MANAGING SOLID WASTE IN AFRICA

A scoping study to prepare the ground for future action

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INTRODUCTION

Technically, solid waste includes refuse from households, non-hazardous solid waste from institutions, industries and commercial establishments, market waste, yard waste and street sweepings. In many low- and middle-income countries, it excludes medical waste (healthcare waste), hazardous industrial waste and sewage, e-waste, radioactive waste. Management of solid waste encompasses the functions of its collection, transfer, treatment, recycling, resource recovery and disposal.

This report is based on desk research and analysis of existing reports, policy documents, academic and research articles, documents from the UN, and news reports. The aim is to provide an overview of the municipal solid waste (MSW) management scenario in Africa, particularly some countries in Sub-Saharan Africa.

However, one of the key challenges in writing this report has been the limited availability of reliable, current and comprehensive data on waste management in these countries, based on systematic sampling methods and surveys. Based on the available data and information, the writers have attempted to put together a profile, which could perhaps prove useful in identifying the gaps working towards filling them in future.

The Sub-Saharan African region, comprising of 48 countries, is witnessing a surge in population growth as well as in its rate of urbanisation. Currently housing 1.03 billion people, the region's population is projected to reach 2.7 billion by 2060[1] (*see Graph 1: Population trends in Sub-Saharan Africa*).[2] In line with this surge, waste generation in this region is also expected to register an over four-fold rise by 2050, according to some reports.

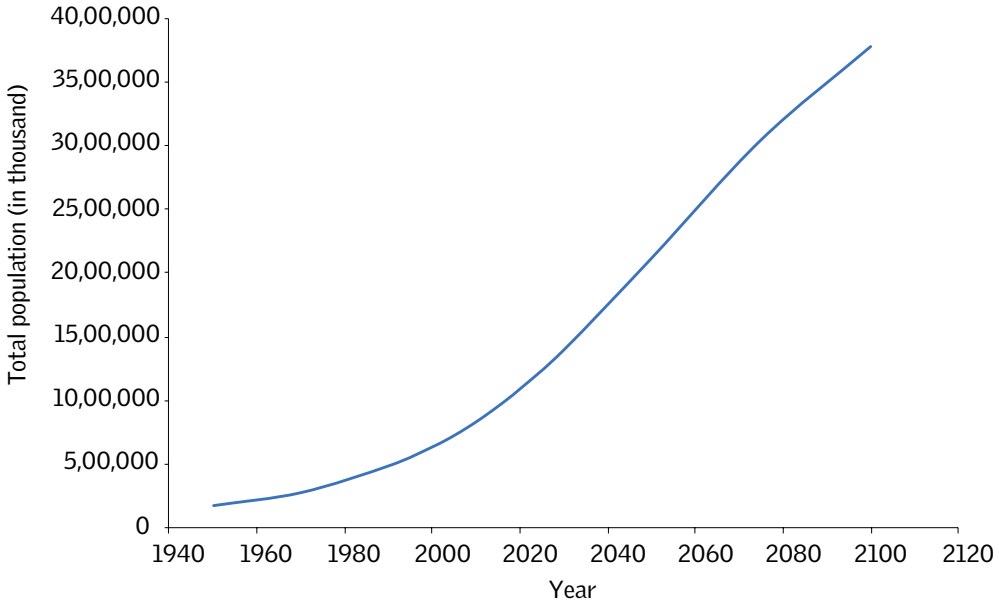
While a large proportion of this population is concentrated in rural areas, there is a trend of workforce migration from the rural to the urban, which is fuelling the spread of cities. Urban areas currently contain 472 million people: this is expected to double over the next 25 years. The global contribution of African urban inhabitants is projected to grow from 11.3 per cent in 2010 to 20.2 per cent by 2050.[3]

HOW MUCH WASTE DOES SUB-SAHARAN AFRICA GENERATE?

In 2016, Sub-Saharan Africa (SSA) generated 174 million tonne (MT) of waste: the per capita generation was 0.46 kg per day.[4] Although solid waste generation is currently lower in Africa than in the developed world — the SSA region has the lowest per capita generation rate globally[5] (*see Graph 2: Projection of per capita waste generation in Sub-Saharan Africa vs the global average*) — the region is expected to become a dominant region globally in terms of total waste generation if current trends persist.[6]

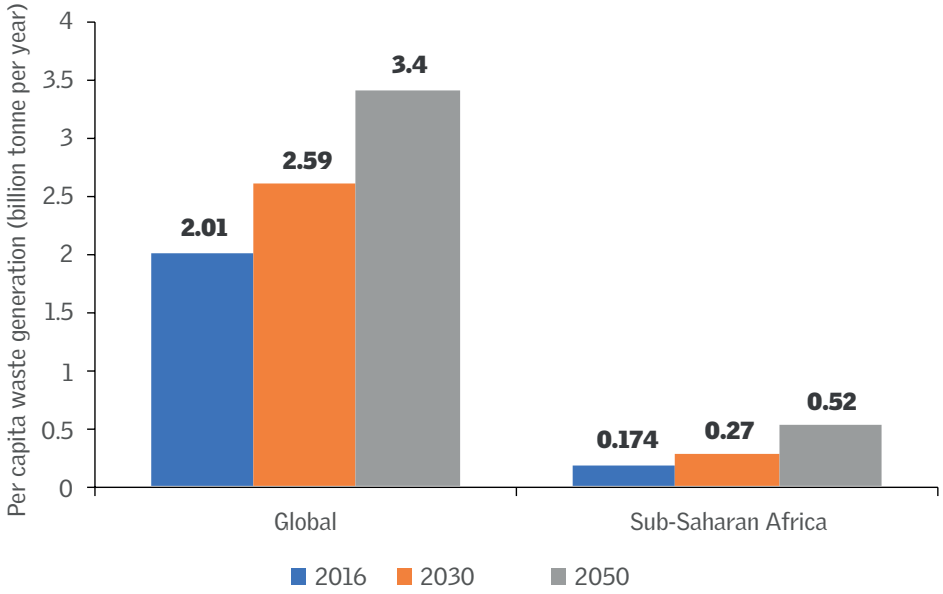
The countries in Sub-Saharan Africa are also expected to witness a major economic transition over the coming century as their populations explode, their rural-to-urban migration increases, and their consumption patterns change. All this will contribute to an exponential rise in waste generation, and put a huge strain on natural resources and the already stretched public and private sector services and infrastructure for managing solid waste.

Graph 1: Population trends in Sub-Saharan Africa



Source: United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects 2019, Volume II: Demographic Profiles

Graph 2: Projection of per capita waste generation in Sub-Saharan Africa vs the global average

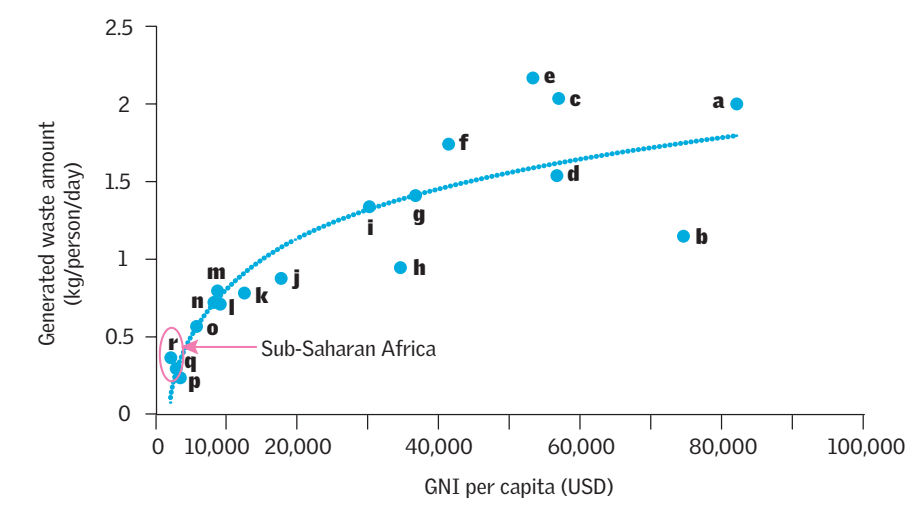


Source: World Bank, 2018, What a waste 2.0

WASTE GENERATION AND ECONOMIC AFFLUENCE

Data indicates that generation of solid waste has a clear relation to the degree of economic development in a country. The jump in waste generation is sharp during initial stages of economic development, particularly until the per capita GNI reaches US $10,000 (see Graph). The Africa Solid Waste Management Data Book (2019) reports that the rise in waste generation has plateaued or even declined slightly in some developed nations as their economies have matured. In the case of Sub-Saharan Africa, which is beginning to see an economic uptick but has a per capita GDP of only US $1,600 (2017), the rise is significant. It is expected that waste generation will continue to rise in line with economic growth in this region.

Graph: How they go together



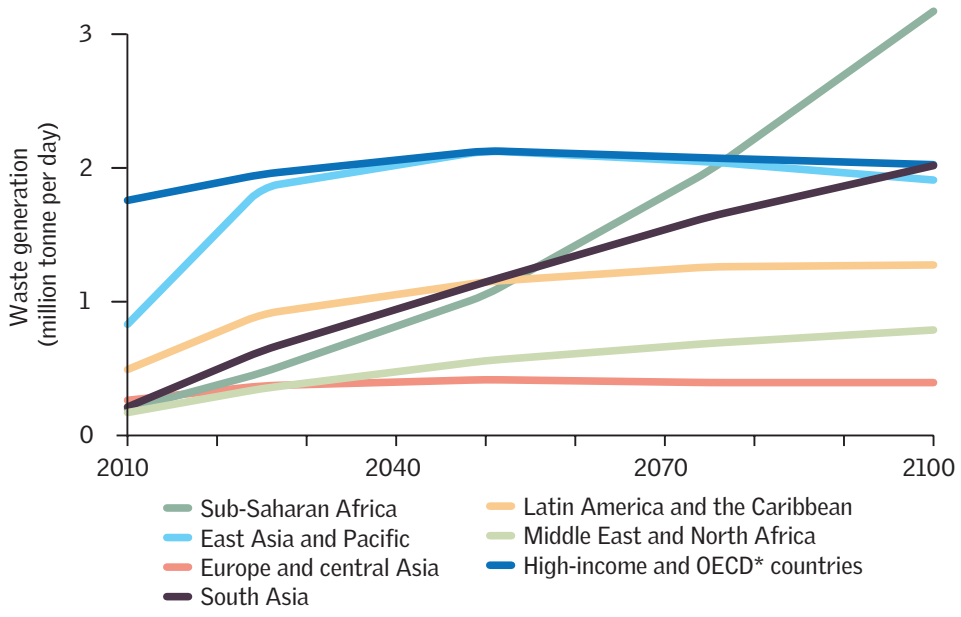
Note: (a) Switzerland, (b) Norway, (c) USA, (d) Australia, (e) Denmark, (f) Germany, (g) France, (h) Japan, (i) Italy, (j) Czech Republic, (k) Poland (l) Malaysia, (m) Mexico, (n) Brazil, (o) Thailand, (p) Indonesia, (q) Philippines, (r) Vietnam

Source: Africa Solid Waste Management Data Book 2019, African Clean Cities Platform (ACCP) Secretariat

According to a study published in *Nature* magazine, waste generation will continue to rise in the fast-growing cities of SSA. In fact, the urbanisation trajectory of Africa will be a key determinant in the intensity of the 'global waste peak'[7]. Using business-as-usual projections, the study predicted that by 2100, solid waste generation rates in this region will exceed 11 MT a day — several times more than today's rate (0.5 MT a day) (*see Graphs 2 and 3: Projected per capita waste generation in Sub-Saharan Africa vs the global average and Projected waste generation by region*).

With lower populations, denser and more resource-efficient cities, and less consumption (along with higher affluence), the peak could come forward to 2075 and reduce in intensity by more than 25 per cent. This could cut down the region's waste generation by around 2.6 MT per day.[8]

Graph 3: Projected waste generation by region



Source: Hoornweg, D., Bhada-Tata, P. and Kennedy, C., 2013. Environment: Waste production must peak this century. Nature, London, UK

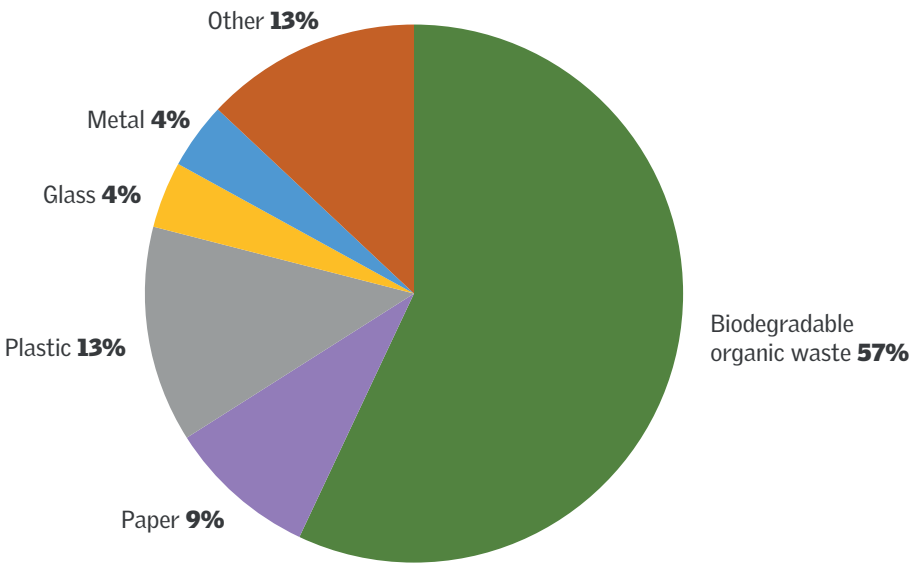
WHAT IS THE COMPOSITION OF THE REGION'S WASTE?

The waste generated in SSA has a high proportion of biodegradable organic material, accounting for about 57 per cent of the total waste generated (*see Graph 4: Waste composition in Sub-Saharan Africa*). The presence of high fraction of biodegradable organics is attributed to poor food preservation and preparation methods in these countries.[9] Organic waste generated is more heterogeneous in urban areas compared to the rural areas. Also, the quantities of waste are typically more in urban areas.

The proportion of recyclables such as plastics, paper, metals and glass are comparatively lower in SSA countries than in high-income nations. The proportion of plastic waste varies from 10 to 20 per cent for most of SSA countries depending upon their economic level.[10] The average percentage of plastic waste is 13 per cent, as reported by the United Nations Environment Programme in 2018. The key drivers which affect plastic waste generation are income levels, economic growth, population growth, changes in consumption patterns and migration. Currently, the region generates an estimated 17 MT of plastic waste every year, which is not recycled efficiently.[11]

Typical consumption patterns in the region are changing and moving towards consumption of more packaged products and electronic items, which will further increase the proportion of plastic and e-waste (which typically comprises of non-ferrous metals such as aluminium, copper and even gold which could be potentially recycled). It has been reported that if these valuable metals are recycled, they could earn the region an income exceeding Euro 55 billion. Rwanda and Uganda are two of the countries which have formed policies and guidelines for the management of e-waste.[12] In most of the other countries in the region, e-waste is disposed of along with the other components of municipal solid waste.

Graph 4: Waste composition in Sub-Saharan Africa



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

HOW DOES THE REGION COLLECT ITS WASTE?

The average MSW collection rate in Sub-Saharan Africa is only 44 per cent. Waste collection is typically done in a dual system, in which the waste is first collected door-to-door and later from a centralised point where the collected waste is aggregated. The collection rate is reported to be higher in urban areas compared to rural areas.[13] The rate varies between countries, cities, and even within cities. For example, the collection rate for Lagos city in Nigeria is above 90 per cent, while for Jimma in Ethiopia and Wa in Ghana, it could be below 55 per cent.[14]

A lack of collection and transport equipment is one of the major challenges and reason behind the low collection rate. An estimated 238 million of the region's urban population lives in slums or informal settlements,[15] where collection vehicles and workers cannot reach easily.

Since the SSA countries' waste typically contains high proportions of biodegradable organics which are higher in water content, the types of waste compactor vehicles typically used in developed nations are unable to function effectively in these countries — they offer little advantage in terms of increasing the waste density.[16] The absence of proper maintenance of these vehicles is also a major challenge. Most of the times, these vehicles become non-operational because of maintenance difficulties which include lack of technical capacity, complicated mechanisms and equipment, lack of the time for carrying out repairs or maintenance, and a lack of budget needed to import parts.[17] Experiences in Abuja (Nigeria) show that advanced compactor trucks provide little advantage for African conditions owing to the high proportion of organic matter in the MSW, as well as servicing requirement.[18]

Primary waste collection is often performed by a wheelbarrow or a donkey cart in many African cities. Although these methods allow for efficient waste collection, they are not capable of long-distance transport or for moving waste in bulk. In some cases, therefore, systems have been adopted in which transfer points have been set up — the primary collection is performed by wheelbarrow or donkey carts, and the waste is later collected by a motorised vehicle (secondary collection or transport).[19]

The uncollected waste is often managed independently by households, or openly dumped or burned.

WHAT PRACTICES DOES THE REGION FOLLOW IN DISPOSAL AND DUMPING?

Open dumping is the predominant waste disposal method adopted by the SSA countries. Open dumping is a practice where solid wastes are disposed of in an open area in a manner that does not protect the environment, where they are susceptible to open burning and are exposed to the elements, vectors and scavengers.

The SSA region has 19 of the world's 50 biggest dumpsites.[20] Most of these dumpsites and landfills are non-engineered. Researchers from the Liverpool John Moores University, UK and the University of Lagos, Nigeria studied 31 landfill sites in 13 countries in the SSA region — they found that 90 per cent of these were classified as disposal sites with no or very limited controls. The landfills were actually dumpsites having no leachate collection and treatment systems, composite liner, or gas collection systems (*see Table 1: List of studied dumpsites*).[21]

Table 1: List of studied dumpsites

S.No.	Landfill name	Location	Waste generated per year (in tonne)	Level assessed
1	Olusosun	Lagos, Nigeria	2,100,000	2
2	Solous	Lagos, Nigeria	820,000	1
3	Musaka	Cameroon	36,650	1
4	Mbellewa	Bamenda, Cameroon	35,152	0
5	Antula	Guinea Bissau	21,776	0
6	Mpape	Abuja, Nigeria	-	1
7	Igbatoro	Ondo Nigeria	100,000	0
8	Epe	Lagos, Nigeria	12,000	1
9	Awotan	Oyo, Nigeria	36,000	0
10	Lapite	Oyo, Nigeria	9,000	0
11	Eneka	Port Harcourt, Nigeria	45,600	0
12	Ajankanga	Oyo, Nigeria	-	0
13	Aba-Eku	Oyo, Nigeria	-	0
14	Unguwan Dosa	Kaduna, Nigeria	-	0
15	Wakaliga	Uganda	-	0
16	Kiteezi	Uganda	-	1
17	Bakoteh	Kanifing, Gambia	-	0
18	Granville Brooke	Sierra Leone	-	1
19	Kingtom	Sierra Leone	-	1
20	Garankuwa	Pretoria, South Africa	-	1
21	Nduba	Kigali, Rwanda	140,752	1
22	Kadhodeki	Nairobi, Kenya	-	0
23	Coastal Park	South Africa	-	3
24	Hatherley	South Africa	-	1

S.No.	Landfill name	Location	Waste generated per year (in tonne)	Level assessed
25	Gachororo	Juja, Kenya	-	0
26	Vingunguti	Tanzania	-	1
27	Dompoase	Kumasi, Ghana	-	2
28	Bellville South	Cape Town, South Africa	-	3
29	Gamodubu	Gaborone Botswana	-	3
30	Robinson deep	South Africa	-	3
31	Koshe	Bole and Akanki Kality sub-city, Addis Ababa, Ethiopia	over 300,000	0

Notes

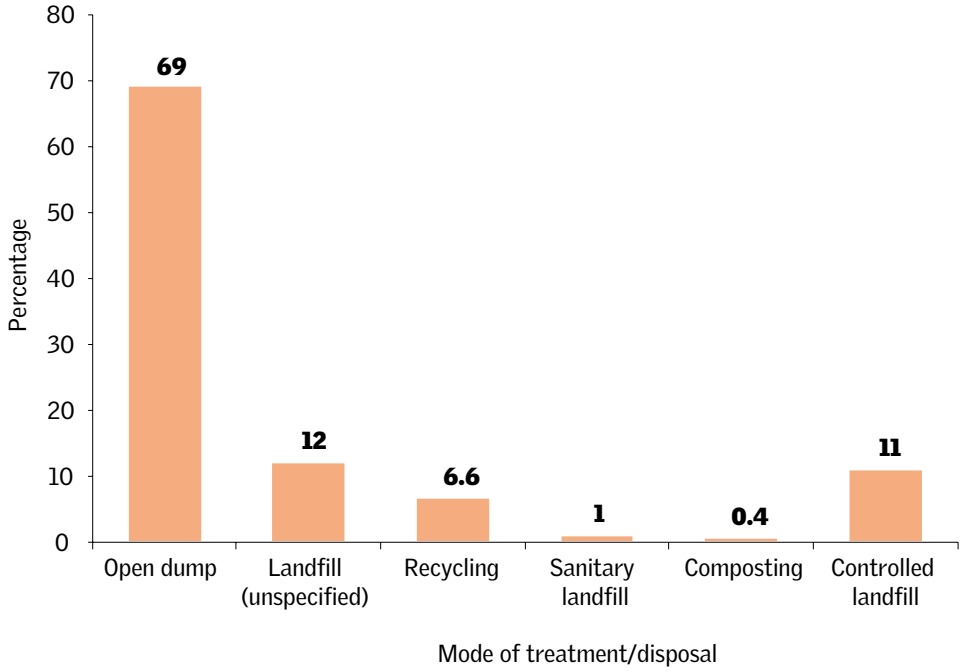
	Level of control	Construction, operations and maintenance
0	None	Uncontrolled dumping — no controls, lacking leachate and gas collection and treatment system
1	Low (semi-controlled facility)	Waste placed in designated area; some site equipment, some containment and management of combustion process; basic operating procedures to control nuisance
2	Medium (controlled facility)	Emission controls to capture particulates; trained staff follow set operating procedures; equipment properly maintained; waste compacted using site equipment; waste covered (but irregularly)
3	Medium/high (engineered facility)	Engineered landfill site: use of daily cover material; some level of leachate containment and treatment; collection of landfill gas, high levels of engineering and process control, turbulence and temperature; emission controls to capture acid gases and capture dioxins; active management of fly ash
4	High (state-of-art facility)	Built to and operating in compliance with international best practices including fully functional sanitary landfill site: properly sited and designed; leachate containment (naturally consolidated clay on the site or constructed liner); leachate and gas collection; gas flaring and/or utilization; final cover; post closure plan

Source: Idowu, I.A., Atherton, W., Hashim, K., Kot, P., Alkhaddar, R., Alo, B.I. and Shaw, A., 2019. An analyses of the status of landfill classification systems in developing countries: Sub Saharan Africa landfill experiences, Waste Management, Elsevier, Amsterdam, The Netherlands

WHAT IS THE REGION'S RECORD IN RECYCLING AND TREATMENT LIKE?

Considering that nearly 80 to 90 per cent of the MSW generated in Africa is recyclable, it makes little sense that more than 90 per cent of the waste generated in Africa is still disposed of on land (open dumping and controlled and uncontrolled landfilling). With so little regard for the opportunity that waste presents as a secondary resource, only 4 per cent of the waste generated in Africa is recycled currently, mostly by informal reclaimers, as has been reported by the United Nations Environment Programme in 2018.[22]

Graph 5: Waste management methods in SSA countries



Source: World Bank (2018)

A 2018 World Bank report says that around 6.6 per cent of the waste is recycled or recovered in the SSA countries.[23] Open dumping, however, remains the most common disposal method, accounting for nearly 70 per cent of the total waste generated, followed by landfill disposal which accounts for another 24 per cent (*see Graph 5: Waste management methods in SSA countries*).

Recycling is typically done by the informal sector, a critical workforce which is never recognised for its work.

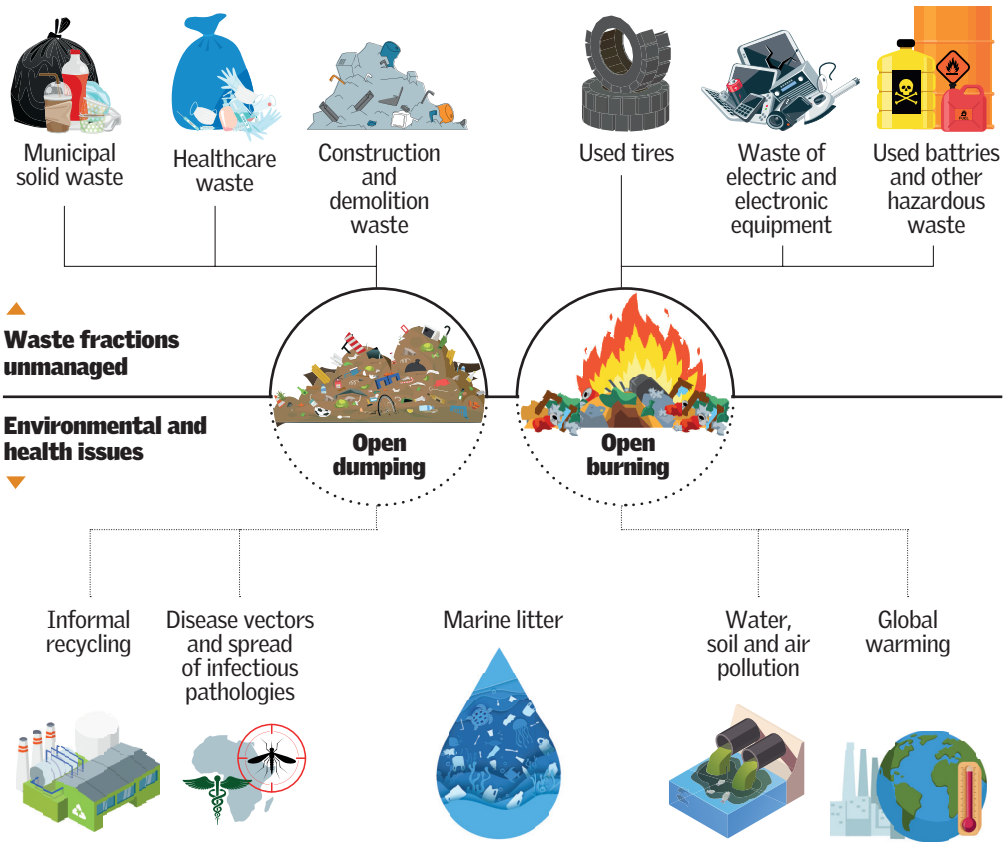
SO, WHAT'S BREWING IN THE SSA REGION AS A RESULT?

While the growing piles of debris and waste is a cause for concern, what is more worrying is the unscientific management of this waste, a major proportion of which is dumped in the open. A 2017 report by CSE — *Integrated Waste Management Policy and Legislation for African Nations* — has pointed out the key hurdles in instituting sustainable solid waste management systems in this region. These include meagre source separation, an absence of waste data inventory including classification and characterisation of waste streams, and limited institutional capacity to scientifically manage different material streams to secure maximum recovery, processing and recycling. The findings of this report have been further validated by two scoping studies done by CSE to gauge the solid waste ecosystem in Eswatini and Tanzania.

According to the World Bank's 2018 report *What a waste 2.0*, the Sub-Saharan African countries accounted for 9 per cent of the global waste production in 2016 — together, they generated nearly 180 tonnes of waste. Out of this, 60 per cent was disposed of in open dumpsites. In fact, 19 of the world's 50 biggest open dumpsites are located in Sub-Saharan Africa.[24]

The impacts of this have been (and continue to be) quite severe (*see Figure 1*). The indiscriminate dumping has become a potential trigger for a host of environmental and health

Figure 1: Impacts of open dumping and waste burning



Source: Mebratu, D and Mbandi, A, 2022. Open Burning of Waste in Africa: Challenges and Opportunities, Engineering X (founded by the Royal Academy of Engineering and Lloyd's Register Foundation) and the United Nations High Level Champions (UNHLC)

hazards. Besides gaseous emissions, leakage of waste into land, surface water and groundwater is common. Open dumpsites are breeding grounds for pests, insect-vectors, rodents etc, and increase the chances of outbreaks of diseases ranging from cholera and malaria to zika virus and hantavirus pulmonary syndrome.[25] Constant exposure to gases (such as hydrogen sulphide) emanating from open dumpsites can lead to lung disease and other non-respiratory illnesses.[26]

Open burning of waste is rampant in almost all the countries in the region, leading to significant air pollution. It is estimated that more than 1.2 million premature deaths occur every year in Africa due to exposure to air pollution; the waste sector is estimated to contribute approximately 29 per cent of the particulate matter, as per global estimates.[27] The most severely affected are informal sector waste-pickers and the marginalised poor living close to dumpsites.

Greenhouse gas emissions resulting from improper waste management is another measure of the impact on environment. Globally, in 2005, nearly 3 to 5 per cent of the total anthropogenic GHG emissions were contributed by the world's waste sector — dumpsites in developing nations (including those in the SSA region) are said to account for a large proportion of this.[28] In 2009, this region's waste-related activities had accounted for nearly 5 per cent of the global greenhouse gas (GHG) emissions; the figure increased to 9 per cent by 2020.[29]

The reason for this is clear. Sub-Saharan territories, which usually lack any policies on food loss and waste management, produce waste with a high biogenic carbon content of around

DUMPSITE ACCIDENTS

The more direct impact of sloppy solid waste management practices in this region has been a series of dumpsite accidents (*see Table*). Huge mountains of waste have collapsed in numerous cities in these countries as a consequence of improper disposal site management and excessive piling of waste, leading to a loss of many lives.

Table: Major dumpsite accidents in recent years

Year	Name of the dumpsite	City and country	Number of fatalities	Other impacts	Cause of the accident
2017	Koshe dumpsite	Addis Ababa, Ethiopia	116	Not assessed	Unscientific design and operations of the dumpsite[33]
2018	Hulene dumpsite	Maputo, Mozambique	17	Five homes crushed in the disaster[34,35]	Unscientific design and operations — immediate trigger was heavy rains
2016	-	Cotonou, Benin	100	More than 200 injured	Reportedly, gasoline was being used to burn some of the food waste, which caused a blast even as people were filling sacks with discarded flour[36]
2017	-	Conakry, Guinea	8	Many injured	Torrential rains[37]
2016	Mbeubeuss dumpsite	Dakar, Senegal	3	Several missing38	Unscientific design and operations

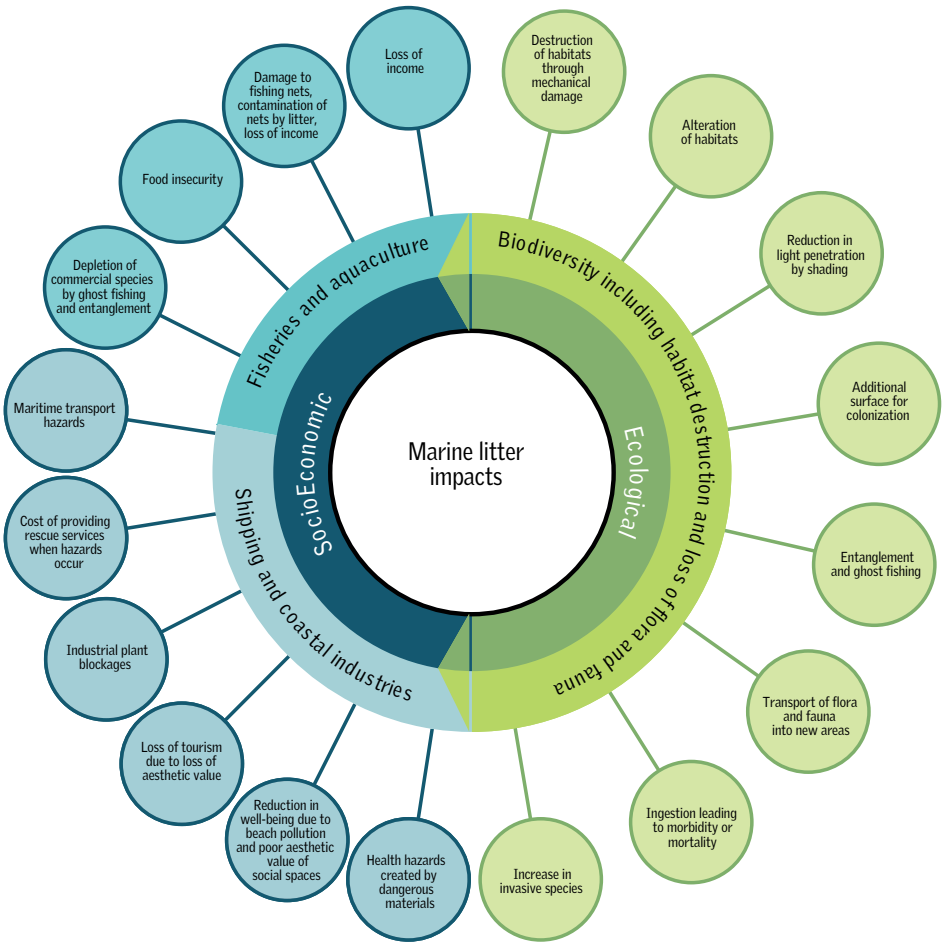
56 per cent (+/-25 per cent) — about 40 per cent more than what is generated by developed countries. The organic waste bearing this biogenic carbon is disposed of in uncontrolled dumps, and produces huge amounts of methane.[30]

Besides biodegradable organic waste, plastic waste is also becoming a significant problem. Nearly 17 MT of plastic waste is generated by Sub-Saharan Africa annually; of this, only 12 per cent is recycled.[31] The majority of plastic is either burned or dumped, with significant quantities entering rivers, streams and lakes and eventually making its way to the oceans (*see Figure 2*).[32]

It is clear that waste management systems in African countries need an urgent overhaul. It has become imperative for these countries to adopt and implement sustainable solid waste management practices based on the principles of circular economy and resource conservation. This will also help them achieve the targets under the UN's Sustainable Development Goals (SDGs).

According to a report '*Open burning of waste in Africa: Challenges and opportunities*' authored by the UN High-Level Champions Waste Leads Desta Mebratu and Andriannah Mbandi: "Around 70-80 per cent of the municipal solid waste generated in African cities is

FIGURE 2: MARINE LITTER AND ITS IMPACTS



Source: Abidjan Convention and GRID-Arendal, 2020, Preventing and Managing Marine Litter in West Central and Southern Africa — A review

recyclable — such as biodegradable waste, plastics and paper — and could be worth US $8 billion per year if kept in a circular economy." The report "recommends taking an engineering approach to addressing the structural deficiencies in waste management and promoting a circular economy that prioritises reuse, recycling and recovery and that will strengthen local manufacturing, create jobs, reduce unemployment, support inclusive and sustainable local and regional economies, and reduce air pollution and greenhouse gas emissions."[39]

THE NEED TO HAVE A GLOBAL FORUM OF CITIES FOR CIRCULAR ECONOMY

Africa in general — and Sub-Saharan Africa in particular — with its galloping population, its urban sprawl, and its potential to contribute in no small measure to the world's 'waste problem', needs urgent intervention. It must explore environmentally sound and economically viable methods of municipal solid waste management that can ensure institutional, financial, environmental, economic and social sustainability.

In fact, the concerns that we see in Africa are similar to what is witnessed in India: the scale of the problem, the challenges, and the roadmap that could lead to lasting solutions are more or less the same. Centre for Science and Environment (CSE), the India-based think tank which has been working in the global ecosystem for over 40 years in 26 countries across Africa and Asia, believes this issue requires a collaborative and joint global action – which is why it has initiated the process of establishing an international forum of countries and cities from the Global South: a forum which will offer a platform for sharing and exchange of knowledge, ideas, information, policy interventions, opportunities and best practices on solid waste management.

CSE's initiative has been named the 'Global Forum of Cities for Circular Economy' in Solid Waste Management, and it aims to help nations in the Global South – including the countries in Sub-Saharan Africa -- adopt appropriate evidence-based learnings, policy interventions, institutional frameworks and implementation modalities to establish sustainable solid waste management systems based on the principles of circular economy.

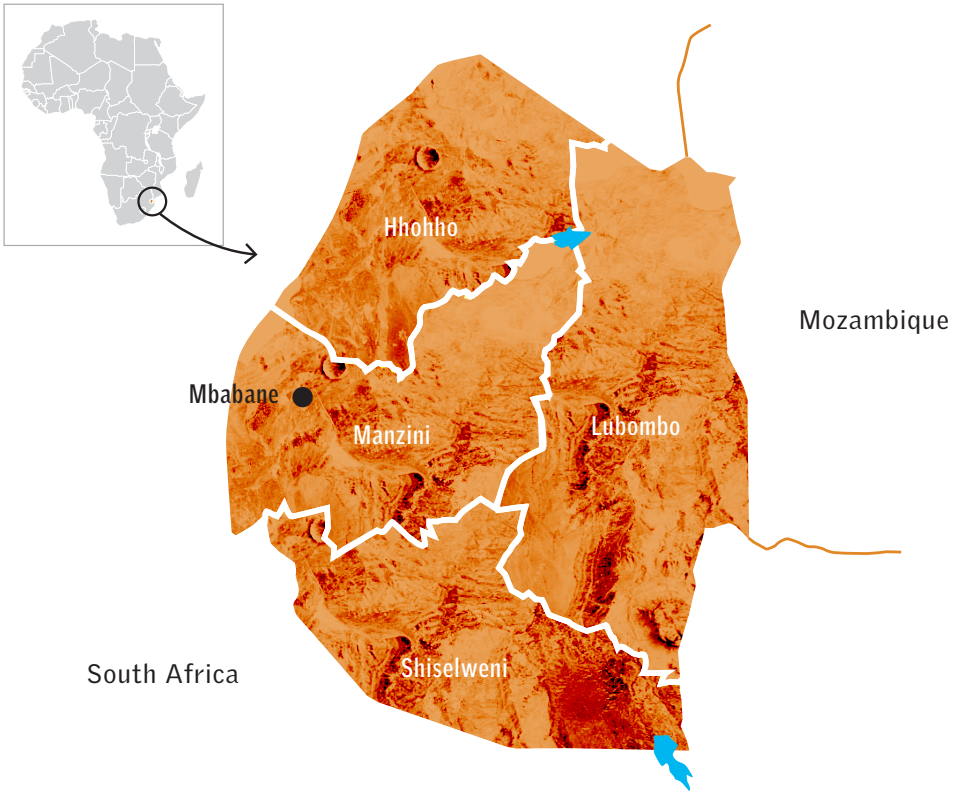
The 'Global Forum of Cities for Circular Economy' is, therefore, conceived as a bridge for countries and cities to connect with each other in the pursuit of achieving sustainable solid waste management practices and become pioneers of waste management themselves -- eventually emerging as models to inspire and influence others.

Ten nations in Sub-Saharan Africa – Eswatini, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Rwanda, Tanzania, Uganda and Zambia -- have agreed to join the Forum at the onset; the number is expected to go up as more cities from across the world take to reinventing their waste management systems with the help of evidence-based research and best practices.

This document, a secondary scoping research on the state of solid waste management systems and practices in these 10 countries, hopes to offer some insights into the kinds of regional, local and national challenges that confront these countries, and what could be the building blocks of a possible way forward.

Based on information available in the public domain, the study has tried to assess the level of source separation practised in these countries, along with the collection efficiency, transportation systems for waste, processing and treatment facilities and disposal methods and practices. We are hopeful that this study will serve as an initiatory step towards beginning discussions on the subject, and will provide the framework for exploring possibilities of collaboration.

Eswatini



Population	**1.15 million**
Population density	**67 persons per square km**
Area	**17,364 square km**
Municipal solid waste generation per annum	**0.23 million tonne**
Source segregation percentage	**Data not available**
Collection efficiency	**70 per cent**
Percentage of waste recycled, processed and recovered	**30 per cent**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

ESWATINI

The Kingdom of Eswatini — formerly known as the Kingdom of Swaziland — is situated in the south-eastern part of Africa. With a land area of over 17,000 square km, the country has an elevation range of 60-1,860 metre above the sea level. Eswatini is landlocked, with South Africa to its north, west and south and Mozambique on the east.

Although small in size, Eswatini is characterised by a great variation in its landscape, geology, soils, climate and biodiversity. It is a lower-middle-income country with a GDP of US $4.71 billion. **It has a population of 1.15 million people,[1] and the annual growth rate of this population is 0.9 per cent.** Between 2007 and 2017, Eswatini's population had grown by 10 per cent.[2]

Mbabane, with a population of a little over 90,000 in 2010, is the capital and the largest city. Most of the population is concentrated in the Manzini and Hhohho regions, which — as a result — also account for the lion's share of the country's generation of urban solid waste.

With rising population density and rate of urbanisation, waste generation is increasing. In the future, waste management is expected to become even more challenging and expensive for the government, local authorities and urban residents.[3]

Garbage collection from peri-urban and rural areas in Eswatini

CSE

POLICY INTERVENTIONS

The key policies governing waste management in Eswatini are the Waste Regulations Act of 2000, the Environmental Management Act (EMA) of 2002, and the National Solid Waste Management Strategy (NSWMS) (*see Table 1: The legal framework for waste management in Eswatini*). The NSWMS attempts to give effect to the two Acts. It details out the goals and action

Table 1: The legal framework for waste management in Eswatini

Key legislative documents for waste management	Mandate related to waste management
Waste Regulations Act, 2000	• Guides authorities to manage different fractions of waste. • Mandates proper storage of waste in urban areas and the use of waste receptacles such as bins and skips (in inaccessible areas) for different categories of waste (household, commercial, recyclable), making it compulsory to store it in aforementioned manner. • Mandates collection of solid waste at least once a week and transportation of different streams of waste to approved disposal facilities. • Mandates waste disposal only in designated landfills or dumpsites and lists penalties in case of non-compliance.
Environmental Management Act (EMA), 2002	• Provides national guidelines and standards for waste management with respect to waste reduction, reuse, recycling and recovery; physical separation of waste; movement of waste and its final disposal. • Provides for minimisation of waste generation wherever practicable – says that waste should, in order of priority, be reused, recycled, recovered and disposed of safely in a manner that avoids creating adverse effects or, if this is not practicable, is least likely to cause adverse effects. • Provides for setting up a National Waste Information System and initiating awareness programmes about the importance of managing waste
Litter Regulations, 2011	• Makes provisions to manage littering in urban and peri-urban areas – dumping, depositing, dropping, throwing, discarding or littering in any public or private property, river stream or any other body of water in the country is prohibited unless otherwise stated.
National Solid Waste Management Strategy (NSWMS)	• Has set goals for stakeholders (with a cross-sectional approach) to achieve effective and efficient waste management services based on a waste hierarchy approach. • Has provisions to implement waste management hierarchy; 100 per cent source segregation programmes; divert recyclables from landfills by creating material recovery facilities, buy-back centres, sorting centres, etc; and ensure access to waste management services for all in urban and rural areas.

Source: Compiled from various sources

points for all relevant government agencies for adopting and implementing a holistic approach in waste management.

GENERATION AND COMPOSITION

In its National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases 2017, the Eswatini Environment Authority (EEA) estimated the municipal solid waste generation in the country to be 238,341 tonne per year in 2016.[4] Per capita waste generation was calculated at almost 0.2 kg a day (*see Table 2: Annual waste generation in Eswatini*).

However, this estimation does not provide the correct picture, as 76 per cent of the country's population which resides in rural areas reportedly generates 0.43 kg per capita daily as against 0.9 kg per capita per day in urban areas. Per capita waste generation of Eswatini's rural population is in line with the average per capita generation in Sub-Saharan Africa — 0.46 kg per day (reported by the World Bank in 2016).

Four cities — Mbabane, Manzini, Matsapha and Piggs Peak — where over 54 per cent of the urban population lives, together contribute around 84 per cent of the total waste generated in Eswatini's urban areas.[5]

A study done by Nxumalo, et al. (2020) on *Plastic waste management practices in the rural areas of Eswatini* says that affluent urban areas are not the only household waste generators; some peri-urban and rural areas located relatively close to towns and cities also generate a high quantity of waste. This was attributed to a common trend locally in which the urban workforce has been relocating to neighbouring rural areas. This has resulted in some rural areas recording a higher affluence level than even nearby townships.

The waste generated in Eswatini comprises of 50-55 per cent organic fraction; the remaining 45-50 per cent is recyclable waste (such as paper, plastic, metal, glass) and inerts (such as C&D debris, drain silts and road sweepings).[6] However, the National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Releases in 2017 has estimated that inerts made up 30 per cent, while the dry fraction is merely 10 per cent of the total waste generated (*see Graph 1: Waste composition in Eswatini*).[7]

These findings are debatable because the estimations are not based on systematic and scientific sampling procedures. Moreover, this assessment may have included waste reaching the dumpsite for ultimate disposal, excluding the valuable recoverable material or the dry fraction of waste which would have been extracted already by the informal sector. No official study to assess the composition of waste has been done so far in the country despite the existence of a legal mandate to conduct such studies in order to adopt appropriate technologies for treating and managing waste.

COLLECTION

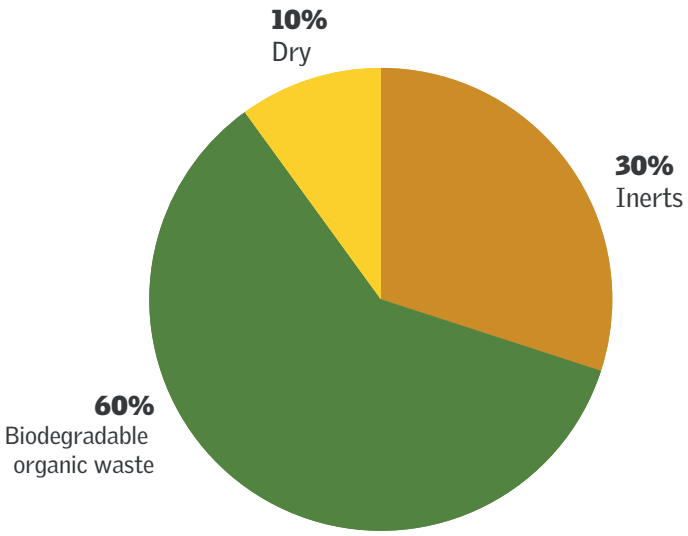
Compared to other Sub-Saharan countries, Eswatini has an efficient waste collection system in place — the collection efficiency stands at 70 per cent.[8] However, it is important to note that the collection of waste is only efficient in certain areas and nearly non-existent in many rural and peri-urban locations.[9]

Table 2: Annual waste generation in Eswatini

Annual waste generation (in tonne)	1996	2017	Percentage increase in waste generation
Urban	**44,567**	**100,103**	**125**
Rural	**41,756**	**138,237**	**231**
Total	**86,323**	**238,340**	**176**

Source: State of Environment Report, 2001; National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Release, 2017, United Nations Industrial Development Organization (UNIDO) and the European Union

Graph 1: Waste composition in Eswatini



Source: National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Release, 2017, United Nations Industrial Development Organization (UNIDO) and the European Union

A 2017 CSE report — *Integrated Waste Management Policy and Legislation for African Nations* — states that door-to-door collection is handled by municipalities in the major urban areas.[10] However, the 2017 National Inventory on Open Burning Practices and Unintentional Persistent Organic Pollutants Release states that collection efficiency is merely 42 per cent, with collection frequency varying from once to thrice a week depending on the affluence of the area as per the UNIDO report (2017). Currently, major urban areas like Manzini, Matsapha and Mbabane consist of peri-urban areas where household waste is not adequately collected by municipalities.

Waste is collected in non-compartmentalised vehicles. Segregation is not practised in any of the towns. For areas that collection vehicles cannot access or for informal settlements, municipalities have set up collection centres. However, there are no transfer stations in any urban area.

DUMPING AND DISPOSAL

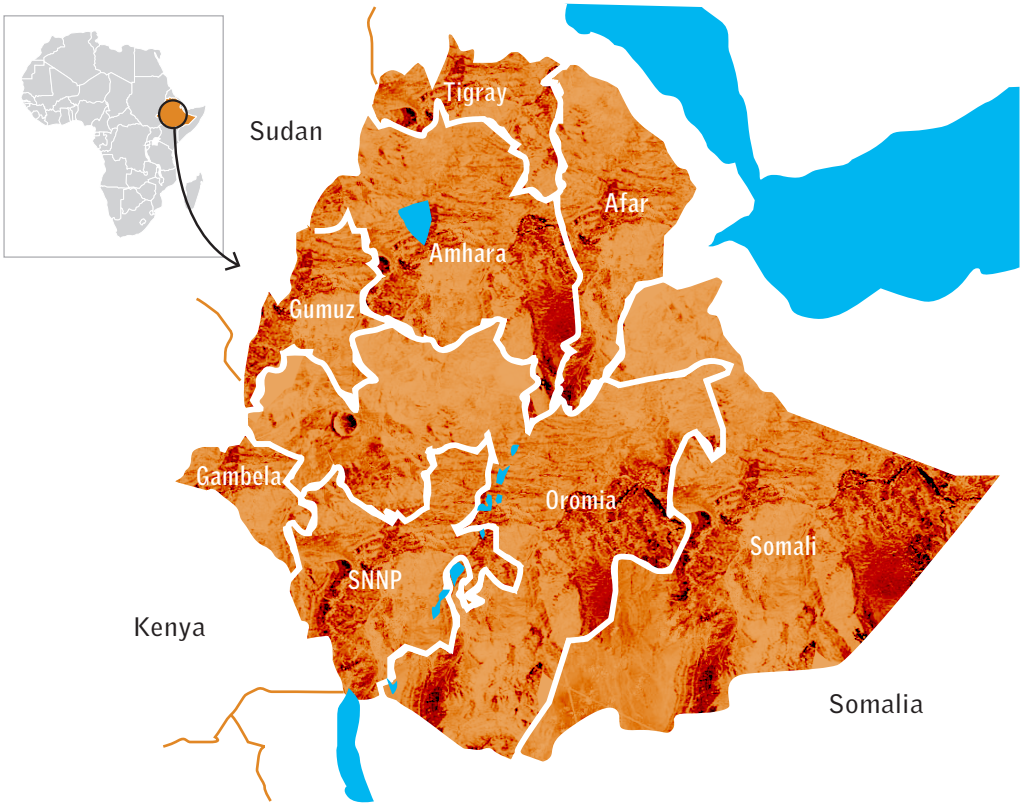
In Eswatini, cities and major towns dispose of their solid waste in dumpsites, while smaller towns burn their waste in the open.[11] Once waste reaches a landfill or dumpsite, recyclables are extracted by waste-pickers who collect different types of plastic, paper, metal and cardboard. These waste-pickers work independently, without any direct linkages to any authority responsible for the dumpsite or landfill. As a result, they are sometimes denied access to the dumpsite. Although they contribute significantly to the recycling of waste in Eswatini, they do not have access to sanitary facilities or protective equipment.

RECYCLING AND TREATMENT

It is estimated that approximately 30 per cent of the waste is recycled in the country. Recycled waste not only refers to processed waste but also to the waste which is recovered and reused at the source or at the community level.[12]

A whopping 45 per cent of the total waste generated in the country is burnt, leading to emissions.[13] The remaining waste is disposed of — this could have been seen as a positive sign had the rest of the waste been processed, leaving only 25 per cent for the landfill. However, as mentioned above, the waste which is dumped in landfills or dumpsites is poorly managed, leading to environmental pollution and methane gas emissions.

Ethiopia



Population	**117 million**
Population density	**115 persons per square km**
Area	**1,104,300 square km**
Municipal solid waste generation per annum	**Rural — 0.6-1.8 million tonne/year Urban — 2.2-7 million tonne/year[1]**
Source segregation percentage	**NA**
Collection efficiency cities	**Data not available**
Percentage of waste recycled, processed and recovered	**5 per cent (informal)[2]**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

ETHIOPIA

Ethiopia, officially known as the Federal Democratic Republic of Ethiopia, is a landlocked country in eastern Africa bordered by Djibouti, Eritrea, Kenya, Somalia, South Sudan and Sudan. The geography of Ethiopia consists of high plateaus and a central mountain range divided by the Great Rift Valley. The national capital and largest city, Addis Ababa, is situated in the highlands bordering the Valley; it is also economic and cultural centre of the country.

Ethiopia is the second-most populous country in Africa after Nigeria.[3] In fact, it has one of the fastest growing populations in the world, with a growth rate of 3.02 per cent per year. If this rate persists, the population is expected to reach 210 million by 2060.[4]

Over 21 per cent of the population in Ethiopia is urban (nearly 24 million people in 2020)[5]; this segment contributes more waste than the country's rural dwellers. Like other African countries, Ethiopia too is undergoing fast-paced urbanisation leading to the creation of slums and informal habitats with poor and insufficient municipal solid waste management systems.

POLICY INTERVENTIONS

Ethiopia is one of the few countries in the Sub-Saharan African region which has put in place several policies and laws aimed at regulating the implementation and enforcement of sustainable waste management practices in the country (*see Table 1: The legal framework for waste management in Ethiopia*). Besides municipal solid waste management, Ethiopia has also issued regulations for the environmentally sound management of e-waste and hazardous waste (for electrical and electronic waste management, the Disposal Regulation No 425/2018 and for hazardous waste management, the Disposal Control Proclamation No 1090/2018).

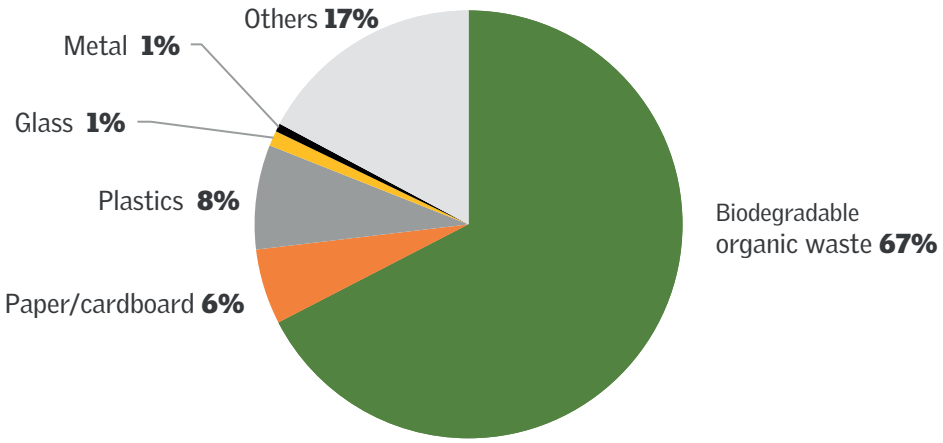
Table 1: The legal framework for waste management in Ethiopia

Key legislative documents for waste management	Mandate related to waste management
Ethiopian Environmental Policy, 1997	Provides for management of waste generated from different sources. Article 3(7) on Human Settlement, Urban Environment, and Environmental Health deals with waste collection services, recycling of solid waste, safe disposal, and the requirement of scientific studies to identify suitable sanitary landfills.
Public Health Protection Proclamation No 200/2000	Prohibits disposal of solid, liquid or any other type of waste that can adversely affect human health and environment.
Environmental Impact Assessment Proclamation No 299/2002	Mandates the requirement of EIA for waste disposal facilities such as waste incineration and landfill sites.
Environmental Pollution Control Proclamation 300/2002	Covers the management of hazardous and non-hazardous wastes (specifically through Article 5). Sub-article 1 of Article 5 states: "All urban administrations shall ensure the collection, transportation, recycling, treatment or safe disposal of municipal waste through the institution of an integrated municipal waste management system."

Key legislative documents for waste management	Mandate related to waste management
Solid Waste Management Proclamation No 513/2007	Covers the general obligations of the urban administration on solid waste management planning, inter-regional movement of solid waste, management of household solid waste, waste collection, storage, transportation, recycling, incineration, scientific disposal, and auditing of solid waste disposal sites. • Addresses the significance of community participation in SWM — solid waste management action plans designed by and implemented at local urban administrative levels help ensure community participation.

Source: Compiled from various sources

Graph 1: Composition of municipal solid waste in urban Ethiopia



Source: Hirpe, L and Yeom, C, 2021, Municipal Solid Waste Management Policies, Practices, and Challenges in Ethiopia: A Systematic Review, Sustainability, MDPI, Basel, Switzerland

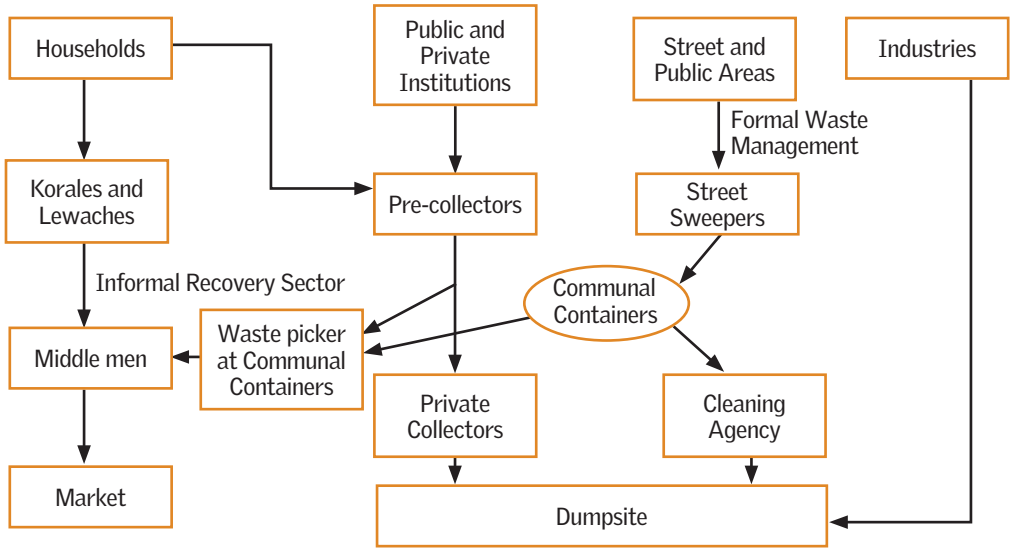
Despite being the central policy document guiding city authorities to sustainably manage their waste, the Solid Waste Management Proclamation No 513/2007 has certain limitations. To begin with, the supporting guidelines crucial for implementing waste management laws and proclamations are not available. Also, the more preferred options in the waste management hierarchy — waste prevention and reduction, separation at source, and provisions for collection of waste service charge (collection fee) — have not been given adequate attention.

COMPOSITION AND GENERATION

Total waste generation in Ethiopia is estimated as 2.2 to 7 million tonne per annum (MTPA) in urban areas and 0.6 to 1.8 MTPA in rural areas. According to the Ethiopian Environmental Protection Agency (2004), per capita waste generation in Ethiopia ranges from 0.17 to 0.48 kg/person/day for urban areas and from 0.11 to 0.35 kg/capita/day for rural areas.

The waste mainly comprises of biodegradable organics (67 per cent) which can be processed and converted into compost or biogas if separated at source. Recyclables such as glass, metal, plastics and paper contribute about 16 per cent of the total waste generated (*see Graph 1: Composition of municipal solid waste in urban Ethiopia).*

Figure 1: The municipal waste management system in Ethiopia



Source: Teshome, F B, 2021, Municipal solid waste management in Ethiopia; the gaps and ways for improvement, Journal of Material Cycles and Waste Management

COLLECTION

Nearly 30 to 50 per cent of the solid waste generated in Ethiopia's urban areas remains uncollected.

In capital Addis Ababa, the figure is about 20 to 30 per cent. A study by the UNDP in four major cities says that only 40 to 50 per cent of the waste generated is properly collected and disposed of.

Another study by Hawassa University in Ethiopia identifies the reasons behind the inefficient solid waste management in Addis Ababa as "*inaccessibility of the city due to the geographical and urban structure, lack of properly designed collection route system and time schedule, inadequate and malfunctioning operation equipment, open burning of garbage, poor condition of the final dump site, littering of the corner around the skips which encouraged illegal dumping*." Obviously, the waste collection system in the city and the entire country needs an urgent overhaul.

The collection service is mostly run in a public-private partnership model. A study by the Switzerland-based Swiss Federal Institute of Aquatic Science and Technology has proposed a few measures for the financial sustenance of the PPP model for waste management in Bahir Dar and other regions of Ethiopia.

The measures include (i) improving the efficiency of collection fee by linking the fees of solid waste collection to water supply; (ii) increasing the value chain by sales of organic waste and recycling products; (iii) diversifying revenue streams and financing mechanisms (polluter-pays, cross-subsidy, and business-principles); and (iv) cost reduction and improved cost-effectiveness.

DISPOSAL AND DUMPING

Disposal sites in Ethiopia are constructed and operated without any scientific investigation or consideration of their impacts. At many of them, hazardous wastes are disposed of mixed along with municipal solid waste. The dumpsites are not soil-covered and fenced to avoid public health problems or environmental pollution. Open burning of waste is practised by households and the municipalities to just get rid of the waste.

The Repi dumphill is the major disposal site in Addis Ababa; it started receiving waste from the city in 1968. Earlier, it was situated on the outskirts of the city; but with rapid urbanisation over the years, the city has grown and the garbage pile is now located in the middle of the city. The continuous dumping of waste at Repi has had deadly consequences: in March 2017, a part of the dumpsite collapsed, killing nearly 113 people.[6] About 500 informal waste workers work at the dumpsite and are potentially exposed to great health and safety risks.[7]

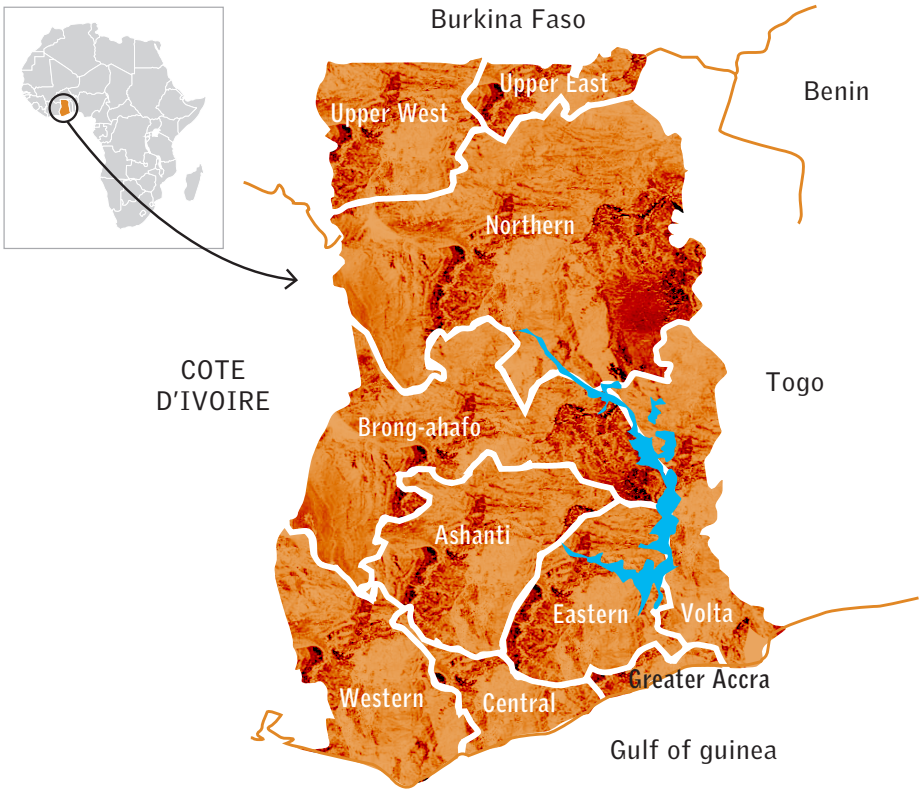
TREATMENT AND RECYCLING

The current Ethiopian municipal solid waste management system consists of collection, transportation and land-based disposal. Only 5 per cent of the total waste collected is recycled; that too, informally.[8] This implies that sustainable solid waste management strategies such as prevention, reduction, reuse, and most importantly 'recycling and treatment' are not practised in the cities or in the rural areas (where the collection rate itself is meagre).

A 2015 review[9] titled '*Micro and small enterprises in solid waste management: Experience of selected cities and towns in Ethiopia*' advocated engagement of medium- and small-scale industries in solid waste management to enhance the service and increase recycling rates. The study stated that "solid waste management services in Ethiopia were mainly the responsibilities of municipalities, which got culminated in inadequate service provision. Thus, the integration of Micro and Small Enterprises (MSEs) by the government has recently being considered as an option. Participation of medium-scale enterprises in SWM started in 2003-04 in Addis Ababa and expanded to other cities following the proclamation of a National Solid Waste Programme in 2007".

In Addis Ababa, a new waste-to-energy plant was set up in 2018 for thermal treatment of municipal refuse. The plant was an outcome of a partnership between the Government of Ethiopia and a consortium of international companies including Cambridge Industries Limited (Singapore), China National Electric Engineering and Ramboll, a Danish engineering firm. The plant has the capacity to incinerate 1,400 tonne of waste every day and help Addis Ababa meet 30 per cent of its household electricity needs, as reported by the United Nations Environment Programme in 2018.[10]

Ghana



Population	**31 million**
Population density	**137 persons per square km**
Area	**238,535 square km**
Municipal solid waste generation per annum	**4.6 million tonne**
Source segregation percentage	**Data not available**
Collection efficiency	**50-70 per cent**
Percentage of waste recycled, processed and recovered	**30 per cent**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

GHANA

The Republic of Ghana is located in West Africa, and has a coastline of 550 km. It is bounded by the Gulf of Guinea and the Atlantic Ocean to its south, and shares borders with Ivory Coast in the west, Burkina Faso in the north, and Togo in the east.

Ghana has a tropical climate with two major seasons: rainy and dry. The average temperature is 30°C and annual rainfall is between 1,100 mm in the north to 2,100 mm in the south. The capital and largest city is Accra; other major cities are Kumasi, Tamale, and Sekondi-Takoradi.

With 31 million people and a population growth rate of about 3.4 per cent per year, Ghana is predicted to face big challenges in waste management in the future.[1] Rapid urbanisation is adding to the problem, putting to test local authorities' ability to manage and dispose of waste in a scientific manner.[2]

POLICY INTERVENTIONS

The legal regime in Ghana mandates that management of all the waste generated in municipalities is the responsibility of the concerned assemblies and ministries – these, therefore, are mandated to collect, recycle and dispose of the solid waste (*see Table 1: The legal framework for waste management in Ghana*).

It is important to note here that the policies and regulations that connect the assemblies with private companies are crucial and contribute effectively in solid waste collection, treatment and disposal in Ghana. These regulations include the Local Government Act, the National Procurement Act, the Local Governments By-law, the Environmental Sanitation Policy, and other state conventions that provide rules for solid waste management.[1]

Table 1: The legal framework for waste management in Ghana

Key legislative documents for waste management	Mandate related to waste management
Local Government Act, 1993	Section 10 (3) of the Act specifies one of the roles of the local government as being responsible for the development, improvement and management of human settlements and the environment in the district; positions the local governments to promote the management of all aspects of environment including MSW management in their areas of jurisdiction. Stipulates that local governments are to initiate programmes for development of basic infrastructure and provide municipal works and services in the district, including engineered landfill sites for treatment of solid waste after disposal, transfer stations for the waste and good roads to cart the waste from the transfer stations to the landfill sites by trucks. Lays the ground for formulation of bye-laws for efficient SWM in cities.

Key legislative documents for waste management	Mandate related to waste management
The National Building Regulations, 1996	Stipulates that a building for residential, commercial, industrial, civic or cultural use shall have a facility for refuse disposal, a standardised dustbin and other receptacles approved by the assembly in which all the waste generated shall be stored pending final collection by the trucks and delivery to the final disposal site.
Environmental Sanitation Policy, 1999	Provides specifications for environmental sanitation services such as solid waste management, liquid waste and industrial waste management, public cleansing and vector and pest control. Sets guidelines regarding storage and collection sites, transportation, treatment and disposal methods. Emphasises on collection of data on waste produced by all sectors of the economy and promotes R&D in all the sectors including waste. Ensures private sector participation and the provision of 80 per cent of SWM in all the assemblies.
Ghana Landfill Guidelines, 2002	Provides guidelines for landfill classification, site identification, design, upgrading of existing dumpsites, operation and maintenance, closure, restoration and aftercare.
Public Procurement Act, 2003	Requires the Assemblies Tender Boards to use competitive bidding to select companies based on four key variables — evolving practice of SWM, households' involvement for service sustainability, private company capacity and regulatory mechanisms and control for SWM in relation to service quality.
National Environmental Sanitation Strategy and Action Plan (NESSAP), 2010	Developed in response to the urgency of refocussing the environmental sanitation sector in Ghana to meet the medium-term development policy framework objectives of the government, as well as those of the Millennium Development Goals (MDG) and other international initiatives. Serves as a Global Framework for Action for efficient and scientific treatment of domestic solid waste, industrial waste, healthcare waste and wastewater.
Hazardous and Electronic Waste Control and Management Act, 2016	Provides guidelines regarding the transport and management of hazardous waste. Covers the control and management of polychlorinated biphenyls, electrical and electronic levies, electrical waste recycling plants and other provisions for environmentally sound management of e-waste and hazardous waste.
National Solid Waste Management Strategy for Ghana, 2020	Developed to help ameliorate priority challenges in SWM, ensuring alignment with existing administrative and governance structures, inclusivity of key stakeholders (government, private sector, and development partners), and recognition of challenges for vulnerable groups. Focuses on waste reduction, reuse, efficient collection, scientific treatment and recycling and proper disposal.

Source: Compiled from various sources

GENERATION AND COMPOSITION

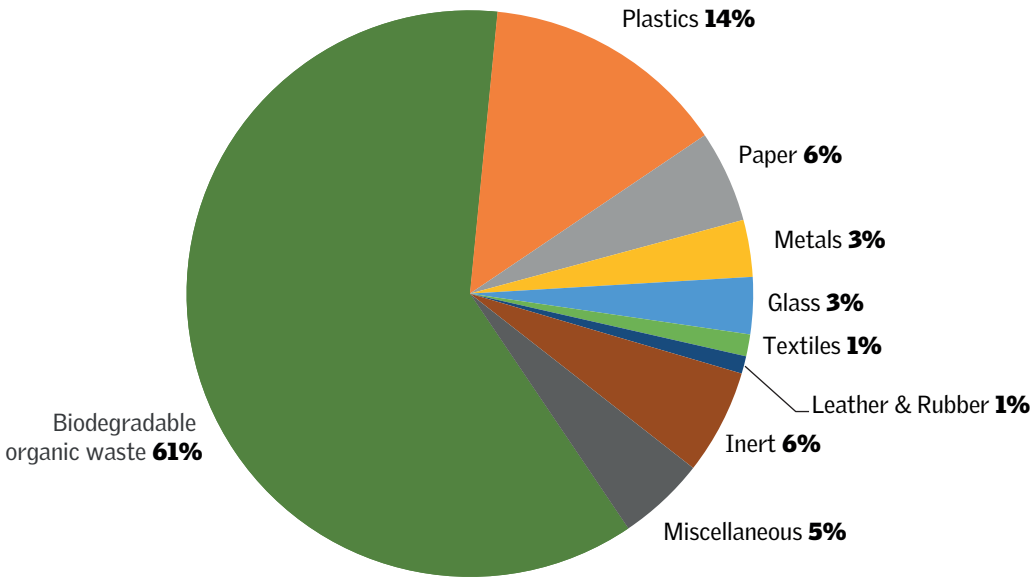
A study by the Kwame Nkrumah University of Science and Technology in Kumasi, Ghana and the Technical University of Denmark has reported that the rate of waste generation in Ghana is 0.47 kg/person/day, which is equivalent to 12,710 tonne per day and 4.64 million tonne per annum.[2] It is important to note that the waste generation rate varies widely across geographical locations, with the coastal and forest zones generating a higher quantum than the northern savanna zone.

The composition of the waste is predominantly organic in nature. Biodegradables contribute nearly 61 per cent of the total waste (*see Graph 1: Waste composition in Ghana*). The daily per capita generation of biodegradable waste including organics and paper has been found to be 0.318 kg; for non-biodegradables or recyclables (including metals, glass, textiles, leather and rubbers), the figure is 0.096 kg. The generation of inerts and miscellaneous waste is 0.055 kg/person/day.

A 2015 study — *Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana* – has reported that "in the coastal zone, the organic waste fraction was highest but decreased through the forest zone towards the northern savanna. However, through the same zones towards the north, plastic waste rather increased in percentage fraction. Households did separate their waste effectively averaging 80 per cent. However, in terms of separating into the bin marked biodegradables, 84 per cent effectiveness was obtained while 76 per cent effectiveness for sorting into the bin labeled other waste was achieved".[3]

The study also reported the waste composition in the capital city Accra, based on systemic sampling procedures: the composition was found to reflect the national average, with 61 per cent biodegradable organics, 14 per cent plastics, 6 per cent inerts, and the rest comprising of recyclable dry waste. The waste composition in Kumasi (second largest city in Ghana) comprises of 64 per cent biodegradable organics and a high percentage of inerts (wood ash, sand and charcoal).[4]

Graph 1: Waste composition in Ghana



Source: Miezah et al, 2015, Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana

COLLECTION

In Accra, nearly 65 per cent of the households in the Greater Accra Region have their solid waste collected (*see Table 2: Waste collection and disposal in Ghana*).[5] According to a 2021 study by the World Health Organization, about 17.4 per cent of the waste is disposed of through public dumping, while 14.6 per cent of households burn their waste.[6] In the other regions of Ghana, nearly 30-50 per cent of the solid waste generated is never collected for disposal – it ends up dispersed on the streets, in drains and in streams.[7]

In many of the urban regions, collection efficiency is poor due to inadequate infrastructure and a lack of capacity to deal with the process of waste collection. A study conducted to explore the perspectives and experiences of private waste management companies in Ho municipality of Ghana[8] has revealed that the manual nature of waste collection and disposal poses a huge challenge. There is a severe crunch of equipment and machinery – the available fleet of waste collection trucks, compactors and other heavy-duty equipment needed for effective solid waste management is completely inadequate. When collection trucks break down, large volumes of solid wastes remain uncollected, leading to frequent occurrences of cholera and dirt-related infectious diseases.[9]

Table 2: Waste collection and disposal in Ghana

Method of waste disposal	Ghana (percentage)	Greater Accra Region (percentage)
Collected	**21.9**	**65.4**
Burned by the households	**19.5**	**14.6**
Public dump	**47.8**	**17.4**
Dumped indiscriminately	**10.8**	**2.7**
Total	**100**	**100**

Source: Mudu, P et al, 2021. Solid waste management and health in Accra, Ghana, World Health Organization, Geneva

DUMPING AND DISPOSAL

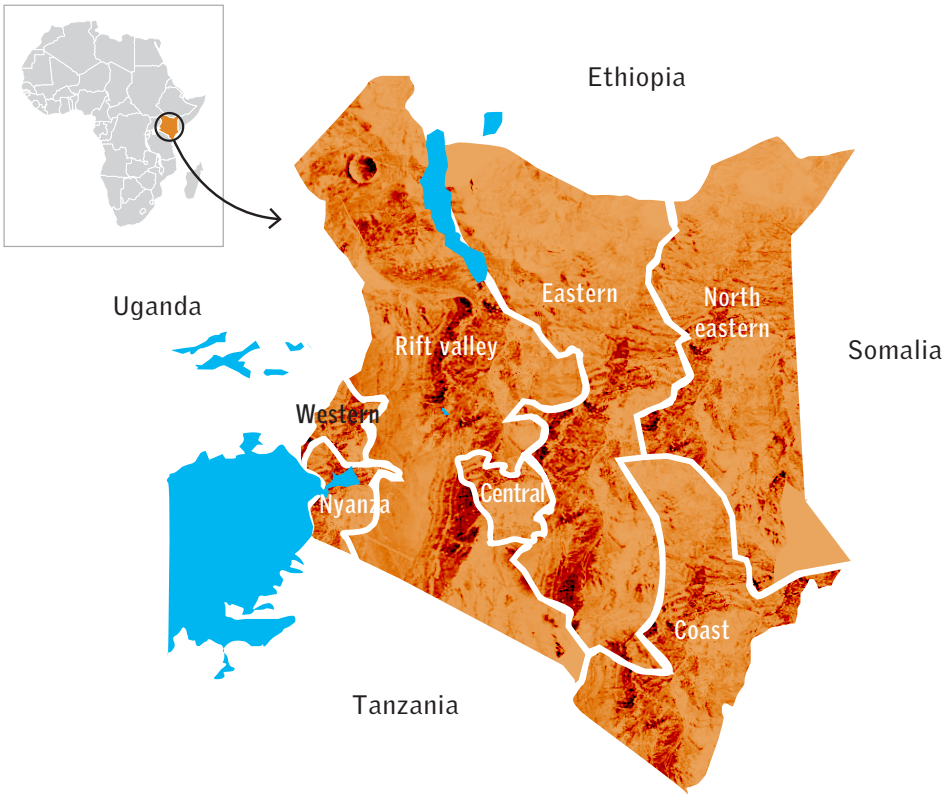
As reported by the Kwame Nkrumah University of Science and Technology, there is no source segregation of waste in the city of Kumasi. The city authorities adopt various waste disposal methods including controlled dumping, sanitary landfilling, composting, and incineration. But uncontrolled dumping and open dumping remains the leading form of waste disposal in all Ghanaian cities, especially in the lower-class neighbourhoods and central business districts. Environmental and health hazards such as odour and vermin infestations, as well as smoke from open fires, are the major problems associated with poor waste management practices in Ghana.[10]

TREATMENT AND RECYCLING

In Accra, the private sector is responsible for municipal solid waste management for over 20 years. Waste collection coverage stands at not more than 65 to 75 per cent, while 62 per cent of the total waste generated is deposited in regulated landfills.[11] Thus, a significant proportion gets dumped either by the public or by unauthorised waste dealers in the environment.

Ghana's waste management also faces financial constraints. For instance, a cost of US $307,340 and US $163,910 is incurred every month on solid waste haulage and maintenance of dumpsites, respectively, in Accra; Kumasi spends about US $491,730 every month on solid waste collection and disposal.[12] Even such substantial amounts has not proved to be sufficient.

Kenya



Population	**44 million**
Population density	**115 persons per square km**
Area	**569,137 square km**
Municipal solid waste generation per annum	**8 million tonne**
Source segregation percentage	**Data not available**
Collection efficiency	**28-58 per cent**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

KENYA

Kenya, on the eastern part of Africa, is bordered by the Indian Ocean, Somalia, Ethiopia, Sudan, Uganda and Tanzania. The climate is tropical along the coast, temperate in the interior and semi-arid to arid in the eastern and northern parts of the country.

Kenya is a developing country, with a growing population (currently at about 44 million). The country is witnessing rapid urbanisation (growth estimated at 4 per cent per annum) and increasing urban poverty — however, as of 2014, 75 per cent of the population continued to live in rural areas.

It is estimated that 34.8 per cent (10 million) of the total population of Kenya lives in urban centres, with the largest five cities (Nairobi, Mombasa, Kisumu, Nakuru and Eldoret) accounting for a third of this number.

POLICY INTERVENTIONS

The Constitution of Kenya's (2010) Article 42 provides that "Every person has the right to a clean and healthy environment," and that the State will "Eliminate processes and activities that are likely to endanger the environment". Moreover, the Constitution devolves responsibilities to authorities over waste management.

Kenya has addressed the concern of waste management as part of the nation's development agenda (Kenya Vision 2030), the National Climate Change Action Plan, and various laws and regulations including the Environmental Management and Coordination Act (EMCA, 2015), the Environment Policy (2013), the National Solid Waste Management Strategy (2015), and the Waste Management Regulations of 2006 (*see Table 1: The legal framework for waste management in Kenya*). However, the legal and policy regime needs to be further strengthened for the country to achieve its waste management goals.

Table 1: The legal framework for waste management in Kenya

Key legislative documents for waste management	Mandate related to waste management
Waste Management Regulations (2006)	• Lays down the standards for treatment and disposal of all categories of wastes including solid, industrial, hazardous and biomedical wastes, pesticides and toxins, and radioactive substances. • Includes regulations for stakeholders such as waste generators and transporters. • Provides specific procedures for handling different types of wastes depending upon their sources (such as domestic, industrial, hazardous etc). • Gives guidelines for licencing procedures.

Key legislative documents for waste management	Mandate related to waste management
Environment Policy (2013)	• Seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. • Strengthens the legal and institutional framework for governance and management of environmental and natural resources.
Environmental Management and Coordination Act (EMCA, 2015)	• Amendment of the EMCA 1999. Gives a list of projects which require submission of Environment Assessment Study report, including waste management projects.
National Solid Waste Management Strategy (2015)	Prepared to establish a common platform for action between stakeholders to systematically improve waste management and lays the framework for improved waste management in Kenya. Under this, the Vision 2030 has set flagship projects for five cities of Mombasa, Kisumu, Eldoret, Nakuru and Thika to have fully functional and compliant waste management systems by developing strategies towards achieving clean environment. The objectives of the strategy are: • Formulate policies, legislations and economic instruments • Reduce waste quantities • Inculcate responsible public behaviour on waste management • Promote waste segregation at source • Promote resource recovery for materials and energy generation • Establish environmentally sound infrastructure and systems for waste management

Source: Compiled from various sources

GENERATION AND COMPOSITION

In 2014, Kenya's 11.2 million urban population generated 5,600 tonne per day of municipal solid waste (*see Table 2: Population growth and waste generation*).[1] However, a 2021 study by the Ministry of Environment and Forestry reported that Kenya generates 22,000 tonne of MSW

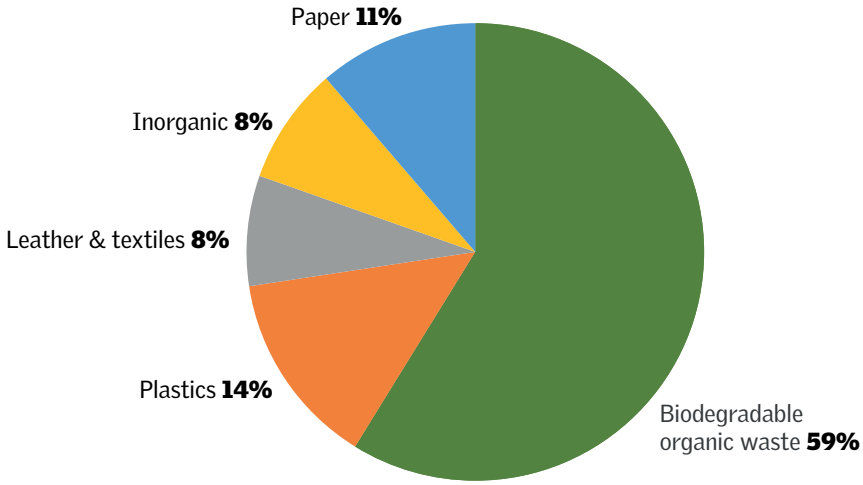
Table 2: Population growth and waste generation

Year	National population	Urban population		Estimated total urban MSW generated (tonne per day)a
		Million	Percentage of total population	
2011	**41.1**	**9.9**	**24.1**	**4950**
2012	**42.5**	**10.2**	**24.0**	**5100**
2013	**43.7**	**10.9**	**24.9**	**5450**
2014	**44.9**	**11.2**	**24.9**	**5600**

aCalculation based on a conservative daily per capita generation rate of 0.5 kg of MSW. This is the reported rate as of 2012, which would have increased now as a result of changing urban lifestyles.

Source: Soezer, A, 2017, A Circular Economy Solid Waste Management Approach for Urban Areas in Kenya, Ministry of Environment and Natural Resources, Nairobi, Kenya and United Nations Development Programme (UNDP).

Graph 1: Composition of waste in Kenya



Source: Eyinda, M K, 2011, 'Nairobi municipal solid waste composition and characteristics relevant to a waste-to-energy disposal method' (Doctoral dissertation, University of Nairobi, Kenya)

per day. This was calculated by assuming an average per capita waste generation of 0.5 kg for a current population of 45 million, which translates into eight million tonne annually.[2]

Out of this, nearly 40 per cent is contributed by urban areas. Waste generation in urban areas is expected to reach 5.5 million tonne a year by 2030, which is thrice the amount generated in 2009. The average per capita waste generation in the main Kenyan municipalities with solid waste disposal sites is approximately 0.46 kg a day. Nairobi appears to be generating more, at a per capita rate of 0.75 kg per day.[3]

A study by the University of Nairobi has reported that the composition of waste in Nairobi averages at 58.8 per cent biodegradables, 13.8 per cent plastics, 7.8 per cent leather and textiles, 8.3 per cent inorganic, and 11.3 per cent paper.[4]

COLLECTION

The collection efficiency in Kenyan cities ranges between 28-58 per cent.[5] As per the study conducted by the Ministry of Environment and Forestry in 2021, about 40 per cent of the population in major cities receives waste management services; in many cities, lower-income and informal settlements do not have any waste collection systems at all.

In cities where the waste is collected, it is done so either by municipal collection services administered by local authorities which are charged with the responsibility of collecting and disposing municipal wastes within their areas of jurisdiction;[6] or by private micro-entrepreneurs, who receive a small collection fee from households and businesses and additional earnings from recycling materials, especially plastic and paper. Most households, however, still handle their own waste by dumping it in public spaces, open burning or composting.

Centralised MSW management systems are used by most local authorities in Kenya. According to estimates from the World Resources Institute and the USAID, local authorities in developing countries spend over 30 per cent of their budgets on refuse collection and disposal, but can only collect a maximum of 50-70 per cent of the waste generated.[7]

DUMPING AND DISPOSAL

All counties in Kenya have uncontrolled waste dumpsites, where leachates pollute the waterways and underground aquifers, and where burning waste emits toxic air and noxious fumes. Take the case of Mombasa: Open dumping is the only method of waste disposal practised by the municipal council. There are two dumpsites in the city — Kibarani and Mwakirunge. They are basically two pieces of vast open land designated for the disposal of waste. The Kibarani dumpsite is older, but it continues to receive waste from all the municipal trucks.[8]

In fact, all dumpsites in Kenya are overflowing with a mix of all types of waste and are very poorly managed. Some of the dumps in Kenya's major urban areas, such as the Dandora dumpsite in Nairobi, Kachok in Kisumu (and Kibarani in Mombasa), have been in operation for over 40 years.[9]

TREATMENT AND RECYCLING

There is no systematic waste segregation at source in Kenyan cities; the recovery of recyclable items like plastics, papers, glass and metals is done by informal waste-picker groups — but they can recover only a fraction of the total recyclable materials,[10] mostly directly from the dumpsites. The informal sector is also involved in sorting and separation of organic waste, which constitutes about 70 per cent of all the waste generated.

While informal waste-pickers at the dumpsites are exposed to health hazards like toxic chemicals, pests etc, their critical role and significance has received some attention thanks to the efforts of community-based organisations.[11]

Privatisation of waste management services — including collection and disposal — has been approved by the Ministry of Local Government in Kenya.[12] But the waste recycling companies say that extracting recyclable materials is often impossible in practice as most household waste is not sorted and is comprised of 60 per cent organic waste; cleaning recyclables that have been mixed with other waste is expensive.

Due to the high quantum of organic waste in the MSW, anaerobic decomposition has been recommended as a suitable solution for urban areas such as Kisumu, due to its potential of generating electricity and reduced environmental impacts.[13]

Recycling companies are also faced with other challenges such as opaque regulatory requirements, multiplicity of licences and charges, lack of distinction in licensing of waste collection and recycling companies, and the fact that a lack of sufficient controls at recycling sites are frequently leading to their use as dumpsites rather than materials recovery centres.

Mozambique

Population	**30.6 million[1]**
Population density	**40 persons per square km[2]**
Area	**801,590 square km**
Municipal solid waste generation per annum	**2.5 million tonne[3]**
Source segregation percentage	**Data not available**
Collection efficiency	**28-56 per cent[4]**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

MOZAMBIQUE

Mozambique lies on the south-eastern coast of Africa, bordering the Mozambique Channel in the Indian Ocean. Its immediate neighbours are Zimbabwe, Zambia, Tanzania and Malawi. Mozambique's terrain varies from coastal lowlands to high plateau in northwest, and mountains on its west.

Mozambique's urban population is growing, albeit slowly. In 2007, just over one in four Mozambicans (30 per cent) lived in urban areas. This percentage is expected to grow to 40 per cent by 2040.[5]

The country has 53 municipalities, one Level A city, three level B cities, nine level C cities and 10 level D cities. The classification is based on the degree of development attained by the country's urban centres.

POLICY INTERVENTIONS

In 1999, the decentralisation process transferred significant responsibilities from the Central to the local government — this included the responsibility for solid waste management. The process was, however, not accompanied by a transfer of the much-needed financial, technical and institutional resources.

Recognising the seriousness of the municipal solid waste management challenge in the country, the government has now introduced the Strategy for Integrated Municipal Solid Waste Management in Mozambique. This strategy has developed the technical, institutional and management frameworks for MSW to be adopted in the country by 2025. It also guides different stakeholders on how to design, implement and manage public cleaning systems involving participation of all sectors.

Table 1: The legal framework for waste management in Mozambique

Key legislative document for waste management	Mandate related to waste management
Environmental Framework Law, Act No 20/97 approving the Environment Act (Lei do Ambiente)	Establishes the steps that need to be taken for exploiting natural resources sustainably, and the impact assessment conditions that must be fulfilled for avoiding environmental disasters. Consists of 34 Articles defining natural elements, as well as authorised activities relevant for exploitation of the environment. Establishes national programmes for environmental management under competent authorities.
Decree No 94/2014 approving the Regulation on Urban Solid Waste Management	Aims at establishing general rules related to residue disposal, including municipal solid waste management rules that would apply to all natural and legal, public and private persons involved in the production and management of urban solid waste, industrial waste and medical waste.

	Lays down the general principles of waste management, the powers and obligations (such as the obligation to draw up an integrated management plan for MSW and the obligation to establish environmental licensing of centres for treatment and disposal of MSW). Establishes the fees and penalties for illegal activities.
Law of Local Government (Lei das Autarquias Locais)	Establishes the legal framework for implementation of waste management by the local government. Refers to environmental issues, in particular the removal processes, treatment and disposal of solid waste, including medical and toxic waste.

Source: Compiled from various sources

GENERATION AND COMPOSITION

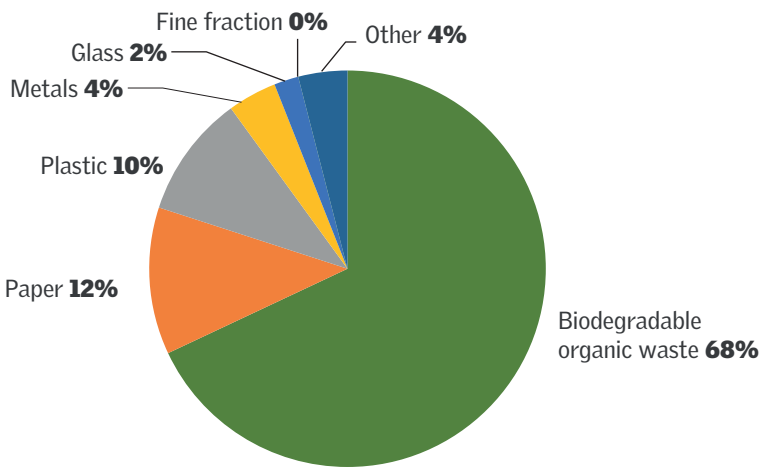
The first reliable information on waste generation, composition and characterisation in Mozambique emerged out of a project conducted in 2002 by the Ministry of Coordination of Environmental Affairs (MICOA) — the project was titled AGRESU (Apoio a Gestão de Resíduos Sólidos Urbanos).[6]

Studies by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, a German development agency, has indicated that waste generation in the inner city sums up to one kg per day per person, compared to 0.56 kg per day per person in suburban areas.[7]

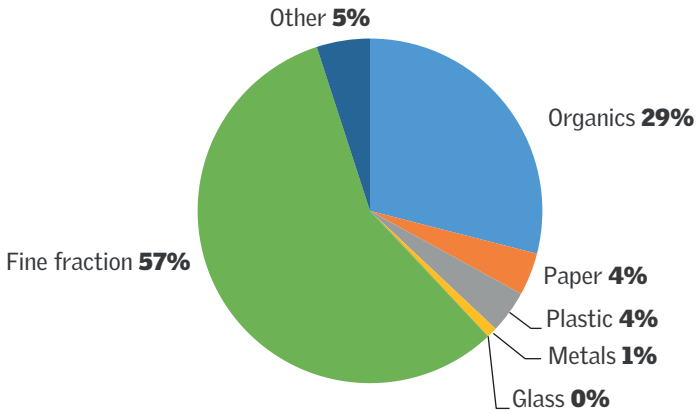
Data for waste composition exists only for the capital city of Maputo. For the rest of the country, there are only estimates. Of the waste generated by Maputo city, 68 per cent is organic (*see Graph 1a: Waste composition in Maputo city*) which can easily be treated using methods like biomethanation or used as compost. Almost 28 per cent of the waste is recyclable.[8]

However, the generation of organic and inorganic fractions in the waste witnesses a decline in the suburban areas — to 29 per cent and 9 per cent, respectively (*see Graph 1b: Waste composition in Maputo — suburban*). 'Fine fraction' has been explained as "sand and dust" in the limited literature that is available.[9] The reason for such a high amount of fine material has not been explained in any of the studies.

Graph 1a: Waste composition in Maputo city



Graph 1b: Waste composition in Maputo (suburban)



Source: 2014, Tas A and Belon A, A comprehensive review of the municipal solid waste sector in Mozambique, Associação Moçambicana de Reciclagem (AMOR)

COLLECTION AND TRANSPORTATION

Waste collection efficiency in the municipalities of Mozambique varies from 28 per cent to 56 per cent.[10] In a lot of regions, waste collection services are limited to the affluent communities. In some neighbourhoods of Maputo, the municipality provides a door-to-door collection service. The municipal law in Maputo directs every waste generator generating more than 25 kg of waste per day to hire a waste management service provider.

The more common model of waste collection in the city is primary (door-to-door) collection by private contractors, who deposit the collected waste at the secondary collection points. The municipality is responsible for collection of the waste from these secondary points and transport it to the dumpsite. The local government is also responsible for the monitoring the contractors to facilitate collection and transportation to relevant disposal sites.

In some suburban areas, a two-step collection system is followed: locally based small-scale enterprises collect the urban waste twice a week. They are paid by the municipality. The waste is then transported to larger containers placed at accessible points (secondary collection points).

DISPOSAL AND DUMPING

Almost all the urban solid waste that is generated in Mozambique reaches the nearest dumpsites or gets dumped in the open, burned or mismanaged.

The largest dumping site in the country is Hulene in Maputo, located in the suburban part of the city. About 70 per cent of the city's waste is dumped here.[11] The dumpsite is not marked with a boundary and is close to residential areas, making its location inappropriate. Similarly, the dumpsite in Beira, Mozambique's third largest city, is located in a flood-prone area, and poses a severe environmental and health hazard to residents.

The Maputo municipality has developed a development programme for municipalities aimed at converting existing uncontrolled dumpsites into controlled waste dumps by adapting cell systems and trench methods, apart from other measures such as legal and institutional reforms and capacity building.

TREATMENT AND RECYCLING

Urban solid waste is sometimes used to fill in potholes, particularly those caused by rainwater. Suburban communities practise 'informal' waste management — basically, burying and burning. However, this system is not ideal; with growing neighbourhoods, there is no space, inside or outside the yards, for this type of management of waste.

GUSTAVO MAHOQUE, THE WORLD BANK

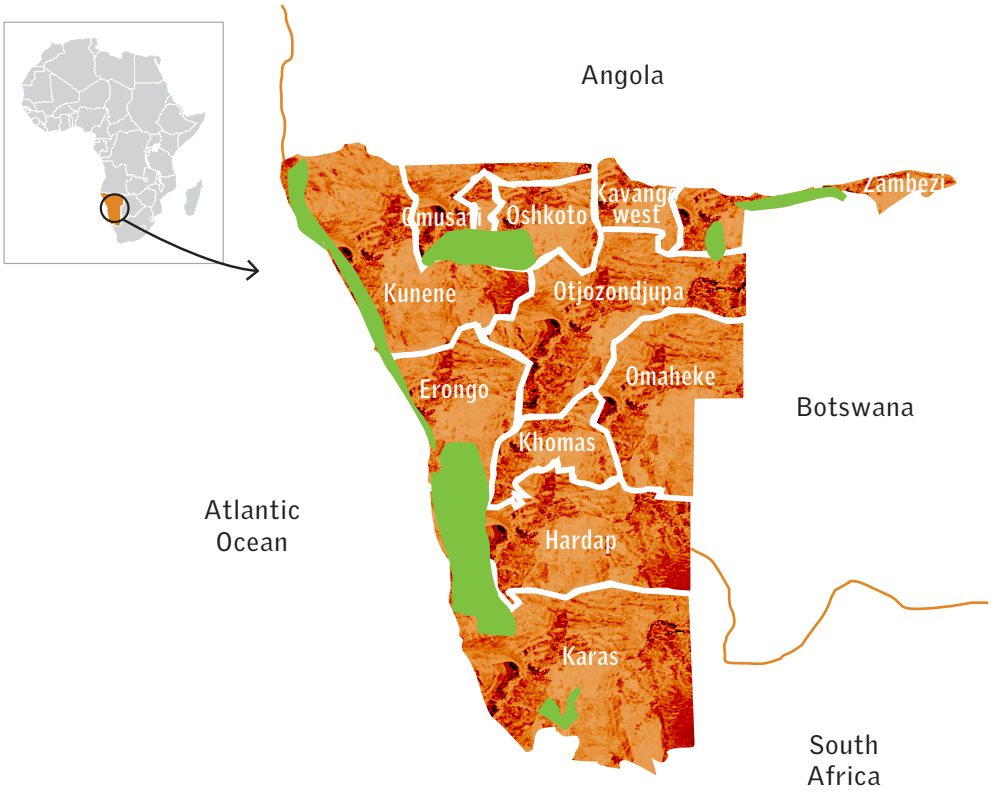
Waste collection in a Maputo neighbourhood

The system does not envisage special treatment for the toxic and non-biodegradable components. The final destination of solid waste in Mozambique is mostly open bins and uncontrolled dumpsites, with no or very little waste treatment.

In some cities like Beira, contractors have been engaged by the local government and allotted land by the municipality. This land is utilised for tipping the collected waste and separation, followed by composting (in the case of organic waste). The compost is then sold to local farmers. However, the value of the dry recyclable fraction of waste gets compromised due to non-separation of urban solid waste at source.

The industrial demand for recycled materials is weak in Mozambique.[12] Most of the fractions of waste like PET bottles, metals and glass are recycled and exported. However, some fractions like paper and plastics (like polypropylene and polyethylene) are recycled and used within the country. Only a small handful of private companies are involved in the recycling of waste.

Namibia



Population	**2.54 million[1]**
Population density	**3 persons per square km[2]**
Area	**824,292 square km**
Municipal solid waste generation per annum	**0.25 million tonne[3]**
Source segregation percentage	**Data not available**
Collection efficiency	**42.4 per cent[4]**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burying and burning**

Source: Compiled on the basis of all the literature cited in this report

NAMIBIA

Namibia, officially the Republic of Namibia, is located in southern Africa, and borders the Atlantic Ocean on its west. It shares land borders with Zambia and Angola to the north, Botswana to the east and South Africa to the south and east.

Almost 52 per cent of the Namibian population has been reported as urban, with an annual increase of 3.8 per cent.[5]

The country has a total of 14 regions, which are further sub-divided into 121 constituencies. Namibia has three major municipalities (called the Part 1 municipalities), 10 smaller municipalities (called the Part 2 municipalities), 25 town councils and 13 villages.[6]

Namibia is faced with numerous challenges related to solid waste management, ranging from waste collection, recycling and disposal to a resource crunch for local governments and littering. The National Solid Waste Management Strategy reports a lack of coordination between stakeholders. The private sector has shown an interest in offering solid waste management services, but more support is needed from the government.

POLICY INTERVENTIONS

Namibia does not have specific regulations dedicated to solid waste management in the country. Waste management has found a mention in the Environment Protection Act of 2007, which is the parent act on environmental matters.

Namibia has developed a National Solid Waste Management Strategy (NSWMS) with 2018 as the base year — the aim is to achieve certain objectives by 2028. Some of these milestones are:

- Setting up a solid waste management unit in the Ministry of Environment and Tourism
- Setting up a solid waste management advisory panel
- Adopting solid waste management regulations
- Developing guidance material on solid waste management planning

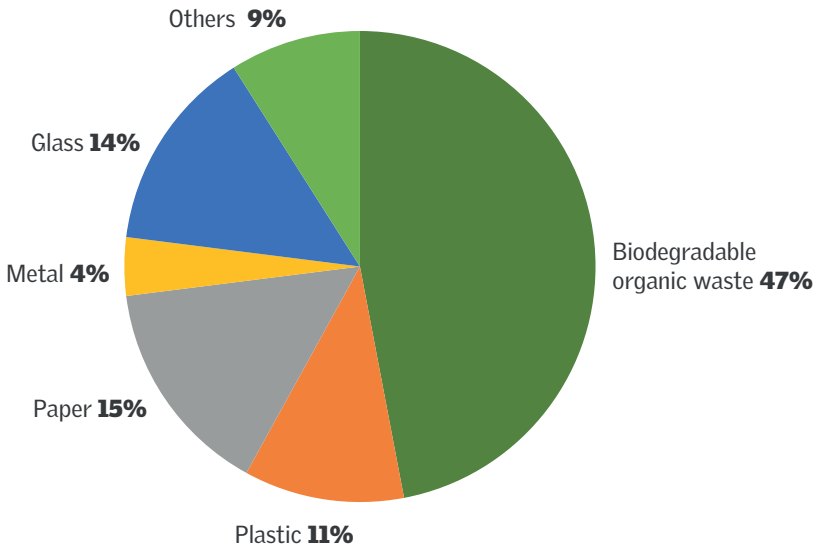
The regulations have not been adopted yet, and are currently on hold pending amendments to the Environmental Protection Act.

Table 1: The legal framework for waste management in Namibia

Key legislative document for waste management	Mandate related to waste management
Environment Protection Act, 2007	Explicitly mentions the principles of reduce, reuse and recycled for managing solid waste. Encourages adoption of approaches that cause highest benefits and least environmental damage at an acceptable cost. Defines the terms "disposal site" and "waste", and lays down the process for identification of waste disposal sites — disallows waste disposal on land without an environmental clearance. Regulations for disposal of certain kinds of waste are in the preparatory stage.

Source: Compiled from various sources

Graph 1: Waste composition of Windhoek city



Source: 2009, Municipal waste management in Namibia: The Windhoek case study, Universidad Azteca

GENERATION AND COMPOSITION

Very few towns in Namibia have reliable waste statistics. Ondangwa town has recorded that approximately 746 tonne of waste is produced from its households annually. An estimated 0.14 kg of waste is generated per capita per day in the town.[7]

Based on waste audits conducted in 2004, it has been estimated that Windhoek's (the capital city of Namibia) households produce 24,861 tonne of waste every year, with daily per capita generation ranging from 0.19 kg to 0.7 kg.[8] The variation can be attributed to the difference in income levels across the city.

Waste composition studies are limited to a handful of towns and cities in the country. A composition study was conducted in 2007 for Windhoek, which found the quantum of biodegradable waste to be the highest in the city's total waste (*see Graph 1: Waste composition of Windhoek city*).

COLLECTION AND TRANSPORTATION

Households have been identified as the major source of waste in Namibian urban centres. In Windhoek, the waste generated from households is collected by the Solid Waste Management Division (under the Department of Infrastructure, Water and Waste Management). The Division has a tariff chart that informs citizens about the service and its user charges. In 2012, the city came up with a waste collection calendar. The city's area was divided into five zones and the days and timings for waste collection in each zone were specifically mentioned on the calendar.

Municipal waste generated in commercial areas, industrial areas and public spaces, and the clearing of secondary collection points, is the responsibility of the Solid Waste Management Division as well as private companies, some of which are engaged in offering waste collection services in informal settlements.

As per available reports, the collection efficiency of municipal solid waste in Namibia has been reported to be 42.4 per cent.[9]

THE NAMIBIAN

The Kupferberg landfill, Windhoek

DISPOSAL AND DUMPING

The most common method of managing waste in the country is collect-and-dump in the nearest available dumpsite. For Windhoek, the Kupferberg landfill is the designated disposal site. Municipal solid waste as well as hazardous waste find their way to Kupferberg. According to the city authorities, a total of about 78,572 tonne of MSW was received at the Kupferberg landfill in 2016, averaging at about 6,548 tonne per month.[10] In the same period, almost 13,113 tonne of hazardous waste was received at the landfill, averaging almost 1,093 tonne a month.[11]

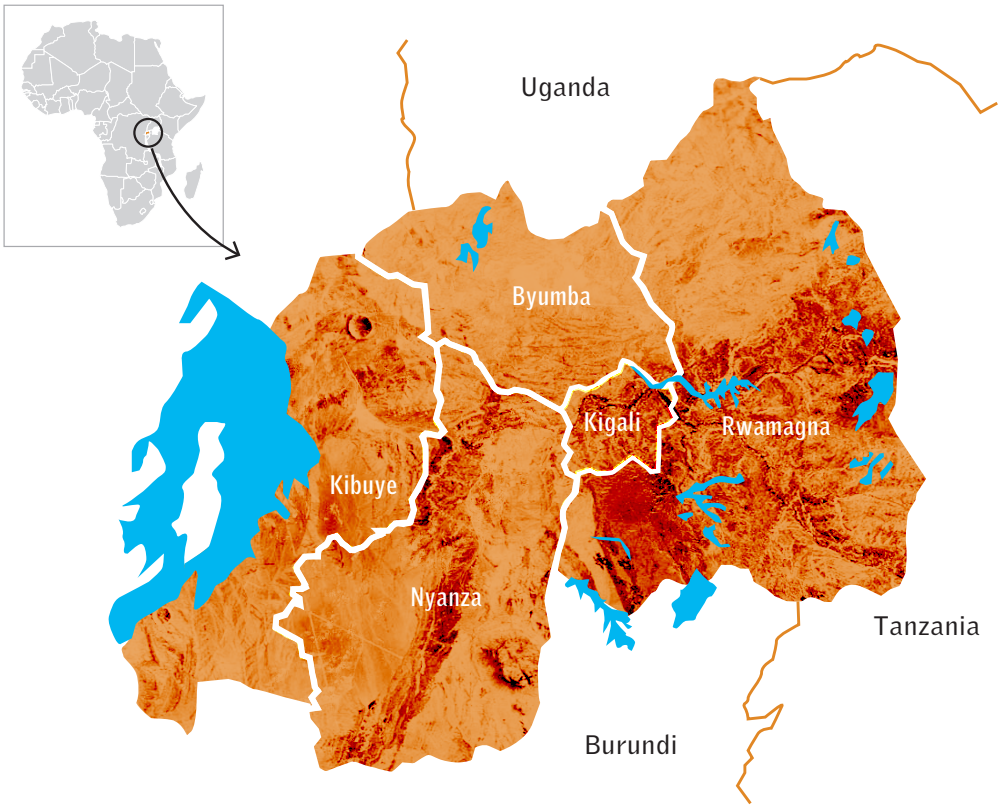
TREATMENT AND RECYCLING

As said above, almost all the collected waste in Namibia is channelised to the nearest dumpsite. At the dumpsite, private companies deploy their personnel — mostly comprising of waste-pickers — to reclaim the recyclable material. There are no recycling facilities in the city of Windhoek. Most of the waste is pre-processed to facilitate easy transportation and is sent to South Africa for further recycling into usable end products.

According to the city of Windhoek's *State of Environment Report, 2008*, an average of 6.5 per cent of the total waste collected between March 2006 and January 2007 comprised of recyclable materials. However, the waste composition of Windhoek city suggests that more than 40 per cent of the waste has the potential to be recycled.[12] This could have been possible if source segregation of waste was practised in the city.

This also suggests that the waste collection, diversion and recycling eco-system is not optimised, thus leading to inefficient handling and management. This is the reason the city ends up spending much more than it should to manage its solid waste.

Rwanda



Population	**13 million**
Population density	**525 persons per square km**
Area	**26,338 square km**
Municipal solid waste generation per annum	**2.2 million tonne**[1]
Source segregation percentage	**Data not available**
Collection efficiency cities	**For Kigali:** 49 per cent; other cities: less than 10 per cent
Percentage of waste recycled, processed and recovered	**10 per cent**[2]
Disposal methods	**Dumping, burning**

Notes: 1. Estimated value considering the total population and per capita waste generation; 2. 2019, Kabera T and Nishimwe H, Systems analysis of municipal solid waste management and recycling system in East Africa: Bencharking performance in Kigali city, Rwanda

Source: Compiled on the basis of all the literature cited in this report

RWANDA

The Republic of Rwanda is a landlocked country situated in the Great Rift Valley of Central Africa. It shares its border with Uganda, Burundi, Tanzania and the Democratic Republic of Congo.

With around 80 per cent of the country's area draining into the Nile and 20 per cent into the Congo, Rwanda has many lakes including Lake Kivu, one of the world's deepest. It has a temperate tropical highland climate, but the temperatures are comparatively lower than in other equatorial countries because of its high elevation.

Rwanda is experiencing a major economic boost, and Kigali (the capital) is the focal point for many of the transformations; almost the entire additional GDP growth is being generated in Kigali. The total population was nearly 13 million in 2020[1] and is projected to reach over 25 million by 2065. Rwanda's urban population more than doubled since 2002. In the last 25 years, the urban population has grown from 4.6 per cent of the total to 18.4 per cent. The country's urban population is expected to reach 35 per cent of its total population by 2024.[2]

A major consequence of this surge has been the ever-increasing volumes of municipal solid waste. In fact, over the last decade, Rwanda has recognised poor solid waste management practices as a key obstruction towards achieving its sustainable development goals. While the country has set SWM targets at the national and city levels, meeting the demands of waste collection and disposal and minimising the associated environmental hazards is becoming increasingly challenging for Rwanda's urban authorities.

POLICY INTERVENTIONS

According to a report by jerry-can, an urban planning research and action consultancy based in Kigali, "the backbone of all waste management activities in the country is the Organic Law Determining the Modalities of Protection, Conservation, and Promotion of the Environment in Rwanda (2005). While outlining the general principles that guide the whole environment sector such as the protection principle and the polluter-pays principle, the Organic Law on the Environment also establishes a legal footing and delegates responsibilities to different competent authorities, in addition to establishing both the Rwanda Environment Management Authority (REMA) and the National Fund for Environment in Rwanda (FONERWA)."[3]

Among the initiatives in Rwanda in which management of municipal solid waste features prominently is the recently launched 'Waste to Resources' project. In August 2021, Rwanda's Ministry of Environment, Ministry of Infrastructure, the City of Kigali and the Global Green Growth Institute (a treaty-based inter-governmental development organisation that aims to promote economic growth and environmental sustainability) jointly launched this project in Kigali. The project is based on gainful utilisation of organic waste and management of plastic and e-waste through community awareness, capacity building and strengthening the policy and regulatory environment for circular economy initiatives in the waste sector.[4]

Rwanda also has the National Environment and Climate Change Policy, which has identified haphazard waste management as one of the key challenges in environmental management; the policy promotes waste recycling and treatment based on the principles of circular economy.[5]

Since 2008, Rwanda has banned the manufacture, import and use of plastic bags — also known as polyethylene bags or non-biodegradable polythene bags — with a few exceptions (hospital plastic aprons, plastic bags used in tree nurseries, plastic reservoirs, cellophane for food wrapping in hotels, etc). Currently, biodegradable bags are used mainly for carrying frozen fish and meat. In addition to that, plastic packages for foods (such as potato chips) are only allowed for authorised companies with clear business plans detailing how their bags will be collected and recycled.

Table 1: The legal framework for waste management in Rwanda

Key legislative documents for waste management	Mandate related to waste management
Law No 04/2005 of 08/04/2005: Organic law determining the modalities of protection, conservation and promotion of the environment in Rwanda	Sums up waste management issues in some articles of different chapters including Human activities, Obligations of the State, Decentralised entities and the population, Incentives to persons that conserve the environment, Preventive and punitive provisions etc. Article 32 stipulates that no one is permitted to dispose of waste in an inappropriate place, except where it is destroyed in a formal set-up (such as an incinerator plant) or in a treatment plant and after being approved by competent authorities. Article 33 asserts that any waste, especially from hospitals, dispensaries and clinics, industries and any other dangerous waste, shall be collected, treated and changed in a manner that does not degrade the environment in order to prevent, eliminate or reduce their adverse effects on human health, natural resources, flora and fauna and on the nature of the environment. It is stipulated in Article 35 that removal of waste shall be done in accordance with existing rules and where possible it shall be carried out with an aim of enhancing.
Law No 16/2006 of 03/04/2006 determining the organisation, functioning and responsibilities of the Rwanda Environment Management Authority	Determines the responsibilities, powers, organisation and functioning of the national authority to manage environment, known as the Rwanda Environment Management Authority or REMA.
Law No 17/2019 relating to the Prohibition of Manufacturing, Importation, Use and Sale of Plastic Carry Bags and Single-Use Plastic Items	Prohibits the manufacturing, import, use and sale of plastic carry bags and single-use plastic items. Provides guidelines for the collection, recycling and inspection of plastic and single-use plastic items. The law gives exceptional authorisation for home compostable plastic items.
National Environment and Climate Change Policy 2019	Promotes sustainable waste management system to reduce greenhouse gas emissions in Rwanda and encourages involvement of private sector investment, especially the development of appropriate water and sanitation technologies and infrastructure for waste management. Promotes circular economy in waste management and innovative solutions to utilise the recyclable materials, harness energy, reduce landfill sites, EPR etc.
Regulations No 002/EWASTAN/SW/RURA/2015 of 24th/April/2015 governing solid waste recycling in Rwanda	Provides a regulatory framework for the design, installation and operations that recycle, compost or convert solid wastes. Offers guidelines for the location, installation and operation of the recycling facility.

Source: Compiled from various sources

GENERATION AND COMPOSITION

The average daily per capita waste generation in Rwanda is 0.49 kg. However, the amount of municipal solid waste produced per capita varies considerably in the country. For example, for urban areas such as the cities of Kigali, Muhanga and Huye, waste generation is estimated to be in the range of 0.56 to 0.7 kg per capita per day (*see Table 2: Waste generated in the major cities of Rwanda*).

Urban waste generation in Kigali city is expected to increase by 63 per cent over the next 10 years, from around 600-800 tonne per day in 2019 to 1,300 tonne per day by 2030.[6]

The composition of the waste generated in Rwanda shows that biodegradable organic waste contributes significantly to the total. Previous studies on the characteristics of Kigali's

Table 2: Waste generated in the major cities of Rwanda

Districts	Private cleaning services and agencies	Landfill sites	Quantity of waste generated per year (in tonne)
Rubavu	Acape; Yfsp	Rutagara	**11,520**
Huye	Afab, Duhuzingufu Envirocare, Replaced by Kpc), Isokoyubuzima, Endsco Ltd.	Rwabayanga Mukura	**1290.5**
Nyamagabe	Umucyo Iwacu Gasaka, Harama Isuku Kigeme	Akabacuzi	**5712.7**
Muhanga	Tubusezerere,	Mushubati	**3285**
Rusizi	Ener, Coamecya, Jyaheza.	Ruhimbi	**11,5040**
Musanze	Koamu, Twite Ku Isuku N' Isukura Turengera Ibidukikije, Kg Harvest	Rugeshi	**1806.7**
Kigali City	Coped Ltd	Nyanza which is currently replaced by Nduba	**204,252**

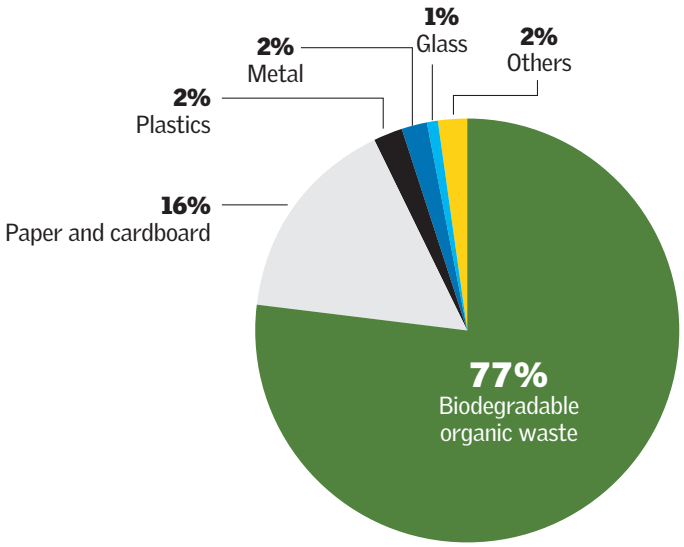
Source: Uwineza, C, 2012, Municipal solid waste status in Rwanda, National University of Rwanda, Butare, Rwanda

waste indicate that organics are likely to make up between 66-70 per cent of the total waste generated. Overall, these estimates are higher than what is predicted by the UNEP's Global Waste Management Outlook, which indicates that organics account for approximately 53 per cent of total waste in low middle-income countries — which corresponds to Kigali's GDP per capita (*see Graph 1: Waste composition in Rwanda*).[7]

COLLECTION

The collection rate in Kigali is 49 per cent.[8] As a point of comparison, these estimates are slightly higher than the average waste collection estimates in urban low-income countries (48 per cent), and significantly higher than rates in Sub-Saharan Africa in general (44 per cent). Kigali's collection rates are comparable with some other major cities in Sub-Saharan African countries, including Nairobi in Kenya and Kampala in Uganda.

Graph 1: Waste composition in Rwanda



Source: 2013, Rwanda Environment Management Authority

However, the collection coverage rates in other cities of Rwanda are low. For example, in Muhanga and Huye, the rates are less than 10 per cent — with Muhanga having a collection rate of only 7.5 per cent.[9]

In most cities in Rwanda — including Huye and Muhanga — door-to-door waste collection services are provided by private companies. However, the service is irregular for households; commercial establishments are given higher priority by the private waste collectors. This is mostly because waste collection companies have a limited capacity for service delivery.[10]

DISPOSAL AND DUMPING

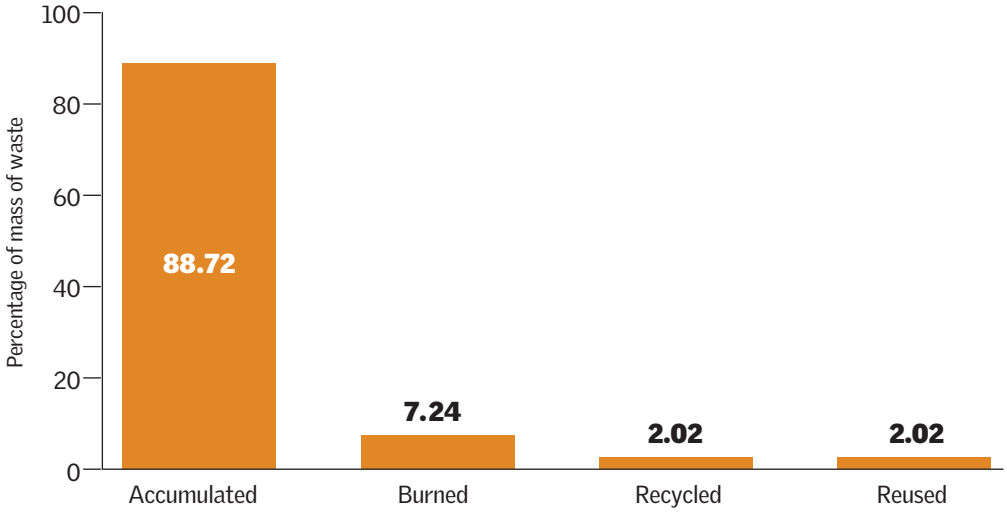
In areas in the country where there is no waste collection, communities typically dump their waste on the closest empty plots or public spaces, or into water channels (*ruhurura*), creeks or rivers, fouling the environment. Some people in Gasabo district burn the waste in their backyards, producing severe obnoxious gases and particulates polluting the surrounding air.[11]

There is not a single landfill in Rwanda which is scientifically designed and operated. In Kigali, the Nduba dumpsite located in Gasabo is the main waste repository. The dumpsite covers an area of approximately 43 acre (over 17 hectare), and is managed by the city authorities. Approximately 300 personnel work at the dumpsite in different capacities. The dump has a leachate catchment area which was found to be heavily saturated with solid wastes during a site inspection. No effective methane collection systems are there. Sections of the dump are also demarcated for the disposal of healthcare wastes, expired food products, organics, plastics, faecal sludge, liquid wastes, metals, cardboards, and glass products.

There are organised groups of workers at the dumpsite who sort the recyclables such as paper, metal, and plastics. Recyclable materials are compacted onsite, weighed, and sold to recycling companies.[12]

While mismanagement at the Nduba landfill has been a major issue, environmental degradation at the dumpsite has largely been caused by the fact that the site was never designed as a sanitary landfill.[13] This holds true for the other cities as well. Several attempts have reportedly been made to build a sanitary landfill, composting facility and a waste-to-energy site, but all these efforts have failed due to various reasons.

Graph 2: Disposal methods in Kigali city



Source: Iraguha, F et al, 2022, 'Assessment of current solid waste management practices, community perceptions, and contributions in the city of Kigali, Rwanda', IOP Conference Series: Earth and Environmental Science, IOP Publishing

TREATMENT AND RECYCLING

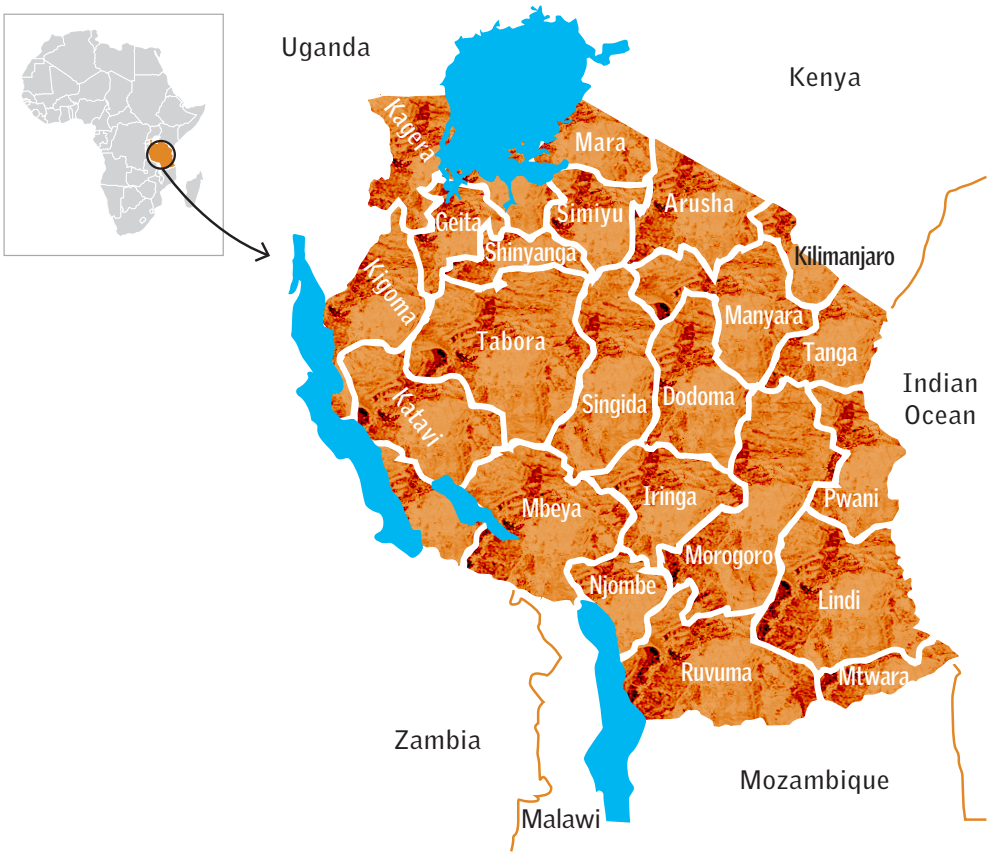
Out of the total waste generated in the city, Kigali accumulates nearly 89 per cent of its waste at its dumpsite — a mere 2 per cent of the waste collected is recycled, 2 per cent is reused and about 7 per cent is burnt (*see Graph 2: Disposal methods in Kigali*). Out of the total waste that reaches the dumpsite (89 per cent), nearly 35.5 per cent is composted (at the dumpsite) and used as fertilisers.[14]

However, the Rwanda State of Environment and Outlook Report (2021) has reported that currently, nearly 10 per cent of the total collected waste is recycled in Kigali, and a meagre quantity of organic waste is formally composted.[15]

In Huye and Muhanga, biodegradable organic waste is sorted manually and composted by a private company at the sanitary landfill. Only 30 per cent of the organic compost (5 tonne out of the 15 produced) is sold.[16]

The low composting capacity can be attributed to a complete lack of source segregation of the waste, weak marketing strategies of the compost-making firm, and non-certified quality of the compost. Also to be blamed is the fact that compost derived from waste is not recognised as a fertiliser option by the Rwanda Fertilizer Policy.

Tanzania



Population	**59.73 million[1]**
Population density	**67 persons per square km[2]**
Area	**945,087 square km**
Annual municipal solid waste generation (only Lusaka) (excluding C&D waste and inert)	**12.1-17.4 million tonne[3]**
Source segregation percentage	**Data not available**
Collection efficiency	**50 per cent**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burying and burning**

Source: Compiled on the basis of all the literature cited in this report

TANZANIA

Tanzania, officially known as the United Republic of Tanzania, is a mid-sized east African country located south of the Equator. It is bounded by Uganda, the Lake Victoria and Kenya to the north; the Indian Ocean to the east; Mozambique, Lake Nyasa, Malawi and Zambia to the south and southwest; and Lake Tanganyika, Burundi and Rwanda to the west. Tanzania has an 800-km coastline.

Dodoma is the designated capital, but Dar es Salaam remains the seat of government administration as well as the largest city and port in the country. According to the 2012 population census, about 29.61 per cent of the population lives in urban areas.

Tanzania is a democratic unitary republic, with both a national government and a devolved government for the island of Zanzibar, which has autonomy for non-Union matters. There are a total of 148 districts, 44 urban councils, 133 rural councils, and close to 2,918 villages.[4]

Before early 1990s, waste management services were provided free of cost by the government, but with Tanzania becoming a capitalist economy in the early 1990s, solid waste management services began to be increasingly privatised and contracted to private sector companies and community organisations.[5]

POLICY INTERVENTIONS

The Environmental Management Act, 2004 (EMA) is the parent act for protection of environment in the country and establishes the legal and institutional framework for sustainable management of environment, including waste management. The Act established the National Environmental Advisory Committee (NEAC) with the role of advising the minister responsible for protection and management of environment. It confers the role of enforcement on the National Environmental Management Council (NEMC).

TABLE 1: THE LEGAL FRAMEWORK FOR WASTE MANAGEMENT IN TANZANIA

Key legislative documents for waste management	Mandate related to waste management
Environmental Management Act, 2004	Divided into 20 parts, each part of this Act deals with a broader subject and has sections that talk about particular areas of concern. Part IX is dedicated to waste management, which includes solid waste, litter, liquid waste, gaseous waste and hazardous waste. Sections 114-119 specifically deal with solid waste.
Environmental Impact Assessment and Audit Regulations, 2005	Makes it an offence to begin, finance, permit or licence any projects listed in the regulations without the developer submitting to the licensing or permitting authority an application for an EIA certificate in the format of a project brief. The First Schedule, in the Type A projects category for which it is mandatory to undertake environmental impact assessment, includes construction of municipal solid waste landfill facilities under the head of municipal solid waste.

Environmental Management (Fee and Charges) (Amendment) Regulations, 2016	Amends the Environmental Management (Fee and Charges) Regulations of 2008. Prescribes fees with respect to EIA, environmental compliance monitoring and audit, registration of environmental experts, environmental quality standards, ozone depleting substances, management of wastes, biosafety, noise and vibrations, and other activities related the environment.
Environmental Management (Solid Waste) Regulations, 2009	Details the requirements and responsibilities for managing solid waste in Tanzania. Highlights waste minimisation and cleaner production principles alongside the duty to safeguard public health and environment from adverse effects of solid waste. Lists the permit requirements (Part III) — any person dealing with solid waste as collector, transporter, waste depositor or manager of a transfer station must apply to the local government authority for a permit. The local authority will also issue licences/permits to operate solid waste disposal sites. Mandates annual reporting by local government authorities.

Source: Compiled from various sources

The Act also gives powers to the regions to designate a Regional Environmental Management Expert (REME), and empowers local government authorities to appoint officers to oversee implementation of the EMA.

GENERATION AND COMPOSITION

Before the 1990s, waste management services were provided free of cost by the government in Tanzania. With the country becoming a capitalist economy, solid waste management services started getting privatised and contracted to private sector companies and community organisations.

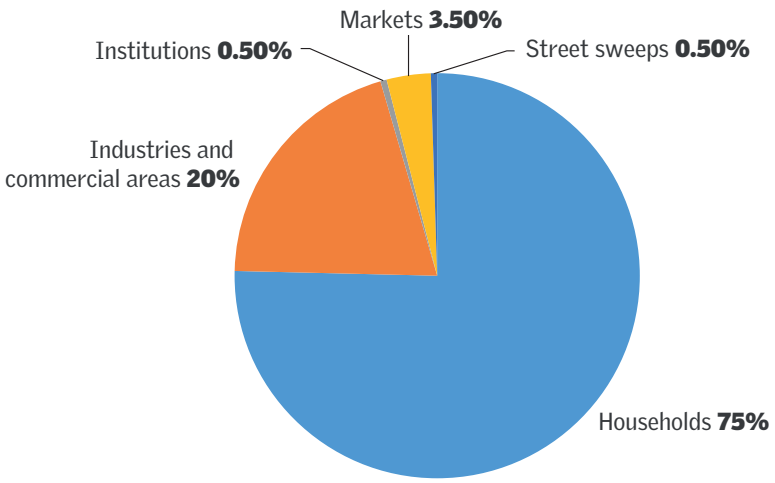
GEOPHREY ZENDA

Waste collection vehicle in Tanzania

According to official sources, Tanzania generates an estimated 12-17.4 million tonne per year of solid waste (0.66-0.95 kg per capita per day). On average, each person produces 241-347 kg of waste annually. The biggest source of the waste are households, followed by industries and commercial areas (*see Graph 1: Major sources of solid waste*). In fact, Tanzania's waste generation is increasing at an estimated rate of about 5 per cent per year.[6]

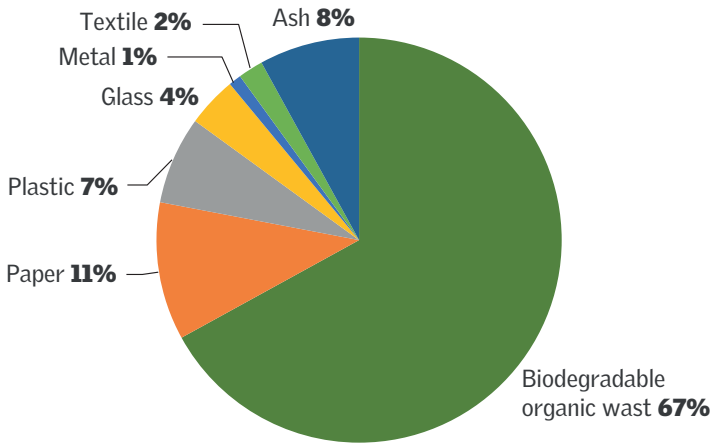
The typical waste composition in Tanzania is depicted in the Graph 2. As evident in the graph, a significant fraction of the municipal waste in Tanzania is biodegradable organics like other sub-Sahara African countries. 11 per cent of the total waste is paper and plastics and remaining fraction is glass, metal and textile and ash.

Graph 1: Major sources of solid waste



Source: 2020, Tanzania Investment Guide on Waste Management, Vice Presidents Office, United Republic of Tanzania

Graph 2: Waste composition in Tanzania



Source: 2020, Tanzania Investment Guide on Waste Management, Vice Presidents Office, United Republic of Tanzania

COLLECTION AND TRANSPORTATION

On an average, close to 50 per cent of the waste is collected; the rest is disposed of by open burning, burying or haphazardly dumping it.[7] The majority of households use poor standard waste storage containers ranging from salvaged drums or tins, paper bags, plastic bags, jute bags or sacks.

The key actors in the solid waste collection business are:

- Local government authorities
- Community-based organisations (CBOs)
- Private companies

Trucks used for collection and transportation commonly include rear and side loaders, which are open- and closed-body types. Some urban authorities employ compactors, tractors, trailers and hand-driven pushcarts.

Common problems facing collection and transportation of MSW include high operational costs, mainly due to the poor choice of vehicles and distances from the collection point to disposal site. Other factors include inaccessibility of some localities, improper planning of collection routes and frequencies, limited supervision, poorly motivated workers, and low public awareness.

DISPOSAL AND DUMPING

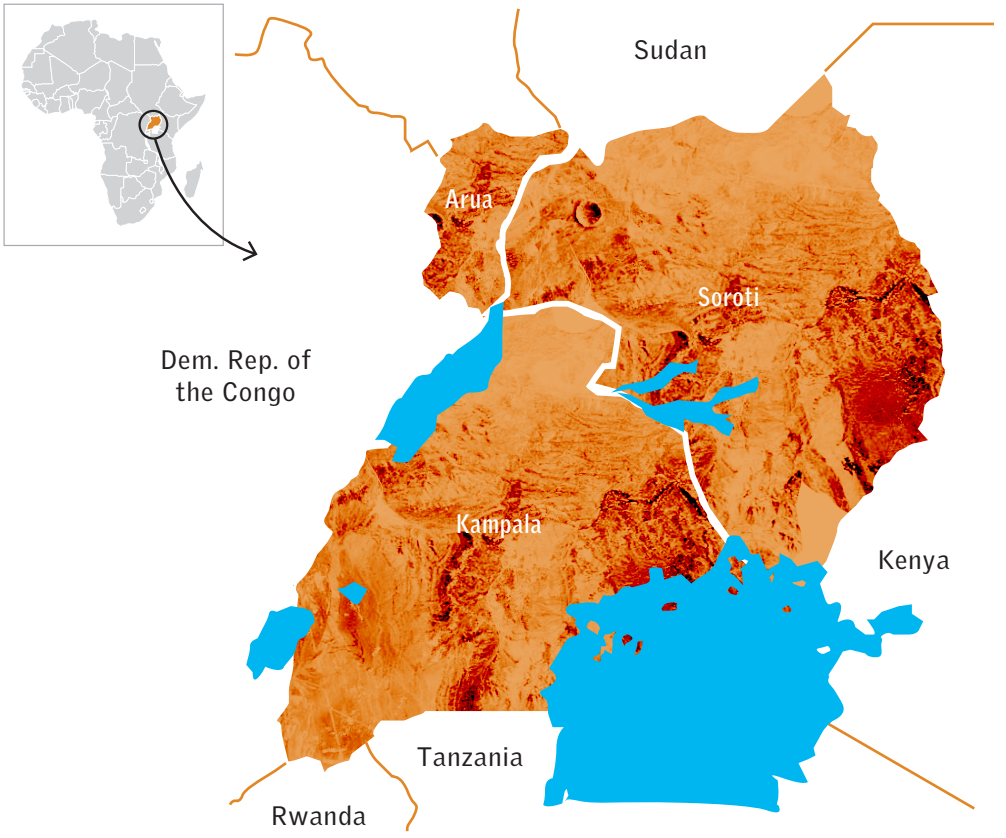
More than 90 per cent of MSW in Tanzania is believed to be disposed of in an unsatisfactory manner — most of it in open and poorly operated dumpsites across the country.[8] A few municipalities — such as Arusha, Tanga, Mwanza, Ilemela, Mbeya, Dodoma, Kigoma and Mtwara — have improved landfills (with lining and leachate collection system) constructed under the Tanzania Strategic Cities Project (TSCP).

TREATMENT AND RECYCLING

Recycling of MSW is largely informal in Tanzania: only about 5-10 per cent of the total waste generated is recycled.[9] The waste that is recycled primarily includes plastics, paper, scrap metal, aluminium cans and glass.

Very few households segregate waste at the household level. Most urban areas have minimal waste segregation at source. Besides this, the other key challenge is the poor quality of recovered materials due to contamination as a result of mixing waste streams.

Uganda



Population	**48 million**
Population density	**157.1 persons per square km**
Area	**241,038 square km**
Municipal solid waste generation per annum	**6.6 million tonne**
Source segregation percentage	**Data not available**
Collection efficiency	**43.7 per cent**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burning and landfilling**

Source: Compiled on the basis of all the literature cited in this report

UGANDA

The Republic of Uganda is a landlocked country in East Africa. Lake Victoria (Africa's largest freshwater lake)[1] occupies a significant portion of the southern part of the country. Uganda's terrain, typically, can be called a plateau with a circumference of mountains; it shares its southeastern border with Kenya and Tanzania.[2]

Uganda is also located within the Nile basin and has a varied but generally altered equatorial climate. Of its over 48 million population, nearly nine million live in Kampala, the country's capital and largest city. About 25 per cent of the population lives in urban areas (11 million people in 2020).[3]

Like many other developing countries of the Sub-Saharan Africa region, Uganda is facing rapid urbanization: the rate is a little over 5 per cent per annum.[4] This has led to a massive mushrooming of slums that lack necessary services and infrastructure, and that are characterized by poor solid waste management.[5]

POLICY INTERVENTIONS

Typically, in the Ugandan regulatory framework, the Constitution comes first, followed by the National Policies, the Acts of Parliament, the regulations that enforce the Acts, and the City Council Ordinances.

The legal instruments dealing with municipal waste management in Uganda include the Public Health Act 2000; the Solid Waste Management Strategy (SWMS) of December, 2002 (revised in 2006); the Local Governments Act of 1997 (revised in 2004); and the Constitution of Uganda (amended in 2005). There is also the Solid Waste Ordinance of Kampala City Council Authority - Statutory Instrument 243-21, otherwise titled as the Local Governments (Kampala City Council) (Solid Waste Management) Ordinances (*see Table 1: The legal framework for waste management in Uganda).*

Table 1: The legal framework for waste management in Uganda

Key legislative documents for waste management	Mandate related to waste management
The Environment Act, 1995 (Chapter 153)	Does not primarily deal with the management of municipal solid waste but includes provisions for waste management including hazardous waste, chemicals etc; pollution control; and Environment Impact Assessment (EIA).
The Public Health Act, 2000 (Chapter 281)	Does not primarily deal with the management of municipal solid waste management but has provisions for management of slaughterhouse waste. Guides on the management and disposal of any refuse, waste material contaminated with or exposed to the infection of any infectious disease (can be referred as healthcare waste).

Key legislative documents for waste management	Mandate related to waste management
The National Environment (Waste Management) Regulations, 1999	Provides guidance for solid waste management in the country and in Kampala in particular. This Regulation is applicable to (a) all categories of hazardous and non-hazardous waste; (b) to the storage and disposal of hazardous waste and their movement into and out of Uganda; and (c) to all waste disposal facilities, landfills, sanitary landfills and incinerators. However, it has some limitations relating to enforcement and sanctions. For instance, the solid waste management ordinance under the rules does not provide a mechanism for collecting user fees (referred to as solid waste generation fees).
The Local Government Act, 1997	Decentralises the functions, powers, services and responsibility at the levels of the local government. Prohibits the "deposition of waste on a street, public place, unoccupied land of any refuse, rubbish and abandoned vehicles or any other material or thing". Provisions for scientific treatment of waste.
The EIA Regulations of 1998	Annex 3 of this regulation mandates Environmental Impact Assessment (EIA) necessary for waste management projects.
The National Environment (Waste Management) Regulations, 2020	Under the National Environment Act, 2019 and in consultation with the National Environment Management Authority, these Regulations were made on 11th October, 2019 dealing with a wide range of wastes generated from different sources. The waste streams include: Domestic and Municipal Waste, Industrial Waste, electrical and Electronic Waste and healthcare Waste. Provisions for proper collection, transportation, storage, scientific treatment and disposal of waste as well as transboundary movement of waste.
The Local Governments (Kampala City Council) (Solid Waste Management) Ordinance	Applies to all areas of the district, including private premises, Government-owned properties and council properties. Provisions for source separation of waste, collection, storage, collection fees, penalization etc.
Electronic Waste (E-waste) Management Policy, 2012	Develops specific e-waste standards, regulations and guidelines for the acquisition, handling and disposal process. Provides for establishment of e-waste facilities Promotes resource mobilisation of e-waste Provides for development of critical human resource base knowledgeable in e-waste management

Source: Compiled from various sources

As reported by Okot-Okumu and Nyenje in their 2011 report *Municipal solid waste management under decentralisation in Uganda*: "*The legal and policy frameworks in Uganda are limited by either weak punitive measures or lack of enforcement for proper solid waste management. The National Environment Management Agency (NEMA) therefore initiated a project in 2006 under the Clean Development Mechanism (CDM) for solid waste composting in nine municipalities of Uganda to address mounting solid waste management problems*". However, there is no information on the current status of these composting plants.

GENERATION AND COMPOSITION

Studies by researchers from the Kampala-based Makerere University suggest that the average waste generation rate in Uganda's urban areas is 0.55 (0.3-0.66) kg/capita/day. With 75 per cent of the country's population living in villages, the average waste generation in rural areas is estimated at 0.33 kg/capita/day.[6]

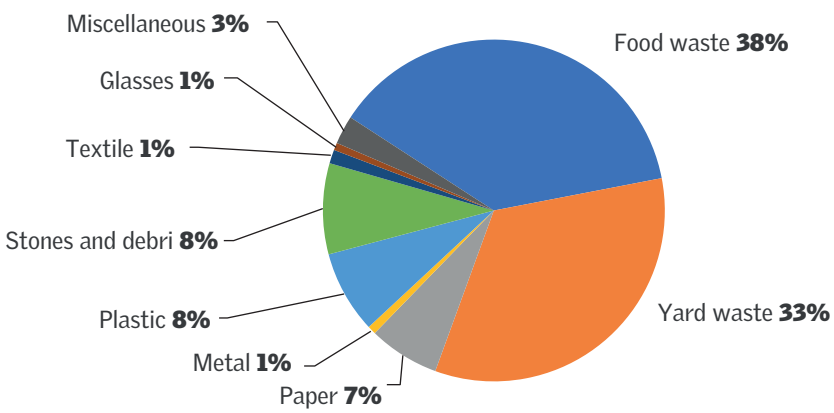
Based on these figures, the total waste generation in urban Uganda has been estimated as 2.2 million tonne (MT) per annum (a 11-million strong urban population with a per capita generation of 0.55 kg); the waste generation by rural areas has been found to be 4.4 MT. About 71 per cent of the country's municipal solid waste is primarily biodegradable in nature (*see Graph 1: Waste composition in Uganda*). The waste composition of urban areas is given in Graph 1. Although, data on the composition of solid waste generated by households in rural areas is not available. Nevertheless, it probably consists of more organic matter than that of urban areas.[7]

COLLECTION

Being largely biodegradable, a bulk of the urban waste is suitable for composting or bio-methanation. Most low-income households dispose of their waste daily as they lack access to appropriate storage; 85.3 per cent of the high- and middle-income citizens dispose of their waste twice a week. About 60 per cent of the commercial premises dispose of their wastes daily.[8]

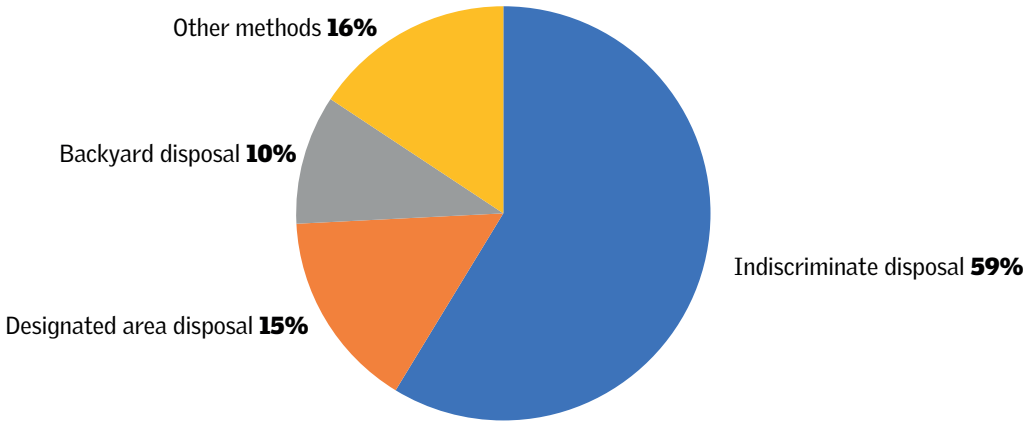
Collection efficiency stands at 43.7 per cent (as reported by Okot-Okumu and Nyenje): the waste is collected from households by collection workers and transferred to collection points (such as skips, bunkers or road verges). This collected waste is then picked up and taken to the dumpsite or landfill — this is done by the Urban Councils.

Graph 1: Waste composition in Uganda



Source: Okot-Okumu, J. and Nyenje, R., 2011. Municipal solid waste management under decentralisation in Uganda. Habitat International, Elsevier, Amsterdam, The Netherlands

Graph 2: Fate of the uncollected waste



Source: Okot-Okumu, J. and Nyenje, R., 2011. Municipal solid waste management under decentralisation in Uganda. Habitat International, Elsevier, Amsterdam, The Netherlands

Private companies do door-to-door collection of waste, especially from high-income households. Between 15 to 60 per cent of the waste generated is collected from areas served by private companies.[9] The urban poor receive very low to no waste collection services due to inaccessible roads, unplanned facilities and neglect by the urban authority. Uncollected waste is disposed of by the community in different ways *(see Graph 2: Fate of the uncollected waste)* — it is usually dumped in open areas, streams, drainage channels, and other places that are inaccessible to waste collection vehicles, thus creating environmental and public health hazards for local residents.[10]

DISPOSAL AND DUMPING

A significant fraction of the waste is indiscriminately dumped in waste dumping sites. Nearly 28,000 tonne of waste is collected in Kampala and transported to the dumpsites every month: this is only 40 per cent of the total waste generated in the city.[11]

The 8-hectare Kiteezi landfill is the primary waste disposal site in Kampala city. Kiteezi lies in a wetland, and some parts of the landfill do not have a liner. Therefore, untreated leachate and landfill gas pose a serious threat to the surrounding environment — as reported by the Makerere University College of Engineering in 2015.[12] The landfill is currently operated by a private firm.

Upon arrival at the site, the waste is weighed; after dumping, waste-pickers sort the recyclables such as paper, metals, and plastics. Crawler trucks are used to spread the waste to facilitate the decomposition of the organic matter. The waste is sometimes sprayed with insecticides to remove the flies before it is covered with soil.[13]

The remainder waste is indiscriminately disposed of, and often results in environmental and public health problems[14] such as blockage of drainage channels leading to flash floods, and contamination of water and soil resulting in spread of diarrhoeal diseases.

Waste dumping sites in Uganda are, in most cases, located in environmentally sensitive areas such as wetlands, boundaries and edges of forests, or adjacent to water bodies. Kampala is the only urban council with a sanitary landfill owned by the city but operated by a private company. All other waste disposal sites are owned and operated by the councils themselves — these are poorly managed, since most resources are allocated to waste collection and not to disposal management. Wastes of mixed origin (domestic, industrial, healthcare and commercial) are disposed of together in these disposal sites.

TREATMENT AND RECYCLING

Urban councils in Uganda do not have the capacity to meet their city's waste collection and treatment demands. Where these services are poor or non-existent, the local communities have developed their own onsite waste management methods.

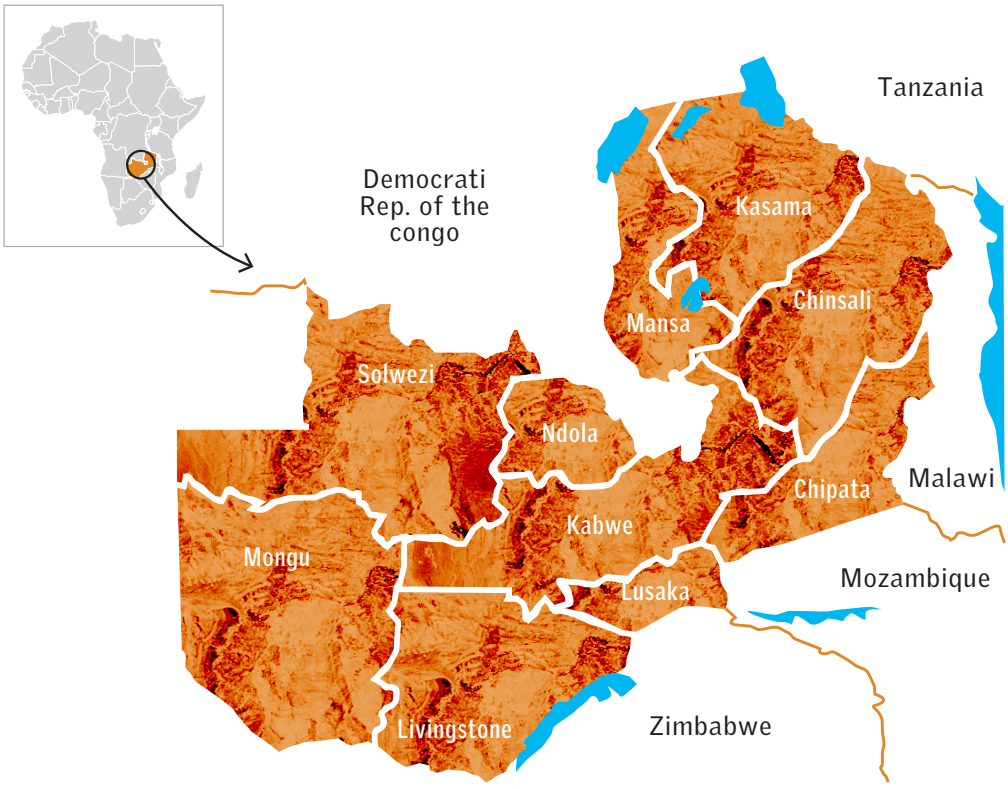
The National Urban Solid Waste Management (NUSWM) policy, introduced in 2017, had not been ratified till the time this report went to press. It is important to note here that the objectives of the policy was to provide a comprehensive national framework for sustainable solid waste management; to establish national leadership on waste management; to clarify and structure the relevant legislation on solid waste management; and to facilitate collaboration with diverse non-state actors.[15]

However, the national strategy for SWM is failing because environmental management is not mainstreamed into local development plans. There is also a problem of weak resource mobilisation due to the lack of fiscal decentralisation and an absence of participatory approach to the decentralisation process. Waste management receives less than 10 per cent of urban council budgets compared to other policy areas.

The informal sector reportedly plays a crucial role in waste recycling in Uganda (as in other developing economies). Waste pickers recover recyclables from waste hotspots, while waste buyers either buy or exchange items for recyclable wastes such as plastics, paper, bottles and old newsprints. The recyclables are then sold to scrap dealers, who supply them to recyclers. As per Okot-Okumu and Nyenje, "Plastics are purchased from waste pickers at US $0.1/kg and sold to recyclers at about US $0.3/kg, while scrap metal is bought at about US $0.1/kg and sold to recyclers at about US $0.35/kg".[16]

Uncollected wastes are burnt (74.1 per cent) or dumped (15.2 per cent) in open spaces. Some households and individuals practice solid waste recycling, reuse, recovery, composting and biogas production.

Zambia



Population	**18.38 million[1]**
Population density	**25 persons per square km[2]**
Area	**752,618 square km**
Annual municipal solid waste generation	**2.6 million tonne[3]**
Source segregation percentage	**Data not available**
Collection efficiency	**45 per cent[4]**
Percentage of waste recycled, processed and recovered	**Data not available**
Disposal methods	**Dumping, burying and burning**

Source: Compiled on the basis of all the literature cited in this report

ZAMBIA

Located in southern Africa, Zambia is a land-locked country bordered by the Democratic Republic of Congo, Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia and Angola. The country is divided into 73 administrative districts and nine provinces.

The estimated population is 18.38 million, with a population growth rate of 2.9 per cent per annum[5]. Population is concentrated largely in the urban areas, in the Copperbelt province and Lusaka, as well as the agricultural zone (southern and central).

Zambia's overall stated goal of solid waste management is to collect and dispose of the wastes generated by its population. Lusaka city is working towards developing an environmentally sound disposal system, along with collection — however, the city is facing challenges because of littering and dumping.

POLICY INTERVENTIONS

The enactment of the Environmental Protection and Pollution Control Act (EPPCA) in 1990 had laid the foundation stone for bringing waste management to prominence in terms of environmental protection. Earlier, there had been initiatives such as the National Conservation Strategy (NCS) of 1985 and the National Environmental Action Plan (NEAP) in 1995 — these were precursors to the existing law for solid waste management in the country.

Zambia also has a solid waste management strategy in place incorporating a vision that includes waste minimisation and recycling, well-coordinated institutional arrangement, and developing treatment and disposal facilities.

Table 1: The legal framework for waste management in Zambia

Key legislations for waste management	Mandate related to waste management
Environment Management Act, 2011	Provides for integrated environmental management — the Act consists of 135 sections divided into 12 parts. Part IV is dedicated to environmental protection and pollution control. Part IV is further divided into eight divisions, one of which is waste management.
Solid Waste Regulation and Management Act, 2018	Issues directives to the ministry, local governments, solid waste management companies, etc. Lays down that a local authority and solid waste management company/companies shall, in respect of their solid waste management area (a) prepare and submit reports relating to solid waste management to the ministers responsible for health, environment or water; (b) ensure that the department/ministries responsible for health, environment or water are immediately notified of any matter related to solid waste management which may adversely affect human health and the environment; and (c) ensure that the department and the Zambia Environmental Management Agency are immediately notified of any matter related to solid waste which may adversely affect or pollute the environment.

Key legislations for waste management	Mandate related to waste management
Statutory Instrument No 12 of 2018 — Local Government (Street Vending and Nuisances) Regulations	Prescribes offences related to public hygiene and order — the offences include unauthorised vending of food and littering. The First Schedule of the Regulations lists out the penal provisions for actions specified.

Source: Compiled from various sources

GENERATION AND COMPOSITION

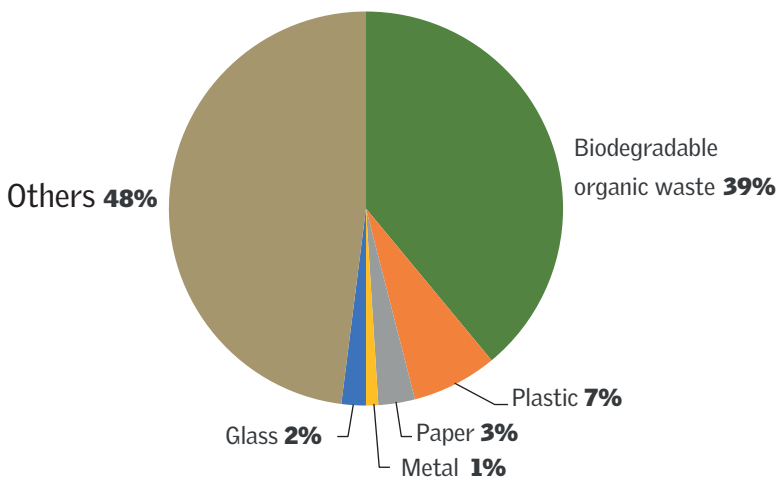
A 1999 study had indicated that over a million tonne of municipal solid waste is generated each year in the various urban centres in Zambia.[6] A study done in 2000 by the Zambia Environmental Management Agency (ZEMA) concluded that the annual average increase of waste in Lusaka alone was expected to rise from 220,000 tonne in 2000 to 530,000 tonne in 2011 — an increase of 141 per cent.[7]

A 2010 study by UN-Habitat highlighted that Zambia's waste generation rate was approximately 0.52 kg per person on a daily basis.[8] However, it should be noted that most of the studies conducted around estimation of solid waste have been limited to the capital city of Lusaka. A solid waste management master plan project report for Lusaka, jointly published by the Lusaka City Council and the Environmental Council of Zambia (ECZ), has estimated the per capita waste generation from households at 0.56 kg/day, while businesses and markets have been estimated to generate 1.7 kg/stall/day.[9]

The country follows a mixed waste collection system: there is no source separation of the waste that is generated. As per waste composition studies conducted in Lusaka, biodegradable wastes occupy the second highest component at 39 per cent of the total waste generated. Other waste like ash and co-mingled waste take the top spot with 48 per cent (*see Graph 1: Waste composition of Lusaka city*).

The high percentage of other waste could be attributed to the non-separation of waste at source. However, this has not been discussed at length in any of the available publications and research documents.

Graph 1: Waste composition of Lusaka city



Source: 2010, Solid Waste Management in World's Cities, UN-Habitat

COLLECTION AND TRANSPORTATION

Waste collection and transportation in Zambian cities is primarily the responsibility of private contractors. These contractors are involved both in primary and secondary waste collection. While private companies offer primary collection in planned settlements, community-based enterprises (CBEs) are involved in primary collection of waste from households in unplanned settlements.

This waste is deposited at designated secondary collection points. Certain private contractors are given the responsibility of collecting the waste from these collection points and taking it away to the disposal sites. In a handful of cases, the municipality also offers secondary collection services. The municipality, through its waste management unit (WMU), is responsible for having an oversight role on the private contractors and can monitor their activities so that they function as per the city bye-laws and the national-level regulations for solid waste management.

All the waste is collected in a mixed form. The bye-laws introduced by the Lusaka City Council way back in 2004 do not refer to source separation of waste.

A 2012 study says that only a fraction of the solid waste generated in urban areas is collected and disposed of at designated sites; the rest is left uncollected on the streets, roadsides and in drains.[10]

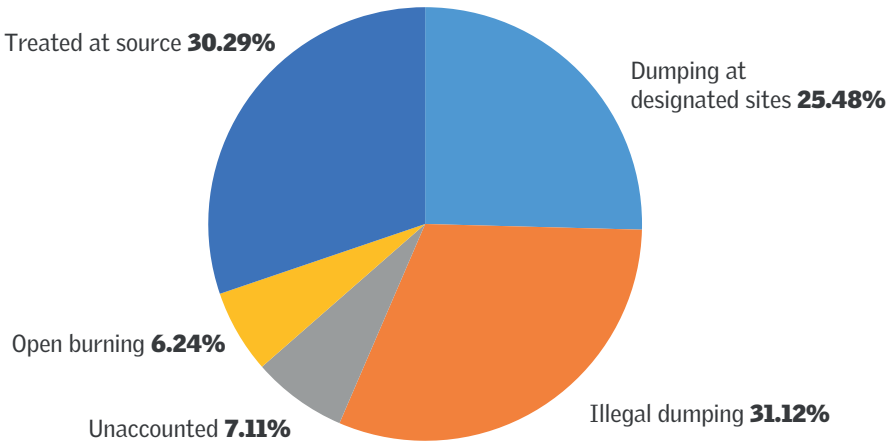
DISPOSAL AND DUMPING

Disposal of waste in Zambia is limited to dumping and open burning. Every year, 77,300 tonne of solid waste is received at the Chunga disposal site, the designated dumpsite, while 94,297 tonne a year is disposed of through illegal means. Close to 57 per cent of the waste is dumped, which includes dumping at designated sites as well as illegal disposal of solid waste.[11]

Reportedly, a considerable amount of the waste is treated at source — this waste is probably handled by the informal sector waste-pickers, who would either use it themselves, or sell it to recyclers (*see Graph 2: Lusaka — where does the city's waste go?*). However, no details have been provided on what kind of activities entail treatment at source.

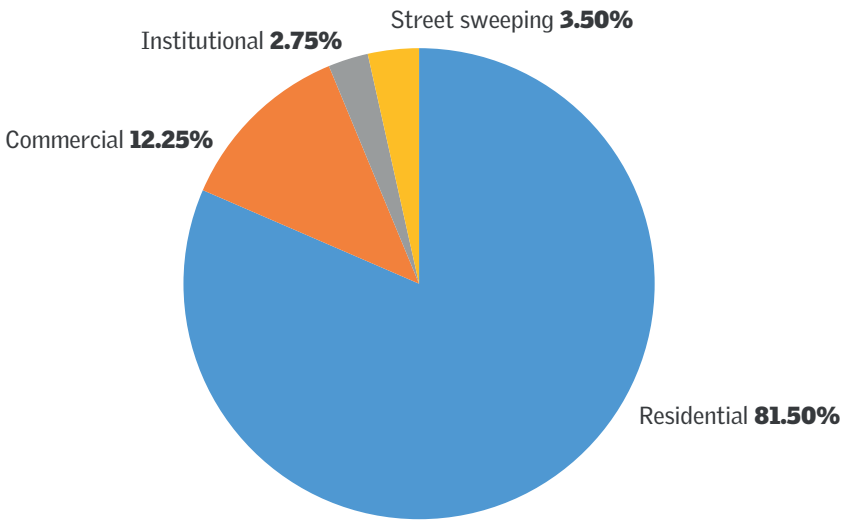
Almost no data is available on the waste management systems in other parts of Zambia.

Graph 2: Lusaka — where does the city's waste go?



Source: 2010, Solid Waste Management in World's Cities, UN-Habitat

Graph 3: Sources of MSW in Lusaka



Source: 2010, Solid Waste Management in World's Cities, UN-Habitat

TREATMENT AND RECYCLING

A 2010 UN-Habitat study has designed a process flow diagram to assess the movement of solid waste across the value chain. Of the roughly 0.3 million tonne of solid waste generated in Lusaka city, more than 80 per cent is received from residential sources (*see Graph 3: Sources of MSW in Lusaka*).[12]

Roughly 45 per cent of the solid waste generated in Lusaka is collected. Less than one third of the waste generated in the city is transported either to recycling facilities or for dumping at designated sites. Recycling markets do exist for materials such as paper, plastics and scrap metals. It is reported that close to 16,087 tonne of these materials are recycled in Lusaka city alone.[13] It should be noted that Lusaka, being the capital city, has a better system for collection, channelising and recycling of materials compared to any other part of the country. Close to 547 tonne of recovered materials are channelised here from the dumpsite to recycling facilities.[14] The major stakeholders who contribute to recycling are contractors and street waste-pickers, with the latter's contribution marking the lion's share of materials channelised for recycling.

CHALLENGES AND RECOMMENDATIONS

THE CHALLENGES

Lack of or insufficient policies, weak implementation

It is critical to have policy, implementation and practice complementing each other for an effective and sustainable solid waste management system. In most countries of Sub-Saharan Africa (SSA), policies are either weak or have had limited influence. In Namibia, for instance, the Pollution Control and Waste Management Bill was passed in 1999 and promulgated into an Act; it stresses upon prevention and regulation of air, water and land pollutants by adopting appropriate waste management strategies. However, Namibia still does not have a dedicated law regulating municipal solid waste management in the country. Ethiopia — another example — lacks the supporting guidelines crucial for implementing its Solid Waste Management Proclamation No 513/2007.

In a number of Sub-Saharan countries including Ghana, Kenya and Uganda, recycling policies have not been institutionalised. The preferred options in the waste management hierarchy — waste prevention and reduction, separation at source, and provisions for collection of waste service charge (collection fee) — are not given adequate attention in the laws.

Regulatory bodies in this region are mandated to issue guidelines and standards for implementation of effective waste management practices. However, a wide gap exists when it comes to getting the mandates translated into actions. To add to this, in some countries, policy mandates have not been notified by local governments. For example, in Eswatini, legislations such as the Waste Regulations, 2000 and the National Solid Waste Management Strategy talk about waste segregation, but guidelines are still required to specify the number of streams the waste should be segregated in — these guidelines are missing.

In most of the countries, waste management policymaking remains largely a function of the national government, while implementation and legislation is delegated to local governments. The space for involvement of multiple stakeholders, including the national government, community-based organisations (CBOs), private service providers and city governments has not been created — which has resulted into a clear disconnect between the various stakeholders. Existing laws on waste management, therefore, are not enforced due to ineffective coordination.

Limited enforcement of waste management laws may be attributed both to inherent weaknesses in the laws themselves, and a lack of devolution (fund-functions-functionaries) to ensure compliance and enforcement. For example, the entire region suffers from an absence of strict regulation on illegal dumping of waste. Even where such a regulation exists (as in Rwanda and Uganda), offenders are never penalised. Policies lack constitutive and constraining instruments.

Countries like Uganda have bye-laws in place to ensure waste disposal in an environmentally sustainable manner, but these are not enforced, leading to uncontrolled dumping and burning of waste.

Regulations in different countries have defined the duties of the city or municipal authorities regarding waste management. But these duties need to be supported by a solid institutional and implementation mechanism at the local level — this has been largely found to be lacking. In Eswatini, for instance, there is an absence of clarity on the implementation mechanism to be adopted for enforcing the framework for sustainable waste management. There are no specific guidelines, standard operating procedures or protocols for enforcing implementation.

It is important to note that urban local bodies are required to adopt and notify bye-laws to address local solid waste management-related challenges. Except for Uganda, Rwanda, Tanzania, Zambia and Ghana, the other SSA countries covered in this study have not notified any bye-laws. According to private contractors providing waste management services in countries like Ghana, some of the existing bye-laws are not effective enough due to an ambiguity in the roles and responsibilities that have been laid down in them, and a lack of coordination among regulatory agencies. The legal and institutional framework for waste management for rural and peri-urban areas — where a significant proportion of these countries' populations live — is all the more limited. Institutional responsibilities laid out for the concerned authorities for service provision (including identifying and implementing appropriate waste management systems), financial devolution, and enforcement monitoring for meaningful action are also either limited or non-existent. Rural areas even lack a legal mandate or a capacity to operationalise waste management services. This calls for a stronger linkage between traditional and formal government authorities.

Absence of credible data

A comprehensive assessment of sustainable waste management options in a country can only be made with a reliable waste inventory that needs to be periodically updated as a part of a regular institutional monitoring system. Such a system is critical for planning infrastructure, mapping of stakeholders and adopting critical policy measures to drive solid waste management in the right direction.

The SSA region suffers on this count: there is an absence of basic statistics on waste generation and composition in all the countries. A few studies — limited in scope — are available, but these are difficult to validate; the methodologies used are not consistent and are sometimes based on assumptions and not on scientific measurements.

Most of the times, data is available only for the capital city and is unrepresentative of the national scenario — particularly on recycling rates and quantity of waste scientifically treated and disposed of. There is no data on solid waste generation and composition in rural areas.

There do exist legal mandates for collection of data on waste management, monitoring compliance and enforcement. Local authorities in these countries are required to report waste quantities generated within their administrative jurisdictions to the regulatory bodies. But reliable information can only be obtained by instituting appropriate quantification and characterisation studies, maintaining records of waste processing and weighbridge records at dumpsites, and conducting regular surveys of different waste types and waste fractions from various waste sources — things which are not being done.

No source segregation

In all the SSA countries (except Namibia) studied in this report, there exist laws and regulations that mandate local government authorities to implement source segregation of municipal solid waste. But there is no mention of how many fractions of waste should be considered for separation at source.

There is also a dearth of infrastructure and equipment that is needed for ensuring separation of waste at source. Awareness campaigns have not been given enough importance to make the entire approach inclusive and participatory; the staff are untrained; and transportation vehicles are not designed with dedicated compartments for transporting different streams of waste (primarily wet and dry waste). Due to the mixing of different components of waste, there is almost none or limited processing and recycling options available once the waste is collected by city authorities.

Inefficient collection and transportation

In all the SSA countries studied in this report, collection efficiencies are not up to the mark and are inconsistent for ensuring proper management of waste. The average collection rate in SSA countries is a meagre 30-50 per cent. Incomplete collection leads to the proliferation of illegal collection points and informal heaps.

Usually, waste is only collected in the urban areas — even in these pockets, all the households

are not covered. Some of the capital cities such as Kampala (Uganda), Kigali (Rwanda), Accra (Ghana) and Addis Ababa (Ethiopia) are collecting more than half of the waste generated in their respective regions. Considerable collection efficiencies in the capital cities are achieved because of the collaboration and interventions of the local governments, private sector, NGOs and CBOs at both household and commercial levels to improve the quality of waste streams and recover partial revenue. The scenario is very different in most of the peri-urban and rural areas — collection services here are either extremely strained or non-existent.

Where it is being done, waste collection takes place in two steps: in most countries, primary collection happens using handcarts, tricycles, and donkeys which collect waste from households for transportation to an aggregation site. From the aggregation site, small vehicles and trucks are used to bring waste to the final disposal ground.

It is important to note here that many of the urban local bodies do not even engage in door-to-door collection — they carry out curb-side collection through skip bins. Most have deployed secondary collection vehicles, and there is a severe shortage of primary collection vehicles such as auto-tippers, wheel barrows and tricycles, due to which door-to-door collection is hindered.

After collection, waste is transported to dumpsites. There are no transfer stations in the cities and towns of most of these countries; many of the city authorities do not even have official secondary collection points, which means every waste collection truck has to take the waste directly to the dumpsite. This leads to insufficient collection of waste and formation of illegal collection points, thereby aggravating problems like open dumping, burning and burying of waste.

Nominal processing and treatment

As per a 2018 World Bank report, nearly 70 per cent of the waste collected in Sub-Saharan African countries is disposed of in dumpsites or burnt — only 7 per cent of the waste is recycled and treated.

The region suffers from an absence of processing and treatment facilities. Since the waste is collected in a mixed form, it becomes practically impossible for city authorities to channelise the dry recyclable fraction to existing recycling facilities. However, the informal sector in the region plays a significant role in extracting recyclables from the mixed waste, once the waste reaches the dumpsites.

There are no formally established material recovery facilities or sorting centres for processing dry fractions of waste. The recycling space is dominated by informal workers who scavenge for recoverable materials from dumpsites and sell them to unauthorised recyclers. Similarly, the wet fraction (biodegradable organics) is also not treated efficiently through composting or biomethanation.

Unscientific disposal

There is an absolute dependence on dumpsites as the final mode for disposal. As a result of the currently practised linear economy model — where the end-of-life products or waste are disposed of in landfills without any scientific treatment or recycling — a lot of materials having resource value are being indiscriminately dumped and hence, lost.

The construction and operation of the landfills are also a matter of concern. Landfills have been termed as 'engineered or scientific', but there are no clear guidelines in terms of design, site selection or operational criteria. There are no standard operating procedures adopted by the city authorities for ensuring scientific operations at landfills/dumpsites.

In addition, large quantities of waste are dumped at prohibited sites or illegal dumpsites, thus contributing to environmental deterioration. SSA countries also face challenges of scarcity of land (for dumping waste) and over-exploitation of facilities and continued disposal at a dumpsite even after its designed capacity has been exceeded.

In 2020, Uganda prepared guidelines for the management of its landfills. The guidelines cover the entire value chain of a landfill, from design and environmental considerations to surface and groundwater monitoring, the liner system, leachate collection, landfill gas, infrastructure and operations, and landfill closure and decommissioning. The guidelines also provide detailed

explanations, checklists and standard operating procedures, as well as risk assessment criteria which specify acceptable levels of risk to the environment or human health.

In Rwanda, the Environmental Impact Assessment Guidelines for Waste Management (2009) have some provisions for landfill siting and construction — but these are not exhaustive. There are the landfill guidelines of 2002 as well, which provide for landfill classification, site identification, design, upgrading of existing dumpsites, operation and maintenance, closure, restoration and aftercare.

It is important to consider here, once again, the role of the informal sector, which has a very strong presence in the solid waste management ecosystem of SSA countries. Informal ragpickers are a common sight in both urban and rural areas. However, since they work in close proximity to a variety of wastes — including biomedical and hazardous wastes — they are exposed high health risks. These countries need to identify the informal sector hotspots in their cities and plan their inclusion into the formal waste management operations.

Financial constraints

Laws cannot be enforced effectively unless there is a political will, followed by an availability of a financial devolution mechanism. In this region, the budgets allocated for sustenance of waste management services are often insufficient. The revenue earned from collection fees is so meagre that it is inadequate in meeting the operational costs incurred by local bodies for waste management services. Also, since recycling rates are low, it is not feasible for city authorities to earn anything significant from sales of recyclables.

To enhance the financial sustainability of the overall process, city authorities need to shift focus towards channelising waste from various sources to relevant processing facilities, and extracting optimum amounts of valuable resources, while also creating meaningful livelihood opportunities for formal and informal workers in the process.

THE RECOMMENDATIONS

Strengthen existing policies, formulate new policies and bye-laws

- Institute suitable policies, incentives and guidelines to promote waste reuse, recycling and recovery, including the adoption of advanced policy instruments to provide financial allocation to local bodies; consider introducing Extended Producer Responsibility (EPR), wherever appropriate.
- The countries which have dedicated rules on solid waste management should introduce guidelines and standard operating procedures for attaining high levels of recycling rate, construction and operation of landfill facilities, design and operations of material recovery facilities, and design and operations of compost or biogas facilities.
- Formulation of bye-laws at the local level can potentially help. For example, in Ghana, one of the most important provisions of the legislation is the power of the District Assemblies to make bye-laws for the functions conferred under Act 462 or any other enactment. As a result, most of the Assemblies have adopted bye-laws on sanitation and waste management.
- Zanzibar, a semi-autonomous island under Tanzania, has passed the Urban Municipal Council Solid Waste Management (SWM) Regulations, 2019 which was drafted with the help of Centre for Science and Environment. The law has contributed in attaining a sustainable solid waste management system in the region. The regulation emphasises the generator's responsibility to segregate domestic waste into three streams — compostable, recyclable and non-recyclable — which is then handed over to the city authorities. The regulation is based on the 'polluter pays principle', under which the generator has to pay a user fee or service charge on a monthly basis to the council. In addition, the council is required to educate and train households, businesses and other institutions on the merits of reducing, segregating, reusing, recycling and composting solid waste at source; this should be done in partnership with environmental non-profits, schools, universities, youth councils, women's associations, and donor agencies or organisations. The occupier is provided or supplied a solid waste receptacle by the council whenever deemed necessary.

Inventorise the waste

- The most crucial part of waste management is the creation of a reliable database on waste quantity and composition based on systematic sampling and scientific analyses. The data can be utilised for purposes ranging from making waste management plans and facilitating their implementation and monitoring, to forecasting future generation and composition of waste.
- The region is plagued by a severe lack of credible data — in the absence of which, it becomes difficult to design and plan sound waste management strategies or to make wise budget allocations.
- Waste regulations in SSA countries mandate data collection on various aspects of waste management, monitoring compliance and enforcement. However, very limited data on waste has been collected and documented by city authorities or regulatory bodies. Efforts must be made to improve the information base in order to facilitate integrated waste management systems in these countries.

Mandate source segregation and make it non-negotiable

- Municipalities must ensure separation of municipal solid waste at source. This must be non-negotiable as no other alternative can possibly provide a robust and economical solution for sustainable waste management. Accordingly, local bodies should create processes and devise management systems to segregate different waste streams generated from households and bulk waste generators.
- This can only be achieved by adopting an inclusive approach to engage with all types of waste generators to inform, educate and communicate them with locally relevant behaviour change campaigns. The community in general, and community-based organisations and NGOs in particular, should become active participants to deliver the message to trigger recycling and reuse of recyclables (plastics, paper, glass, metal, etc) in cities. CBOs and NGOs can be the best vehicles to promote public awareness about waste management. They can also engage in educational outreach programmes for small-scale generators, restaurants, wholesale and retail merchants, and commercial establishments.
- Source separation can be achieved by establishing an extensive information-education-communication (IEC) activity and awareness campaign as well as monitoring the outcomes in waste disposal behaviour of the generators. This can be done by the municipal councils in association with NGOs/informal groups/volunteers.
- Training of waste collectors for collection of segregated waste from households is required along with regular follow-ups to monitor the progress. Once door-to-door collection of segregated waste begins, municipal council/ informal workers/volunteers need to keep regular track of the percentage of segregation in each ward and also make sure that the segregated fractions are treated accordingly for revenue generation.
- City authorities should plan and implement capacity building programmes to train and educate the municipality workforce, citizens, educational institutions, commercial establishments, hotels and restaurants, and administrators of public places (bus stands, airports, railway stations, etc.).

Encourage public participation in waste management

- Participation of communities in sustainable solid waste management has been reported to yield many benefits in terms of storage of waste in dedicated bins; reduced quantities of litter; lesser waste burning activity etc. Such participation also serves to involve residents actively in municipal affairs and gives them a sense of ownership.
- SSA countries must promote environmental awareness and education among their people and ensure their participation in municipal affairs — especially with regard to indigenous knowledge, the role of women and youth in safeguarding the environment and the criticality of source segregation.
- In Rwanda, a state-wide communal workday commonly referred to as '*Umuganda*' is practiced by communities — it means getting together for a common cause or goal. On the last Saturday of each month, from 8:00 AM to 11:00 AM, businesses close and traffic comes to a halt as

Figure 1: IEC material for propagation developed for source separation of waste in Zanzibar

Source: CSE, 2018

citizens are expected to participate in *Umuganda*. Typically, they clean the streets, plant trees, cut grass, and trim bushes alongside the roads. A significant portion of *Umuganda's* activities is devoted to clean-up events which potentially contribute in keeping the city garbage free. Such community participation and cultural norms could be utilised as tools for effective waste management in other SSA countries as well.

- Currently, the rural and urban communities in many of the SSA countries are not aware of the waste management legislation in their respective nations, or their rights and duties in terms of managing waste and the essential role they need to play. Governments will have to put in much more effort into environmental education and awareness to empower not only local authorities, but also these communities.
- Community-based organisations and non-profits should be encouraged to be a part of solid waste action plans. In some of the cities in this region, CBOs are formally working in providing solid waste management services. For example, in Mwanza (Tanzania), more than 14 CBOs and two private collectors have been formally contracted to provide these services with some assistance from the city authority.

Establish an efficient collection mechanism, as well as material recovery facilities and transfer stations

- The African Union encourages African cities to develop their capacity so that by 2023, they can recycle at least 50 per cent of the waste they generate. If segregation of non-biodegradable and biodegradable waste is efficient, then it makes sorting and recycling a lot easier. Besides, an efficient collection system must be seen as a 'guaranteed service' to build a relationship of trust between local bodies and citizens, which eventually makes introduction of bye-laws more effective.
- Cities should ensure collection systems are efficient and collect segregated wet waste every day from households. Dry waste can be collected once or twice a week while domestic hazardous waste and sanitary waste can be collected once a week with the help of requisite infrastructure and humanpower. This collection frequency can be replicated for institutions as well.
- However, for hotels, restaurants, airports, hospitals and other commercial areas, wet waste can be collected twice a day and dry waste once every alternate day.
- To enhance collection, transportation and recycling efficiency, city authorities may introduce a door-to-door collection system with designated days for collecting dry waste only from individual, commercial and institutional generators.
- Set up decentralised dry waste facilities or material recovery facilities (MRFs) in every city and town.
- Make provisions for adequate and appropriate collection and transportation systems for segregated waste. Waste must be collected and transported in compartmentalised and covered vehicles or covered containers in vehicles to processing facilities and, thereafter, to processing and disposal sites.
- Assign a specific time to vehicles for collection and transportation.
- Identify potential recyclers to whom dry waste can be sold at a reasonable price.
- Assess the requirement for new humanpower and vehicles to strengthen collection and transportation services, and cut transportation costs.
- Introduce technologies like Geographical Information System (GIS), Global Positioning System (GIS), radio-frequency identification tag (RFID), quick reference (QR) and Artificial Intelligence (face recognition, biometric data) to increase monitoring efficiency and reduce deployment of resources.
- Municipal authorities should minimise the cost of collection and transportation of biodegradable waste by setting up decentralised waste processing facilities such as composting units and biomethanation within the community with the help of CBOs, NGOs and self-help groups.

INTERVENTIONS FOR REDUCING PLASTIC POLLUTION IN SSA COUNTRIES

For management of plastic waste and minimisation of the environmental risks due to plastic litter in both urban and rural areas in this region, tried and tested tools such as extended producer responsibility (EPR), deposit refund schemes (DRS), advanced recycling fee (ARF), or a ban on plastic should be adopted with relevant changes for regional suitability. It is important to note that out of the 10 countries studied in this report, Tanzania, Kenya, Uganda, Ethiopia, Rwanda and Zambia have dedicated policies on restricted use of single-use plastics, which are either completely banned or the government levies a very high tax on them.

Kenya has imposed one of the strictest bans in the region on the use of single-use plastics. The import, manufacturing or sales of single-use plastic bags could earn a fine of US $40,000 for companies and US $500 for individuals.

Similarly, Rwanda imposed a national ban on non-biodegradable plastic bags in 2008 and prohibited the manufacture, use, import or sale of plastic carrier bags. In October 2019, it became the first country in Africa to issue a complete ban on all single-use plastics.

Such legal interventions are critical especially for coastal regions in the SSA countries, in order to reduce the problem of marine litter caused due to land-based pollution.

Integrate the informal sector for dry waste recycling

- City authorities should make serious efforts to separate recyclables from other waste fractions (preferably source separated dry waste). All efforts should be made to collect biodegradable wastes and recyclables from the doorstep and deliver these waste fractions directly to the processing plants. For this, the concerned authorities should explore feasible, affordable, and environmentally sound options to recover the maximum possible resources, particularly from dry wastes.
- Existing policies on solid waste management should have provision to integrate the informal sector to leverage on their skills for securing source separated collection and secondary separation at material recovery facilities — wherever such options are found to be feasible. Integration of the informal sector not only creates livelihood opportunities, but also substantially reduces the cost of waste management operations.
- It would be important to institutionalise the homogenous (self-help) groups of ragpickers, NGOs or associations/cooperatives, so that their trained and motivated workforce can be redirected to enhancing and expanding the industry engaged in recycling and reusing of polymeric wastes as well as tackling the problem of non-ideal segregation.
- For example, the Tema Landfill Recyclable Waste Pickers Association is a body working at Kpone landfill in Ghana. This association was formed with the help of an NGO, Women in Informal Employment: Globalizing and Organizing (WIEGO). A total of 4,123 tonne of waste is recovered annually by the waste-pickers at the three major dumpsites in Ghana.
- City authorities in SSA countries should first map the entire network of informal waste collectors, including aggregators and dry waste recycling facilities, to gain operational knowledge of the economy of informal waste collectors.

Ensure effective treatment of biodegradable waste

- Projects related to wet waste treatment should be encouraged and supported for setting up environmentally and economically viable treatment options such as biomethanation and composting plants where the wet biodegradable portion of municipal solid waste can be

processed to produce biogas (in case of biomethanation) or compost (in case of conventional composting or home composting).

- Such plants should preferably be community-based (maximum 20 tonne per day capacity) or decentralised in various parts of the city. In the absence of suitable land or local acceptance, centralised plants may be set up.
- As reported by the World Economic Forum (2021), there exist opportunities to convert biodegradable organics — especially food waste — into clean, affordable energy through biomethanation. SimGas, a private company based in Kenya delivering affordable small-scale biogas and bio-sanitation to consumers, sells modern biodigesters (made from recycled plastics) that convert manure into biogas for cooking fuel and produce a bioslurry that can be used as fertilizer. It has served more than 75,000 families in Kenya alone.
- In Kenya another company called Safi Organics is turning food waste into carbon-negative fertilizer that enhances soil health and sequesters carbon. Such interventions are required in other regions of SSA countries so that a significant fraction of waste comprising of food waste and yard waste can be treated for recovery of useful products. This will also reduce the greenhouse gas emission due to dumping of organic waste in the landfills in SSA countries.

Manage special wastes — sanitary, domestic hazardous, healthcare waste and e-waste

- Household waste typically comprises biodegradable kitchen waste, packaging plastics, non-packaging paper and cardboard, packaging glass, and packaging paper and cardboard. E-waste, sanitary waste and healthcare waste are also generated from households and efforts should be made to segregate and treat these waste streams in a different manner as these are relatively more infectious and hazardous in nature.
- The COVID-19 pandemic has generated huge quantities of waste all across the world. This has to be addressed with extreme caution in order to prevent sanitation workers from contracting the infection while dealing with waste generated from households and institutions. Co-disposal of municipal solid waste (general waste) with other waste categories should be strictly prohibited by the authorities.

Ensure engineered landfill construction for disposal of inerts and rejects, close down old dumpsites

- Only Uganda and Ghana (among the countries covered in this study) have developed guidelines for landfill construction and operations — these include specifications on design and site selection criteria for construction of sanitary landfills.
- Setting up of sanitary landfills for disposal of inerts and residual waste from processing plants should be facilitated through a public-private partnership.
- Landfill construction projects must be of large capacity and designed for a period of 25-30 years with initial cell capacity to handle not less than 100 TPD of inerts and residual waste for five years to ensure economic viability and professional management.
- Residual waste from all processing facilities should be sent to an engineered landfill. For minimising the requirement of land for disposal of such waste, and to ensure economy of scale, regular monitoring and professional management of the facility, large common regional sanitary landfills covering at least 40,000 people may be set up for the disposal of only inerts in a cost-effective manner on a cost-sharing basis among the beneficiaries and municipal authorities.
- Independent landfills may be setup in cities with above one million populations. Besides, sustainable operational practices such as daily cover, compaction of waste, and disposal of non-recyclables and non-compostable waste should be adopted.
- In addition, the remediation and closing of already existing dumpsites is extremely important in all the SSA countries. Rehabilitation and remediation of landfills or dumpsites, including landfill mining or closing of dumpsites, should be initiated on a priority basis in the cities where water table is typically high and the amount of waste being deposited is huge. Based on cost-benefit analyses, strategic policy and technological interventions regarding remediation and capping should be undertaken.

Build capacity for integrated waste management

- It is of paramount importance to build capacity of local officials for an integrated approach to solid waste management and to create a resource pool at key leadership positions that can drive the entire initiative to institutionalise a more sustainable, environment friendly and decentralised system of waste management.
- The process of capacity building needs to be planned in a phased manner to facilitate a 'learn and do' mode of implementation. The process also needs to create a pool of master trainers across themes concerning various facets of municipal solid waste management. These master trainers would be responsible for building capacity of ward-level officials, door-to-door collectors, volunteers for IEC campaigns and others to develop a common understanding around key parameters of circular economy that are vital for decentralised management.
- Capacity building of other stakeholders is equally important. There has to be a mission mode approach for capacity building of communities about the importance of source segregation and making them aware of sustainable waste management practices.
- Urban local bodies should design trainings on integrated solid waste management systems, plan communication campaigns and monitor the planned activities. Prepare an annual training calendar for capacity building of officials.
- Plan exposure visits to cities with best practices for learning through field visits and interaction with city officials and other stakeholders.
- Monitoring and evaluation of compliance of other environmental legislation with the provisions of the waste regulations/other regulations related to waste management should be done.
- Create a task force with selected senior officials from all units, and create an institutional mechanism to periodically review the progress made on various programme components and take necessary course correction measures.
- Improve coordination among various units and associated ministries.
- Strengthen community-level surveillance to ensure source segregation and the anti-littering initiatives by engaging with citizens through IEC tools.

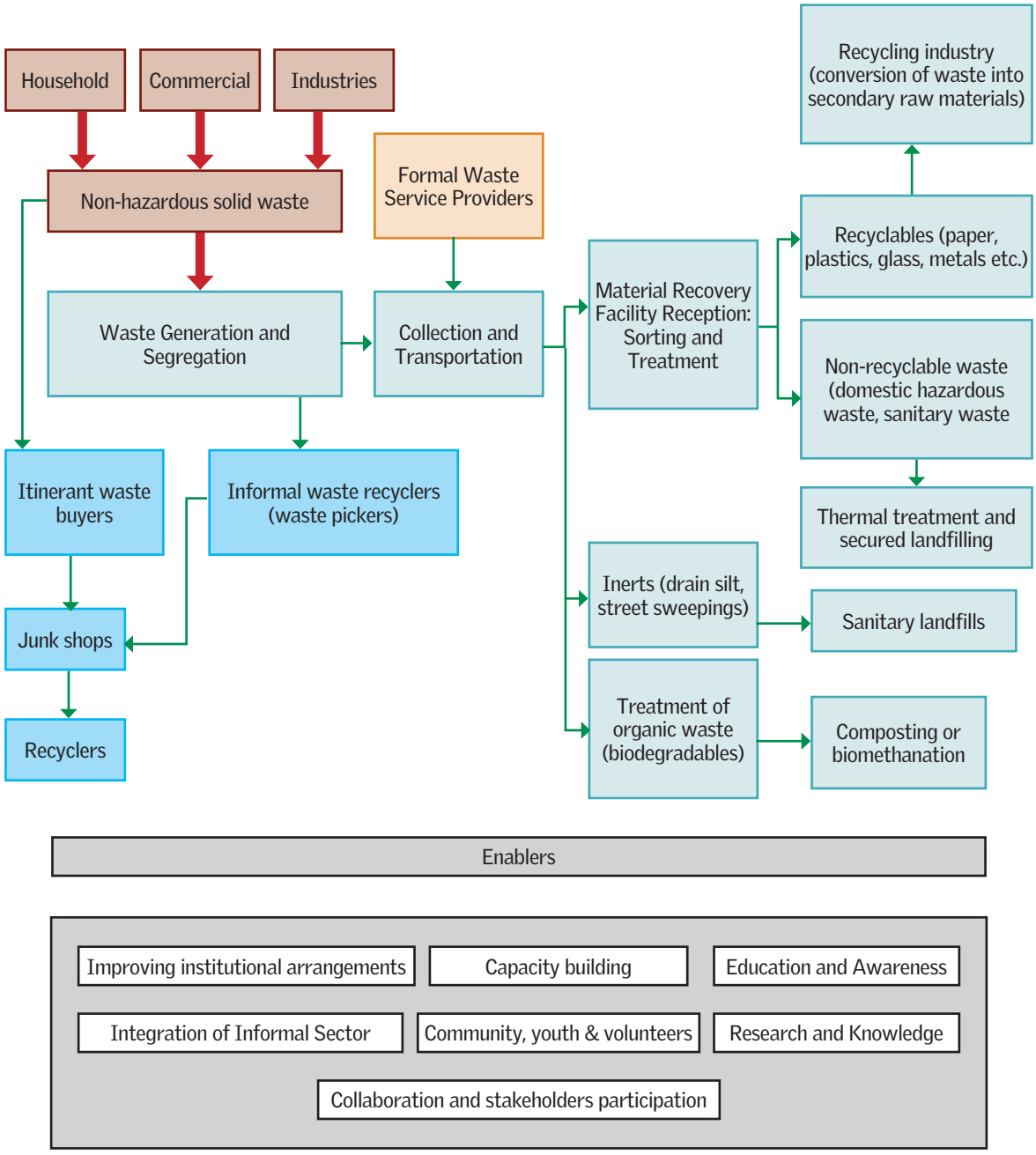
Ensure monitoring and evaluation

- The local government should not only make policies and action plans to achieve efficient solid waste management by adopting sustainable practices, but also ensure that the action plan and policies are being implemented on ground. In order to achieve this, a proper monitoring system is essential.
- Monitoring can be carried out at the local level by the concerned authorities during routine inspections. It must be designed in a way that allows the authorities to create fair statistics on quantities of waste generated, how much is source separated, how much is collected, treated and scientifically disposed of. It will help to identify the gaps and challenges which eventually contributes in formulating strategies and plans to overcome the challenges in the implementation of sustainable solid waste management action plan.
- At the national level, the regulatory authorities in the SSA countries should also conduct random audits and inspections on a regular basis to identify the knowledge and infrastructural gaps and competence of the concerned officials. This kind of evaluation practice will help develop future strategies and targets in order to bridge the existing gaps in the policies at the national level.

Encourage partnerships between NGOs, CBOs, municipalities and the private sector

- The importance of NGOs and CBOs as well as the private sector in providing waste management-related services has been acknowledged in almost all the countries in SSA, and especially in the urban settlements.
- The public-private partnership (PPP) model has to be promoted for accelerating the supply of public services and alleviating the government's financial burden. There have been several examples across the SSA countries where waste management services are being provided with the collaboration of government and private companies. A suitable institutional arrangement

Figure 2: Conceptual model for the proposed circular economy for waste management value chain in SSA countries



Source: CSE

can help to facilitate the involvement of private sector and PPP adoption in SSA countries.

- In many countries of SSA region, providing waste management services is the sole responsibility of the private sector. For example, in Tanzania, waste management services in Dar es Salaam in 1994 was one of the first to be privatised — this example was followed by municipalities in countries such as Kenya and Uganda.
- Private players that have the means and are willing to pursue waste management businesses in SSA countries should be provided with opportunities and promoted through bye-laws. For example, the Jinja Solid Waste Management Bye-Laws of 2005 in Uganda recognises the role of private companies in the collection and disposal of waste, when practiced in a sustainable manner and for a fee. Transparency is important in this context — tenders for SWM contracts in Uganda are advertised through the media and is followed by open bidding.
- For financial sustainability and infrastructural development, SSA countries can seek funding from global funding agencies like African Development Bank, World Bank and European Commission. The World Bank finances and advises on solid waste management projects using a diverse range of services, including traditional loans, results-based financing, development policy financing and technical advisory. World Bank-financed waste management projects address the entire lifecycle of waste - from generation to collection and transportation, and finally treatment and disposal.
- A classic example is the case of Mozambique where the World Bank had approved a US $100 million grant to the capital city of Maputo to support the implementation of municipal reforms, including infrastructure required for solid waste management in the city.

Overall, it is strongly recommended that the SSA countries should review the existing solid waste management laws and policies and strengthen them, taking into consideration emerging and contemporary issues on waste management, best practices and lessons learnt. The SSA region should formally adopt the circular economy approach in SWM. This strategy should focus on waste reduction, reuse and recycling whilst using best available technologies for waste to wealth conversion, and scientific landfilling of inerts and residual solid wastes. The development planning agencies should make targeted efforts to create markets and engage the local community to make SWM environmentally sustainable, financially feasible and socially acceptable.

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With its growing population and galloping urbanisation, Sub-Saharan Africa is all set to contribute hugely to the global solid waste problem. This scoping study profiles the municipal solid waste management processes and systems in 10 countries from this region -- countries which have agreed to join a CSE-initiated Global Forum of Cities for Circular Economy. The Forum is an effort towards bringing together nations from the Global South to share experiences, inspirations and learnings on waste management

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