the resource. Recycling, if it occurred, was done on personal initiative. The differences between rich and poor concerning collection were minimal, as

everyone was served by the local authorities. It is important to mention that the demographics of Nairobi have changed dramatically over the past few decades, meaning the differences between rich and poor have increased, the number of people living in slums and poor neighborhoods is now much higher, as well as the number of rich people and neighborhoods. More densely populated areas, such as slums, are likely to make it more difficult to gain access for collection vehicles, which can contribute to even larger differences between rich and poor.

4.2 From the 1990s until today

The drastic changes in population, consumption patterns, and waste generation levels created issues for NCC, and by the end of the 1980s, it was estimated that they managed to collect around 20% of the waste generated in Nairobi compared to the 90% in the 1970s (Njoroge et al., 2014). The responsibility of NCC shifted from collecting waste to managing the collection services, and an Environmental Department was established in 1996 as the key authority in charge of the waste management in Nairobi, a shift from seeing waste as only a public health issue, but also an environmental issue (Oyake-Ombis, 2012). According to Alder (1995), Nairobi City Council (NCC) did not manage to collect waste from the entire city, and there were big differences between rich and poor neighborhoods in their possibility of having household wastes removed. Poor neighborhoods increasingly experienced growing piles of waste scattered around, occasionally collected by NCC, but often after they had already become hazardous to the people living near the piles. Rich neighborhoods, on the other hand, also had the opportunity to pay private companies to collect their waste in case it was not collected by the NCC, something that was out of reach for the poorer neighborhoods (Alder, 1995).

4.2.1 Attributes of the waste regime, composition and amount

Little technology is in place regarding waste management in Nairobi. Weighbridges were introduced at Dandora Dumpsite in the early 2000s as one step to collect data on the waste generated and collected in Nairobi, but it is not clear where this data is stored or who collects it and mentions of the weighbridges seem to only take place until around 2009, something that may imply that they are no longer in use. Thus, no large data collections on waste have been possible to find. News about a waste-to-energy plant funded by the Sustainable Energy Fund for Africa under the African Development Fund came in 2017 (African Development Fund, 2017), but only in 2020 did the companies enter into an agreement, indicating a long process

ahead before the plant is ready and its technology can provide any benefits for the population (Projects Today, 2020).

Like in other developing countries, landfills are the most common waste disposal option in Nairobi, combined with illegal dumping and unregulated burning in regular ovens or kilns (NEMA, 2015). There is some recycling being done, however a very low percentage. Exact numbers regarding how much waste is actually recycled are fluctuating, as is exemplified in Table 2 where the results of different studies are presented. Much of the recycling that takes place is done manually by dismantling and segregating different types of materials and selling to scrap dealers or others who can use the materials. Some private companies have larger equipment for their recycling, with machines that does some of the work, such as shredding plastic or melting metal. Nevertheless, manual labor is the most important input of the waste management regime in Nairobi. Although some companies do have large trucks for collecting waste, the poor infrastructure many places in the city makes it impossible for large vehicles to access many areas, and therefore smaller vehicles, carts, trolleys, or similar are more convenient. In general, there are few technological developments despite vast amounts of information available on the negative consequences of waste mismanagement.

Table 2: Examples of recycling and recovery rates in Nairobi.

Sources	Treatment
Oyake-Ombis (2017)	Recycled: 5%
NEMA (2015)	Recovered: 45%
JICA (2010a)	Recycled & recovered: 5%
Njoroge et al. (2014)	Reused and recycled: 3.7%
Soezer (2017)	Recovered: 10% Recycled: 5%
Blottnitz et al. (2010)	Recycled: 8%

Japan International Cooperation Agency (JICA) carried out a big data collection project in 2009-2010 to gather important data for the Integrated Solid Waste Management Plan for the City of Nairobi. Although the data is now ten years old, it is one of the few large data collection projects that have taken place in Nairobi; therefore, the numbers give a good indication of the situation at that time, and it is also often referred to by others as the main source of data on waste in Nairobi. Regarding the composition of waste, food waste holds the largest fraction of

the total waste, averaging at 64% in different residential areas and seasons (JICA, 2010b). The share is as high as 71% (high-income area, the dry season) and as low as 50% (slum area, wet season). This is followed by paper at an average of 14% and plastics at 10%. These shares also differ greatly depending on the type of residential area and the season. The numbers are similar to those of Khamala and Alex (2013) with food/organic waste at 59%, plastics at 13.8%, and paper at 11%. More recent numbers for the region say that food/organic waste in sub-Saharan Africa, on average, was 43% of the total waste generated, which is a drastic decrease since 2010 (Kaza et al., 2018). Additionally, plastic is at 8.6%, paper and cardboard at 10%, and "other" (inert waste) at 30%. Table 3 shows a more detailed list of the waste composition in Nairobi.

Table 3: Waste composition in Nairobi.

Sources	Food/organic	Paper	Plastic	Other	Glass & Metal
JICA (2010a)	64%	14%	10%	-	3.2%
Khamala and Alex (2013)	59%	11%	13.8%	7.5%	7.7%
Kasozi and von Blottnitz (2010)	58.6%	11.9%	15.9%	9.7%	3.9%
UNEP (2018a)	65%	6%	12%	15%	3%
Kaza et al. (2018)	43%	10%	8.6%	30%	-
Average	~58%	~10.6%	~12%	~15.6%	~4.5%

The numbers from Kaza et al. are the most recent, however, they present an average for sub-Saharan Africa and thus the numbers for Kenya are likely to differ somewhat. Despite the lack of specific numbers for Kenya and Nairobi, a decrease in the organic component and increase in the other components is common as countries develop and incomes rise, because of the change in lifestyles following higher income and increased urbanization (Kaza et al., 2018). As Kenya went from a lower-income country to a lower-middle-income country in 2014, the changes in consumption patterns follows the expected consequence. People buy more food in supermarkets not only at food markets or directly from the farmer, with large international supermarkets like Carrefour and Shoprite opening in Kenya in recent years, and online shopping and food orders becoming widely available through apps and websites like Jumia, Glovo and Uber Eats (Correspondent, 2019; Jumia, n.d.; Miriri, 2019). This growth in access and convenience for the consumers, coupled with their improved financial situation, contributes to an increased share of other items than food ending up in the consumers' waste bins. Poverty is still prevalent in Kenya, but in Nairobi the population is large and the number

of people with improved personal economies is growing. Kenya's continued economic growth is therefore likely to further contribute to both this trend and the trend of an increased amount of waste generated per capita.

Knowing the composition of the waste generated in an area is important for several reasons. One important reason is to find out what the optimal way to utilize waste as a resource is, in which the quality and quantity of components might be critical in making decisions. For instance, using waste as a source of energy is very relevant for Kenya, as it is a country with a shortage of power, and waste is essentially a free source of power (Khamala & Alex, 2013). Additionally, incinerating waste reduces its size drastically, something that is also very relevant for Nairobi, where there is a shortage of land and dumpsites are overflowing. The composition is only one of several characteristics that have to be known about the waste to decide if it is suitable to be used in a waste to energy plant, namely moisture, density, and calorific value (Khamala & Alex, 2013). These factors influence both costs and effectiveness, where for instance high moisture content (often the case for organic waste) means higher costs, as it might need additional fuel to generate power or energy to dry the waste before combustion. However, compared to other energy sources, it is likely to be cheaper despite the additional costs. Not all fractions are ideally incinerated, such as plastic, as it is often more polluting to burn it than leave it at a landfill (Eriksson & Finnveden, 2009). This only goes for non-recyclable plastic, as recyclable plastic should be recycled for best use of the resource. However, calculations on exactly which treatment is optimal for each fraction regarding energy use, emissions, climate effects, etc. are very complex and will not be further discussed in this paper, but see for example WRAP (2010) for more information.

The amount of waste generated per capita per day is also difficult to pin down as a result of broken and missing weighbridges and a large amount of mismanaged waste. However, some estimates say that the total amount of waste generated per day in Nairobi is between 2000 and 3000 tons per day (Table 4). Estimates on how much each person generates vary, but in general finds that low-income areas generate less waste per person (~0.53 kg) and high income more (~0.80 kg), or an average of ~0.72 kg (Blottnitz et al., 2010; Kasozi & von Blottnitz, 2010; UNEP, 2018a). JICA estimated the total amount per day to be 1530 tons in 1998, indicating a large growth in total waste generation during the last two decades (JICA, 1998). Collection rates are also differing slightly in the different sources, but in general around half of the waste

generated per day is estimated collected, of which some is recycled and recovered, some burned, and some dumped.

Table 4: Waste generation and collection in Nairobi.

Source	Waste generated per day (tons)	Waste generated per person per day	Waste collected	Waste not collected
JICA (1998)	1530			
Kasozi and von Blottnitz (2010)	3121	0.65 kg	1560 tons	1560 tons
NEMA (2015); Oyake-Ombis (2017)	2400		1800 tons	600 tons
Blottnitz et al. (2010)	3000	0.2 – 0.8 kg	1500 tons	1500 tons
Soezer (2017)	3030	0.75 kg	33%	2000 tons
UNEP (2018a)		0.72 kg	1350 tons	
JICA (2010a)		0.80 kg	33%	
Njoroge et al. (2014)				2500 tons

4.2.2 Agents of the waste regime

By 1997, NCC had signed several public-private-partnerships, contracting out the responsibility of collection to waste handlers, something that improved the collection rates slightly. This was also the time where the differences between rich and poor neighborhoods started, however, with the private companies that mainly focused on collecting waste from the rich neighborhoods of Nairobi (Njoroge et al., 2014).

The National Environmental Management Authority (NEMA) is today the main body in charge of coordinating environmental activities in Kenya (NEMA, 2020b). NEMA was established in 1999 as the "principal instrument of Government for the implementations of all policies relating to the environment" (NEMA, 2020a). Therefore, NEMA is in charge of following up on the efforts made by the local governments and making sure they immediately take measures if laws are not respected, such as dumping waste illegally.

The Nairobi City County (NCC), under the Environment, Energy, Water and Sanitation Department (previously Environmental Department), is the responsible body for waste collection, waste management infrastructure, waste data collection, county waste management budgeting, and providing waste containers and collection trucks (among other things)

(Government of the Republic of Kenya, 2019; Republic of Kenya, 2015). Elements can be outsourced to private companies and organizations, but the NCC is formally in charge of following up on the implementation. They are also in charge of facilitating proper disposal of waste, that being landfills, incinerators, or recycling stations. The Institute for Social Accountability (TISA) in Kenya has done research on SWM practices in Kenya and how NCC works, and how the SWM budget is implemented (The Institute for Social Acountability, 2016). They found that local youth groups and community-based organizations were the most important in performing SWM tasks but that there was still around half a billion KSH allocated to NCC staff working on SWM. Additionally, in the budget for the fiscal year 2014/15 around 400 million KSH was budgeted for new waste collection vehicles, upgrades on Dandora Landfill and waste bins in informal settlements (The Institute for Social Accountability, 2014). However, lack of transparency in how the money was actually spent and what the NCC employees on payroll perform was a common problem emphasized by TISA in their reports. In 2010, JICA found in their preparatory survey problems with NCC, such as "over-staffing under the complicated vertical structure; poor intra-departmental and inter-departmental coordination and communication; unclear individual mandates and job descriptions; unaccountable and slow decision-making of managers" (JICA, 2010a, S-3). Additionally, they lacked capacity and training to perform their SWM tasks properly and the budget to carry out the proper training needed, and there is a monitoring and evaluation system (which NEMA and NCC are in charge of) that is highly insufficient and in reality no laws, bylaws, acts, or regulations are being monitored, inspected, or enforced properly (JICA, 2010a).

In 2020 a new public office was established in Nairobi called the Nairobi Metropolitan Services (NMS). According to some news stories, NMS has taken over the responsibility for waste management from the NCC, among other services, and is currently in charge of collection, transportation and disposal of waste in Nairobi (Kinyanjui, 2020). However, the information available on the NMS is limited to news stories, as well as NMS' own twitter and Facebook accounts, as their website is currently not functional. According to their posts on social media, the NMS has reactivated 21 vehicles for waste collection and, are working on establishing a waste-to-energy plant, they are closing down illegal dumpsites, and have reactivated the monthly clean-ups for inhabitants, which they hope to make mandatory by law in the long term (NMS_Kenya, 2020). According to a newsletter from the Waste Wise Cities Campaign of UN-Habitat, the NMS is in the process of fashioning a new Solid Waste Management Action Plan where principles of circular economy will be central (UN-Habitat, 2020). Parallel to this

development, the Kenyan government is in discussions with the United States about an import deal, where Kenya will receive 500 million tons of plastic waste from the US each year (Ngounou, 2020; Tabuchi, Corkery, & Mureithi, 2020).

There are at least 300 private companies, informal and formal, contributing to collecting waste in Nairobi (Njoroge et al., 2014). In addition to this, there are a few thousand individuals informally collecting, picking, or recycling waste (numbers here are very uncertain) and there are junk shops selling recyclable goods recovered from the dumpsites (JICA, 2010a; UN-Habitat, 2010). The companies and groups collecting waste from households normally charge a fee, and the prices for the services differ greatly, as well as which services the companies provide. Some even recycle e-waste, while others mainly collect waste to make sure it does not remain on the street. The main activity the private and informal companies have in common is that they are important waste handling agents that all work to remove waste from the street, as well as taking advantage of the economic opportunity that comes with waste. The private companies that are formalized and have agreements with the local government are seen as important contributors to SWM, and the NCC relies heavily on these companies to do all physical levels of waste management. Through the Public-Private-Partnership Act of 2013, companies have the opportunity to be formalized and contribute to carrying out government projects, given that their application is approved by the Public-Private-Partnership Committee (Republic of Kenya, 2013b). However, there are certain formal criteria that the private companies need to fulfill in order to be allowed to apply, such as criteria related to finance, which excludes many companies leaving them informal. Informal actors are rarely acknowledged by the NCC as official contributors, and therefore they have also not made it easy for them to become formalized and thereby an integrated part of the SWM system and activities (UN-Habitat, 2010). Further adding to the challenges of the informal sector is that by law, it is not allowed to remove waste from official dumpsites or landfills, such as Dandora (Government of the Republic of Kenya, 2019; Republic of Kenya, 2015). Although this regulation is not heavily enforced, it contributes to neglecting the importance of the waste pickers in recycling, recovering, and reusing waste in Nairobi. Table 5 shows one estimate of how much some of the informal waste actors in the Dandora area recover each day. The numbers are just one estimate of one area on how much waste some informal actors treat per day, but it shows that their contribution is significant and should not be neglected, as they manage to remove at least 100 tons of waste from landfill each day.

Table 5: Recovery rates by informal agents surrounding Dandora (JICA, 2010a).

Actors	Amount recovered
Junkshop	40 kg/day
Broker trading Dandora	370 kg/day
Broker trading, in town	550 kg/day
Recycling factories	148 tons/day
CBOs	9-12 tons/day

As for the waste generating agents, the consumers are central in the regime. The population growth in Nairobi is very high and likely to increase by millions within a few years. Population growth is an important driver of increased waste generation, especially when coupled with other drivers like economic growth and development. As previously mentioned, Kenya is in a phase of high economic growth and especially among some groups in the population, the wealth is increasing and thereby the waste generation. Greater access to consumer products, supermarket food, take away food, shopping, etc. is rapidly filling the waste bins in many people's homes, without proper action to change either consumer habits, awareness, or facilitating for proper disposal of the waste generated. Household members' habits are therefore important to be aware of, such as consumption patterns, income, and purchasing power, to establish how to create awareness of the issues related to waste. Increased consumption, however, is a complex topic that there is no one obvious solution to, and consumption will continue to increase along with the national economic development. Discussions on whether developing countries can 'leap-frog' or will experience the same consumption growth that industrialized countries did, as well as the question of what value consumption beyond the basic needs actually brings deserves a thesis on its own. However, the waste generating agents, the consumers, are relevant to mention as a part of the regime as their involvement is critical for the development of an appropriate SWM system.

4.2.3 Institutions: legal, rules and regulations

In 1999, the *Environmental Management and Co-ordination Act* was passed as a framework for environmental law, under which further subsidiary laws were passed to manage the environment and the solid waste (Haregu et al., 2017; Republic of Kenya, 2012 [1999]). In the following years, solutions to the waste management issue kept being put on the table and it kept failing. The *Constitution of Kenya* from 2010 declares that every citizen has the right to a protected and clean environment, sustainably managed to ensure that the future use is not compromised by the present use (Constitution of Kenya, 2010). The constitutional statements regarding the environment were followed by *The National Environment Policy* (2013a), stating

that the government would create an SWM strategy, encourage using economic incentives for SWM, and promote the establishment of proper SWM facilities. *The National Solid Waste Management Strategy* (NEMA, 2015) did indeed follow up on the National Environment Policy, and there the government further states that they will develop solutions to manage solid waste in the country and create a shared action platform for all stakeholders involved in solid waste management in Kenya. The main goal of the strategy is for Kenya to follow the Zero Waste Principle, in which no resource goes wasted, but rather is put back into the economy, creating more employment opportunities, wealth generation and simultaneously have a positive impact on the environment (NEMA, 2015). Additionally, the strategy aims to create a list of minimum requirements when it comes to waste management, such as ensuring that waste is collected, transported to a designated site using designated vehicles, and having the site regulated and the waste weighed at its arrival.

These requirements were followed first by the *Nairobi City County Solid Waste Management Act* (2015) (NCCSWMA) and then the *Sustainable Waste Management Bill* (2019) (SWMB). The NCCSWMA stipulates, among other things, the responsibility for collection, transportation, treatment and disposal of waste. The goal of the Act was to create a legal framework to aid in achieving the Integrated Solid Waste Management Plan for the City of Nairobi, Kenya 2010-2020. The Sustainable Waste Management Bill enacted in 2019 is the most recent addition to the legal framework on solid waste management in Kenya. Its goal is to create a legal framework for sustainable waste management in a green economy, protecting the constitutional right "to a clean and healthy environment" (Constitution of Kenya, 2010, § 42). The Act defines the division of responsibility regarding waste management, stipulates the measures and actions needed to achieve a clean and healthy environment free of mismanaged waste, specifies which duties each entity are in charge of to ensure sustainable solid waste management, as well as identifies the role of the public, access to information, financial sources for SWM, and finally how the processes and legal requirements will be monitored. The two acts clearly state that the responsibility of solid waste management lies with the County Governments, both regarding delivering collection centers, infrastructure that allows for proper segregation, collection, and recovery, collecting data on waste, and be in charge of the budgeting of SWM in the respective counties (Government of the Republic of Kenya, 2019; Republic of Kenya, 2015). In the NCCSWMA, the responsibility of private individuals is also stipulated, from the responsibility of the person to segregate waste at home, to their responsibility to have it collected by a county approved SWM company. The NCCSWMA also

describes the different offenses related to SWM, such as not segregating waste at home not using the appropriate color-coded bin liners, using an SWM collector not approved by the country government, or disposing of waste anywhere but in a designated waste container, among other things (Republic of Kenya, 2015). These two acts play key roles in the Kenyan legal framework regarding SWM, as waste management receives its own acts focusing on creating the basis for developing a well-functioning waste management system.

Between these two acts, the perhaps most heavily enforced legal regulation came: the plastic bag ban. It prohibits the use of plastic bags such as shopping bags, smaller flimsy bags used for fruit and vegetables, small plastic bags for food storage like bread, and large bags for bins and household waste (except the ones specifically produced for waste companies). The ban is an addendum under the Environmental Management and Co-ordination Act sections 3 and 86, prohibiting the "use, manufacture and importation of all plastic bags used for commercial and household packaging defined as follows: (a) Carrier bag – bag constructed with handles, and with or without gussets; (b) Flat bag – constructed without handles, and with or without gussets" (The Kenya Gazette, 2017). Bags for industrial use are exempt. The ban is heavily enforced, with controls at the airports for import of bags and in general it being impossible to purchase plastic bags anywhere. Breaking the law, for instance by importing bags, can lead to fines starting from four million Kenyan shillings (around USD36,600) or a minimum of one year in prison (NEMA, 2017).

The latest addition to the legal framework is the *Environmental Management and Co-ordination (Extended Producer Responsibility) Regulations* (2020), which are regulations under the Environmental Management and Co-ordination Act. These regulations aim to make it mandatory for all producers to create products and packaging that are sustainable throughout the entire life cycle of that product or packaging. By using a life cycle perspective, the products and packaging need to be environmentally sustainable from their start to finish. This means that the producers are also responsible for the end-of-life of the products and need to use materials that are possible to reuse or recycle, compostable or if not schemes for returning the products at the end of their lives have to be created. Additionally, waste at the production source has to be minimized, circular economy and environmental consciousness promoted, and environmental costs have to be added to the final price of the product. All actors that either produce or import products are involved in the regulations but are not necessarily the ones that will have to do the collection or recycling as this can be contracted out to waste management

companies or others with the relevant expertise. The importance of the Extended Producer Responsibility (EPR) regulations is that by giving the responsibility to the producers, it is possible to do more in terms of achieving the first step of the waste hierarchy, which is the upfront prevention of waste. Although all waste will not be prevented, by forcing producers to have an environmentally sustainable production process with reduced waste generation at the production source, some waste elements will have to be removed as they are not sustainable, cannot be reused or recycled, or are superfluous, which will contribute to reducing the amount of waste generated in total. Although the EPR cannot alone solve the waste management problems in Nairobi, such regulations are an important step in the right direction – if they are actually implemented and enforced.

Other legal documents that are important for waste management in Kenya are:
Environmental Management and Co-ordination (Waste Management) Regulations of 2006, (Republic of Kenya, 2006a) stating that anyone who generates waste is responsible for collecting it, segregating hazardous waste from other waste, and dispose of it in the proper facility. *The Occupational Safety and Health Act* (2007) is stating that in workplaces that produce chemicals, the employer is responsible for ensuring a proper collection, recycling, and disposal system. *The County Governments Act* (2012), where public services' tariffs and pricing should promote recycling of waste, among other things. *The Environmental Management and Co-ordination (Water Quality) Regulations* (2006b) prohibiting dumping of any kind of toxic waste into water sources and to use any kind of wastewater for irrigation. *The Environmental (Impact Assessment and Audit) Regulations* (2003) requires project reports to be made for any kind of project that uses materials in their project. The reports should include a description of materials, by-products, waste, and waste treatment. Additionally, an environmental impact assessment report should be made on the effects of the project on the environment, and an audit and monitoring report on continuous effects on the environment, including waste generation.

4.2.4 Institutions: conventions and norms

Environmental awareness and protection are growing concerns among certain community groups in Nairobi and Kenya (e.g., Komb Green solutions, Friends of Karura Forest, Takataka Foundation) as well as some individuals. These groups and individuals organize cleanups, such as cleaning up the Nairobi River, creating green and clean parks in slum areas, creating plastic-free and general waste-free zones such as forests, as well as try to spread awareness of the

negative consequences of mismanaged waste. There are also some NGOs working with creating awareness about waste in Kenya, such as Greenpeace Kenya and World Wildlife Fund (WWF) Kenya, as well as some donors such as the Sustainable Energy Fund for Africa working on solutions involving using waste as a source of energy. These actors contribute to sharing knowledge about waste and its effects on nature and wildlife and the need to treat it properly. However, studies have found that there is limited knowledge on the importance of waste reduction and recycling, especially among those who live closest to the waste dumps, although knowledge about the fact that waste causes health problems is fairly common (Chege & Mberu, 2018). Spreading awareness in a large population takes time, and when the SWM systems to facilitate segregation at home do not exist, even those who have the knowledge are forced to continue as before, mixing food waste with sanitary products and metal, potentially eliminating the possibility of recycling the product at all. Similarly, if the collection systems fail, people are forced to use rivers, streams or other places in nature to dump their waste and/or sewage, even if they know it causes problems. This can lead people to not think of the value of waste creating norms and conventions that are not in line with environmental awareness and protection. It is essential to recognize that these changes take time, and while the contribution of organizations, NGOs, donors, and others is significant in creating changes, the changes will not happen overnight but through an extended period of time.

4.2.5 Patterns of interaction and outcomes

The patterns of interaction lead to problems piling up and eventually, failure of the regime. The current regime does not motivate its agents to act towards the shared goal of a proper waste management system in Nairobi, despite the fact that waste is possible to reuse as input in other industries, the obvious gaps in technology that, if fixed, could positively contribute to solving the problems, and the large number of agents involved of which many lacks proper training and capacity to handle their job. The resource in question is not used to its full potential, and what could have contributed to economic growth and development is left creating problems instead.

The collection and recycling rates are low, causing environmental and health problems while wasting a resource that could reduce costs in other sectors, as well as cut emissions both from landfills and resource extraction. The largest share of the burden, however, is carried by the poor. They are the ones living in areas that are not well-served with proper waste collection

and are located closer to dumpsites, providing a harmful environment to live in, with issues such as air and water pollution causing serious health problems.

5.0 Results: The role of the private sector

In this chapter, I present data collected from interviews of actors within the private sector of waste management, both waste management companies and companies otherwise involved in the waste management environment in Nairobi, as well as some actors that have knowledge about the system either through research or project-related work. The companies are referred to as private waste companies or private sector companies, considering that they work with waste but in different ways. In this chapter, I address the following research questions:

1. How are the private companies included in the SWM system, and what are their prospects for expanding?
2. Which of the Waste System Elements do the private sector handle, and are there any regulations protecting the health of the workers and the environment?
3. What are some of the main issues the private sector experiences in performing their work?

5.1 Inclusion of private companies in the SWM system and prospects for expanding

Although only four companies were interviewed for this study, their answers give an insight into how the environment is for companies that are trying to establish themselves within the waste sector in Nairobi, at which scale they are able to operate, and how they contribute to the larger waste management picture.

Three of the companies have some sort of official license to operate from NEMA that allows them to work with waste in Nairobi. When asked about having a contract with the national or local government, it was emphasized that it is not a direct contract between the government and the company, rather a set of guidelines combined with licenses to operate as a company working with waste. It became clear from the interviews that the agreements with the local or national government differ depending on exactly which tasks the company tackles, the types of waste, and the different treatment options they offer. Having the agreements is important for the companies because by being formalized, their space for dealing with waste is much bigger

than the informal actors. The last company is a not-for-profit organization, which currently operates without a governmental contract. Though they pointed out the fact that they have cooperated directly with the government on some projects where their equipment was used, and therefore the government is well aware of their existence and line of work despite not yet having a contract. They also mentioned that it is in the pipeline, but as the company is still young, the process takes some time.

Two of the companies replied that they work within the Occupational Health and Safety regulations, which are not specifically created for companies working with waste management, but in general for companies who have employees. However, specified for those working with chemical substances, systems for safe collection, treatment, and disposal of waste and because of its potential health and safety risks (Occupational Safety and Health, 2007). It does not put specific requirements for protective gear for employees; however, the respondents said they provided gear for their employees to wear as well as having rules regarding the use of large machinery to prevent accidents at work, and naturally treated and disposed of their waste with regards to environmental and personal health.

The private companies were established based on their own initiative and recognition of a lack of proper management for certain types of waste, or lack of responsibility taken by the government to deal with mismanaged waste in nature, or a market for recycling certain types of waste. Financially, the companies stated to be supported from different sources, such as grants or investments, private funds for the initial starting period, sales of products, as well as membership fees or payments from customers. The private companies are all looking for expansion possibilities but reported several reasons for why it is a slow process to expand in Nairobi. Firstly, financing was mentioned as a reason that slows down possible expansion, as lacking funds prevents hiring processes and purchases of new equipment or other things necessary for growth. Secondly, capacity building is a much needed but time-consuming task, contributing to a slow expansion process. Thirdly, the need for solid partnerships was mentioned as a time-consuming task that makes the expansion process slow, but when it is in place, it will allow the companies to expand much more rapidly.

The waste environment in Nairobi was mentioned to be complex and even chaotic at times, with a very large number of actors involved on all levels, but with little, oversight making sure the processes are sustainable and seamless. The companies interviewed all aim for sustainable

processes where the endgame is to manage waste according to international sustainability standards focusing on the health of people and the environment, combined with creating economic revenue. However, it was mentioned that the price often is the main competitive factor, not sustainability, making it more difficult for companies focusing on sustainability to be prioritized by individual consumers or companies because they are more costly to use: *"And you know, for me, how do I, how do I pay proper wages? How do I provide protective clothing? How do I deal with the difficult fractions? How do I comply with legislation when my competition is really a guy sitting on the side of the road, doing none of those? […]. But by the same token, we don't want to [...] destroy the income potential for people. So we want to take these informal guys somehow over time and bring them into the formal system, but that is easy to say and extremely difficult to do"* (Waste Company B).

Almost all respondents mentioned that they feel the increasing demand for eco-friendly and sustainable waste management and that the environment for working towards sustainably dealing with the current waste issues in Nairobi is ripe. More and more companies and people want to make sure that their waste is handled sustainably, and therefore the opportunity to expand for waste management companies is felt to be there. However, other obstacles like lack of funding makes the process slow down, as indicated in the following statements:

"There has been people who have reached out to us and like are very interested in getting to understand [recycling], both from like people who are in the waste management space, but also other people who just see a concern and have prioritized it in their business operations" (Waste Company D).

"We get tons of calls from new real estate companies saying, we want to be sustainable in this building we are putting up. What are the opportunities? We get many calls asking I have bottles, where can I take them? And so we are almost under pressure" (Waste Company C).

5.2 Collection, treatment, and disposal of waste

The different companies perform different tasks depending on which fraction of waste they work with. While some companies perform the whole process themselves, others are responsible for collection and segregation, while they send the fractions to others for recycling. Regarding collection, collection centers, collection from landfills or dumpsites through use of informal waste pickers, and different agreements were the ways the companies reported to

collect their waste[7]: *"We haven't gotten to collecting it from [households yet], but we hope to do so in the future, but at the moment it's just through our collection centers. So you would drop off your plastic to a collection center that is convenient to where your location is, once it's aggregated there, we transport that to our factory"* (Waste Company A). The waste was then taken to the different locations where the companies work, to be segregated, and even recycled. The companies that use collection centers already let the consumers separate some of the waste in different bins, while they do further separation in their own facilities, such as one company separating plastics into more than 40 fractions.

For the treatment, both segregation and recycling were said to be done mainly through manual labor, with some machinery to wash and shred the waste. For the companies that also recycle the waste themselves, sophisticated machinery was used for the recycling processes. One company created plastic pellets, which are sold directly to production companies as raw material. Another company does the whole process themselves, even creating new products from the collected plastic that are then sold to customers. The profit earned from the sales goes back into the company and is used to finance purchases of new machinery, create workshops, and contribute to the local community. The companies interviewed stated that there is collaboration among them to ensure the highest possible recycling rate of the waste that is collected and that the waste is treated with the best technology available to maximize its utilization and minimize negative impact.

Waste transport was reported to be done with both small and large vehicles, which were either owned by the company or rented, depending on their needs and financial situation. The vehicles were used both for transporting waste to the companies' locations and from there to other companies or landfills when or if necessary. While the final disposal was either done in local disposal sites or one company that has their headquarter in another country had their non-recyclable waste shipped there because of better landfills options such as regulated, sanitary landfills. Regarding reduction, the waste management companies are not working on projects related to reducing the amount of waste generated; this is rather done by entirely other actors, not in the waste management sector.

[7] There are also some private sector companies collecting at households, however they were not interviewed for this study, as mentioned in the methods chapter.

5.3 Issues experienced by waste management companies

Multiple issues were mentioned by the interviewees, both relating directly and indirectly to their businesses. Collecting enough waste, properly dealing with particular fractions, sustainable waste management is voluntary, and issues related to the inclusion of informal actors.

Collecting enough different types of waste was mentioned many times as a challenge for the companies. This was because the way waste is currently collected means that it often goes to a landfill first, then it has to be collected from the landfills. This reduces the amount of waste that can be recycled. None of the companies interviewed performed home collections, which would automatically reduce the amount of waste collected and make the companies depend on either collection from landfills or voluntary disposal from individuals and companies, as highlighted in the quotes below:

"Our core business is actually trying to get to segregation at source so that now we don't have to be recovering from the dumpsites, but it's collected segregated, which improves quality of recycling, which allows for circular economy even more because then you have cleaner materials" (Waste Company C).

"We work with informal waste pickers; we've integrated them into our business model. And they are the ones who go through the daunting task of having to go through landfills to separate the waste for us […]. But I'd say there's still not enough plastic, and I think it's because of the collection persons and how it's done" (Waste Company A).

One of the main reasons mentioned why it is difficult to collect enough waste was the fact that having to deal with waste sustainably is voluntary. This means that, for instance, those who cannot afford to have their waste taken care of properly, or those who do not have the knowledge will keep dumping their waste on landfills or similar, instead of using a company that has a mandate to recycle and compost as much waste as possible: "*I would say our largest challenge is that it's still a voluntary scheme"* (Waste Company C). The companies interviewed treated from 10 tons per month to around 1000 tons of waste per month but said to have the capacity to do more. However, the challenges with collection were the main reason they did not manage to increase the amount of waste treated.

Another problem mentioned was lacking technology to deal with one specific fraction, which could either force companies to landfill the fraction or store it until there is an option to deal with it sustainably. One example given was one type of batteries that could not be recycled properly, which the company still tried to collect for storage until they could find a proper solution: *"So now I've probably got 20 tons of batteries that I have to find a solution for"* (Waste Company B). However, they mentioned that although some companies try to create backlogs for these fractions to be dealt with later, often the informal actors deal with in an improper way to get one part of the item to sell to brokers or middlemen, potentially causing harm to themselves and the environment. As one respondent said: *"most of the waste is handled by just you know people, or waste pickers, normal waste pickers who have no experience or professionalism in handling waste"* (Waste Specialist A). Another company mentioned that even if they know what they need of equipment to be able to deal with one part of the waste management process, sometimes it could be very difficult to find the needed materials or parts in Kenya, creating a long waiting time before the machinery could be used: *"so for example the motor that's required in our shredder, we weren't able to find that specific motor in Kenya for a long time"* (Waste Company D).

Lastly, something that was mentioned by three of the four companies was the role of the informal actors. However, the perception of the informal actors' role in the waste management system differed greatly between the different respondents. All mentioned the importance of waste pickers in the system and the fact that they are doing a very important yet often neglected job. Where opinions differed was on how the informal actors can be included in the formal system. One respondent mentioned that their company firstly had concerns about taking informal actors in on their payroll and then potentially having to let them go after a short period of time because of lacking funds. Secondly, using informal actors to for instance, collect waste was perceived as challenging because it is difficult to ensure that the process is done properly regarding where and how the waste is collected, and who collects it, as emphasized in the quote below:

"We've looked at working with informal people, but there's two problems. One that has to be funded because you can't viably do that properly. And also, you have to be very careful with downstream what's happening. A, you don't want to get stuff that is stolen and B, you don't want to be encouraging child labor for example" (Waste Company B).

The same informant stated that they want to include the informal actors in the formal system in the long run; however, it cannot be done overnight as it is a complex process if you want to ensure a stable income: *"What we don't want to be doing is destroying livelihoods and then make rich people richer"* (Waste Company B). Contrasting to this view, the two other companies saw the informal actors as exclusively positive and they had them included in the business model as waste collectors, earning money for the waste they collect. However, their challenge with the informal sector was that the collection capacity is much lower than they could wish for since it is done manually from dumpsites and therefore, there is a limit to how much waste can physically be collected in a day: *"As it is, the bulk of the [collection] happens informally where we have traders, we call them waste entrepreneurs who collect from the streets, from the dumpsites, from drop off points, and then they trade in [the waste]"* (Waste Company C).

How the safety of the informal actors was ensured, how much they earn from collecting for these companies, or the age of the collectors used was not specified, however.

6.0 Results: The future waste management scenarios

These results present the opinions of five people working in waste management companies, as well as two specialists on waste in Kenya and Nairobi. The results are looking at what the future of waste management in Nairobi may become by pointing out the current challenges and solutions. Additionally, the results complement some of the data presented in chapter 4. In this chapter, I am addressing the following research questions:

1. Which issues are currently the main challenges in ensuring a well-functioning waste management system in Nairobi?
2. Which recommendations are there for solving Nairobi's waste management problems?
3. Which future scenarios are currently most likely for Nairobi?

6.1 Issues preventing SWM system

6.1.1 Lacking action from local government

I aimed to find out what the informants thought about the main problems preventing a functional SWM system from being established and running, what the solutions to the problems could be, and how the future of SWM looks in the case of Nairobi. What emerged from the

interviews was that each respondent identified multiple issues on how the SWM in Nairobi is carried out and that there are issues on all levels of the system. Starting from the governmental level, the local governments were recognized and mentioned by all to officially be in charge of collecting and treating waste, but also known for not actually doing that job, neither currently nor for the last couple of decades. The informants highlighted the private and informal sectors as the reasons why things actually are taken care of, both because they see that waste is a problem that needs to be fixed and because they see the economic potential that lies within waste and therefore take advantage of it. While the private and informal sectors were seen as responsible and important in the SWM system in Nairobi, the local governments are not seen as taking responsibility for something that is, in fact, their assigned job. The views of the local government in taking responsibility can be underscored in the two following quotes:

"… this function is allocated to the government, you know the county government, they are meant to take up the responsibility of cleaning the waste in Nairobi, which unfortunately just never happens" (Waste Company A).

"… they're not exactly a shining light of responsibility" (Waste Company B).

However, one did not think the local government was at fault for not doing the complete SWM job and that it was not the employees' lacking interest in doing the job that stopped the local government from collecting, transporting, and disposing of waste. Rather the problem starts at a higher level of government with a lack of investments and budgetary allocations, manpower, and capacity in their job made it impossible for them to do, and if they had been allocated these resources, they would do the job.

6.1.2 Lacking relevant technology

Lacking technology and facilities were reasons mentioned several times, combined with the fact that it is just easier and less costly for both people and corporations to dump the waste, rather than to figure out the proper, sustainable way of dealing with it. Even for those who want to deal with their waste properly, finding someone who appropriately takes care of the waste in a facility with good technology that also focuses on the health and safety of the employees is difficult. Technological developments are not advanced and widespread, and they are costly; therefore, it becomes easier to throw everything in one bin than to sort out what to do with it. This goes for both individuals and companies, as clearly stated by one informant: *"It's so easy*

for any individual or corporate, just to chuck stuff out and know it'll go away, then to have to pay for it to be done properly" (Waste Company B).

6.1.3 Lack of awareness

This ties to another reason mentioned by everyone: the lack of awareness, knowledge, or understanding about waste, what to do with it, how, and why, both on individual and corporate levels. This lack of social responsibility and getting people to understand their own role in the process was seen as a main problem for the failing system, in addition to the lack of action taken by the local government. The waste life cycle starts before something is thrown in the bin, and people could contribute to making the process easier by separating waste at home. However, most people do not have any form of segregation at home, and the process of first finding out where it can be taken to for proper disposal and then knowing what type of waste goes in which bin contributes to preventing people from doing this themselves. Even with the opportunity to segregate at home, knowledge about which materials belong in which container is crucial, and facilitation to make this as easy as possible for the consumers is necessary since people do not have the knowledge. As one informant stated:

"I would have to sort out all sorts of waste, first I need a bin that has all three parts. That means I also need space. I need to understand materials and the contents. Like if I use the Tetrapack it has aluminum and it's paper. If I use foil, but it's oiled … we don't understand waste and what is waste, and what waste is useful … We don't understand it. We cannot do something we don't understand. I think that's the first problem" (Waste Specialist B).

6.1.5 Poverty and differences between rich and poor

Segregating waste was also mentioned to be an issue of class and something that is just for the upper-middle class and upper class of society to do. The lower classes are already suffering from many other and more serious problems and therefore being concerned with segregating waste at home is unlikely to take place without proper incentives. "*The issue is of poverty, you know most people are concerned about earning the basic livelihoods, looking for money for food, daily food, daily wages so they really not mind about waste and how it is managed, they have other, bigger things to mind about"* (Waste Specialist A). Waste itself was mentioned to be a very class-oriented issue in general, where only those who can afford it can deal with it properly and they are not forced to live next to waste or to work with waste. Waste picking was mentioned to be the last resort for people to earn money and, therefore, not something done by

less poor people. Additionally, wealthy people live far away from dumpsites and are generally treated with proper waste collection services, and thus do not need to think much about waste in their daily lives. *"[The waste] is taken away from the suburbs and moved into the rural areas. So, you know, people in the leafy suburbs are not experiencing that much [littering], but you know, you go into the rural areas and that's where all the [waste] is going"* (Waste Company D).

6.1.6 No proper legislation in place

Lack of proper legislation and policies was also mentioned as a very problematic issue, and that for waste to be dealt with sustainably proper waste legislation needs to be put in place. It was said that currently, there is no legislation forcing people to segregate waste at home, preventing illegal dumping or making recycling mandatory. It was said that without legislation, there is nothing holding corporations and manufacturers responsible for either production or disposal of products, and there is nothing guiding people along the right way, and then they do not know what they are doing. One mentioned that if the proper legislation was there, forcing people to segregate waste at home, combined with the proper infrastructure making it easy for people to segregate at home then have it collected, Kenyans (from the middle and upper classes) would gladly do it. However, it was also mentioned by one respondent that a big problem in Kenya is corruption, and just creating new laws and policies will not necessarily help the situation, rather it could create new occasions to break the laws to earn money or other personal gains: *"The problem in Kenya is really not about legislation all the time. It's about corruption and people getting around the law. So having the law is one thing, but that often just provides an opportunity for people to even pay to ignore it rather than follow it. Corruption is our biggest challenge"* (Waste Company B). Corruption, vested interests, and cartels were also pointed out as the main problems by another respondent, and that Nairobi could improve their waste management system by cutting the losses of those gaining anything from the current system: *"I'd say corruption. Nairobi has so much vested interest that leaves money in everything. [...] So that cartels is such a lucrative business. And many times a bunch of those cartels are sitting in governmental offices. […] if Nairobi wanted to organize waste management, they just cut the losses of whoever is benefiting from dumping at the dumpsites"* (Waste Company C).

6.1.7 Unexploited economic opportunity

Finally, it was seen as a problem that the economic opportunity is ignored or not understood, and therefore a whole employment sector lies untapped. Kenya is a country with a growing

economy, but not yet strong and with a majority of people still working in the informal sector. Therefore, waste management is an opportunity to employ people, reduce the burden on the environment, and generate income that should have been taken already.

Kenya has an economy that there is hardly any money, there's hardly any jobs. I feel like this is a sector that would cover all three things, People, Planet, Profit (Waste Specialist B).

6.2 Recommended solutions to solve the problems

Solving the waste management problems were not recognized as a quick and easy task by anyone, but the solutions presented indicated an agreement on certain actions that would create a large difference. Four things were mentioned multiple times, namely awareness creation, create proper legislation, have an inclusive process, and finally, collaboration. In addition, one mentioned budgetary allocations and investments as one of the most important solutions.

6.2.1 Awareness raising

Firstly, awareness creation and consumer education were issues mentioned many times as very important steps in improving the SWM system in Nairobi. People are not informed about waste, neither about waste as a resource nor the problems it can cause, meaning it is treated simply as something to get rid of. One also mentioned that for education and awareness to have an effect, it has to be combined with the appropriate infrastructure. It would be pointless to make people separate waste at home if the rest of the process is lacking. However, awareness was seen as key to solving waste management problems, and one of the main solutions that should be implemented to improve SWM in Nairobi, as emphasized in the three quotes below:

"… conduct more public awareness to get people to learn how to deal with their waste so they don't see waste as waste but also a resource" (Waste Specialist A).

"Consumer awareness for sure, for sure, we have to tell people why it's important. Not tell, actually discuss. We have to discuss with people why it's important to manage waste and how" (Waste Specialist B).

"I think awareness creation is definitely one of the biggest things that we have to do and do it like it's setting up a new constitution. Involve everyone because there are so many levels

of waste management; the producers, the consumers, the waste collectors, the recyclers. All would have demands on how they want this waste managed" (Waste Company A).

One respondent mentioned that awareness and education could contribute to changing behavior, which again can initiate policies for change. Its difficulty was however, also recognized, especially the differences between upper and lower classes in creating and spreading the awareness and education: *"... education of consumers and consumer choices, which is easy at the upper level, but obviously at the lower level, it's more difficult* (Waste Company B)".

6.2.2 Inclusive processes

As also mentioned in some of the quotes, this connects with the second solution mentioned, which is to have a more inclusive process when establishing legislation, strategies, solutions, etc. and ask more people about their opinion before making decisions that will influence their lives. Waste management concerns everybody, and therefore the solutions should be based on peoples' opinions, something that is likely to make more people follow the rules, "*Everybody in every class of the economy has a say in the waste management"* (Waste Specialist B). Including people in these processes was seen as making it more likely that they would be effective because they would be adapted to their needs and situations, instead of people being told to do something that is very difficult for them.

6.2.3 Collaboration

Collaboration and partnerships were other topics mentioned as important solutions. This both concerned bringing the informal actors into the formal system and also that the local government should support the private companies that are taking on the task of dealing with waste. Currently, private companies are helping the local government where they do not manage to do everything they should; however, it was clear that they need further support if they are going to be able to expand and fully do the tasks needed. "*There's room for a lot of collaboration between the government and the private companies. Any services that the government is not able to, private companies can brainstorm and come up with how [to solve]"* (Waste Company A). Partnerships between the public and private sector was also suggested as a solution because *"that creates a system of checking that also keeps us accountable"* (Waste Company C). The idea of this form of regulation between different parts is that it would prevent a lot of waste from reaching dumpsites because actions are always being checked and

controlled by partners. It was clear that better communication and cooperation between the local government and the private companies would benefit both parts, as well as the community, and therefore should be prioritized. Suggestions on how it could be done were e.g., financial support to the private companies, better sharing and use of existing knowledge and capacities, and partnerships.

6.2.4 Legislation

As expected after lack of legislation being mentioned as one of the main reasons why the current SWM system in Nairobi is failing, a need for legislation on SWM was mentioned by almost everyone as a key solution to solving these problems: "*to solve solid waste problems, we need to draft policies on waste management*" (Waste Specialist A). Waste management policies were mentioned by all as an important step that would dramatically change the current waste situation and allow for proper management of waste: *"I think policies would be the key to actually managing waste"* (Waste Specialist B). This applied to all levels of waste management and included legislation for both corporates and private individuals on how they should dispose of their waste, as well as legislation on import of waste, production of items that eventually becomes waste, banning certain items that commonly are sources of litter, and legislation on how the different fractions of waste should be treated. It was further added by some that enforcing and implementing legislation also has to be in focus, not just creating the laws. This was exemplified with the plastic bag ban, which has been heavily enforced since it came into place in 2017, and that because of the enforcement, you can no longer get a hold of plastic bags in Kenya.

6.2.5 Investments, budgetary allocation

Lastly, one mentioned investments and changed budgetary allocations as the most important solutions because lack of money stops many of the processes regarding waste management. Budgetary allocations could be changed both nationally and locally in order to create more room for the local waste management departments to take action on the current problems as well as expand to be able to cover the entire city with SWM services.

6.3 Nairobi's waste management future

There was a generally optimistic view of the future in waste management, despite identifying multiple and complex problems and time-consuming solutions: *"So I think the future, I'm not going to guarantee anything, but it does look hopeful"* (Waste Company D). The fact that more

people are aware of the environmental issues we are facing around the world and the problems humans are responsible for and, therefore, also responsible for fixing was mentioned multiple times. It has become "trendier" to be concerned about recycling and reducing waste and to try to protect the environment. This is seen to lead people to demand better solutions, something that will eventually make the government provide appropriate solutions:

"People are demanding for better packaging, more sustainable packaging, cleaner environment, employment within waste management. When there is that demand the government has to take care of its people by creating a policy that actually makes sure that these things happen" (Waste specialist B).

"I think the recent trend is that people have become alert to the need to protect the environment, so a lot of people trying to be innovative around waste to do that" (Waste Company A).

Waste management is seen as a sector that will employ many people in the future, and a consequence of that will be cleaner cities that are healthier and more beautiful to live in. Circular economy was also mentioned as likely to be a part of the future and a way to make sure the economic outcomes of waste are integrated into the Kenyan economy. It was also mentioned that in the future, the government would invest heavier in the waste management sector and thereby improve infrastructure, secure sanitary landfills, as well as programs making sure that waste that is compostable will be composted and, what is recyclable will be recycled. There was a hope that there might be more bans like the plastic bag ban or the ban on single-use plastic items in national parks, which have both had a large impact on how much plastic is left in nature. There was also an optimistic tone around the fact that Kenya has indeed managed to create and enforce some strong regulations to reduce specific types of waste, despite not being a wealthy and industrialized country and that therefore there is hope for the future: *"We are trying to be a country that can be an inspiration for other countries"* (Waste Specialist A).

Innovation was mentioned as something that is currently contributing to ensuring a better future and something that there will be a lot more of in the coming years. More people are seeing the opportunities in the field and have ideas of how to contribute, leading to new companies being established in the waste management field: *"There are more and more people who are trying to get into this field, and, you know, there are more and more people that are coming with*

innovative ideas, more and more initiatives" (Waste Company D). The level of innovation was mentioned as one of the most important contributions from the private sector within waste management because innovation is necessary to find new solutions for waste management. Additionally, the expertise within the private sector was highlighted as an important reason why the private sector needs to play a big role in waste management in the future. Although it was recognized by all that the private initiatives are important for the role of waste management in Nairobi as one of the main contributors to improving and encouraging sustainable waste management, the opinion on the exact relationship between the private and the public sector was not completely in unison. There were both arguments for a large public sector and small private sector, the opposite, and something in between. But it was agreed upon that the private sector is going to be very central in the future of waste management in Nairobi. Table 6 presents a summary of the challenges and the potential solutions as presented by the respondents.

Table 6: Summary of challenges and possible solutions.

Challenges	Possible Solutions
Lack of action taken by the local government	Improved collaboration between the different actors working within waste management
Lack of technology and facilities	Investments and budgetary allocations
Lack of awareness and knowledge	Focus on awareness spreading
Poverty and differences between rich and poor	Inclusive processes
Lack of relevant legislation	Create relevant legislation
The role of informal actors	
Unexploited economic opportunity	

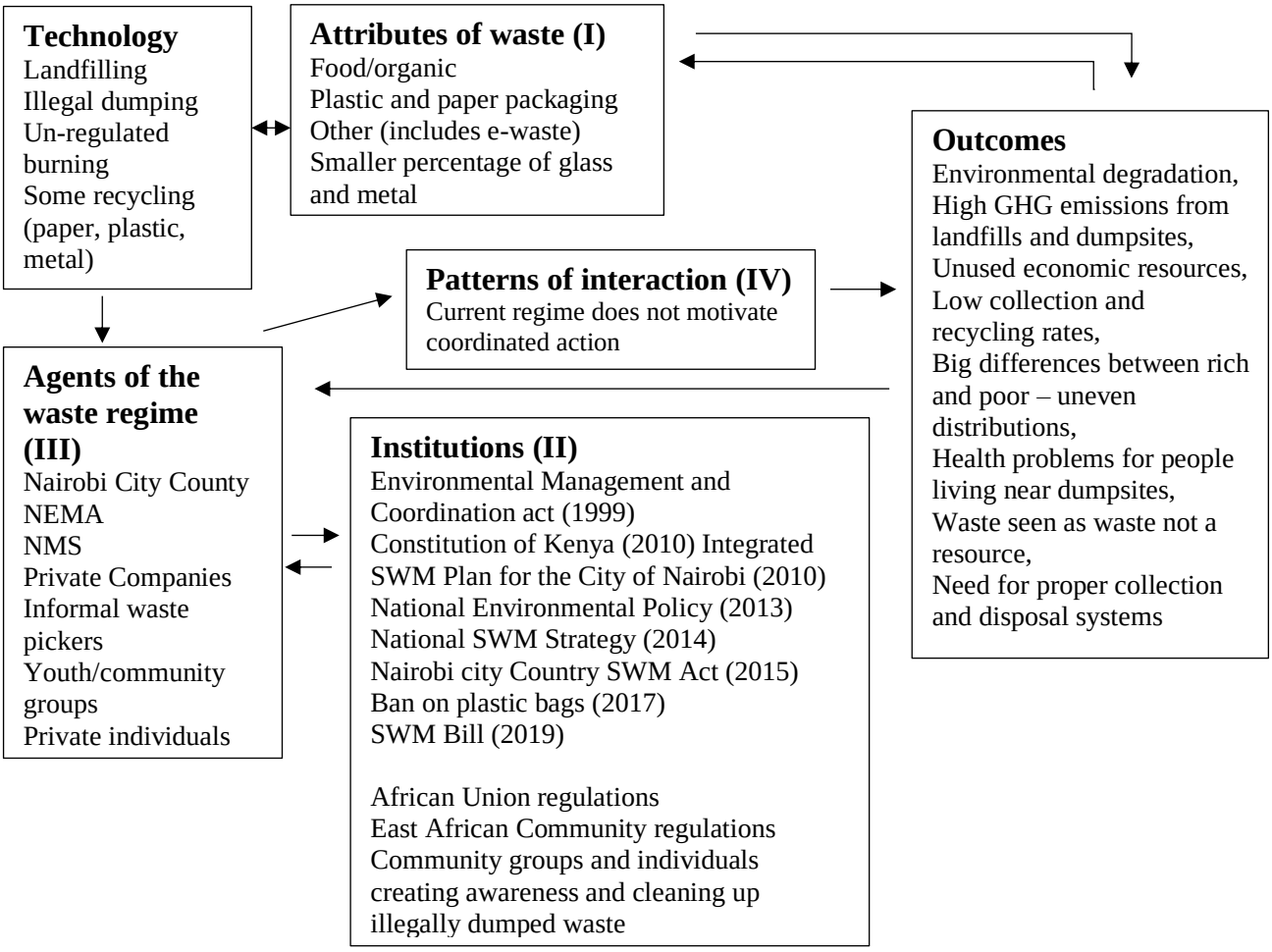
7.0 Discussion

In this chapter I go through and discuss the three objectives SWM initiatives implemented by the national and local government, private sector's role and the future scenarios.

7.1 SWM initiatives implemented by the national and local government

The current regime motivates choices that are bad for both humans and the environment, causing problems with long term consequences. Waste is piling up, and waste is barely used as a resource. Waste is furthermore associated with costs rather than revenues, indicating an inefficient regime for the waste resource (Vatn, 2005).

Figure 4: Framework for analyzing problems with waste usage (Vatn, 2005).



In Nairobi, the problems with waste management are widely known, something that is likely one of the reasons why so many new laws and strategies are created. However, the laws do not effectively manage to solve the problems they are meant to as concrete action towards achieving the SWM policies is not evolving as rapidly as the policies themselves. This causes many negative outcomes for people and the environment, including environmental degradation, emissions from landfills both to air and soil, and subsequently health problems among people living near dumpsites and landfills, further underlining the fact that poor people are experiencing the majority of the negative outcomes. Waste is therefore causing more problems than it is solving, and there is an urgent need for proper collection and recycling systems. The problems of waste utilization in Nairobi are presented in Figure 4 above.

The relationship between the agents of the regime and how their powers and roles are shared is an important reason for the malfunctioning SWM system. The local government (NCC) is supposed to be in charge of the physical aspects of SWM while NEMA is the one that should

be supervising the processes, writing out strategies, and handing out licenses and contracts to waste operators. In the national and local policies, the different roles and their importance are clearly conveyed. In practice, however, these roles are not functioning well, and clear guidelines on this coordination are lacking. This fragmented sharing of responsibility can make it difficult to handle large scale projects that require thorough following up and management, such as collecting and treating waste in a city of 4-5 million. Regarding input legitimacy as mentioned by Vatn (2015), the current processes are lacking in transparency concerning decision making and responsibility. Clearly establishing roles and responsibilities, making sure potential overlaps are avoided while main tasks are properly handled by someone with the appropriate knowledge and capacity and processes are transparent, would be an important step in solving the SWM problems in Nairobi. There is a potential for the newly established NMS to solve these problems by taking charge of the physical aspects of waste management such as collection and transportation to a larger degree than the NCC has been able to, however as their functions only started in mid-2020, the full results of their work are yet to be seen. There is also limited information available on how the NMS is going to work with the private companies who are currently working on managing waste. Their precise role is therefore still uncertain.

Neither NEMA nor NCC collect, transport, or treat waste; this is mainly done by the private and informal companies. Although many companies are licensed by NEMA to manage waste, there are too many companies for either NEMA or NCC to have full oversight over, both those formally licensed but also the few hundreds working without a license or contract. Additionally, despite having a Public-Private-Partnership Act, it is unclear in the waste management policies how the relationship between the private and the public sector should be carried out. A study on public-private partnership (PPP) performance in Lagos, Nigeria, highlights the fact that a clear strategy is important, as since introducing a PPP strategy on waste management, Lagos' waste management situation has improved greatly (Aliu, Adeyemi, & Adebayo, 2014). In Nairobi, where the local government's work with SWM is insufficient because operational capacity is lacking, a clear PPP strategy for SWM could be highly beneficial.

Furthermore, the lacking capacity and proper training of people is very ineffective and reflects poor use of SWM funding and lack of efficiency. The goals of a clean environment for all, and sustainable waste management systems are not reached at the lowest cost possible, contributing to low legitimacy of the governance structures (Vatn, 2015). The problems pointed out by both

TISA and JICA concerning budgets and funding are important and at the core of the failing SWM system, namely that those in charge do not know how to properly solve the problems they are facing and do not have the means to improve the situation. Issues with SWM funding are common in developing countries, and the consequences are many. A study by Lohri, Camenzind, and Zurbrügg (2014) on financial sustainability in SWM in Bahir Dar, Ethiopia, found that the funds for SWM normally only come from fees on the services, while diversification of income such as following the polluter pays principle and selling organic waste products like compost could improve the revenue stream for the companies working on waste management. The solutions for increasing the SWM funding are also relevant for the Nairobi waste management situation, where lack of funding has been a recurring problem, and the largest fraction of waste is organic. Sophisticated technology is needed for this process, but by utilizing the organic fraction better, there could be increased revenue, reduced GHG emissions, and a large reduction in the amount of waste put on landfills.

NCC is also in charge of collecting data on waste, but as previously mentioned, there is a significant lack of data on waste in Kenya and Nairobi, indicating that this task is also neglected, despite its importance. Lack of updated data is problematic because it prevents the ability to follow up on potential progress on waste management, reduction, and prevention policies and their results, it hinders proper comparative studies that could recognize patterns and driving forces for waste generation, and it reduces the ability to raise awareness of developments related to waste (Xue et al., 2017). It also prevents the possibility of monitoring waste generation rates, waste composition, and waste collection rates, which are all important for adapting regulations, policies, and measures accordingly. Knowledge about waste generation rates is key to providing the appropriate collection services and for disposal and treatment options. Although not sufficient, it is necessary to put appropriate measuring equipment in place, and a system for collecting data from private companies needs to be established.

The number of legal documents and policies is very high, and it is likely that a lot of resources has been spent on producing such a number of documents and that they are created in an attempt to solve a waste or environment-related problem. However, having such a wide base of documents might do more harm than good. Firstly, getting an overview of what is covered is very difficult, and secondly, the laws and policies are not useful until they are implemented and enforced, something that has not been of main focus with the local or national government.

This is relevant for both international conventions like the Basel Convention and national laws, such as the Nairobi City County Solid Waste Management Act. Additionally, some of the plans and strategies have goals that seem unrealistic given the status of when they were written, such as the *Integrated Solid Waste Management Plan for the City of Nairobi* (2010), which had as a goal to "Increase the level of collection from current 50% to 75% by 2013 for all zones and to better than 95% by 2020" (p. 3). The goal was not realized, along with the plan in general, and a great deal of concrete physical action would have needed to be implemented to achieve the goals. Examples are increase budgets for SWM, improve infrastructure and road access enough for collection vehicles to access the waste even in areas with poor roads, procure proper vehicles and provide maintenance of them, hire and train a high number of staff and dedicate entire new areas for the waste to be disposed of as the only official landfill in Nairobi is full. Similarly, the strategy presented by NEMA in 2014, *The National Solid Waste Management Strategy*, which aims to follow the Zero Waste Principle by 2030. Achieving a Zero Waste Principle, or a completely circular economy, for an entire economy means that the waste hierarchy is followed unfailingly, where waste is mainly prevented or reduced at its source, and only a fraction is disposed of. In a country where less than 5% of waste is recycled, and where there is not even a basic waste collection service that works, leaving around 400 tons of waste uncollected every day, achieving a Zero Waste Principle in 15 years demands a lot of work. Additionally, the immense backlog of waste that exists in Nairobi needs to first be removed from streets, waterways, natural reserves, other dumpsites, and areas surrounding Dandora, which is a demanding process. When taking into consideration that in 1998, JICA made a master plan to clean up Nairobi and solve the SMW problems, yet in 20 years, little progress on that has actually been made, achieving all the above-mentioned targets in 15 years is perhaps going to be difficult. The policies in general do not meet the overall wanted goals in Nairobi, diminishing the output legitimacy (Vatn, 2015). Furthermore, it is important that recycling and reuse of waste are further emphasized in the SWM policies in the future, combined with collection and disposal. To achieve this, a change in how waste is viewed by policymakers is necessary, where a greater focus is put on its potential as a resource rather than as "garbage" or "trash" that needs to be removed.

A general lack of enforcement and implementation of SWM policies in Nairobi and Kenya means that the SWM practices in Nairobi are not following the evolution of modern SWM rules, policies, and strategies, and this policy-action gap needs to be closed in order to achieve higher levels of waste collection and better treatment than is currently offered. Haregu et al.

(2017) found that when looking at SWM policies in Nairobi and Mombasa, this gap was caused by weak institutional structures, weak or lacking enforcement of policies and frameworks, obstacles related to moving dumpsite locations, lack of at-home waste segregation, and an insufficient number of staff in relevant agencies. Furthermore, lack of implementation could also be related to corruption and informal power structures. Corruption is a well-known problem in Kenya, and personal interests and gains might provide a motivation to avoid or work around rules that do not provide for their personal interests, something that reduces the effectiveness of any policy and thereby its legitimacy (Vatn, 2015). This has, for instance, been a common problem after the Basel Convention, where import of hazardous waste still takes place because it fulfills someone's personal interests and gains. Breaking the rules through corruption, power misuse, and vested interests causes the regime to have low validity making it not function in the long term (Vatn, 2015). As previously mentioned, corruption prevents development, and it prevents measures from being achieved, which could for example be measures to actually improve the SWM system.

The plastic bag ban from 2017 was perhaps a step in the right direction because its strict enforcement forced people to stop using plastic bags through being very difficult to purchase or otherwise get a hold of. It was an institutional choice with the clear aim of protecting the environment and support environmental values within the country while also aiming to change people's behavior regarding their actions regarding plastic bag waste (Vatn, 2015). However, by just removing the option of using plastic bags, attitudes and disposal practices do not necessarily change, as education on why plastic bags are bad is important for changing attitudes. Additionally, for some vendors, the removal of the bags made it difficult to sell their products, causing negative economic consequences for some groups of people (Geoffrey & Mutune, 2020). After the ban came into force, some producers began producing plastic bags of a different quality that resemble mesh fabric but of a poor quality preventing them from being reused. This forced NEMA to extend the ban to also include non-woven bags, however, again without aiming to change the disposal practices related to small carrier bags (NEMA, 2019). Light-weight plastic carrier bags are a big environmental problem, and Kenya has one of the strictest regulations in the world on plastic bags. As the ban is fairly new, the full results of which effect the ban has on the environment are limited, but some results are likely to be seen in the long term. However, as Geoffrey and Mutune (2020) found, the lack of replacement options for the plastic bag creates difficulties for many people working informally, and they still perceived their physical environment as being dirty even after the ban. A study from

Portugal also found that a tax on plastic bags did not affect the perception of how much litter was in nature and the seas (Martinho, Balaia, & Pires, 2017). Awareness creation on the effects of waste in nature is crucial to avoid the same behavior with the new types of bags as with the old, as single-use fabric bags made of plastic (e.g., polyester) also will cause problems if left in nature. This has to be combined with viable options for those who depend on the light-weight carrier bags, ensuring that those who already carry many of the heaviest burdens related to waste are not also unjustly experiencing the heaviest burdens of the new environmental protection policies.

Awareness and access to information are, in general, important in the future of SWM in Kenya and Nairobi. High awareness among the public can lead to pressure on politicians to take action and to therefore create movement in a process that has had a standstill. Institutional change might appear as a consequence of increased awareness, as people might begin to behave differently because of new values caused by increased awareness among the public (Vatn, 2015). In Nairobi, however, there is low awareness of the negative consequences of mismanaged waste among some groups, as emphasized by Egondi et al. (2013) in their study among the inhabitants in one of Nairobi's largest slums and people directly working with waste. Chege and Mberu (2018), on the other hand, found that there was some knowledge about the problems that waste created, but not about how to treat waste in terms of reduction, home segregation, and recycling and why it is important. This is further emphasized by NEMA in its National Solid Waste Management Strategy, where they put a fair amount of blame on the public for not segregating at home, dumping waste illegally, and in general, failure of individuals to take responsibility (NEMA, 2015). Reasons for the limited knowledge, however, are not mentioned. Finding the full list of legal documents related to waste management in Kenya and Nairobi is very difficult and time-consuming and finding the progress reports that are claimed to follow the policies is nearly impossible even with full and stable internet access. Websites are also complicated to navigate through, and consistency in where documents are published and stored is low. Kenya is a country with poor infrastructure in many areas and far from all people have access to electricity, internet, a smartphone, or a computer. Additionally, there is around 20% illiteracy in Kenya (Central Intelligence Agency, 2020a), meaning that even with access to policies, they cannot be read by all. This, combined with the confusion created by the local government in who is responsible for waste collection, transportation, and planning, as well as lack of proper facilities to dispose of the waste, can easily lead to either apathy and carelessness or to people trying to solve the problems on their own by removing

waste themselves, without focusing on doing it in the safest and most sustainable way. A more participatory approach is necessary for a functioning SWM system, to ensure that people will actually follow the rules and regualtions.

Considering how waste especially causes problems for people of lower socio-economic classes is also very central. People living in poverty and working in informal jobs have less job security, insurance, and power in making legal changes, or in general less power. It can be discussed whether the problems with waste would have been dealt with faster if the consequences fell more heavily on the rich and powerful rather than the poor (Vatn, 2015). Therefore, the question of having a proper SWM system is also about justice and equality and finding solutions that have positive outcomes for people with different wealth statuses. This also relates to the economic benefits coming from using waste as a resource. It is not established who will get the benefit of the waste resource, nor who "owns" the waste since the local government is regulating it, but the private companies are handling it and thus earning money from it. Currently, at least 1000 people are relying on waste picking as their main source of income, plus people working as middlemen, recyclers, and scrap dealers (UN-Habitat, 2010). In the law, it is defined that the physical access to landfills is limited to the local government, but in practice, this is not followed. It is also defined by law that only the local government has withdrawal access of the waste from landfills, but also this is ignored in practice. If the goal is for the private sector to be in charge of all physical aspects of waste management and no informal actors are allowed, a plan to integrate and formalize the informal actors will be of high importance. If the goal is for the NMS to take over the physical aspects of SWM and perhaps share it with the private sector, a clear public-private-partnership strategy is nevertheless needed.

7.2 The role of the private sector

Although the companies were in different ways recognized by or working with the government, the differences in contracts or recognition are contributing to an already complex waste environment where many actors are involved. Lacking an overall responsible actor and clear guidelines from the government slows down potential progress that could be made if the companies had a clear framework to work within, also including how the informal actors should be involved. As suggested by the Integrated Sustainable Waste Management (ISWM) framework, the role and inclusion of stakeholders are crucial for a functioning system. The waste system in Nairobi would benefit from a clear inclusion of the private companies and

establishing their role in waste management, how they can collaborate among themselves and with the local government. To further include the inhabitants in Nairobi, the waste generators, what they consider important and feasible for them, could contribute to a more seamless system, based on the needs and opinions of everyone included, not only the government. As mentioned in chapter 7.1, a clear strategy on the public-private relationship lacks in the national and local policies, and further experienced in practice by the companies. Currently, the system is complex, which slows down its progress, despite many actors working on improving the SWM situation in Nairobi.

The companies all feel like their work is needed and there is a demand for their services, and that this demand is growing as awareness around waste and the environment is becoming more common. However, the complexity of the waste environment can make it difficult for people to understand what they should do or who they can contact, which further underlines the need to create a simpler and more inclusive system that will facilitate an easy disposal system that will encourage people to dispose of their waste properly rather than discourage them. Studies on behavior and waste management have found that the more demanding or time consuming a task is, e.g., having to drive somewhere to be able to properly dispose of a specific type of waste, the more discouraged people are to comply (Mintz, Henn, Park, & Kurman, 2019). Therefore, facilitation for easy disposal is important, which means the government and the private companies have to work together.

From the interviews with the waste companies, it became clear that they work with all the waste system elements of the ISWM framework except generation and reduction. Collection, transfer and transport, reuse, recycling, recovery, treatment, and disposal are all included in the mandates of the companies, although they cover different elements in the different companies. This a common feature in developing countries and has also been found in other parts of Kenya, such as Eldoret and Mombasa (Maloba, 2012; Ombaba et al., 2014). However, the focus of all the companies extends beyond collection to recovering and recycling as much as possible, to contribute to increasing the low recycling rate in Kenya, which, as previously mentioned, is currently around 5%. Looking further than only collection and disposal is crucial for a sustainable future where waste is considered a resource to be included in the economy.

The amount collected and treated by the private companies varied, with the maximum reported amount was 1000 tons per month. Only four companies were interviewed for this study, and

the numbers are therefore not representative for the entire private sector, however with a large amount not collected every day and a large amount reaching landfills and dumpsites, there is a gap between how much waste is generated and how much private companies manage to collect and treat every day. At up to 3000 tons of waste generated per day, or around 90.000 tons per month, there is still a significant amount of waste that potentially can be collected, recycled, or otherwise reused, but changes in the current SWM system and how waste is collected are needed to achieve that. Private companies undeniably contribute positively to the waste environment in Nairobi; they have the knowledge, skills, and equipment necessary for SWM. However, coming back to the previously mentioned point, there is an urgent need for a clear PPP strategy or framework for private companies to map the way ahead. The companies themselves requested more collaboration with both the government and other actors, something that could potentially contribute to improved services and growth within the private companies. Avoiding collaboration and letting the private companies work in a free market could have some negative effects such a monopoly, high prices, and no regulations to protect workers and the environment (Post & Obirih-Opareh, 2003). To successfully include the private sector, the government needs to be involved and to establish the rules within which the private sector works. It is also important that the government is involved in the pricing of services because people living in poor neighborhoods and slums are not able to pay the same prices for services as people in rich neighborhoods, and therefore are likely to have poorer services available, especially if the private companies are allowed to work without governmental intervention. It is important that decisions are made on the level of privatization necessary to create a balance between the private and the public that is beneficial. Furthermore, some companies work with informal actors, although there is no legislation deciding how their work conditions should be, meaning that there could be child labor involved, the workers could be in direct contact with dangerous chemicals and materials, and the environment is not necessarily considered in the waste collection process.

The issues experienced by the companies regarding performing their work were varied, but also similar issues were experienced by the different companies. Lacking technology and financial resources negatively affect the possibility to perform solid waste management services, and consequently might prevent companies from expanding their services. Obamba et al. (2014) found similar experiences in private companies in Eldoret Town, Kenya, who contributed positively to the waste management in Eldoret, but also because of lacking

resources and technology, were prevented from further expanding their businesses and contribute even more in managing the town's waste.

The inclusion of informal actors and their role in the general waste environment is a very important subject because the informal actors play a major role in waste management in Kenya and in developing countries in general. There is no doubt that the informal waste pickers contribute significantly to reducing the amount of waste that goes to landfill in Kenya, but the relationship between the private companies and the waste pickers is complicated. In the ISWM framework, stakeholders are of key importance, and therefore, it is necessary that all stakeholders are included when new policies, frameworks, and regulations are formulated. This includes formal and informal actors, as well as the general population, both rich and poor. Including all stakeholders in the policy formation processes will also be a fundamental point for the establishment of sustainable, inclusive SWM systems in the future.

7.3 The future scenarios

There was a shared impression among the respondents that waste management legislation should be established as one of the main recommendations to the SWM issues in Nairobi and to ensure a future with sustainable waste management. Considering the fact that the legislation on waste management in Nairobi is very extensive, it highlights the need for implementation and enforcement of the current laws and policies as many of the restrictions requested by the respondents do, in fact, exist. For instance, as stipulated in the *Nairobi City County Solid Waste Management Act* (2015), it is mandatory for households to segregate waste at home, and not doing so is an offense. However, that part of the law is not (commonly) enforced, and many people do not have access to home collection or drop off locations where they can deliver their segregated waste. It is also illegal to dump waste on dumpsites or landfills not approved by the government and illegal to take waste from dumpsites such as through waste picking. It is clear that more has to be done regarding the implementation of relevant policies, as even those working within the field are unaware of the great number of policies that exist in Kenya.

It was clear that awareness was an important topic for those interviewed, both because it was mentioned to be generally lacking in Kenya and also because it was noticed to be on the rise. Awareness about waste and public participation are crucial elements of successful waste management systems, and without it, policies are likely to fall through and not contribute to progress (Desa, Ba'yah Abd Kadir, & Yusooff, 2011; Hasan, 2004). It is found that including

education on waste and waste management in school curricula is an effective way to increase public awareness on waste (Hasan, 2004). This is a long-term solution, however, and in Kenya, a large number of children do not attend school, and therefore have to be reached in other ways. The fact that awareness and education of the public were mentioned multiple times as two of the most important solutions to the SWM issues in Nairobi indicates that education in schools, although necessary, might not be enough to spread awareness and that efforts have to be made to reach adults on a short-term basis, such as through campaigns or education in workplaces.

Awareness is important to motivate people to act in specific ways; however, it is also important to look at cultural aspects when considering how to spread awareness, as culture is found to strongly affect motivation to act (Markus, 2016). E.g., if the culture is individualistic, the motivation often is internal and based on doing good, while in more community-based cultures, motivation is rather based on norms and what is socially expected from an individual in the culture. This is relevant to consider in the Kenyan context because to be able to spread awareness in the most relevant way, cultural aspects have to be considered.

Awareness combined with collaboration and partnerships will be crucial because awareness of the problems related to waste can contribute to residents demanding better solutions from their waste management companies. Post & Obirih-Opareh, (2003) found that residents of rich areas in Accra, Ghana, demanded cleaner areas and better collection systems than they were offered, and therefore hired additional companies to take care of their problems properly. Knowledge among citizens and having them included in the processes of planning the systems they will use can ensure that the best methods are installed in each area and contribute to a feeling of responsibility among the citizens to contribute to keeping their area clean. Similar results were found in Munala and Moirongo's (2017) study on the waste management problems in Kisumu, Kenya, where lack of participation from the local population, caused by lack of awareness, highlighting the need for awareness and participation in developing a functional, sustainable waste management system.

The socio-economic aspects of waste which were mentioned in the interviews are important because of how waste affects people differently based on wealth. However, the argument that people of lower classes living in poor residential areas have other things they are concerned about, and therefore waste and its pollution is not of great concern disagrees with the findings of Muindi et al. (2014). They found that especially air pollution was of great concern among

slum residents in Nairobi. Although knowledge about the exact causes and consequences of the pollution might be low, the concern is present, indicating that the inclusion of people of all classes is important in creating an SWM system that is sustainable, effective, and inclusive.

This study revealed that there is a generally optimistic view shared about the future of waste management in Nairobi, despite reflections around the fact that the system has many flaws, and solving the problem demands complex governance solutions. Growing environmental awareness in some groups of society leads to new companies being established and new solutions being put on the table. Solutions such as the plastic bag ban came as a result of people seeing the problems created by plastic bags in nature and pushing for action from the government to solve the problem. The optimism is also important for companies working within the waste management field because it will help them evolve and expand and keep looking for new solutions to the waste problems.

The tone might not have been as optimistic if people living in near proximity to Dandora landfill or other dumpsites had been asked because the waste that already exists is creating a lot of challenges for them concerning their health. However, the optimism felt by those working with waste in Nairobi might indicate that there will be some changes in the waste management system in the near future.

7.4 Recommendations for further study

Firstly, more research on waste in Nairobi should be carried out, especially looking at people's relationship to waste, their knowledge about and attitudes toward waste, and their interest in segregating waste at home and contribute to recycling. Additionally, research on the internal structures in the local and national governments (NCC, NEMA, and NMS), their tasks and performance, and what is preventing tasks to be completed sufficiently would be beneficial. Quantitative research on private companies and their contribution to recycling revealing representative numbers on how much the private sector contributes in terms of recycling, reuse, and recovery of waste can be very useful to see the whole picture of the work done by private companies. Looking specifically at policies for waste reduction would also be useful, because as stated in the waste hierarchy, prevention and reduction are the preferred methods of waste management before recycling and reuse. Finally, introducing education on waste in schools would be an important step in spreading knowledge and awareness in the population, which could contribute to less waste being thrown out in nature by individuals in the long term.

8.0 Conclusion

Solid waste management initiatives

There are definitely flaws within the local and national governments that have to be solved for the future waste management in Nairobi to function properly, such as the large policy-action gap that has emerged since the turn of the millennium. Understanding what the desired outcome of the current waste regime are and how the institutional structures are trying to ensure good outcome is challenging. According to the law, there should a clean and healthy environment for all, but according to the actual outcomes, relevant solutions are not implemented, and the problems grow. The current regime is fragmented with problems at multiple levels and with an unfair burden falling on the poorest.

The poor solid waste management situation in Nairobi is influenced by many factors. Starting with the complex relationship between the local bodies in charge of waste management in Nairobi, NEMA, and NCC, where understanding who is in charge of what and who actually performs each task is difficult. It is characterized by fragmentation, lack of transparency, and lack of oversight. There is really no "owner" of the waste problem; therefore, there is also no proper solution on the table. Furthermore, the lack of capacity and knowledge within the local government is critical, and proper training is a necessity. The fact that governments are lacking in performance leads to many smaller actors taking responsibility to either take advantage of the economic opportunity in waste or to try to fix the problems they are experiencing by themselves. But without proper cooperation, management, or other relevant steering from local governments, it is difficult for small actors to scale up enough to start tackling the large amounts of waste that already exists and is being generated every day.

The large number of legal frameworks and policies that are in place should be a good steppingstone to change norms and conventions. However, the continuous addition of policies has not led to larger awareness among the public, something that is needed to eventually change the norms and conventions related to waste. More effort should be put into concrete action working towards the desired outcome.

The role of the private sector

The private companies, as well as informal actors, play an undeniably important role in the waste management system in Nairobi. They contribute to managing solid waste where the local

government is not able to cover the needs of the entire city. However, a clearer relationship or partnership between the private and public sector and a strategy for the relationship forward need to be established to ensure the best possible outcomes that are accessible for all inhabitants in Nairobi, not depending on their wealth status or neighborhood. The waste environment in Nairobi is very complex, with many actors involved and little oversight. Clearer legal regulations and greater enforcement of laws are needed to ensure a system where companies can work at their full capacity, and more waste can be collected and recycled.

The future scenarios

Looking ahead, waste management seems to be of increasing concern in Nairobi and Kenya, and although there is still a way left before the system functions perfectly, it is important to remember that the process for change is slow and has also been slow for other countries. If focus is put on creating awareness, improving collaboration, and clearly establishing roles and relationships, Nairobi might have a sustainable waste management system in the near future.

It can perhaps be argued that there is a new regime forming, given the more dedicated laws on waste that have been enacted in the past five to ten years, as well as the newly established Nairobi Metropolitan Services, and the increase of companies looking at sustainably treating waste. However, the results of these changes are yet to be seen, and therefore close monitoring of the subject will be relevant.

9.0 Literature

African Development Fund. (2017). Sustainable Energy Fund for Africa improves waste-to-energy electricity in Kenya with US $1 million grant. Retrieved from https://www.afdb.org/fr/news-and-events/sustainable-energy-fund-for-africa-improves-waste-to-energy-electricity-in-kenya-with-us-1-million-grant-17709#:~:text=The%20Sustainable%20Energy%20Fund%20for,%2Denergy%20(WTE)%20plant

African Union. (2015). Agenda 2063: the Africa we want. Popular version. *Addis Ababa: AUC*.

African Union. (2020, 12 July). Member States. Retrieved from https://au.int/en/member_states/countryprofiles2

Alder, G. (1995). Tackling poverty in Nairobi's informal settlements: developing an institutional strategy. *Environment and Urbanization*, *7*(2), 85-108. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/095624789500700203

Aliu, I. R., Adeyemi, O. E., & Adebayo, A. (2014). Municipal household solid waste collection strategies in an African megacity: Analysis of public private partnership performance in Lagos. *Waste Management & Research*, *32*(9_suppl), 67-78. https://doi.org/10.1177/0734242X14544354

Amugsi, D. A., Mwangi, J. N., Haregu, T. N., Aboderin, I., Muindi, K., & Mberu, B. U. (2016). *Solid Waste Management Policies in Urban Africa: Gender and Life-course Considerations in Nairobi and Mombasa*. Retrieved from http://www.indiaenvironmentportal.org.in/files/file/Solid%20Waste%20Management%20Policies%20in%20Urban%20Africa.pdf

Anschütz, J., IJgosse, J., & Scheinberg, A. (2004). Putting integrated sustainable waste management into practice. *WASTE: Gouda, The Netherlands*. Retrieved from https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/schwerpunkte/sesp/CLUES/Clues_arabic/Tool/12_1.pdf

Basel Convention. (2019). Basel Convention Plastic Amendments. Retrieved from http://www.basel.int/Implementation/Plasticwaste/PlasticWasteAmendments/Overview/tabid/8426/Default.aspx

Basel Convention. (n.d.). The Basel Convention At A Glance. Retrieved from http://www.basel.int/Portals/4/Basel%20Convention/docs/convention/bc_glance.pdf

Bello, I. A., bin Ismail, M. N., & Kabbashi, N. A. (2016). Solid waste management in Africa: A review. *International Journal of Waste Resources, 6*(2), 4-7. Retrieved from https://archpublichealth.biomedcentral.com/articles/10.1186/s13690-016-0166-4

Blottnitz, H. v., Kasozi, A., & Cohen, B. (2010). *Integrated Solid Waste Management Plan For the City of Nairobi, Kenya 2010 - 2020*. Retrieved from http://www.centreforurbaninnovations.com/sites/default/files/Integrated%20Solid%20Waste%20Management%20Plan%20for%20Nairobi%20City.pdf

Bryman, A. (2016). *Social research methods* (5th edition). Oxford: Oxford university press.

Central Intelligence Agency. (2020a). The World Factbook: Kenya. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html

Central Intelligence Agency. (2020b). The World Factbook: South Sudan. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/geos/od.html

Cerda, A., Artola, A., Font, X., Barrena, R., Gea, T., & Sánchez, A. (2018). Composting of food wastes: Status and challenges. *Bioresource technology, 248*, 57-67. https://doi.org/10.1016/j.biortech.2017.06.133

Chege, M., & Mberu, B. (2018). *Improving solid waste management practices and addressing associated health risks in Nairobi and Mombasa* (Urban Africa Risk and Knowledge Briefing No. 11). Retrieved from https://www.researchgate.net/publication/327393654_Improving_solid_waste_management_practices_and_addressing_associated_health_risks_in_Nairobi_and_Mombasa_Urban_Africa_Risk_and_Knowledge_Briefing_No_11

Constitution of Kenya. (2010). *The New Constitution of Kenya Promulgation*. (L.N. 133/2010.). Retrieved from http://www.kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=Const2010#KE/CON/Const2010/chap_11

Correspondent. (2019, 1 February). Delivery App Glovo Launches in Nairobi. Retrieved from https://www.capitalfm.co.ke/business/2019/02/delivery-app-glovo-launches-in-nairobi/

County Governments. (2012). *County Governments Act*. (No. 17 of 2012). Retrieved from http://www.parliament.go.ke/sites/default/files/2017-05/CountyGovernmentsAct_No17of2012.pdf

Desa, A., Ba'yah Abd Kadir, N., & Yusooff, F. (2011). A study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management. *Procedia-Social and Behavioral Sciences, 18*, 643-648. https://doi.org/10.1016/j.sbspro.2011.05.095

East African Community. (2001). *The second EAC development strategy 2001-2005*. Retrieved from http://repository.eac.int/bitstream/handle/11671/204/2nd%20EAC%20Development%20Strategy.pdf?sequence=1&isAllowed=y

East African Community. (2011). *EAC Development Strategy (2011/12-2015/16)*. Retrieved from https://www.preventionweb.net/files/EAC%20development%20strategy.pdf

East African Community. (2018). *EAC development strategy (2016/17-2020/21)*. Retrieved from http://meac.go.ke/wp-content/uploads/2020/03/5th-EAC-Development-Strategy.pdf

East African Community. (2020, 20 March). Overview of EAC. Retrieved from https://www.eac.int/overview-of-eac

Egondi, T., Kyobutungi, C., Ng, N., Muindi, K., Oti, S., Vijver, S. V. d., . . . Rocklöv, J. (2013). Community perceptions of air pollution and related health risks in Nairobi slums. *International journal of environmental research and public health, 10*(10), 4851-4868. https://doi.org/10.3390/ijerph10104851

ENVILEAD. (2005). *A Study of Waste Incineration Activities in Nairobi that Release Dioxin and Furan into the Environment*. Retrieved from https://ipen.org/sites/default/files/documents/4ken_kenya_waste_burning_and_incineration-en.pdf

Environmental Regulations. (2003). *Environmental (Impact Assessment and Audit) Regulations*. (L.N. 101/2003, Corr. No. 40/2003, L.N. 133/2007, L.N. 30/2009.). Retrieved from http://extwprlegs1.fao.org/docs/pdf/ken53040.pdf

Eriksson, O., & Finnveden, G. (2009). Plastic waste as a fuel-CO 2-neutral or not? *Energy & Environmental Science, 2*(9), 907-914. https://doi.org/10.1039/b908135f

Freedom House. (2020). Kenya. Retrieved from https://freedomhouse.org/country/kenya/freedom-world/2020

Gan Business Anti-Corruption Portal. (2017). Kenya Corruption Report. Retrieved from https://www.ganintegrity.com/portal/country-profiles/kenya/

Geoffrey, E., & Mutune, J. (2020). Revisiting Kenya's Ban on Plastic Carrier Bags. *Kenya Policy Briefs, 1*(2), 33-34. Retrieved from https://www.researchgate.net/profile/Bishal_Bharadwaj2/publication/306039486_Plastic_Bag_Ban_in_Nepal_Enforcement_and_Effectiveness/links/57ac5a7e08ae0932c9746f24.pdf

Gertsakis, J., & Lewis, H. (2003, March). Sustainability and the waste management hierarchy. Paper presented at the EcoCycle Victoria.

Gibbs, C., McGarrell, E. F., & Axelrod, M. (2010). Transnational white-collar crime and risk: Lessons from the global trade in electronic waste. *Criminology & Public Policy, 9*(3), 543-560. Retrieved from https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1745-9133.2010.00649.x

Godfrey, L., Ahmed, M. T., Gebremedhin, K. G., Katima, J. H., Oelofse, S., Osibanjo, O., . . . Yonli, A. H. (2019). Solid Waste Management in Africa: Governance Failure or Development Opportunity? In *Regional Development in Africa*: IntechOpen. https://doi.org/10.5772/intechopen.86974

Government of the Republic of Kenya. (2019). *The Sustainable Waste Management Bill*. Nairobi: Ministry of Environment and Forestry, Retrieved from http://www.environment.go.ke/wp-content/uploads/2019/05/04-05-2019-NATIONAL-WASTE-MANAGEMENT-BILL-2019.pdf

Grover, A., Gupta, A., Chandra, S., Kumari, A., & Khurana, S. (2015). Polythene and environment. *International Journal of Environmental Sciences, 5*(6), 1091-1105. https://doi.org/10.6088/ijes.2014050100103

Haregu, T. N., Ziraba, A. K., Aboderin, I., Amugsi, D., Muindi, K., & Mberu, B. (2017). An assessment of the evolution of Kenya's solid waste management policies and their implementation in Nairobi and Mombasa: analysis of policies and practices. *Environment and Urbanization, 29*(2), 515-532. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/0956247817700294

Harrington, J., & Manji, A. (2013). Satire and the Politics of Corruption in Kenya. *Social & Legal Studies*, *22*(1), 3-23. https://doi.org/10.1177/0964663912458113

Hasan, S. (2004). Public awareness is key to successful waste management. *Journal of Environmental Science and Health, Part A, 39*(2), 483-492. https://doi.org/10.1081/ESE-120027539

Henry, R. K., Yongsheng, Z., & Jun, D. (2006). Municipal solid waste management challenges in developing countries–Kenyan case study. *Waste management, 26*(1), 92-100. https://doi.org/10.1016/j.wasman.2005.03.007

Hoornweg, D., & Bhada-Tata, P. (2012). *What a waste: a global review of solid waste management.* Washington, DC: The World Bank.

Hoornweg, D., Bhada-Tata, P., & Kennedy, C. (2015). Peak waste: When is it likely to occur? *Journal of Industrial Ecology, 19*(1), 117-128. https://doi.org/10.1111/jiec.12165

Hope Sr, K. R. (2014). Kenya's corruption problem: causes and consequences. *Commonwealth & Comparative Politics, 52*(4), 493-512. https://doi.org/10.1080/14662043.2014.955981

ISWA. (2017). Special Report for #closeddumpsites: Kenya's Dandora Dumpsite - a Health and Environmental Tragedy. Retrieved from https://www.iswa.org/home/news/news-detail/article/special-report-for-closedumpsites-kenyas-dandora-dumpsite-a-health-and-environmental-tragedy/109/

JICA. (1998). *The study on solid waste management in Nairobi City in the Republic of Kenya*. Retrieved from https://openjicareport.jica.go.jp/pdf/11451630_01.pdf

JICA. (2010a). *Preparatory survey for integrated solid waste management in Nairobi City in the Republic of Kenya. Executive Summary*. Retrieved from https://openjicareport.jica.go.jp/pdf/12005443.pdf

JICA. (2010b). *Preparatory survey for integrated solid waste management in Nairobi City in the Republic of Kenya. Waste Generation and Composition Analyis*. Retrieved from https://openjicareport.jica.go.jp/pdf/12005468_01.pdf

Jumia. (n.d., 25 August). About Us. Retrieved from https://www.jumia.co.ke/sp-about_new/

Kasozi, A., & von Blottnitz, H. (2010). Solid Waste Management in Nairobi: A Situation Analysis Technical Document accompanying the Integrated Solid Waste Management Plan. *Report for City Council of Nairobi, contract for UNEP*, 59. Retrieved from http://www.ecopost.co.ke/assets/pdf/nairobi_solid_waste.pdf

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. Washington, DC: The World Bank. Retrieved from https://openknowledge.worldbank.org/handle/10986/30317

Kenya National Bureau of Statistics. (2019). *Gross County Product 2019*. Retrieved from https://africacheck.org/wp-content/uploads/2019/02/Gross-county-Product-County-GDP.pdf

Khamala, E., & Alex, A. (2013). Municipal solid waste composition and characteristics relevant to the waste-to-energy disposal method for Nairobi city. *Global Journal of Engineering, Design and Technology, 2*, 1-6. Retrieved from https://www.longdom.org/articles/municipal-solid-waste-composition-and-characteristics-relevant-to-the-waste-toenergy-disposal-method-for-nairobi-city.pdf

Kinyanjui, M. (2020, 12 October). NMS boss Badi to launch ‘mandatory' city clean-up exercise. *The Star*. Retrieved from https://www.the-star.co.ke/counties/nairobi/2020-10-11-nms-boss-badi-to-launch-mandatory-city-clean-up-exercise/

Knoema. (2020). Kenya - Contribution of travel and tourism to GDP in current prices. Retrieved from https://knoema.com/atlas/Kenya/topics/Tourism/Travel-and-Tourism-Total-Contribution-to-GDP/Contribution-of-travel-and-tourism-to-GDP#:~:text=In%202019%2C%20contribution%20of%20travel,average%20annual%20rate%20of%2010.86%25.

Kralj, D., & Markič, M. (2008). Building materials reuse and recycle. *WSEAS transactions on environment and development, 4*(5). Retrieved from https://www.researchgate.net/profile/Davorin_Kralj/publication/237433515_Building_Materials_Reuse_and_Recycle/links/0f31753c6859b0784c000000/Building-Materials-Reuse-and-Recycle.pdf

Kumar, S., Gaikwad, S., Shekdar, A., Kshirsagar, P., & Singh, R. (2004). Estimation method for national methane emission from solid waste landfills. *Atmospheric environment, 38*(21), 3481-3487. https://doi.org/10.1016/j.atmosenv.2004.02.057

Local Government Act. (1963). *Local Government Act Chapter 265. Revised edition 2010 [1998]*. (L.N. 256 of 1963). The National Council for Law Reporting with the Authority of the Attorney-General Retrieved from http://extwprlegs1.fao.org/docs/pdf/ken129003.pdf

Lohri, C. R., Camenzind, E. J., & Zurbrügg, C. (2014). Financial sustainability in municipal solid waste management–Costs and revenues in Bahir Dar, Ethiopia. *Waste management, 34*(2), 542-552. https://doi.org/10.1016/j.wasman.2013.10.014

Lovejoy, L. E. (1912). Garbage and rubbish. *Proceedings of the Academy of Political Science in the City of New York, 2*(3), 62-69. Retrieved from https://www.jstor.org/stable/pdf/1171738.pdf

Maloba, N. I. (2012). *Factors influencing effective solid waste management: The case of Municipal Council of Mombasa, Kenya.* (Master Thesis). University of Nairobi, Nairobi. Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/6977/Maloba_Factors%20influencing%20effective%20solid%20waste%20management.pdf?sequence=1&isAllowed=y

Markus, H. R. (2016). What moves people to action? Culture and motivation. *Current Opinion in Psychology, 8*, 161-166. https://doi.org/10.1016/j.copsyc.2015.10.028

Martinho, G., Balaia, N., & Pires, A. (2017). The Portuguese plastic carrier bag tax: The effects on consumers' behavior. *Waste management, 61*, 3-12. https://doi.org/10.1016/j.wasman.2017.01.023

Ministry of Environment and Forestry. (2020). *Extended Producer Responsibility (EPR) Regulations 2020*. Retrieved from http://www.environment.go.ke/wp-content/uploads/2020/05/4th-May-EXTENDED-PRODUCER-RESPONSIBILITY-REGULATIONS-2020-1.pdf

Mintz, K. K., Henn, L., Park, J., & Kurman, J. (2019). What predicts household waste management behaviors? Culture and type of behavior as moderators. *Resources, Conservation and Recycling, 145*, 11-18. https://doi.org/10.1016/j.resconrec.2019.01.045

Miriri, D. (2019, 9 April). Carrefour Kenya targets number 2 retail ranking this year, franchisee says. Retrieved from https://www.reuters.com/article/kenya-retail-carrefour/carrefour-kenya-targets-number-2-retail-ranking-this-year-franchisee-says-idUSL8N21R3KF

Muindi, K., Egondi, T., Kimani-Murage, E., Rocklov, J., & Ng, N. (2014). "We are used to this": a qualitative assessment of the perceptions of and attitudes towards air pollution amongst slum residents in Nairobi. *BMC public health, 14*(1), 226. Retrieved from https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-226

Munala, G., & Moirongo, B. (2017). The need for an integrated solid waste management in Kisumu, Kenya. *JAGST, 13*(1), 65-79. Retrieved from http://ir.jkuat.ac.ke/bitstream/handle/123456789/2481/THE%20NEED%20FOR%20AN%20INTEGRATED%20SOLID%20WASTE%20MANAGEMENT%20IN%20KISUMU%2C%20KENYA.pdf?sequence=1&isAllowed=y

NEMA. (2015). *The National Solid Waste Management Strategy*. Nairobi: National Environment Management Authority.

NEMA. (2017). Press Statement on Total Ban on all Plastic Bags [Press release]. Retrieved from https://www.nema.go.ke/images/Docs/Awarness%20Materials/PRESS__STATEMENT_ON_TOTAL_BAN_ON_ALL_PLASTIC_BAGS.pdf

NEMA. (2019). Ban on non-woven bags. Retrieved from https://www.nema.go.ke/index.php?option=com_content&view=article&id=282&catid=10&Itemid=433

NEMA. (2020a, 17 March). Establishment. Retrieved from http://nema.go.ke/index.php?option=com_content&view=article&id=1&Itemid=136

NEMA. (2020b, 17 March). Functions. Retrieved from http://nema.go.ke/index.php?option=com_content&view=article&id=2&Itemid=137

Ngounou, B. (2020, 1 October). KENYA: The country will be the new hub for plastic waste produced in USA. *Afrik21*. Retrieved from https://www.afrik21.africa/en/kenya-the-country-will-be-the-new-hub-for-plastic-waste-produced-in-usa/

Ngumba, E., Gachanja, A., & Tuhkanen, T. (2016). Occurrence of selected antibiotics and antiretroviral drugs in Nairobi River Basin, Kenya. *Science of the Total Environment, 539*, 206-213. https://doi.org/10.1016/j.scitotenv.2015.08.139

Niskanen, A., Värri, H., Havukainen, J., Uusitalo, V., & Horttanainen, M. (2013). Enhancing landfill gas recovery. *Journal of Cleaner Production, 55*, 67-71. https://doi.org/10.1016/j.jclepro.2012.05.042

Njoroge, B., Kimani, M., & Ndunge, D. (2014). Review of municipal solid waste management: A case study of Nairobi, Kenya. *International journal of engineering and Science, 4*(2), 16-20. Retrieved from http://erepository.uonbi.ac.ke/bitstream/handle/11295/92590/Njoroge_Review%20of%20municipal%20solid%20waste%20management:%20a%20case%20study%20of%20Nairobi,%20Kenya.pdf?sequence=1

Njuguna, S. M., Yan, X., Gituru, R. W., Wang, Q., & Wang, J. (2017). Assessment of macrophyte, heavy metal, and nutrient concentrations in the water of the Nairobi River, Kenya. *Environmental Monitoring and Assessment, 189*(9), 454. https://doi.org/10.1007/s10661-017-6159-0

NMS_Kenya. (2020). NMS is in the process of establishing Material Recovery Facilities in all the seventeen (17) sub-counties which will support separation of wastes and hence reduce open dumping of waste thus stopping pollution of our environment, control illegal dumping, create jobs for the youth. In: Twitter. https://twitter.com/NMS_Kenya/status/1314601260243353603

Nyadera, I. N., Agwanda, B., & Maulani, N. (2020). Evolution of Kenya's Political System and Challenges to Democracy. In A. Farazmand (Ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance* (pp. 1-14). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-31816-5_3997-1

Occupational Safety and Health. (2007). *The Occupational Safety and Health Act*. (No. 15 of 2007). Retrieved from https://www.health.go.ke/wp-content/uploads/2015/09/OSH%20Act%202007.pdf

Ombaba, K. B. M., Arogo, P. A., Murey, E., & Kipngetich, L. J. (2014). Public-Public-Private Partnership for Sustainable Solid Waste Management in Eldoret Town, Kenya. *European Journal of Business and Management (6)*13, 123-128. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/34229560/Public-Public-Private_Partnership_for_Sustainable_Solid_Waste_Management_in_Eldoret_Town__Kenya.pdf?1405641593=&response-content-disposition=inline%3B+filename%3DIISTE_international_journals_2014_editio.pdf&Expires=1605735162&Signature=TbmFN3dvXgLaPHYU8y8C5AcbQCidgSmq6zt5cyH9LKzntyD5geuGnbfsZW8WAMYcVTNgZEAAR4XGYV3f40pms66t5hLiKtzxgpk4rXdVmjMG8suiAPD70LHbZmLV4Pvdiu4QeXTJe4cZTpmbZHa5bPehTR1gGwk0PDyhBqSpiw9GxyhNbZsEa4B5dnB4YvV-twUA-TaVgn-0YZe-CKRVJc6z1F7Q6LmnlQHVWjqPnPGS-7LmphaSWmcSYZoJigPIQgisLZvBQ6417G928BPhbTQ6m2~hvIvhracCnivmS1Xzhede833S7mRKs~hpvD3hKEYtTMeoAEq7E9bzOsPYPg__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Oyake-Ombis, L. (2012). *Managing plastic waste in urban Kenya: niche innovations in production and recycling*. (PhD Thesis). Wageningen University, Wageningen, NL.

Oyake-Ombis, L. (2017). *Awareness on environmentally sound solid waste management by communities and municipalities in Kenya* (Sound Chemicals Management Mainstreaming and UPOPs reduction in Kenya, Ministry of Environment and Natural Resources). Retrieved from https://www.ke.undp.org/content/kenya/en/home/library/environment_energy/Sound-waste-management-bycommunities.html

Owuor, S. O., & Mbatia, T. (2008). *Post independence development of Nairobi city, Kenya*. Paper presented at the Workshop on African capital Cities, Dakar, Senegal. http://erepository.uonbi.ac.ke/bitstream/handle/11295/38925/2008_dakar_workshop.pdf?sequence=1

Penal Code. (1948). *Penal Code (cap. 63)*. (L.N. 124/1964, Act No. 24 of 1967). Retrieved from http://kenyalaw.org:8181/exist/kenyalex/actview.xql?actid=CAP.%2063

Pongrácz, E., & Pohjola, V. J. (2004). Re-defining waste, the concept of ownership and the role of waste management. *Resources, conservation and Recycling, 40*(2), 141-153. https://doi.org/10.1016/S0921-3449(03)00057-0

Pongrácz, E., Phillips, P., & Keiski, L. (2004, June). *From waste minimization to resources use optimization: Definitions and legislative background.* Paper presented at the Proceedings of the waste minimization and resources use optimization conference. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.612.3866&rep=rep1&type=pdf

Post, J., & Obirih-Opareh, N. (2003). Partnerships and the public interest: Assessing the performance of public-private collaboration in solid waste collection in Accra. *Space and Polity, 7*(1), 45-63. https://doi.org/10.1080/13562570309244

Projects Today. (2020). Waste-to-energy plant to come up in Nairobi. Retrieved from https://www.projectstoday.com/News/Waste-to-energy-plant-to-come-up-in-Nairobi

Public Health Act. (1986). *Public Health Act (Chapter 242). Revised Edition 2012 [1986]*. The National Council for Law Reporting with the Authority of the Attorney-General Retrieved from http://extwprlegs1.fao.org/docs/pdf/ken129231.pdf

Republic of Kenya. (2006a). *Environmental Management and Co-ordination (Waste Management) Regulations 2006*. (L.N. NO. 121). Retrieved from https://www.nema.go.ke/images/Docs/Regulations/Waste%20Management%20Regulations-1.pdf

Republic of Kenya. (2006b). *The Environmental Management and Co-ordination (Water Quality) Regulations*. (L.N. No. 120). Retrieved from https://elaw.org/system/files/ke.WaterQualityReg.pdf

Republic of Kenya. (2012 [1999]). *Environmental Management and Co-ordination Act*. (No. 8 of 1999). Retrieved from http://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/EnvironmentalManagementandCo-ordinationAct_No8of1999.pdf

Republic of Kenya. (2013a). *National Environment Policy*. Ministry of Environment, Water and Sanitation. Nairobi. Retrieved from https://climate-laws.org/geographies/kenya/policies/national-environment-policy-2013#:~:text=National%20Environment%20Policy%202013,-Executive&text=The%20Policy%20aims%20to%20provide,institutional%20framework%20for%20good%20governance

Republic of Kenya. (2013b). *The Public Private Partnership Act*. (Acts No. 15). Retrieved from http://www.parliament.go.ke/sites/default/files/2017-05/PublicPrivate_Partnerships_ActNo15of2013.pdf

Republic of Kenya. (2015). *The Nairobi City County Solid Waste Management Act*. (No. 5 of 2015). Nairobi City County Gazette Supplement Retrieved from https://nairobiassembly.go.ke/ncca/wp-content/uploads/acts/2015/Nairobi-City-County-Solid-Waste-Act-2015.pdf

Shamim, A., Mursheda, A., & Rafiq, I. (2015). E-waste trading impact on public health and ecosystem services in developing countries. *J Waste Resources, 5*(188), 2. http://dx.doi.org/10.4172/2252-5211.1000188

Soezer, A. (2017). *A Circular Economy Solid Waste Management Approach for Urban Areas in Kenya* (for the Ministry of Environment and Natural Resources Kenya and UNDP Low Emission Capacity Building (LECB) Programme). Retrieved from https://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMAs/nama-on-circular-economy-solid-waste-management-approach-for-urb.html#:~:text=NAMA%20on%20Circular%20Economy%20Solid%20Waste%20Management%20Approach%20for%20Urban%20Areas%20in%20Kenya,-Aug%2021%2C%202017&text=Instead%20of%20waste%20being%20collected,and%20towards%20various%20recycling%20practices

Stanbury, W., & Thompson, F. (1995). Toward a political economy of government waste: First step, definitions. *Public Administration Review, (55)*5, 418-427. Retrieved from https://www.jstor.org/stable/976766

Tabuchi, H., Corkery, M., & Mureithi, C. (2020, 30 August). Big Oil Is in Trouble. It's Plan. Flood Africa With Plastic. *The New York Times*. Retrieved from https://www.nytimes.com/2020/08/30/climate/oil-kenya-africa-plastics-trade.html

The Institute for Social Accountability. (2014). *Nairobi City County Budget Estimates for the FY 2014/15*. Retrieved from https://www.tisa.or.ke/images/uploads/Nairobi_City_County_Budget_2014_Budget_Analysis_Draft.pdf

The Institute for Social Accountability. (2016). *Status Report on Budget Implementation in Solid Waste Management in Nairobi City County*. Retrieved from https://www.tisa.or.ke/images/uploads/Status_Report_on_Budget_Implementation_in_Solid_Waste_Management_in_Nairobi_City_County.pdf

The Kenya Gazette. (2017). *Gazette Notice No. 2334*. Retrieved from https://www.nema.go.ke/images/Docs/Awarness%20Materials/Gazette_legal_Notice_on_carrier_bags.pdf

Transparency International. (2019). Sub-Saharan Africa: undemocratic regimes undermine anti-corruption efforts. Retrieved from https://www.transparency.org/news/feature/cpi2018-subsaharan-africa-regional-analysis

UN-Habitat. (2010). Solid waste management in the world's cities. *Water and Sanitation in the Worlds Cities*. London, Washington, DC: Earthscan.

UN-Habitat. (2020). Waste Wise Cities Newsletter #6. Retrieved from https://unhabitat.org/sites/default/files/2020/08/wwc_newsletter_vol6_en.pdf

UNEP. (2011). Towards a green economy: Pathways to sustainable development and poverty eradication. *Nairobi, Kenya: UNEP*.

UNEP. (2018a). Africa Waste Management Outlook. United Nations Environment Programme Nairobi, Kenya.

UNEP. (2018b). Our planet is drowning in plastic pollution. Retrieved from https://www.unenvironment.org/interactive/beat-plastic-pollution/

UNEP. (2018c). The Basel Convention & Basel Protocol on Liability and Compensation. Retrieved from http://www.basel.int/TheConvention/Overview/LiabilityProtocol/tabid/2399/Default.aspx

UNEP. (2019). Stockholm Convention Overview. Retrieved from http://www.pops.int/TheConvention/Overview/tabid/3351/Default.aspx

UNEP. (n.d.). The Bamako convention. Retrieved from https://www.unenvironment.org/explore-topics/environmental-rights-and-governance/what-we-do/meeting-international-environmental

Vatn, A. (2005). *Institutions and the Environment*. Cheltenham: Edward Elgar Publishing.

Vatn, A. (2015). *Environmental governance: institutions, policies and actions*. Cheltenham: Edward Elgar Publishing.

Walsh, D. C. (2002). Urban residential refuse composition and generation rates for the 20th century. *Environmental science & technology, 36*(22), 4936-4942. https://doi.org/10.1021/es011074t

Wangatia, V. (2014). *Socioeconomic implications of solid waste management practices on participating households, Kenya.* Community Disaster Interventions (CDI), Nairobi, Kenya.

Wei, Y., Li, J., Shi, D., Liu, G., Zhao, Y., & Shimaoka, T. (2017). Environmental challenges impeding the composting of biodegradable municipal solid waste: A critical review. *Resources, Conservation and Recycling, 122*, 51-65. https://doi.org/10.1016/j.resconrec.2017.01.024

WHO African Regional Office. (2008). Libreville Declaration on Health and Environment in Africa. Libreville: World Health Organization.

Wilson, D. C. (2007). Development drivers for waste management. *Waste Management & Research, 25*(3), 198-207. https://doi.org/10.1177/0734242X07079149

World Population Review. (2020). Nairobi Population 2020. Retrieved from https://worldpopulationreview.com/world-cities/nairobi-population/

WRAP. (2010). *Environmental benefits of recycling - 2010 update*. Retrieved from http://www.wrap.org.uk/sites/files/wrap/Environmental_benefits_of_recycling_2010_update.3b174d59.8816.pdf

Xue, L., Liu, G., Parfitt, J., Liu, X., Van Herpen, E., Stenmarck, Å., . . . Cheng, S. (2017). Missing food, missing data? A critical review of global food losses and food waste data. *Environmental Science & Technology, 51*(12), 6618-6633. https://doi.org/10.1021/acs.est.7b00401

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