TOWARDS CIRCULARITY

Good Practices in Solid Waste Management in Africa: A Compendium

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CONTENTS

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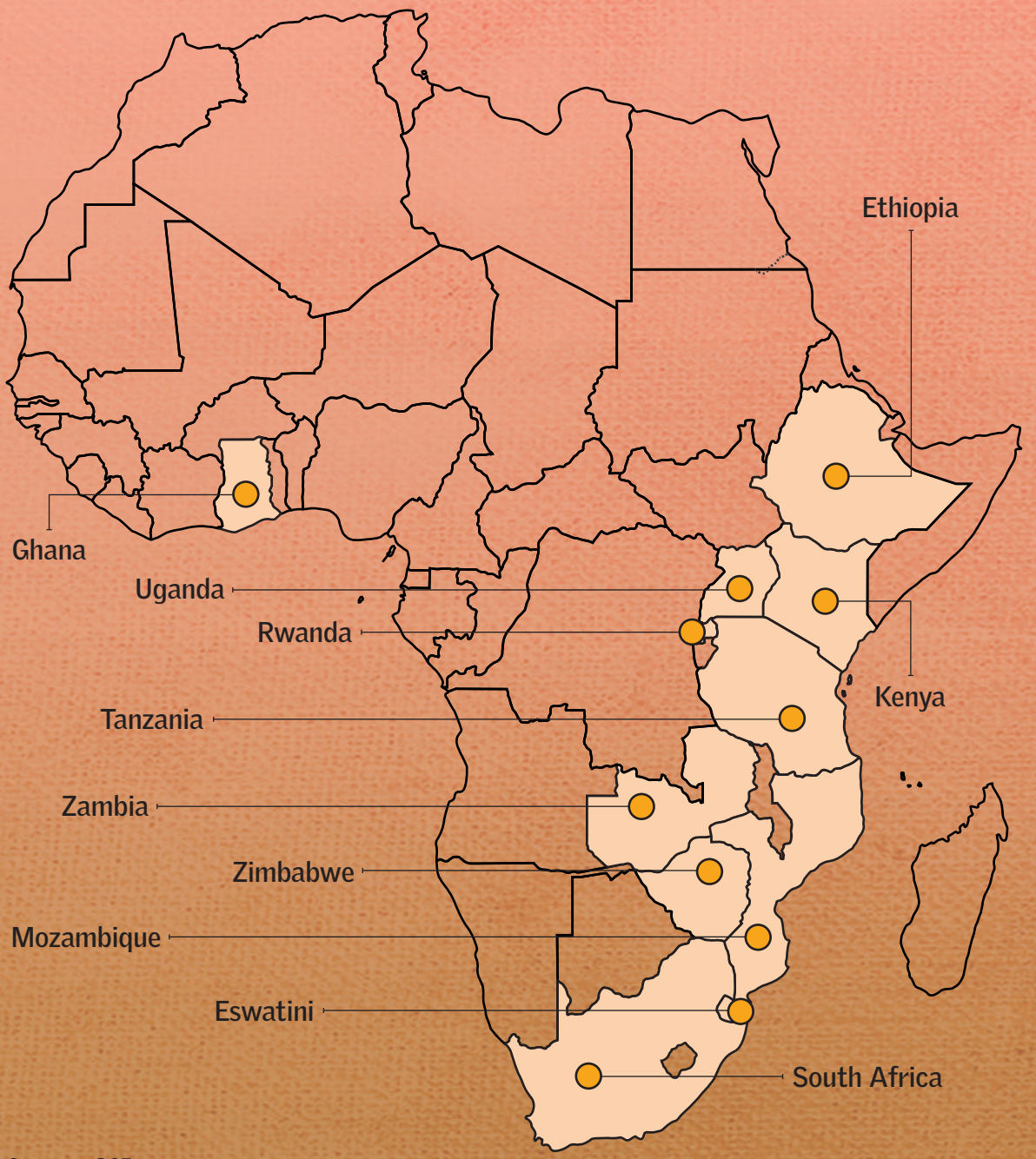
SUSTAINABLE WASTE MANAGEMENT INITIATIVES IN SELECTED AFRICAN NATIONS



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Foreword

The continent of Africa is undergoing rapid urbanization and economic growth, resulting in a significant increase in waste generation. Addressing this pressing challenge is crucial for safeguarding public health, promoting environmental sustainability, and fostering economic development. This compendium highlights a diverse range of innovative, economically viable, and sustainable approaches to solid waste management being implemented across Africa. From community-driven initiatives to large-scale infrastructure projects, these stories showcase the resilience, innovations, and commitment of African communities, organizations, and individuals in their pursuit to a cleaner and more sustainable future.

The compendium documents better practices in the sub-Saharan Africa which has the potential to be replicated as a cost effective and environmentally sustainable model. The initiative to reduce plastic pollution by Eswatini, waste management through innovative technologies and waste-to-energy plant in Ethiopia, biodegradable waste management initiative in Ghana, community-based programs to promote waste segregation and recycling in Kenya, effective educational programs and community-led initiatives to combat plastic waste pollution in Mozambique, citizens' empowerment to take ownership of waste through community-based programs promoting recycling and composting in Rwanda, decentralized systems that integrate informal waste pickers into the formal waste management system and fostering increased recycling and improved livelihoods in South Africa and Tanzania, the black soldier fly model for organic waste management and producing valuable byproducts like animal feed and fertilizer in Uganda, the public-private partnerships in developing sustainable waste management solutions in Zambia, community-based waste management programs, including recycling and composting initiatives in Zimbabwe – all have demonstrated the potential to address the dire need to divert waste from getting to the landfills through processing for value addition and creating livelihoods to the poor and marginalized section. Circularity in all these models are quite evident.

By sharing these inspiring stories from countries across the length and breadth of the continent, we hope to inspire others to take action, learn from the successes and challenges of these initiatives, and contribute to building a more sustainable and climate resilient future for Africa. This compendium serves as a valuable resource for policymakers, practitioners, and researchers working in the field of solid waste management. It offers insights into effective strategies, lessons learned, and potential avenues for further development. We believe that by fostering collaboration, knowledge sharing, and innovation, Africa can lead the way in developing sustainable and equitable solid waste management solutions.

SUNITA NARAIN
Director General, Centre for Science and Environment
New Delhi, India

ESWATINI

ESWATINI

BEST PRACTICE:

Plastic waste management through Phatsa Sakho Nawe Campaign

Population
(in million, as per 2017 Census)
1.2

Area (sq km)
17,364

Number of households
283,483

Number of Regions
4

Number of Tinkundla (Village)
59

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
598

Percentage of households covered under door-to-door waste collection
17

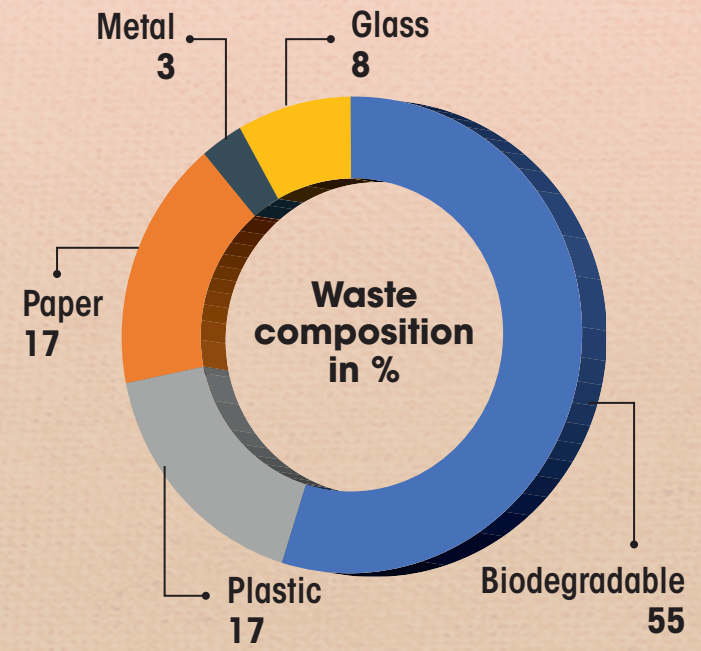
Percentage of waste processed
1

INTRODUCTION

Rapid population growth and urbanization, combined with industrialization and changing consumption patterns, have emerged as primary drivers of increased waste generation in Eswatini. The lack of comprehensive data on waste composition and volume has impeded strategic waste management efforts, hindering the implementation of necessary measures such as behavioural shifts, the development of waste management infrastructure, and the enactment of relevant legislation to address waste reduction, recycling, and proper disposal practices.

Waste composition in Eswatini

Total waste: **598 TPD**



THE TRANSFORMATION

According to the World Bank's "What a Waste 2.0" report, Eswatini generated an estimated 218,199 tonnes of waste in 2016, with an average per capita waste generation rate of 0.45 kg/day. The prevalent practice of landfilling or indiscriminate waste dumping in urban areas is unsustainable due to its extensive land requirements and associated environmental and health risks. Moreover, existing waste management services in urban areas exhibit suboptimal efficiency, with only 50–60 per cent of waste being collected. Compounding these challenges are increasing instances of public littering and the illegal dumping of both household and construction and demolition waste. These multifaceted issues underscore the urgent need for a comprehensive overhaul of Eswatini's waste management systems.

Eswatini has also been contending with the issue of plastic waste pollution, with plastic waste generation surpassing 37,000 tonnes annually. Alarmingly, only half of this waste is collected. However, experts suggest that the actual amount of plastic waste generated is likely much higher.

According to a 2016 survey conducted by the Eswatini Environment Authority (EEA) and UNDP Eswatini, three out of the five major retailers in the country collectively distributed approximately 1.9 million single-use plastic bags per month. Regrettably, around 60 per cent of these plastic bags end up in landfills, while the remainder contribute to pollution in aquatic ecosystems or disrupt other aspects of the natural environment.

This plastic pollution poses risks to domestic animals, which hold cultural significance in Eswatini, particularly for rural smallholder farmers who consider them symbols of wealth. These animals are at risk of ingesting single-use plastic bags while foraging for discarded food, further exacerbating the environmental impact. The detrimental effects of plastic pollution have begun to affect the tourism and livestock industries in both urban and rural areas, resulting in economic losses for affected communities.

Domestic animals at risk of ingesting plastic waste while foraging for food

In addressing the challenge of plastic waste, UNDP Eswatini collaborated with the kingdom to try a comprehensive strategy designed to diminish the prevalence and utilization of single-use carry bags, thereby mitigating plastic pollution.

In conjunction with the EEA and the Ministry of Tourism and Environmental Affairs, the UNDP initiated the Phatsa Sakho Nawe (i.e. Bring your own bag) campaign. Launched on 25 November 2020, the campaign aimed to dissuade retailers from distributing single-use plastic carry bags while advocating for consumers to utilize reusable shopping bags instead.

HOW THE SYSTEM WORKS

The Phatsa Sakho Nawe campaign aimed at addressing the following objectives:

- Reducing the distribution of single-use plastic carry bags by major food retail outlets, particularly during the festive season.
- Increasing awareness about the negative environmental impacts of single-use plastic bags.
- Promoting the sale and use of reusable carry bags, potentially sourced from local textile micro, small, and medium-sized enterprises (MSMEs).
- Advocating for the enactment of the Plastic Bag Regulations Bill in Parliament, which proposes the implementation of a plastic bag levy and offers the option of a complete ban on single-use plastic bags.

In this nationwide campaign, EEA partnered with five major retailers which were Shoprite, Spar, Pick and Pay, OK Foods and Boxer. These retailers had outlets in multiple cities in the country. Thereafter, a whole lot of other shops joined the campaign either through negotiations by the EEA or voluntarily.

To introduce gradual changes in consumer behaviour during the campaign, participating retailers provided shoppers with single-use plastic bags from Monday to Thursday and banned distribution between Friday and Sunday for each week. People were allowed to form a habit of shopping without plastic bags without putting too much pressure on them. This had the benefit that people were incentivized not to disregard the law completely.

One by one, the number of days on which distribution was banned were increased until plastic bags were not distributed at all. Weekly data collection was used to track the distribution pattern of plastic bags in comparison with baseline data. Additionally, qualitative data was collected on consumer feedback, complaints and reactions to the campaign.

As a deterrent measure, the EEA has initiated a pilot programme for levying a tax on the distribution of plastic carry bags. Consumers requesting single-use carry bags will incur a one-time cost per bag, with the tax collected by retailers transferred to authorities through the Plastic Levy Return Filing System (PLRFS). This system aims to facilitate the management of plastic waste throughout the value chain, from collection to recycling and proper disposal.

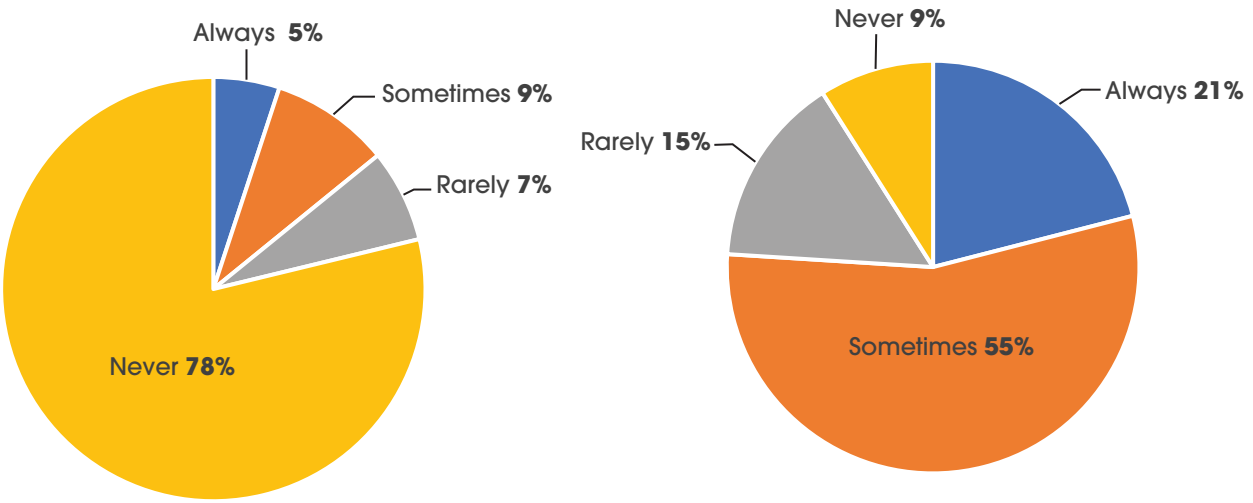
WHAT HAS WORKED

The number of people who always brought their own shopping bags increased from 5 per cent to 21 per cent. While the percentage of people who never carried a carry bag decreased substantially from 78 per cent to 9 per cent.

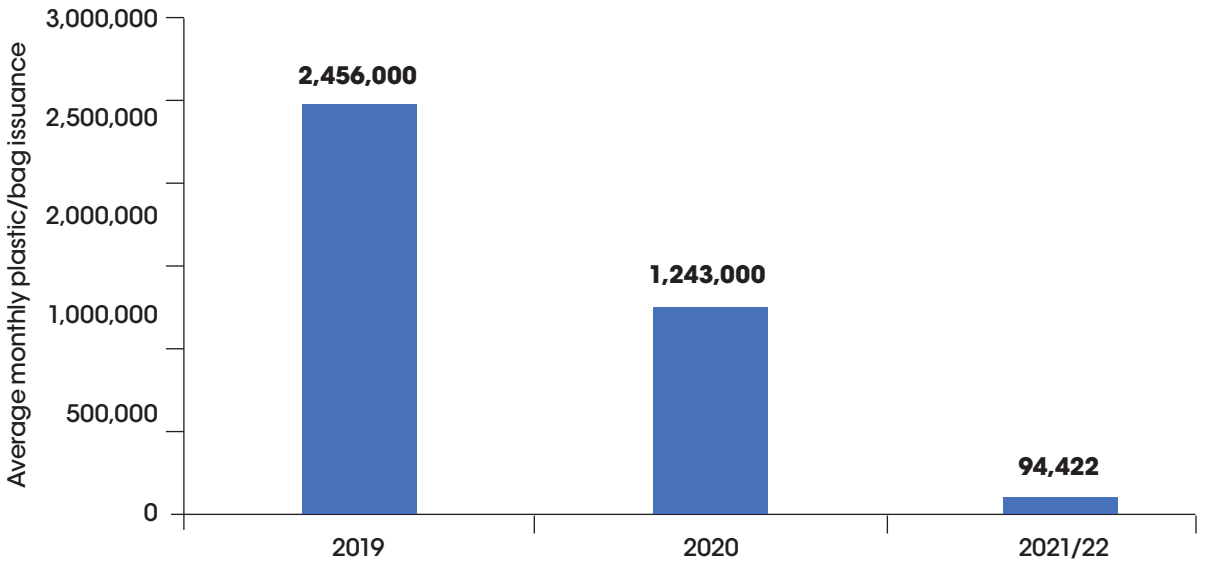
The number of carry bags that were issued in the retail shops also went down drastically in the two-year period of implementation of the campaign.

The issue of pollution caused by single-use plastic bags prompted the EEA to develop the Plastic Bag Regulations' Bill in 2021. This bill adopted a dual-pronged approach: Initially, it proposed the implementation of a levy on each single-use plastic bag distributed by retail

Graph 1: Comparison of bringing own bag before and after campaign



Graph 2: Average monthly plastic issuance in selected shops by year



outlets, followed by the option for the government to consider a complete ban on single-use plastic bags. This phased approach aimed to allow both retailers and consumers to adequately prepare for the potential implementation of a comprehensive ban on single-use plastic bags.

The initiative, initially planned as a three-month campaign, was prolonged to engage citizens and local businesses further. Although the levy strategy demonstrated effectiveness in reducing retailers' distribution of single-use plastic bags, research indicated that this approach will ultimately bolster the economy in the long term. Initially, the levy induced a short-term cost shock for consumers, dissuading them from opting for plastic bags. However, over time, the additional cost imposed by the levy became negligible when compared to the overall shopping expenses. While a complete ban on single-use plastic bags was deemed the most efficient solution to address plastic pollution, the partial ban introduced through the 'Phatsa Sakho Nawe' campaign offered a practical demonstration of the anticipated impacts of a comprehensive ban. It wasreported that the campaign led to a 40 per cent reduction in the circulation of carry bags by major retailers in the country.

Seeing the success of the partial ban, in May 2024, the Ministry of Tourism and Environmental Affairs announced a blanket ban on the sale, use and circulation of plastic carry bags irrespective of thickness. The ban will be effective from 1st December 2024. The Ministry has also prepared a 12 month roadmap for phasing out Extended Polystyrene (EPS), which is widely used across the kingdom.

LESSONS LEARNT

This initiative has facilitated the Vukani BoMake Project (VBP), enabling rural women to generate approximately E120,000 (US $8,000) in revenue within three months through the sale of reusable bags to supermarkets. VBP stands as a testament to the success of the campaign orchestrated by UNDP Eswatini's Accelerator Lab in collaboration with the Eswatini Environmental Authority, the Ministry of Tourism and Environmental Affairs, and five prominent supermarkets across the nation.

Established by Business Women Eswatini (BWE) under the auspices of Business Eswatini, VBP endeavours to empower unemployed rural women by imparting sewing skills, thereby enabling them to initiate businesses within their respective communities. These women craft multiple-use shopping bags utilizing discarded material sourced from textile companies at the Matsapha Industrial Site, a notable departure from the previous practice of sending such waste to landfills.

By repurposing this scrap material, VBP not only provides a sustainable solution to waste management but also supports the country's textile industry. In addition to shopping bags, the women produce reusable masks and sanitary towels, further contributing to environmental sustainability and community empowerment.

REPLICABILITY

In conclusion, the effectiveness of the 'Phatsa Sakho Nawe' campaign highlights the significance of cooperative endeavours involving government entities, international organizations, businesses and local communities in tackling plastic pollution and promoting sustainable development in Eswatini. The potential replication and expansion of the campaign offer hope for realizing more comprehensive environmental and socioeconomic goals throughout the nation.

ETHIOPIA

ADDIS ABABA

BEST PRACTICE:

Energy recovery from waste-to-energy plants

Population
(in million, as per 2019 Census)
4.6

Estimated current population
(in million)
5.7

Area (sq km)
540

Number of households
(in million)
1.5

Number of wards
119

Number of zones
11

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
2,508

Number of sanitation workers
12,000

Waste management vehicle fleet size
300

Percentage of households covered under door-to-door waste collection
75

Percentage of waste processed
25

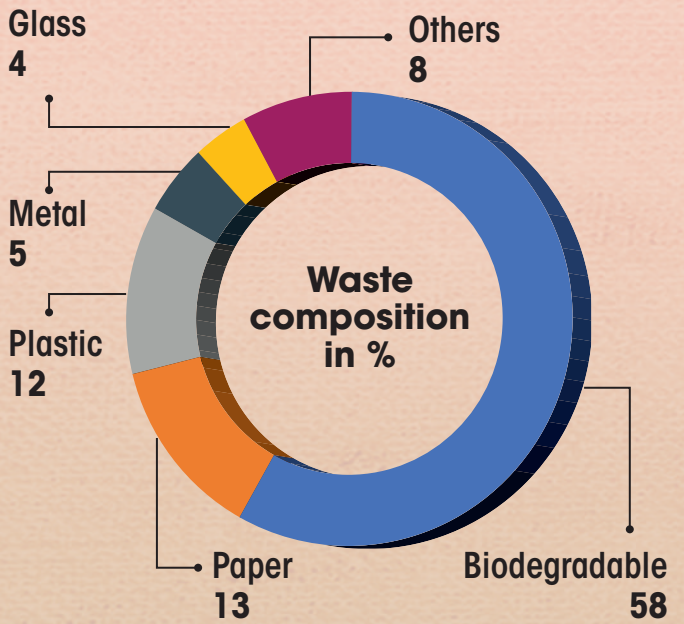
Percentage of households segregating waste
23

INTRODUCTION

Addis Ababa, the capital of Ethiopia and a significant diplomatic hub in Africa, is one of the world's few high-altitude capital cities. The city generates approximately 2,508 tonnes of waste daily (660 g per person per day). The new waste-to-energy facility has the capacity to manage 80% of the city's total waste and generate 25 MW of electricity, fulfilling 30% of the total household electricity needs. Additionally, the city has gained recognition for its effective waste collection and transportation, an achievement attributed to ongoing collaborative efforts with stakeholders through continuous awareness campaigns.

WASTE COMPOSITION IN ADDIS ABABA

Total waste: **2,508 TPD**



THE TRANSFORMATION

With rapid urban development, cities throughout the world have had to grapple with increasing waste pressure. Addis Ababa is no different. Solid waste and sanitation management services in the city were not able to keep pace with the city's expansion and population growth. All its waste was being dumped in an open dumpsite, which had grown to a size equivalent of 36 football pitches. This unmanaged waste posed significant environmental concerns, especially as it was leaching into the river and land.

Things only turned around in 2018 when Addis Ababa established a waste-to-energy plant in Reppie, near the dumpsite. This project was initiated as part of a cleanup programme following a devastating landslide at the landfill in March 2017, resulting in the loss of at least 116 lives. The waste-to-energy plant aims to process 1,400 tonnes of waste—80 per cent of the total waste currently generated by the city—and convert it into electricity. This significant initiative not only improves waste management but also contributes to a substantial reduction in greenhouse gas emissions previously caused by open dumping practices.

HOW THE SYSTEM WORKS

Addis Ababa spans an area of 540 sq km. It is organized into 11 sub-cities, which are further divided into 119 woredas. Each sub-city is assigned 15 staff members, while each woreda office has 10–20 staff members dedicated to solid waste management.

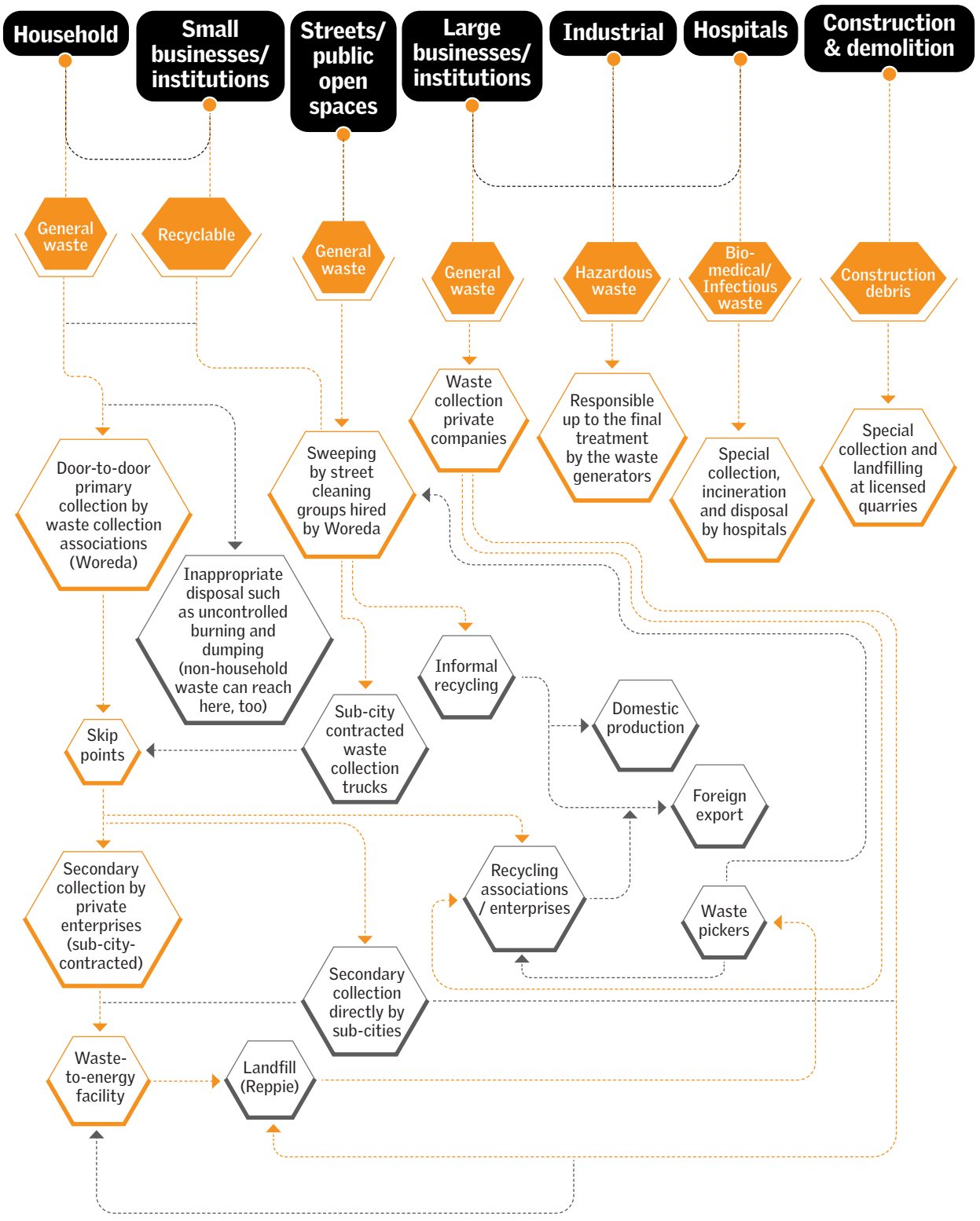
The waste generated from various sources—including households, commercial establishments, street sweeping, industries, hotels and hospitals—is collected through motorized vehicles and push carts, depending on road accessibility. Primary collected waste is transported to 311 skip points in the city, from where motorized vehicles pick it up for transportation to the dumpsite. A total of 80 small and medium enterprises (SMEs) and 8,000 workers are employed for sanitation work.

Upon reaching the Reppie landfill area, transport vehicles are weighed at the entry weighbridge. About 60 per cent of waste is biodegradable and is sent for composting. Non-biodegradable recyclable waste is channelized to a recycling facility. Only the non-recyclable and non-compostable waste is processed through the waste-to-energy plant.

The solid waste electric power station in Addis Ababa city operates by converting waste into energy. The process begins with the transportation of solid waste to the incineration room, where it is burned at high temperatures. This combustion heats water to produce

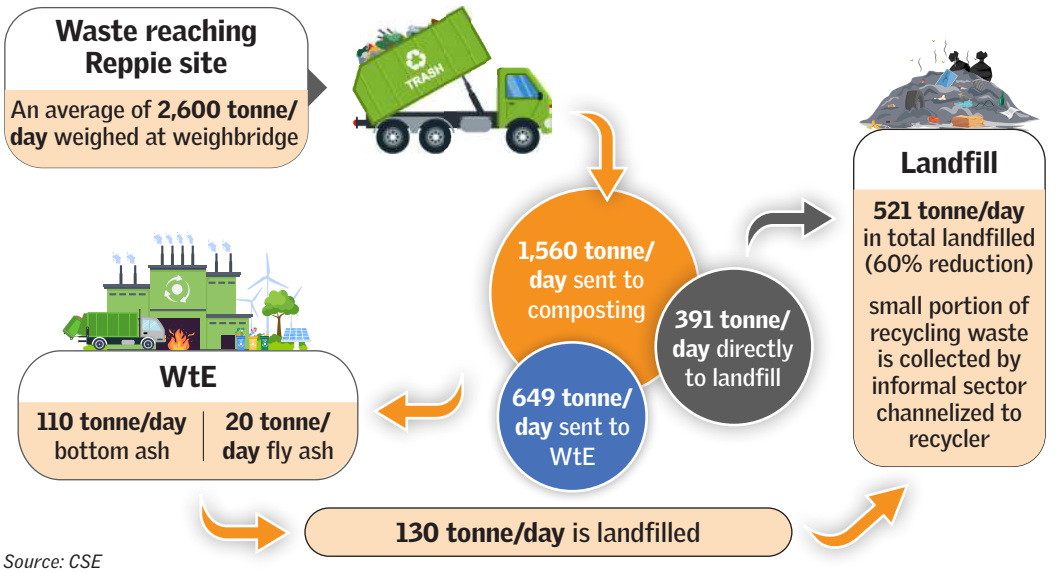
Addis Ababa waste-to-energy plant

Figure 1: Waste management system in Addis Ababa



Source: CSE

Figure 2: Waste management system in Addis Ababa



Source: CSE

steam, which is then directed under high pressure to the power generation room to move turbines and generate electricity. Concurrently, any toxic gases and liquids released during incineration are processed in a treatment room equipped with advanced technology, ensuring the elimination of harmful substances.

The facility houses two generators that utilize the steam from the combustion room. Once electricity is produced, it is distributed through various electrical systems to the power station and then supplied to the residents of Addis Ababa. The remaining by-products, such as bottom and fly ash, are transported to the disposal room. Notably, bottom ash is minimally harmful and can be recycled, often used as a component in block production.

This waste-to-energy plant not only contributes to technological advancement and skill development in Reppie but also plays a crucial role in mitigating environmental pollution and maintaining the cleanliness of the city. Polluting gases are captured to prevent their release into the environment. After combustion, fly ash and bottom ash are removed for further disposal in the Reppie landfill site. The waste-to-energy plant can reduce the volume of waste by 20 per cent.

The waste-to-energy plant is designed to process 1,400 tonnes of municipal solid waste, producing electricity equivalent to 25 MW. This electricity can illuminate 30 per cent of the households in Addis Ababa.

However, challenges associated with the facility include securing an adequate and consistent supply of municipal solid waste, managing environmental and social impacts, and addressing technical and operational issues that hinder the plant from utilizing its full capacity. Currently, the plant processes only 649 tonnes per day of municipal solid waste, generating 11.59 MW of electricity.

Addias Ababa has also instituted penalties for individuals, businesses and institutions for improper handling of solid waste, which includes failure to segregate waste into different categories, unsafe or insecure storage of waste, and disposal methods that harm health or the environment. Individuals may face fines upto 500 birr (US $9), while businesses and institutions could incur fines up to 3,000 birr (US $53).

WHAT HAS WORKED

Outsourcing of waste management activities like waste collection, transportation and disposal to SMEs: This approach leverages the expertise and flexibility of SMEs to adapt to the specific characteristics and requirements of different neighborhoods within the city. They also promote community involvement and entrepreneurship.

Payment to SMEs based on the volume of waste collected: The city administration compensates SMEs for their services based on the volume of waste they successfully collect. This payment model incentivizes SMEs to actively participate in efficient waste collection and management practices, aligning their financial interests with the overall success of the waste-to-energy initiative. By tying compensation to the quantity of waste collected, the system encourages SMEs to explore innovative methods to enhance waste recovery and reduce the overall waste burden on the landfill.

Waste collection fees linked to water consumption rate of residents: The city administration implements a unique and practical approach to fund the waste-to-energy project by collecting waste fees directly from residents. These fees are linked to the water consumption rate of residents, creating a connection between the generation of waste and the financial responsibility of waste disposal.

LESSONS LEARNT

Waste as a valuable resource for energy production: Waste does not have to be treated as a liability. It can also become a valuable resource if used well. This project demonstrates that by converting it into electricity. This innovative approach challenges the traditional perception of waste as a problem to be disposed of and instead showcases its potential as a sustainable energy source.

Job creation: The project has a positive impact on the local economy by creating employment opportunities throughout the waste management process. From waste collection to plant operation and maintenance, the project has generated more than 800 jobs that stimulate economic growth and benefit the community.

Improvement of public health and sanitation: Improved waste management practices lead to enhanced public health and sanitation. By reducing open dumping and associated health risks, the project contributes to creating cleaner and safer living environments for city residents.

REPLICABILITY

The waste-to-energy project in Addis Ababa stands as a source of inspiration for other cities in Africa and beyond. Its success demonstrates the feasibility of waste-to-energy solutions and encourages other urban areas to explore similar initiatives.

Replicating this model in other cities allows them to tap into their waste stream, reducing reliance on conventional energy sources and fostering a more sustainable and environmentally friendly approach to energy production.

By sharing best practices, lessons learned and the positive outcomes of the project, Addis Ababa can inspire and guide other cities in adopting sustainable waste-to-energy solutions, fostering a global movement toward more environmentally conscious and resource-efficient waste management practices.

GHANA

ACCRA

BEST PRACTICE:
Integrated waste management through PPP model

Population
(in million, as per 2021 Census)
5.4

Estimated current population
(in million)
5.7

Estimated floating population
(in million, dialy)
1.5

Area (sq km)
3,560

Number of households
(in million)
1.5

Number of zones
23

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
5,000

Number of sanitation workers
200

Waste management vehicle fleet size
30

Percentage of households covered under door-to-door waste collection
65

Percentage of waste processed
20

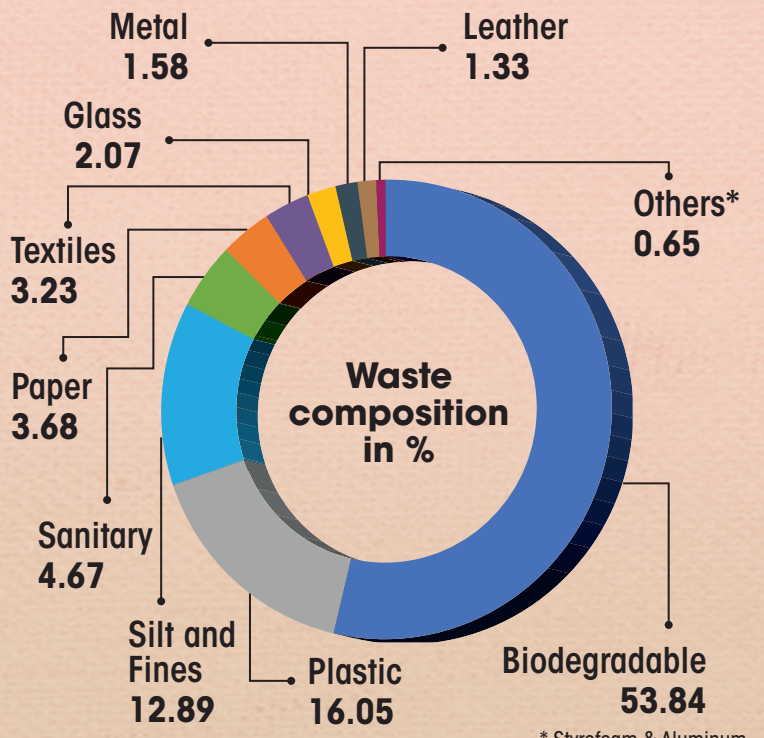
Percentage of households segregating waste
0.2

INTRODUCTION

Accra, the capital of Ghana and often referred to as the Millennium City, is situated on the southern coast along the Gulf of Guinea. The city generates 5,000 tonnes of waste daily. Given Accra's status as a business and commercial hub, it has a floating population of 1.5 million, contributing significantly to waste generation. The Accra Metropolitan Assembly (AMA) has undergone a transformation in waste management, shifting from open dumping and burning to the processing of waste through an integrated waste management facility.

WASTE COMPOSITION IN ACCRA

Total waste: **5,000 TPD**



* Styrofoam & Aluminum

THE TRANSFORMATION

In the 1990s, when Accra was quickly developing, open dumping and burning of waste were prevalent practices due to the lack of adequate waste management infrastructure. About 83 per cent of the total waste generated by the city was being openly dumped and only 11 per cent of the population could access door-to-door waste collection services. The challenge of door-to-door waste collection persists, particularly in low-income communities in Accra. According to the WHO report on Solid Waste Management and Health in Accra, Ghana, open burning and dumping also continue to be issues, albeit with gradual improvements over time.

Given all of that, waste management services have still seen significant improvements since the commencement of the Accra Compost and Recycling Plant (ACARP) in 2012. The state-of-the-art integrated solid waste management facility processes 2,000 tonnes of collected city waste daily. Biodegradable waste is transformed into compost, promoted for use as organic fertilizer, and sold directly to individuals and bulk consumers from the facility and city distributors. Recyclable plastic is converted into pellets, while non-recyclable waste undergoes baling for disposal through the cement factory or incineration. Plans for additional facilities include treatment and disposal of e-waste, biomedical waste and domestic hazardous waste.

Data from the Ghana Statistical Service in 2014 and 2019 indicates an improvement in waste collection from 48.5 per cent to 65.4 per cent. However, unattended waste that is burned or openly dumped continues to pose serious environmental concerns in the city. As part of the Accra Climate Plan from 2020–30, efforts have been intensified to enhance the quality of recyclable waste and reduce wet waste contamination. The city has expanded its source separation initiative to three communities (James Town, Korle Gonno and Mamprobi) and two markets (Agbogbloshie and Kaneshie), in addition to a pilot initiative implemented in schools in 2017.

HOW THE SYSTEM WORKS

The Accra Compost and Recycling Plant is one of largest integrated facilities in Ghana. It is spread over 60 acres of land and has a capacity to process 2,000 tonnes of waste per day.

Collection and transportation

The city of Accra is divided into 23 zones. A contractor is assigned for each zone with the responsibility to collect waste from primary and secondary points. Currently, 65 per cent of the households benefit from door-to-door collection. In order to store and segregate the waste, the contractor is also assigned the duty of distributing dustbins.

The collected waste is transported with the use of a compactor to the Accra compost and recycling facility and other dumpsites. To facilitate secondary waste collection, there are two transfer stations in Teshie and Achimota with respective capacities of 1,200 and 1,300 TPD of waste. The contractors are paid against their performance as assessed by the AMA.

Receiving and pre-sorting waste

The waste collection vehicles are made to go through a weighbridge at the integrated facility for quantity measurement. After that, the waste reaches the receiving platform through a uniform feeder. Primary and secondary sorting of waste into different categories such as plastic, metal, cardboard, textile, rubber, leather, paper, etc. is done manually over a conveyor belt. The waste is then passed through a magnetic separator for separation of any other ferrous material.

Windrow composting

After sorting, biodegradable waste is transported to a windrow platform for the creation of windrows. Culture is introduced to expedite decomposition, and the windrows are turned once or twice in a week. After complete decomposition, the compost undergoes screening to extract the fine fraction.

The entire composting process, spanning from waste reception to maturation, lasts around 90 days. The resulting compost boasts nutrient-rich qualities, including approximately 2 per cent nitrogen, 0.7 per cent phosphorus, and 0.8 per cent potassium, making it suitable for diverse applications such as agriculture, horticulture and landscaping.

Packaged in 50 kg bags for marketing, it can also be transported by truck to fulfil bulk consumer needs. Despite its location 35 km from the city, the compost is available for purchase from city distributors such as Agric Agro Products, Parks and Gardens, Pure and Perfect in Accra, and We Care Farmers Ltd in Kumasi.

Additionally, the facility has introduced ACARP CompostX liquid fertilizer, designed to enhance marketability by providing consumers with concentrated nutrient content in a smaller volume, thereby promoting increased productivity for various crops. Although still in the developmental phase, it will be scaled up upon successful outcomes, .

Windrow formation

Windrow turner

Packaged compost for sale

Plastic waste management

Plastic waste is pre-sorted, washed to eliminate contaminants and shredded for uniformity. Melted shredded plastic is extruded through dies, forming continuous strands which are cut into small pellets after cooling. Packed in 25 kg bags, these pellets are then supplied to plastic product manufacturing units for creating items like bowls, waste bins and chairs.

Plastic recycling process

Ready plastic pellets for marketing

Dry and inert waste management

Dry recyclable waste—including cardboard, metal, PET bottles, leather, textile and paper—is systematically directed to the appropriate recycling facility. This waste undergoes baling to facilitate transportation. Inert waste, which is neither recyclable nor combustible, is transported to landfill sites for disposal.

WHAT HAS WORKED

Recognizing the importance of community engagement, AMA and other stakeholders have actively worked to enhance segregation and collection efficiency while raising awareness of individual responsibilities. One notable initiative—Organic360—focuses on separate biodegradable waste collection from residents and stakeholders, offering order pickups for food and yard waste. This initiative aims to divert waste from landfills and ensure the production of uncontaminated compost.

The integrated solid waste management facility serves as a model for sorting and utilizing waste collected through various sources. The facility's success is attributable to a robust public-private partnership between AMA and ACARP. Engaging different agencies in various zones has facilitated comprehensive waste collection, contributing to the overall success of the initiative

The assessment and monitoring of agency performance in key areas have elevated the city's service levels, offering valuable comparisons between different agency strategies for mutual learning and improvement. AMA does quarterly evaluations to assess engaged contractors in crucial areas, including innovation, recycling, collaboration with the Waste Management Department (WMD) and MPHD, submission of monthly reports, collection service coverage, general cleanliness, indiscriminate dumping, and contractor/equipment capacity, health and safety.

In the pursuit of sustainable solid waste management aligned with the goal of achieving a circular economy, establishing market linkages for by-products becomes imperative. ACARP focuses on enhancing compost marketability by engaging with consumers and raising awareness about its positive impact on soil quality. Moreover, they innovate by converting compost into liquid organic fertilizers to boost market appeal. Similar strategic approaches are employed for plastic waste management, involving value addition through pellet conversion before being sent to recyclers.

LESSONS LEARNT

Integrated waste management: The facility demonstrates the effectiveness of integrated waste management systems, where various methods such as composting and recycling are employed to manage municipal solid waste efficiently.

Community engagement: Involving the community in waste management initiatives is crucial. The facility's success highlights the importance of community participation in waste segregation, composting and recycling efforts.

Technology adoption: Embracing technology and modern techniques, such as windrow composting recycling processes, can enhance the efficiency and effectiveness of waste management operations.

Impacts

- Implementing windrow composting to manage waste decreases open dumping, thus lowering greenhouse gas emissions.
- Proper onsite plastic waste management improves the recyclability and market value of plastic materials.
- By branding and conducting awareness campaigns, there is increased interest and adoption of compost usage among users.
- The Organic360 initiative emphasizes the separate collection of biodegradable waste from residents and other stakeholders, aiming to reduce food waste and contamination from other waste streams, consequently enhancing the quality of compost.

Public-private partnerships: Collaboration between government bodies, private enterprises and community organizations can drive sustainable waste management initiatives. The facility's partnership with the private sector and community groups showcases the benefits of such collaborations.

Environmental sustainability: Prioritizing environmental sustainability in waste management practices is essential. The facility's focus on composting biodegradable waste and recycling materials contributes to reducing greenhouse gas emissions and conserving natural resources.

Market development: Creating markets for compost and recycled products is vital for the economic sustainability of waste management initiatives. The facility's success in marketing compost and introducing value-added products like liquid fertilizers demonstrates the potential for revenue generation from waste management activities.

Continuous improvement: Continuous monitoring, evaluation and adaptation are essential for improving waste management systems. Regular assessment of operations, addressing challenges and implementing innovative solutions are essential to the facility's success and sustainability.

REPLICABILITY

The replicability of the Accra Compost and Recycling Plant lies in its adaptable and scalable waste management model. With a modular design, community engagement and successful public-private partnerships, the facility's approach can be tailored to diverse local contexts.

The transfer of modern technologies, emphasis on market development, and commitment to environmental sustainability contribute to its replicability. Supportive government policies further enhance the potential for similar waste management initiatives in various regions, providing a comprehensive and effective framework for sustainable waste solutions.

KENYA

NAIROBI

BEST PRACTICE:
Integrated waste management and resource recovery

Population
(in million, as per 2019 Census)
4.4

Estimated floating population
(in million)
2.0

Area (sq km)
696.1

Number of households
1,506,888

Number of wards
85

Number of zones
17

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
3,200

Number of sanitation workers
3,000

Percentage of households covered under door-to-door waste collection
6

Percentage of waste processed
5

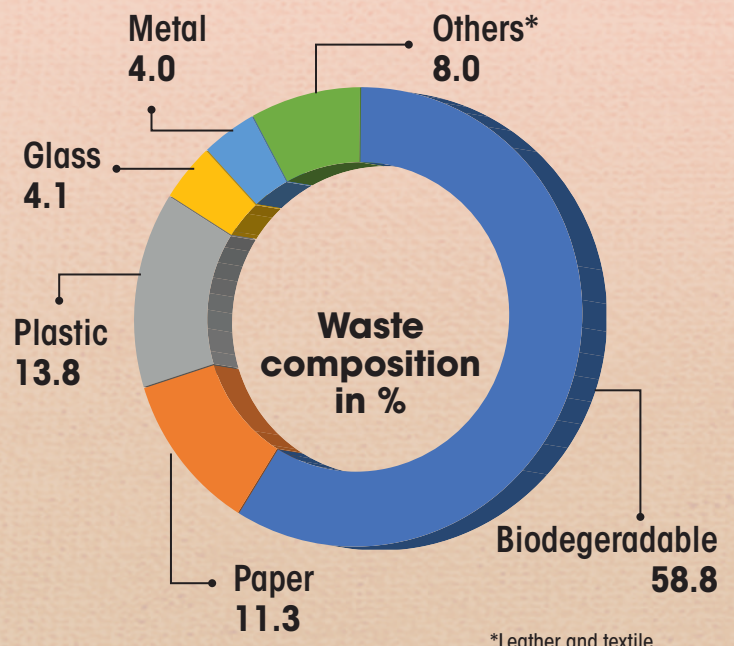
Percentage of households segregating waste
1

INTRODUCTION

Nairobi, the vibrant Kenyan capital, is one of the fastest growing urban areas in Africa. With the biggest airport in East and Central Africa, it is the gateway to numerous safari destinations and attracts millions of tourists. The city is facing serious challenges with the collection, transportation, processing and scientific disposal of waste, resulting in environmental degradation, public health hazards and economic loss. Lack of initiatives to integrate informal wastepickers, who contribute immensely to the recycling and recovery of waste, coupled with weak enforcement of existing laws and policies has resulted in mismanagement of solid waste.

WASTE COMPOSITION IN NAIROBI CITY

Total waste: **3,200 TPD**



*Leather and textile

THE TRANSFORMATION

Since its designation as a city in 1954, Nairobi has had one of the highest growth rates of any city in Africa. The cityscape is increasingly characterized by new skyscrapers, roads, malls and large residential real estate projects. However, all this development has come with some costs.

The growth of its population and physical environment has overtaken the administrative capacity. The city is now producing more waste than its collection capacity. Consequently, open and illegal dumping of waste has risen to such an extent that it is clogging the drain and sewerage system, leading to floods every year exposing communities to hazardous materials, damaging the natural environment and preventing much of the infrastructure from functioning effectively.

Nairobi currently produces significantly higher amount of waste than other cities in Africa—50 per cent more than Addis Ababa and 30 per cent more than Dar es Salaam. The per capita waste generation in Nairobi is expected to increase by 70 per cent by 2030. Only 33 per cent of total generated waste is being collected and disposed of in Dandora dumpsite. The rest is dumped indiscriminately, buried, left unattended or burnt. On top of that, Dandora dumpsite is one of the largest unregulated landfills in Africa. Despite being declared full in 1996, it still receives about 850 tonnes of fresh waste daily.

In addition to the dearth of waste collection services, due to limited budgetary allocation in waste management by the Nairobi City Council (NCC), and lack of skilled human resources, Nairobi's waste management also lags in terms of recycling. Only 5 per cent of the total generated waste is recycled and the city ranks 31st in recycling among 52 Global South counterparts.

Despite inefficient collection systems, limited resources and massive informal settlements, innovative approaches like those adopted by TakaTaka Solutions have begun to offer a glimmer of hope for Nairobi. The word TakaTaka in Kiswahili means "waste".

TakaTaka Solutions is a Kenyan waste management company based out of Nairobi since 2011. With a total of 360 employees, of which 50 per cent are women, they have become the largest waste management company in Kenya. They have an integrated model of collecting, sorting, composting, recycling and buying back waste from waste pickers. They collect 90 tonnes of municipal solid waste (60 tonnes directly by the company and 30 tonnes collected at buy-back centres from wastepickers) which is sorted into 40 different fractions. Approximately 95 per cent of the waste gets recycled, thus leveraging the circular economy model.

HOW THE SYSTEM WORKS

Stakeholder	Roles/responsibility
Government: County & National Environment Management Authority (NEMA)	Licensing and legislation
Wastepickers	Provide segregated waste
Manufacturers	Buy the processed waste
Farmers	Buy the fertilizer made from biodegradable waste
Low-income community	Provide labour working at the company

Source: Field observation by James Mwita, Head Waste Management, Nairobi city.

TakaTaka Solutions is a private entity that collects waste throughout the Nairobi Metropolitian Area covering households, apartments, and businesses like schools, hotels, shops, office buildings, shopping malls, factories and hospitals.

The company provides bins and bin liners to both its residential and commercial clients for better segregation of waste at source. It does daily door-to-door collection of waste from all the sources and brings the collected waste into its sorting facilities, where the waste is sorted manually.

They have also integrated informal workers in their chain. The informal wastepickers collect segregated recyclables and sell them to TakaTaka. They have also installed over 20 recycling stations across the city for the citizens to drop off the recyclables.

Biodegradable waste is converted into black gold compost at their compost plant. This compost is sold to local farmers. Non-biodegradable waste is sorted into 40 fractions like paper, plastic containers and packaging, styrofoam, glass, metal, aluminium, shoes, textiles, etc. Plastic containers and packaging are processed into high value plastic flakes and pellets, which are sold to local manufacturers to make new plastic products.

External recycling partners take away other recyclables. Proper sorting, combined with strategic partenring with local recylers, has helped them achieve a recylcing rate of over 90 per cent.

WHAT HAS WORKED

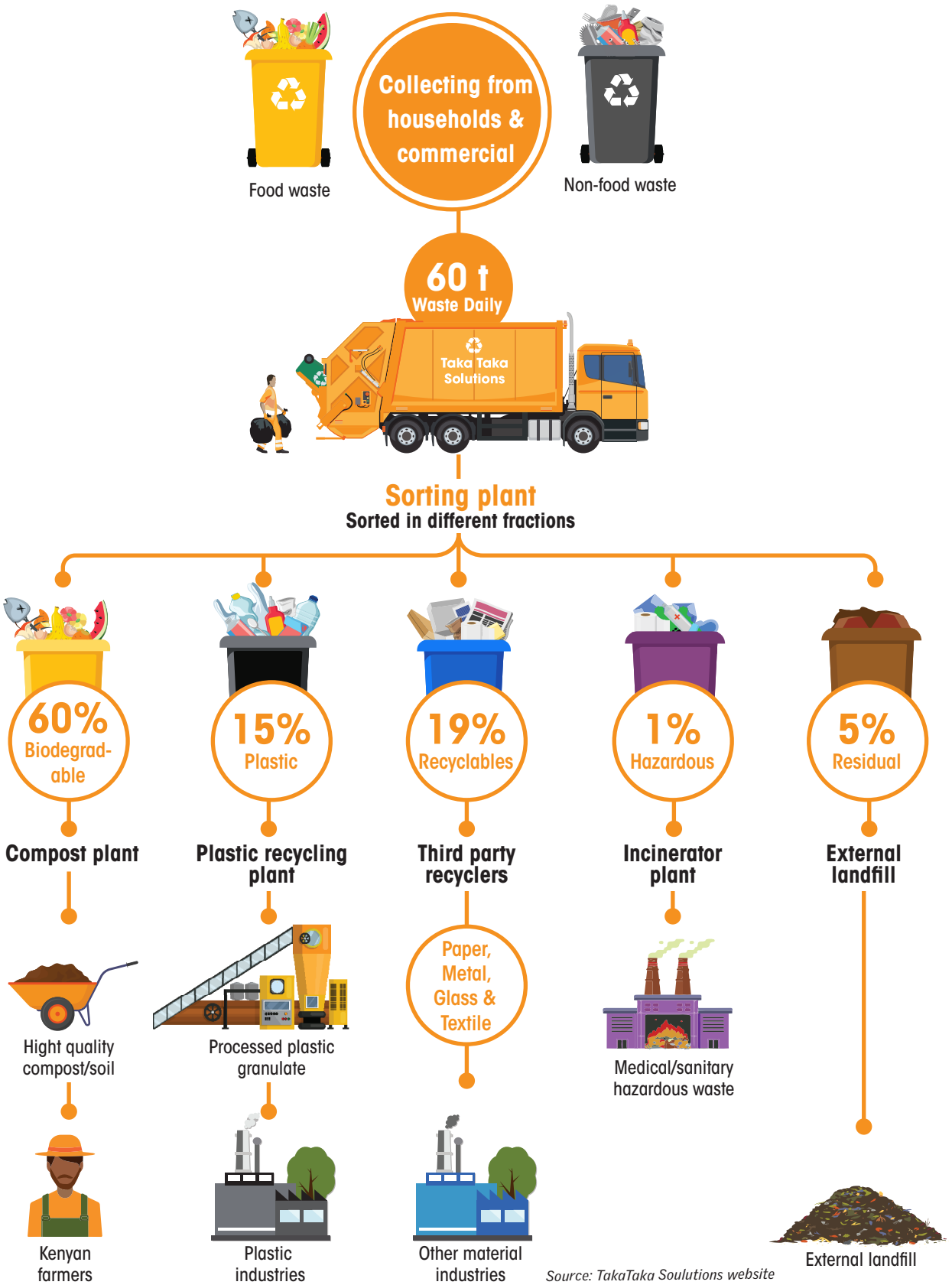
While reports suggest that the whole country has a 5 per cent recycling rate, TakaTaka Solutions has managed to achieve a recycling rate of more than 90 per cent. Moreover, they have integrated wastepickers into the system by buying back the segregated waste they collect.

Water treatment plant within the the takataka solutions facility

The compost quality testing laboratory

Source: James Mwita, Head, Waste Management, Nairobi City.

Figure 1: Process followed by TakaTaka Solutions



Source: TakaTaka Soulutions website

Monitoring

The National Environment Management Authority (NEMA), as per the Nairobi City County Solid Waste Management Act 2015, has provided the necessary permissions and licenses to operate the facility. County and NEMA officials usually come for impromptu visits to check if they still conform.

Initially, the company faced various challenges. Waste was not segregated properly which made it very difficult to process it and sell it. The operation costs were too high and there was not enough skilled manpower to run the sorting machinery. But, gradually, they have smoothened these problems out by making systemic changes and adopting sustainable measures.

1. **Door-to-door collection:** They make sure waste is directed into their system rather than it ending up in landfills. They have 25 collection vehicles which go door-to-door everyday.

2. **Revenue and sense of ownership:** They have agreements with big businesses wherein each business pays according to the amount of waste they collect. Similarly, they have agreements with households as well where every household pays Ksh 500 per month. This revenue not only helps in meeting operational costs, but also creates a sense of ownership among the citizens as they are accessing a paid service.

3. **Advanced sorting and processing:** Waste is first separated into biodegradable and non-biodegradable, and then further sorted for recylcing in their facilities spread across the Nairobi Metropolitan Area.

4. **Livelihood generation for the urban poor:** Along with their regular employees, they have contracted about 300 wastepickers. They have been given proper training and PPE kits. The company organizes an annual medical check-up camp for them and crèches have been established for their children. All these social welfare initiatives have given the project visibility and made it more accepted within the community.

5. **Prioritize composting:** They make composting biodegradable waste a top priority to lessen the load on landfills and create useful fertilizer. They have tied up with local farmers who buy organic manure from the facility, thus ensuring optimum utilization of the end product, along with ensuring a source of revenue for the company. They also have their own laboratory to test the compost quality before selling to the farmers.

6. **Investment in recycling infrastructure:** To ensure better control over the process and reduce dependency on other markets, TakaTaka has made investments in its own recycling facilities.

7. **Lesser waste ending up in landfills:** TakaTaka's success and enhanced citywide recycling directly contribute to a reduction in the amount of garbage that ends up in landfills, which lessens the load on the environment and improves public health.

Compost produced within the facility of TakaTaka solutions-Nairobi

8. **Environmental awareness:** By educating the public about ethical waste management, their work may have a greater impact on changes in behaviour throughout the entire community and thus help in protecting the environment.

9. **Incorporating innovative technologies**
   - They have a washing line for all the waste
   - They do water filtration and recycling
   - They treat the effluent before discharge
   - They use solar lighting instead of electricity
   - They use conveyor belts during sorting
   - They have drums for sorting waste
   - They use baling/compacting machines to create space

10. **Future plans**
   - Tripling the recycling capacity
   - They are the only company with the capacity to recycle flexible plastic, so they want to increase their capacity
   - To open a hazardous waste treatment facility

LESSONS LEARNT

Sustainable waste management strategies, including extended producer responsibility programmes, where producers are in charge of the end-of-life management of their products, can be promoted by cooperation between the public and private sectors. One way

Impacts

- Offers affordable waste management services to all income groups under its coverage.
- Creates jobs, especially for women and youth, in a safe and healthy environment.
- Reduces greenhouse gas emissions by reintegration of recycled fractions into the product value chain.
- Offers customized solutions for different kinds of waste.
- Makes customized data available for commercial customers to enable them to manage their environmental footprint and reduce CO_2 emissions in relation to the take-back system and extended producer responsibility requirements.
- Provides compost made of biodegradable waste.
- Contributes towards a cleaner and healthier environment in Kenya.

to reduce the burden on public funds is to engage private enterprises to invest in the waste management business.

The realization that waste is a misplaced resource and there is a need to put it in the correct place to close the loop of circularity, can do wonders. Recycling, revenue generation, livelihood, women's empowerment, people's participation and environmental conservation are some of the most obvious benefits.

Women play a critical role in the unregulated waste collection industry. Since they frequently endure unjust working conditions and lack of recognition, enhancing efficiency and preventing exploitation can be achieved by integrating them into the formal system with appropriate training, tools and safety protocols. The involvment of women can rejuvinate the waste management ecosystem.

REPLICABILITY

Every city has different waste characteristics, topography and infrastructure. Studying local waste streams, comprehending obstacles in collection, reviewing available legal tools and modifying strategies accordingly would be necessary to replicate the success of TakaTaka.

Local governments can play a pivotal role here by implementing and enforcing available laws mandating source segregation, extending producer responsibility programmes, and providing incentives such as tax rebates and subsidies to enterprises that manage waste in the city.

The long-term viability of the replicated model can be ensured by offering educational and capacity-building initiatives on source segregation of waste, recycling procedures and business management to citizens and waste workers. Securing funds and creating long-term revenue streams are necessary for replicating TakaTaka's business model. This could entail a combination of government assistance, collaborations with private companies and contributions from the community.

MOZAMBIQUE

MAPUTO

BEST PRACTICE:

Repensar Environmental Education Cooperative: Tackling plastic waste through education and community action

Population
(in million, as per 2017 Census)
1.1

Area (sq km)
346.77

Number of households
602,957

Number of wards
19

Number of neighbourhoods
63

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
1,100

Number of sanitation workers
1,000

Percentage of households covered under door-to-door waste collection
65

Percentage of waste processed
1

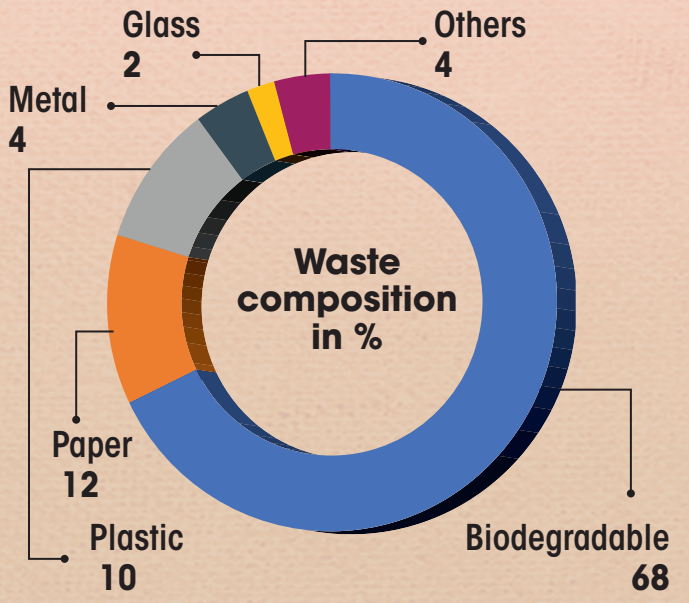
INTRODUCTION

Maputo, the capital and largest city of Mozambique, is situated around 120 kilometres from the borders of South Africa and Swaziland, close to the nation's southernmost point. As a bustling port city, Maputo's economy thrives primarily on trade. The city is divided into seven main administrative divisions, each consisting of various neighbourhoods or smaller urban sections.

While the central areas of Maputo maintain a tidy and clean appearance, sanitary conditions in low-income and impoverished residential areas are deteriorating due to the improper disposal of trash in drains and along roadsides. The destination for waste is an open landfill, contributing to worsening environmental conditions in the surrounding areas.

WASTE COMPOSITION IN MAPUTO CITY

Total waste: 1,100 TPD



THE TRANSFORMATION

Maputo has experienced a notable population increase in recent years, leading to a corresponding rise in solid waste generation. The Municipal Directorate for Solid Waste Management (SWM), under the Maputo City Council (MCC), is responsible for overseeing waste management services in the city. The escalation of waste poses a dual threat to both the environment and public health. Solid waste accumulation can result in leachate, wherein toxic liquids seep into the ground, leading to soil degradation.

Addressing this concern, the Repensar Environmental Education Cooperative in Maputo has prioritized various forms of environmental education—including formal and informal education—alongside promoting Zero Waste initiatives. Through programmes such as the "Ecological School Program - Seeds for the Future," "Project Praia Zero," "Eco N´Sila Project," and the "Marine Waste Program," the cooperative endeavors to raise awareness about sustainable practices and foster a sense of environmental responsibility. These initiatives involve providing essential services, organizing engaging activities, and disseminating educational messages aimed at promoting environmental consciousness and fostering a sustainable future.

HOW THE SYSTEM WORKS

In response to the pressing issue of excessive solid waste disposal in Maputo, the “Repensar Environmental Education Cooperative” embarked on a project aimed at raising awareness about environmental preservation through educational initiatives. The project targeted various community groups including farmers, fishers, informal and formal sellers, and collectors, as well as schools, government bodies, tourists, and all the citizens within project areas.

The project covered specific localities such as Praia da Macaneta, Costa de Sol and Machava, along with all affected schools in the city and province of Maputo. Four distinct programmes were devised to address the waste problem in the city:

1. **Ecological School Program—Seeds for the Future:** This programme focused on formal environmental education, targeting children, teachers and administrative staff, along with their families, in beneficiary schools across Maputo, Matola and Marracuene districts. Its objectives included promoting basic environmental practices, sustainable waste management, zero waste principles and environmental conservation.
2. **Project Praia Zero:** Launched in 2019, this project aimed to protect and conserve the coastal environment of Maputo. It involved establishing a solid waste recovery and purchase centre for the community, aligned with the principles of zero waste, waste valourization and circular economy. The project also provided income-generating opportunities for disadvantaged groups through the purchase of glass, PET bottles and metal.
3. **Project Eco N’Sila:** This initiative focused on implementing environmental education and sustainable waste management programmes in the municipalities of Matola and Machava. It emphasized the protection and conservation of public spaces, such as squares and gardens, with a focus on valourizing glass and PET bottles within a circular economy framework.
4. **Marine Litter Program:** Designed to enhance environmental education and awareness about plastic pollution, biodiversity conservation and climate change resilience on Macaneta Beach. The programme aimed to strengthen national and local approaches to the circular economy by purchasing PET bottles and other recyclable materials. Additionally, it focused on concrete efforts to recover sensitive ecosystems and prevent

Interiors of a house made of recyled bottles in Maputo

pollution, particularly plastic pollution, through environmental education activities and innovative waste recovery solutions.

The stakeholders and their role in this project

The project engaged various stakeholders within the covered neighbourhoods, including community members, schools (directors, teachers and students), tour operators, local government structures, the Royal Norwegian Embassy, the port of Maputo, Coca-Cola Mozambique, Cervejas de Mozambique, Heineken Mozambique, Municipal Councils of the City of Maputo and Matola, several universities, informal and formal vendors, fishers, farmers, activists, volunteers, and other partners.

These stakeholders played a crucial role by providing support in technical, organizational, and volunteering activities. Some of them are also providing financial support to the project. Strong funding is essential for the successful operation of such initiatives. Additionally, some stakeholders collaborated in implementing activities promoting good environmental practices, demonstrating a collective effort towards achieving environmental sustainability.

What challenges were faced and how they were tackled

During its implementation, the project encountered several challenges, but it managed to overcome them effectively. These hurdles included exacerbation of local environmental issues such as erosion, floods and cyclones, as well as insufficient funding for conducting environmental projects and programmes. Additionally, there was a notable absence of recycling facilities tasked with managing waste materials like glass and various types of plastic, which are crucial for reducing solid waste volumes.

To address these challenges, the project undertook various measures, including:

1. Seeking partnerships with both local and international entities to secure financial support for the implementation of environmental projects and programmes.
2. Implementing local initiatives aimed at mitigating and reducing environmental impacts, thereby addressing issues like erosion, floods and cyclones.
3. Researching and developing innovative solutions for promoting good environmental practices, such as utilizing solid waste materials in infrastructure projects.

Innovative practices or approaches that were employed

Throughout the project, numerous innovative practices and approaches were explored and implemented. These included:

- **Application of solid waste in infrastructure:** Utilizing solid waste materials in the construction of infrastructure projects, thereby repurposing waste for beneficial purposes.
- **Melting of plastic waste for various purposes:** Recycling plastic waste by melting it down and using it in the production of items such as pavers, table bases and materials for beauty and clothing.
- **Production of blocks with glass powder:** Creating blocks using powdered glass, providing a sustainable alternative to traditional construction materials.
- **Production of organic compounds and resources from biodegradable waste:** Transforming biodegradable waste into valuable resources and compounds, contributing to the circular economy and promoting sustainability.

WHAT HAS WORKED

The project has yielded numerous positive impacts on local communities, including:

1. Enhanced environmental awareness among all stakeholders, particularly local government agencies, focusing on sustainable solid waste management and environmental protection.
2. Establishment of more than 15 environmental clubs in schools affected by the project, leading to the adoption and dissemination of good environmental practices within families. Parents and guardians have expressed satisfaction with the environmental initiatives undertaken by students.
3. Active participation of associations, travel companies, local government bodies, school administrations and other entities in the community's efforts to sustainably manage solid waste.
4. Increased awareness of the detrimental effects of plastic pollution and enhanced community involvement in its prevention and mitigation within the project areas.
5. Significant reduction in the quantity of plastic debris posing socio-economic and environmental threats along the beaches and surrounding communities of Macaneta and Maputo City.
6. Mozambique achieved remarkable milestones in World Cleaning Day activities, with over 250,000 volunteers participating in 2021, followed by over 2,500,000 in 2022 and 3,250,000 in 2023, securing third place globally and first in volunteer involvement and participation.
7. Development of four practical guides on sustainable waste management, covering planning a cleaning campaign with minimal supplies; implementing a zero-waste programme based on circular economy; establishing ongoing waste management

programmes promoting environmental education; and controlling solid waste and combating plastic pollution.

Key factors that contributed to the project's success

- **Support of local governments and structures:** The Repensar Environmental Education Cooperative's projects receive backing from local authorities, ensuring cooperation and resources for successful implementation.
- **Follow-through with donors, financing sources, and/or partners:** Maintaining communication and fulfilling commitments to donors, financiers and partners ensures ongoing support and trust in project execution.
- **Adherence to established objectives and strategies:** It's vital to stick to the project's goals and plans by monitoring progress for effectiveness, ensuring activities align with objectives and resources are used efficiently.

Quantitative data demonstrating improvement

All projects and programmes of the Rethink Environmental Education Cooperative have generated strong positive impacts:

1. People made aware of good environmental practices (with a focus on waste management)

Year	Ecological School Program	Beach Zero	Eco N´Sila project	Waste Program
2019	10,400	83,699	0	0
2020	11,300	17,192	1,722	0
2021	12,000	3,519	3,357	1,875
2022	12,200	11,173	16,710	2,041
2023	12,600	6,198	5,013	5,921

2. Waste recovered and valued at the Repensar Cooperative Recovery Centres (in kg)

Year	Glass	PET	PP/HDPE	Aluminium	Diverse	Total
2019	337,749	0	0	0	0	337,749
2020	202,995	0	0	0		202,995
2021	141,844	4,189	1,757	41	0	147,831
2022	858,320	15,137	14,013	3,275	0	890,745
2023	126,496	83,441	0	2,448	109,730	322,115
Total						1,901,435

In the Ecocentro da Macaneta of Cooperative Repensar, more than 170,000 glass bottles were used to build the pilot glass house, and more than 160,000 bottles were used to build the inclusion room and permanent exhibition museum. These bottles also served as inspiration for the construction of more than three houses, which were built on the initiative of the Praia da Macaneta community.

Glass bottles and glass blocks were created from glass trash. Different waste materials were utilized (that do not have a commercial value) for infrastructure, including ornamentation. In 2022 and 2023, World Cleanup Day activities aimed at gathering about 8,000 tonnes and 7,000 tonnes of rubbish, respectively.

LESSONS LEARNT

- **Environmental education:** The cornerstone of success lies in educating people about environmental care and its components. Incorporating environmental education into school curricula enables younger generations to develop environmental awareness from an early age. This prepares them to make sustainable decisions in the future.
- **Seeking financial support:** Initiatives like these necessitate robust funding. Governments should allocate funds aimed at improving environmental quality as urbanization leads to increased solid waste disposal. Supporting companies engaged in

World Cleanup Day 2023
Source: Facebook page "Cooperativa de Educação Ambiental Repensar"

waste recycling is essential, acknowledging that quality environmental initiatives come with a cost.

- **Spreading the word:** Extending interventions in good environmental practices to a larger population and more neighborhoods is crucial. This can be achieved by hiring more environmental educators and monitors to effectively disseminate knowledge and promote sustainable behaviours.
- **Implementing sustainability strategies:** Making sustainability strategies a reality involves various endeavours and initiatives, such as creating, introducing and commercializing glass blocks; cultivating and commercializing therapeutic plants; and providing environmental advisory and consulting services. These actions contribute to long-term environmental sustainability and community well-being.

REPLICABILITY

Countries which fall under the bracket of Least Developed and Developing can use the methods developed by The Repensar Environmental Education Cooperative in Maputo. Waste can be used in construction of infrastructure. This includes production of glass houses, glass blocks, and melting of plastic to produce bases for tables and pavers. Such initiatives will give a second life to solid waste.

This will help the countries achieve Sustainable Development Goal 11 (Sustainable Cities and Communities) and Sustainable Development Goal 12 (Responsible Consumption and Production). Proactive involvement of the government in supporting companies which work towards recycling waste will ensure that a greater percentage of solid waste gets processed and minimal amount of waste ends up in landfills and streets.

RWANDA

KIGALI

BEST PRACTICE:

Umuganda philosophy for promoting sustainable solid waste management

Population
(in million, as per 2022 Census)
1.7

Area (sq km)
730

Number of households (2022)
488,868

Number of cells
161

Number of administrative sectors
35

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
800

Waste management vehicle fleet size
8

Percentage of households covered under door-to-door waste collection
Unplanned area: **37**
Planned area: **75**

Percentage of households segregating waste
49

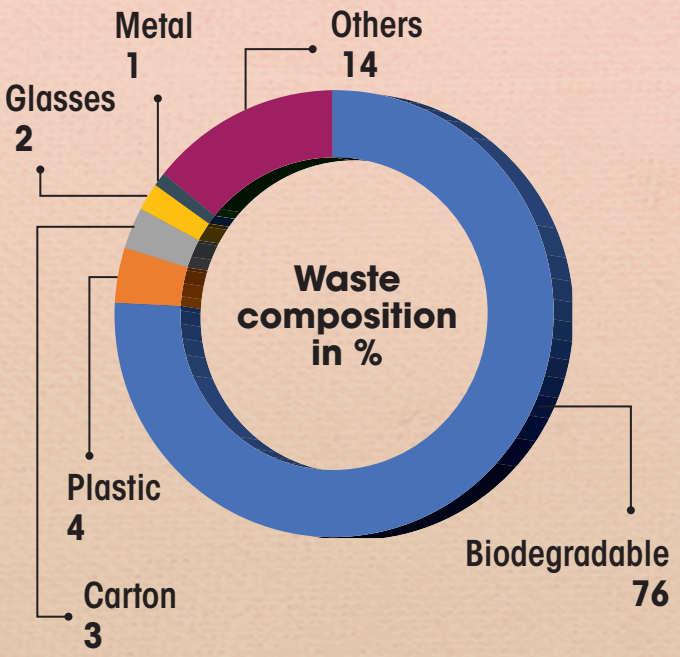
Percentage of waste processed
2

INTRODUCTION

Kigali, Rwanda's capital, is a rapidly growing city with a population of over 1.7 million people. The city is divided into three districts—Gasabo, the largest by area, followed by Kicukiro and Nyarugenge. These districts are further structured into sectors and cells, with villages forming the smallest administrative units. Kigali's strategic location bordering several provinces and its central international airport make it a major tourist hub. Moreover, the city is experiencing rapid growth, with an annual urbanization rate of 4 per cent and contributing over 41 per cent of Rwanda's GDP. More people are generating more waste, especially food scraps and other biodegradable materials.

WASTE COMPOSITION IN KIGALI

Total waste: **800 TPD**



THE TRANSFORMATION

There was a time when Kigali resembled many other rapidly growing cities in Africa—bustling with people, scattered slums, overcrowding, poor sanitation and struggling with waste management. Prior to 2005, Kigali's waste management lacked a unified approach. A key turning point was the enactment of Rwanda's Organic Law No. 4/2005—the country's main environmental management law. This law laid the foundation for sustainable waste management practices by emphasizing environmental principles and responsible resource utilization, specifically in the context of municipal solid waste management.

In 2008, city authorities, backed by the national government, took a pivotal step with a complete ban on single-use plastic bags and plastic packaging materials. Kigalians were encouraged to switch to bags made from sustainable materials like paper, linen, banana leaves and papyrus. Strict penalties, including potential imprisonment, were enforced to ensure compliance. Simultaneously, the government incentivized entrepreneurs to establish manufacturing facilities for these permitted alternatives. The city's greening efforts extended beyond plastic and the inclusion of local communities played a crucial role in maintaining cleanliness.

While significant progress has been made in managing this waste since 2005, challenges remain. Littering is illegal, and waste collection has improved, but collectors often face health risks due to improper handling, and the waste can contaminate groundwater. Despite recycling efforts, the amount of waste recycled is still low. Most of the city's municipal solid waste (88.72 per cent) still ends up accumulated in landfills. Only a small portion is actively treated through incineration (7.24 per cent), recycling (2.02 per cent) and reuse (2.02 per cent).

Municipal solid waste generated in Kigali was primarily disposed of legally at the Nyanza landfill. However, due to its limited capacity, Nyanza landfill was eventually closed and replaced by the Nduba dumpsite in 2012. The Nduba dumpsite, located on the outskirts of Kigali, has become the city's primary waste disposal site since then. While it serves as a temporary solution, concerns have been raised about its long-term sustainability and potential environmental impact, including leachate, vermin and spontaneous combustions. With the city producing around 800 tonnes per day of municipal solid waste, finding better ways to manage it, especially the biodegradable portion, is crucial for the city's health and environment.

Recognizing the significant contributions of voluntary interventions across various sectors, Rwanda established a national volunteerism policy in 2012. This policy aims to provide guidelines for managing volunteer activities, ensuring the rights and responsibilities of both volunteers and organizations. Its overarching objective is to integrate volunteerism into the national development process, harnessing the potential of human resources as active agents of sustainable development and transformation. Volunteerism has deep roots in Rwandan tradition, manifested through self-help, mutual aid, caring for the vulnerable and community service. Today, it continues through activities like "Umuganda".

Translated from Kinyarwanda, "Umuganda" signifies "coming together in common purpose to achieve an outcome." In 2005, Rwanda formalized the practice of Umuganda through a dedicated policy. This policy mandates participation for all Rwandan citizens between the ages of 18 and 65, with the exception of expatriates and those above 65 who can still choose to participate. Held once a month on the last Saturday, Umuganda—a civil conscription scheme and cornerstone of Rwanda's Vision 2020—fosters citizen participation, inclusiveness and behavioural change. In 2016, the policy was revised to enhance community engagement and introduce innovative approaches. This includes leveraging the expertise of individuals with specialized skills and mobilizing institutions to diversify Umuganda activities within communities.

National Clean-up Day

A significant portion of Umuganda's endeavours concentrate on environmental preservation and public cleanups. During a community clean-up in 2005, residents were asked to collect all the plastic they could find. They came up with a vast amount of plastic and the sheer volume alarmed everyone. This event signalled a turning point. It not only sensitized the communities to the problem of plastic pollution, but it also got politicians thinking about the issue. Even President Paul Kagame participated in the clean-up, highlighting the national significance of the problem.

A nationwide media campaign was launched, further raising awareness. Local NGOs and businesses were commissioned to create alternatives, primarily focusing on cotton or banana leaf bags. The advocacy proved successful, and in 2008, a bill was finally passed to ban plastic bags in the country. While the affected private sector initially resisted the ban, the successful culmination of the campaign can largely be attributed to the development of a consensus among the people against plastic pollution.

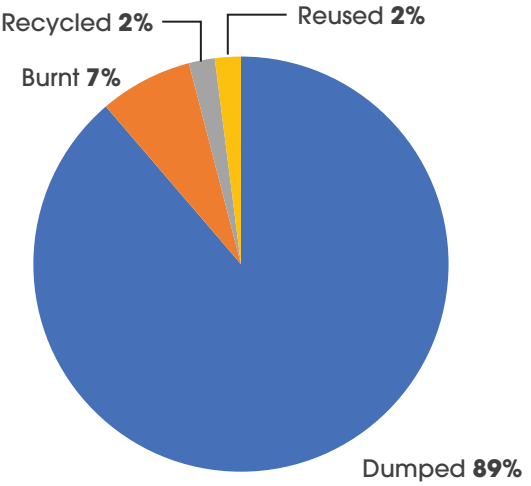
HOW THE SYSTEM WORKS

Similar to the historical practice of calling upon family and neighbours for assistance with challenging tasks, Umuganda involves city-wide clean-up efforts, including collection and proper disposal of municipal solid waste. During Umuganda, shops close and cars are off the streets to facilitate this collective action. Participation is mandatory, with hefty fines imposed for non-compliance.

Beyond enforcement, the authorities actively promote cleanliness as a cultural value through awareness campaigns. Aesthetically designed waste bins are strategically placed throughout public spaces, reinforcing responsible waste disposal habits.

- **Reduced plastic waste:** The plastic bag ban implemented alongside Umuganda has significantly reduced plastic pollution in Kigali. The regular clean-up efforts ensure proper disposal of any remaining plastic waste, minimizing its environmental impact.

Graph 1: Waste Disposal Process of Kigali City



Source: Compiled by CSE

- **Improved drainage systems:** Umuganda involves clearing drainage systems of debris and municipal solid waste, preventing blockages and potential flooding, and reducing the spread of waterborne diseases and contamination of water sources.
- **Reduced disease outbreaks:** By keeping the city clean and addressing sanitation issues, over the years, Umuganda has helped create a healthier environment, potentially reducing the spread of diseases associated with improper management of municipal solid waste.

WHAT HAS WORKED

While a specific percentage improvement is challenging to quantify, it's evident that Umuganda plays a crucial role in promoting a culture of cleanliness, community engagement and responsible waste management, contributing significantly to Kigali's overall progress in solid waste management.

- **Large-scale clean-up efforts:** During Umuganda, Kigalians participate in city-wide clean-up activities, leading to the removal of accumulated waste from streets, neighbourhoods and public spaces. This collective effort significantly reduces the amount of waste left unattended, preventing environmental pollution and potential health hazards. Studies show that citizens themselves recognize the environmental benefits of Umuganda, with a significant portion (56 per cent) reporting cleaner neighbourhoods and 16.3 per cent reporting improved air quality.
- **Increased awareness and community ownership:** The regular participation in Umuganda fosters a sense of shared responsibility for cleanliness within the community. This heightened awareness encourages responsible waste disposal habits beyond the designated clean-up days, leading to a gradual decrease in overall waste generation and improper disposal.
- **Infrastructure development and maintenance:** Umuganda often involves activities like building new roads, clearing land for community gardens and even constructing toilets in areas lacking proper sanitation. This focus on infrastructure development and maintenance directly addresses factors that can contribute to waste accumulation, such as lack of proper waste disposal facilities or inadequate sanitation systems. Umuganda has contributed to 93.3 per cent improvement in infrastructure development between 2007 and 2016 through various activities like road construction and soil stabilization.

This directly benefits solid waste management by facilitating collection routes to allow vehicles to navigate different neighbourhoods more efficiently, optimizing collection times and covering wider areas. Transportation efficiency has increased and improved roads have enabled smoother transportation of collected waste to treatment and processing facilities and disposal sites, reducing fuel consumption and operational costs associated with solid waste management.

- **Collaboration and resource sharing:** The communal nature of Umuganda fosters collaboration and resource sharing among residents. This leads to the community coming together and exploring and implementing innovative solutions for proper management of municipal solid waste, such as sharing composting techniques and organizing community-led recycling initiatives.

LESSONS LEARNT

The success of Umuganda in Kigali offers valuable lessons for other cities and communities seeking to improve their municipal solid waste management practices.

- **Community ownership over waste management:** By actively participating in cleanups and decision-making processes, residents develop a deeper understanding of the challenges and feel empowered to contribute to explore solutions.
- **Behavioural change through participation:** Regular participation in Umuganda activities can lead to positive behaviour change. As individuals and communities work together to clean their towns, they become more mindful of proper waste disposal habits, reducing littering and encouraging responsible waste segregation.
- **Empowering vulnerable community members:** By providing opportunities to participate in waste management activities, they generate income through collection or recycling initiatives. This fosters social inclusion and contributes to a more equitable system.
- **Clear and consistent communication strategies:** These include educating residents about the environmental and health impacts of improper waste disposal. They are vital to encourage long-term behavioural changes and ensure widespread adoption of the project.
- **Incentives as opposed to fines and penalties :** While Kigali's implementation of fines for non-participation in Umuganda reflects the government's commitment to environmental protection, relying solely on penalties may not be sustainable in all contexts. The focus should be on promoting a culture of environmental responsibility and encouraging voluntary participation through incentivization.

REPLICABILITY

The core principles behind Umuganda—community participation, environmental responsibility and collective action—hold significant promise for replication in other towns and cities. While some aspects like community cleanups can be universally applied, other aspects such as frequency of cleanups, types of activities and incentive structures might need to be tailored to specific community needs and cultural norms.

There should be a focus on phased implementation. Starting with smaller communities like villages or towns can provide opportunity for a valuable pilot project. This allows for easier organization, fosters a stronger sense of community ownership, and provides valuable data for adapting the project for larger populations.

Partnering with local leaders and community representatives is key. Engaging with all age groups is important. While a legal mandate to participate might not be feasible everywhere, exploring alternative directives related to solid waste management and incentive structures can encourage participation.

SOUTH AFRICA

ETHEKWINI MUNICIPAL AREA

BEST PRACTICES:

- Integrated solid waste management by the Cleaning and Solid Waste (CSW) Unit
- Marianhill Landfill Conservancy

Population
(in million, as per 2022 Census)
4.2

Area (sq km)
2,556

Number of households (2016)
1,125,765

Number of wards
111

Number of zones
5

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
4,931

Number of community bins
7,000+

Waste management vehicle fleet size
780

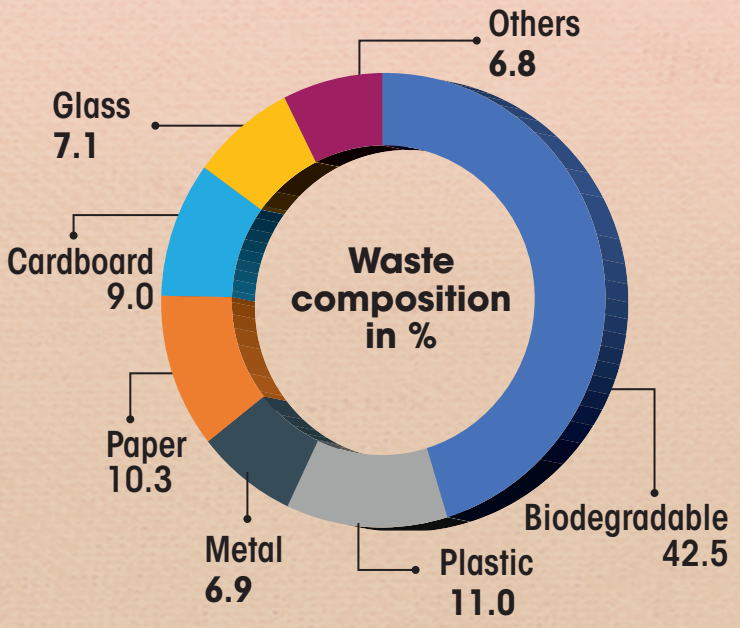
Percentage of households covered under door-to-door waste collection
95.83

INTRODUCTION

The eThekwini Municipal Area (EMA), also known as the Durban Metropolitan Area, is located in the KwaZulu-Natal province of South Africa. A Category A municipality. It is one of the 11 districts of the KwaZulu-Natal province. Covering an area of approximately 2,460 square kilometres and encompassing a diverse range of landscapes—including beaches, hills and wetlands—it is the most populous city in the province and the second most populous in the country. eThekwini is the economic powerhouse of KwaZulu-Natal province, contributing a staggering 59 per cent of the province's GDP. This economic success is fuelled by a diversified economy encompassing manufacturing, logistics, property, and finance.

WASTE COMPOSITION IN ETHEKWINI MUNICIPAL AREA

Total waste: **4,931 TPD**



INTEGRATED SOLID WASTE MANAGEMENT BY THE CLEANING AND SOLID WASTE (CSW) UNIT

THE TRANSFORMATION

EMA contains over a third of the population of KwaZulu-Natal province and must dispose of waste within the municipality. While landfills remain the dominant disposal method, significant efforts are underway to minimize reliance on them. EMA's Cleaning and Solid Waste (CSW) Unit oversees four main landjfills that accept approximately 1.2 million tonnes of waste annually. CSW promotes various waste diversion strategies:

- **Source separation with curbside collection:** "Orange Bag System" for separating recyclables at source, with plans to expand this initiative by introducing clear bags specifically for glass and metals.
- **Material recovery facilities:** Recovering recyclable materials uncontaminated by other wastes. These facilities encompass drop-off centres, buy-back centres and mixed waste material recovery plants.

In FY 2022–23, 399 community bins were placed on the streets across the municipality. The CSW Unit distributed a significant number of wheelie bins during the year, issuing 2,486 new bins to new customers and 973 additional bins to existing customers. Wheelie bins are large, lidded containers on wheels used for collecting household waste.

However, a concerning trend emerged with a high number of damaged and stolen wheelie bins. To address this, the CSW Unit will implement training programmes for both customers and collection teams. These programmes will focus on proper wheelie bin management and handling practices to minimize damage and theft. On a positive note, the wheelie bin maintenance team refurbished an impressive 7,381 bins in that year, ensuring continued use for waste collection.

The CSW Unit acknowledges room for improvement in its complaint resolution process. While the Unit logged a total of 2,061 complaints in the Faultman system, meeting targets proved challenging. For MSW removal complaints, the Unit closed 76 per cent within 72 hours, falling short of the 90 per cent target. Similarly, illegal dumping complaints closed within five days reached 43 per cent, against the targeted 70 per cent. Despite these figures marking an improvement from the previous year, the CSW Unit is committed to achieving the set performance indicators. Refresher training programmes are offered to staff to enhance their efficiency. However, persistent network challenges and load-shedding continue to impede the timely resolution of reported faults.

Landfill sites are very strategically positioned across the eThekwini catchment. Currently, only the Buffeldraaai and Lovu landfills accept municipal solid waste, whilst the Bisasar and Mariannhill landfills have been restricted to only accepting construction and demolition waste, garden waste and sand/cover material. While the new proposed CSW Shongweni Landfill has been recently licensed, it is still under construction.

HOW THE SYSTEM WORKS

The CSW Unit is the leading provider of comprehensive waste management services in EMA:

- Waste collection from all households
- Street sweeping services
- Provision of disposal facilities

CSW's network of facilities includes 32 operational centres, seven transfer stations, three landfill sites, 22 recycling plants, three landfill gas projects and two leachate plants. These assets enable CSW to provide a full range of waste collection and disposal services to residential, industrial and commercial customers.

The CSW Unit provides an effective and efficient standard of service by providing once-a-week refuse removal to 1,164,149 households—386,149 of which are formal households and 778,770 are informal households.

All major streets are swept three times daily in the Central Business District (CBD) area. High pressure washing of streets and pavements in the CBD is carried out at night, particularly in all hotspot areas within the city. There are 32 areas made up of informal settlements that are served through contracted services. These contractors provide once-a-week refuse collection and street sweeping services. However, the once-a-week service for informal settlements has proven to be inadequate due to population densities, absence of household waste storage facilities and poor waste disposal practices. Alternative waste collection methods are yet to be explored to increase collection efficiency in these areas.

CSW has partnered with the Fleet Department, which is responsible for logistics and transportation. The Fleet Department provides vehicles for transferring all municipal solid waste collected across the city to designated disposal points. The CSW Unit manages an impressive fleet of approximately 780 vehicles, ranging from specialized earth-moving equipment to basic collection trucks.

The eThekwini Municipality manages four landfills catering to different regions of the city:

1. **Bisasar Landfill**, operational since 1980, is nearing the end of its lifespan (approximately two years left) despite downsizing to accept specific waste types, such as garden waste, rubble and sand cover. Construction of a new cell aims to reduce transportation costs by allowing for disposal of general waste from central areas.
2. **Mariannhill Landfill**, operational since 1996, also faces a limited lifespan of around two years. Recent upgrades addressed stormwater drainage and leachate management issues.
3. **Buffelsdraai Landfill** serves the northern and temporarily western catchments while awaiting the opening of the new Shongweni Landfill. Construction of a new cell at Buffelsdraai is expected to extend its lifespan for 60–70 years. A new dam capturing contaminated stormwater safeguards the environment.
4. **Lovu Landfill**, opened in 2014, serves the southern areas and boasts a remaining useful life of 26–30 years with the recent completion of a new cell. However, an external audit identified deficiencies in stormwater drainage and leachate management, prompting construction of new drains and a contaminated stormwater dam.

Finally, the Shongweni Landfill is planned as the successor to Mariannhill. Environmental compliance studies are complete, but challenges exist with limited space for infrastructure. A potential road realignment might be necessary, delaying construction by 2–4 years before waste disposal can begin. As an interim solution, western catchment waste is transported to Buffelsdraai Landfill via transfer stations.

Money flow

Of the total revenue generated in FY 2022–23, 64 per cent comes from collecting user charges from residential establishments while 5 per cent comes from the user fee collected from bulk waste generators.

The CSW Unit's waste diversion efforts translate into significant cost savings and economic benefits. Diverting 1,125 tonnes of waste from landfills translates to a cost saving of R2,025,000, which is approximately US $135,000 (this is calculated based on a cost of R1,800 per tonne for landfill disposal). Waste diversion also generates income throughout the value chain. The sale of 1,125 tonnes of waste materials, at an average price of R0.60 per kilogram, generates R675,000 in revenue, which is approximately US $45,000.

In the FY 2022-23, 300 informal waste workers were employed who earned an average of R1,400 per month (US $93.33). The project injects an estimated R5,040,000 back into the economy, which is approximately US $336,000.

WHAT HAS WORKED

As per the 2022–23 Annual Report, the Unit has achieved a commendable target of 95.83 per cent for households receiving basic waste collection services with a weekly schedule.

Collection service by CSW Unit

Table 1: Number of CSW programmes and campaigns from July 2022 to June 2023

	July 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	June 2023	Total
Cleanups	45	29	49	31	55	Beach awareness programmes	8	30	37	35	46	44	409
Environment forums	5	20	20	53	14		2	4	12	18	8	10	166
Illegal dumping	20	54	52	35	28		25	15	53	0	55	53	390
Exhibitions	2	1	4	1	5		0	6	0	14	4	8	45
Schools	2	3	27	5	6		2	37	25	15	18	25	165
Site introspections	-	1	0	26	0		3	0	18	42	48	20	158
Radio/Loud hailing	-	0	24	0	0		0	10	518	0	0	7	559
Door-to-door	63	0	0	0	0		83	151	0	0	0	14	311
Workshops	2	2	15	9	5		1	3	11	0	0	25	73
Informal settlements	3	3	7	5	5		0	8	7	0	0	13	51

Recognizing the limitations of manual data input for mechanical defects and fleet readiness at the workshop, the CSW Unit spearheaded the development of the CSW Fleet Management application. This electronic platform relies on daily input from both the fleet and workshop teams, providing all users with real-time information on the overall health of the fleet. The App generates crucial data for "Off the Road" (OTR) and "Return to Service" (RTS) statuses of the vehicles. The Fleet team captures details of all defective vehicles, and estimated return to service dates by 8:00 AM daily. This ensures that all CSW Line Managers are equipped with real-time knowledge of their fleet's availability, allowing them to implement necessary plans and minimize service disruptions. While still under development, the Fleet Management app is said to hold immense potential to improve collection and transportation efficiency.

To combat illegal dumping, the CSW implemented the Illegal Dumping Eradication Program in collaboration with other stakeholders. Joint operations raise awareness and educate the community, fostering positive behavioural change. Additionally, CSW's dedicated Operations Team assumes responsibility for clearing and cleaning illegal dumps. The CSW employs Enforcement Officers specifically tasked with addressing all complaints regarding illegal dumping. This includes conducting investigations and issuing fines to offenders.

Further, each region holds the responsibility of ensuring illegal dumps within their jurisdiction are cleared within a designated service level timeframe. A noteworthy accomplishment involved the clearance of the city's largest illegal dump, located near the Bisasar Landfill. The closure of this landfill led to increased illegal dumping by both residents and businesses. Consequently, the Department of Environmental Affairs issued a directive to the city. CSW enforcement officers, supported by the Metro Police and SMU, secured the site and enforced relevant bye-laws. During this operation, an average of 25 fines were issued daily.

The CSW Education Department has engaged in a series of MSW programmes and clean-up campaigns across different regions, targeting public spaces, communities, schools, etc.

Achievements:

- A total of 165 school visits throughout the year, instilling awareness on waste management
- Collaboration with interfaith organizations, religious institutions as environmental ambassadors and promoting community beautification
- Engaged in 409 clean-up campaigns, enhancing cleanliness in public spaces and neighbourhoods across different regions of the municipality
- 34 Masakhane outreach programmes were conducted in the following wards: 1, 5, 8, 10,11, 12, 15, 25, 26, 27, 28, 30, 31, 32, 40, 41, 43, 45, 46, 47, 48, 50, 51, 54, 55, 65, 85, 91, 94, 95, 101, 104 & 110
- 73 workshops and education campaigns, addressing various topics such as solid waste management, recycling and safe disposal practices
- CSW conducted 673 meetings, fostering collaboration with diverse stakeholders and contributing to effective municipal solid waste management strategies
- 390 illegal dumping points or garbage vulnerable points (GVPs) were removed between 2022 and 2023
- Conducted 218 on-site visits, addressing complaints by residents regarding improper collection and disposal

Recycling plays a critical role for the CSW Unit in achieving its legal mandate. The national target, outlined in the South African National Waste Management Strategy (Revised 2020), is to divert 40 per cent of municipal solid waste from landfills by 2025. To reach this goal, the CSW Unit embraces a collaborative approach:

- Partnerships with Non-Governmental Organizations (NGOs) and Community Based Organizations (CBOs) to leverage their expertise and community reach.
- Collaboration extends to the provincial KZN Department of Economic Development, Tourism and Environmental Affairs (KZNEDTEA) and sister departments within the municipality, such as Economic Development, Business Support and Producer Responsibility Organizations (PROs).
- The Unit recognizes the valuable role of wastepickers in the recycling process. It has initiated workshops aimed at creating a database of wastepickers and recyclers in each ward. This initiative paves the way for integrating them into a formal waste management system, fostering a more inclusive and sustainable approach.

Use-It, a materials recovery initiative by the CSW Unit, not only provides valuable skills but also formalizes the roles of informal waste workers within the municipal waste management system. During FY 2022–23, the initiative successfully registered a total of 300 informal waste collectors, and delivered training programmes to 30 informal waste workers in various specializations like waste sorting and classification, upcycling, beneficiation, safe disposal practices. CSW's work continues in the current financial year, and their commitment to registering wastepickers with the South African Waste Pickers Association (SAWPA) and a National Government Database further strengthens the programme's focus on creating a more inclusive and sustainable waste management system.

LESSONS LEARNT

The eThekwini Municipality's efforts offer valuable insights for other municipalities seeking to improve their waste management practices. Here are some key takeaways:

- **Importance of source separation:** Effectiveness of the Orange Bag System and planned expansion with clear bags for specific materials highlights the importance of encouraging waste separation at the source. This reduces contamination rates and improves the efficiency of the recycling processes.

- **Diversification of material recovery:** Utilizing a network of drop-off centres, buy-back centres and mixed waste recovery facilities demonstrates the value of a multifaceted approach to material recovery. This caters to different waste streams and maximizes the potential for diversion.
- **Efficient collection system:** eThekwini Municipality's achievement of a 95.83 per cent target for households receiving waste collection service with a weekly schedule indicates a well-organized collection system. Analysing their strategies in route optimization, fleet management and waste collection scheduling could provide valuable knowledge for other municipalities to improve their own collection efficiency.

Despite these efforts, the municipality faces two key challenges:

- While information on the exact recycling rate is unavailable, data suggests it might be below target.
- Landfills remain the dominant waste disposal method. There's a need to increase diversion rates to meet national targets.

REPLICABILITY

The eThekwini Municipality's waste management strategies hold promise for replication in other municipalities. However, successful implementation requires careful consideration of local contexts. Here are some key factors for replicability:

- **Infrastructure and resources:** Existing infrastructure for waste collection, sorting and processing needs to be assessed.
- **Community engagement:** Public awareness and education are crucial for the success of source separation programmes. The eThekwini Municipality's experience highlights the need for effective communication strategies to encourage community participation.
- **Partnerships and collaboration:** Collaboration with stakeholders like NGOs, recycling companies and the private sector can be instrumental in establishing and sustaining waste diversion initiatives.

MARIANHILL LANDFILL CONSERVANCY

THE TRANSFORMATION

Two land uses which often compete for new land amidst the developmental pressures of urbanization are land for conservation purposes and land for new waste disposal sites. The Marianhill Landfill Conservancy (MLC) is an initiative by the EMA designed to address both these issues.

Earlier, landfills were foul-smelling health hazards and an eye sore for settlements close by. The initiative aims to turn landfills into beautiful places that are also economic assets to the community. The primary priorities of the initiative are reduction in pollution and financial sustainability. Apart from technological interventions, an educational facility has also been established to teach people about waste management.

The project was driven by the CSW Unit. It was made possible through 'Carbon Finance,' which is channelled through the World Bank's Prototype Carbon Fund (PCF)—a public-private partnership with participants from several countries worldwide. Enviros UK did some consulting for Mariannhill on leachate treatability. The Provincial Ezemvelo KwaZulu–

Natal Wildlife Board was responsible for granting Mariannhill its conservancy status and it also guided this process. Other stakeholders include the Wildlife and Environment Society of South Africa, the Mariannhill Landfill Monitoring Committee, Mariannhill Monastery, Siyenza Engineers and the Ratepayers Association who provided inputs during the planning and implementation stages of the Mariannhill Landifill Conservancy initiative.

HOW THE SYSTEM WORKS

The main obstacle encountered by the Mariannhill Landfill Conservancy was at the very beginning—when the site's location was being selected. Landfills are associated with foul smells and pollution, so people did not want it near them. Therefore, EMA, NGOs and the community were initially in conflict about the location of the landfill. The tension was resolved via public meetings and in 1996 the infrastructure for the landfill began to be set up.

The Mariannhill Landfill Conservancy was operational for disposal of municipal solid waste until 2021. Now the landfill site only receives construction and demolition waste and garden waste. The landfill will stop receiving any kinds of waste by 2025.

Rehabilitation of the landfill site has begun. It is a comprehensive effort to transform the area from a waste dumping site into a thriving ecosystem. This involves planting native vegetation and creating wildlife habitats, ensuring the safe treatment of leachate and capturing landfill gas to generate electricity. By implementing these strategies, CSW aims to create a closed-loop system where waste products are treated and reused on-site, fostering a new and sustainable environment. The goal is to establish a functional conservancy, a nature reserve that attracts birds and other wildlife, promoting biodiversity and offering educational opportunities for the community. Unlike most other landfills where rehabilitation would normally start at the end of the landfill's lifespan, in this case rehabilitation has already begun while the landfill is still receiving specific types of waste.

Mariannhill has a greater chance of functioning as a sustainable ecosystem because it is linked to other green areas. The conservancy status of the Mariannhill Landfill is rooted in regulations and guidelines set out by Ezemvelo Wildlife. In order to maintain its conservancy status, Mariannhill must simply continue to abide by these.

The landfill also hosts a massively successful renewable energy project. The Durban Landfill Gas-to-Electricity Project, which first started in 2004, is funded by the World Bank. It involves extracting methane from landfills in eThekwini Municipality and using it to run generators that produce electricity for the local grid. The process reduces the impact of the gas on the climate and provides a cleaner energy source.

The electricity produced from landfill gas is sold to eThekwini Municipality's Electricity Department. The project provides the municipality with approximately three megawatts of electricity.

The project has improved the air quality in the area by reducing the amount of landfill gas released into the atmosphere and by diminishing the negative effects of coal transport and coal mining, such as dust and acid mine drainage. To date, Durban's landfills have avoided approximately 2.5 million metric tonnes of CO_2 equivalent emissions. It has also benefitted local air quality by reducing emissions of siloxanes, nitrogen oxides and sulphur oxides.

The improved landfill has also prevented leachate and liquid runoff from polluting groundwater and becoming the breeding ground for disease-carrying animals like rats and flies.

Some 700,000 trees have been planted near landfills. Green areas filled with native plants create buffer zones around the landfill site. The Mariannhill Landfill, in particular,

now serves as an important natural corridor for migratory species and is contributing to preserving an indigenous ecosystem and minimizing biodiversity loss in the area.

Moreover, nearly 2,000 people have been educated in the landfill's conservation and waste management principles. In 2017, eThekwini Municipality received an Honorary Climate and Clean Air Award from the Climate and Clean Air Coalition (CCAC) for the landfill project which it described as the first in Africa, and which is still one of the most successful in the world.

Marianhill Landfill site in South Africa

The Mariannhill Landfill project is part of the UN's Clean Development Mechanism, which is designed to reward developments that lead to a measurable reduction in greenhouse gas emissions

WHAT HAS WORKED

The biggest challenge was to change the mindset of those in charge. It was difficult to convince the City Treasurer and the Councillors that this was a better method when there was no similar project to use as an example. It was believed that it was more expensive to operate in the manner envisaged. However, this has not been the case.

What has changed is cash flow, as some expenditure needs to take place much earlier than in the conventional method. Further, massive expenditure is not required at the end of the life of the site as rehabilitation has continued through the life of the operation and only the final cell will have to be rehabilitated after closure.

The key elements that make the Mariannhill Landfill Conservancy a success include its strong and lasting partnerships, its ability to find multiple sources of funding and the fact that it is driven by the government, proving that the public sector can deliver services in an environmentally friendly manner.

Mariannhill is on the cutting edge of waste management as a result of the extensive consultations with international partners and experts in the planning and implementation stages.

This initiative takes the concept of a landfill—something 'disgusting' that people tend to avoid—and turn it into a beautiful place where plants and animals thrive. The whole municipality is able to enjoy this landfill by spending time at the nature reserve and the open-air amphitheatre.

REPLICABILITY

The landfill-conservancy model could be replicated wherever there is a need for a new landfill site. The requirement is to bring conservation authorities on board very early on in the process.

This model is highly desirable not only because of its benefits for the environment and the community, but the cost-savings on rehabilitation and sewage treatment for the local government, and the opportunity to harness valuable energy from the city's waste.

The initiative has shown that landfills can be well managed in close proximity to domestic residents without detriment to the environment. The immediate community has benefited as there has been less illegal dumping and once the site is closed it will be a green lung for the area. The natural wildlife has benefited as there is 50 hectares of protected land where they can live safely.

Assistance has been given to Johannesburg, Buffalo City, Pietermaritzburg, Howick and several other South African towns. African countries such as Mozambique, Kenya, Uganda and Botswana have been assisted in setting up similar initiatives. Asian countries such as Iran, Malaysia and India have been assisted as well.

SOUTH AFRICA

UMNGENI LOCAL MUNICIPALITY

BEST PRACTICE:

Efficient door-to-door collection of waste in collaboration with local wastepreneurs

Population
(in million, as per 2022 Census)
0.11

Area (sq km)
1,567

Number of households
27,094

Number of commercial establishments
285

Number of industrial facilities
169

Number of wards
13

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
113.5

Number of sanitation workers
102

Percentage of households covered under door-to-door waste collection
60

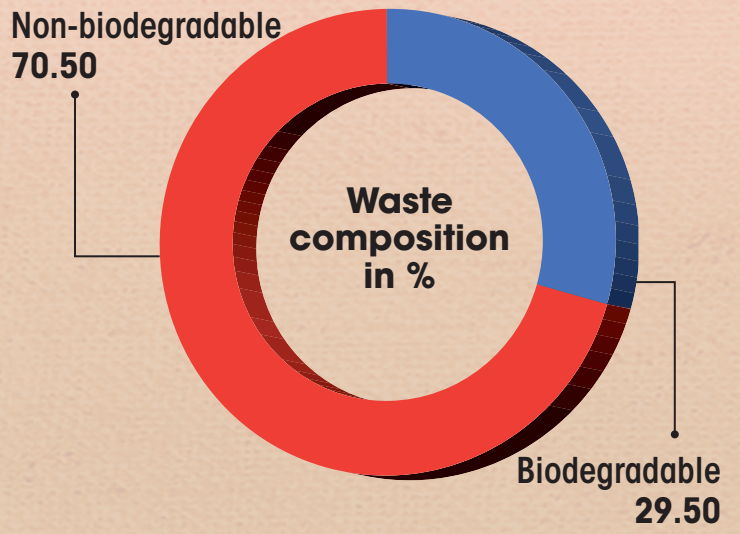
Waste management vehicle fleet size
11

INTRODUCTION

The uMngeni Local Municipality is a Category B municipality located within the uMgungundlovu District of KwaZulu-Natal (KZN) Province, South Africa. The Municipality is named after the uMngeni River that runs through the municipal area. The uMngeni Local Municipality generates a significant amount of waste, totalling 113.5 tonnes per day (TPD). While nearly a third (29.5 per cent) is biodegradable waste, primarily from residential establishments, waste collected from the source is usually mixed in nature. About 60 per cent of the households benefit from door-to-door collection by the municipality, while the rest are either unserviced or have arrangements with private contractors, outside of municipal collection services.

WASTE COMPOSITION IN UMNGENI LOCAL MUNICIPALITY

Total waste: **113.5 TPD**



WASTE MANAGEMENT IN UMNGENI

The municipality collects 100 per cent of waste from commercial establishments, ensuring a clean and responsible disposal system for businesses. Public spaces fare well too, with streets and parks achieving a 100 per cent collection rate. Schools—including private, government and crèches—and religious institutions also have a high collection rate of 90 per cent. However, hospitals and clinics present a unique situation. Due to the nature of the waste generated, only kitchen waste is collected by the municipality. Most hospitals and clinics rely on private companies for scheduled disposal of bio-medical waste, as the Municipality does not extend services for neither bio-medical nor hazardous wastes.

The uMngeni Local Municipality utilizes a network of vehicles for efficient waste management. Their fleet consists of seven 8-tonne refuse compactors for handling large volumes of waste and four manoeuvrable 1.5-tonne light vehicles.

For waste processing and disposal, the municipality has one registered recycling and transfer station. This facility sorts and prepares recyclables for further processing, while also serving as a transfer point for waste before it reaches its destination. In addition to this, there are 25 transfer points, managed by informal waste workers, scattered throughout the municipality.

uMngeni relies on a single landfill site for all non-recyclable and non-hazardous waste. Incineration is no longer a municipal function due to changes in legislation. It's important to note that the municipality doesn't collect hazardous waste. Instead, it gets transported to Msunduzi Municipality, which has a designated facility for safe handling and disposal of such materials to managing hazardous waste, ensuring its proper treatment and minimizing environmental risks.

Informal workers sorting dry waste at the material recovery facility in uMngeni Municipality

Plastics stacked based on their type after collection and sorting by informal workers in uMngeni Municipality

THE WASTEPRENEUR PROJECT

The uMngeni Local Municipality is home to several organizations working towards a cleaner and more sustainable future. The municipality collaborates with the NGO LoveHowick to maintain clean public spaces through regular outreach campaigns. These campaigns involve activities like community clean-up drives and educational initiatives to promote responsible waste disposal practices within the municipality.

The Wildlands Conservation Trust (WCT), a well-established NGO, conceptualized the Wastepreneur Project, which was launched in 2013. The project proposal was submitted to the National Green Fund—a sub-programme of the Department of Forestry, Fisheries and the Environment (DFFE), Government of South Africa. The proposal was successfully supported due to its environmental, social and economic benefits. The three-year initiative ran from January 2013 to March 2016, and specifically targeted low-income households, aiming to empower them through recycling initiatives and promotion of environmental responsibility.

The term "Wastepreneur" here is defined as "a person who is an entrepreneur in the

WASTEPRENEUR PROJECT'S ACHIEVEMENTS (JANUARY 2013–MARCH 2016)

The project's growth led to the creation of subsidiary business "Wildlands Business" and "Wildlands Recycling" within the Non Governmental Organization (NGO). These units accelerated the efforts of the NGO and expanded collection, wastepreneur recruitment, business participation, school engagement and local recycling operations. The project also built capacity and supported Small, Medium and Micro Enterprises (SMMEs) in the recycling sector, promoting their transition to greener and more circular solutions, and encouraging resource efficiency.

A total of 158 people were employed during the project's three-year period in various roles including regional coordinators, depot supervisors, drivers, loaders, administrators, balers, grinders, glass crushers and sorters. About 7,815 wastepreneurs across 151 communities in KwaZulu-Natal, Gauteng and Mpumalanga were supported and trained under the project.

Approximately 31,014,460 kg of recyclable material was collected by wastepreneurs in schools, local businesses and charities over the project duration. This significantly diverted and reduced waste that would have otherwise been dumped in the landfill. The collected recyclables included paper, metal cans, cardboard, glass, polyethylene terephthalate (PET) and other plastics, promoting efforts towards recovering and recycling non-biodegradable waste.

An innovative solution was developed to deal with unrecyclable plastics. They were processed and converted to hard plastic desks. At least 1,000 desks were produced as part of a pilot project for schools. This project attracted substantial financial support from private sector partnerships (R40 million ZAR).

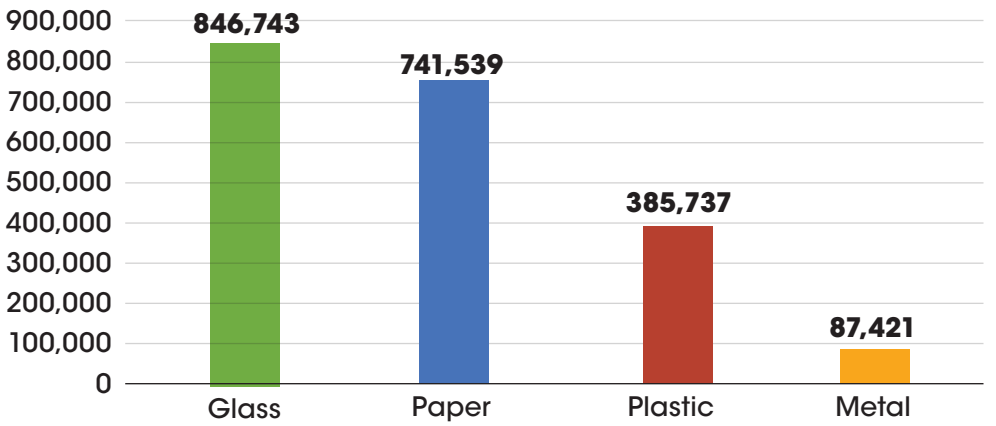
waste sector, specifically one who collects various waste streams separated at source. These recyclables may either be sold for cash or bartered (the trading of one good for another, without the exchange of money) for other goods or services of equal value to the recyclable."

The project's success, including infrastructure investment, subsidiary business unit formation and innovative upcycling solutions like desks from non-recyclable plastics, led to positive socio-economic and environmental benefits. Notably, the project's growth was catalysed by a significant grant from the National Green Fund.

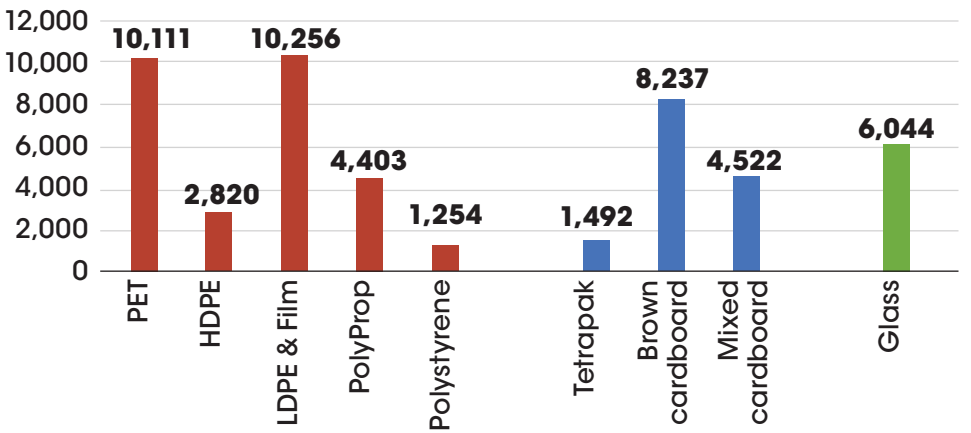
ImagineIF

Building upon the Wastepreneur Project's success, a separately registered NGO, ImagineIF, was established within the uMngeni Municipality. Launched in July 2020, at the height of South Africa's COVID-19 lockdown restrictions, ImagineIF's programme focuses on municipal solid waste recycling, upcycling, innovation and enterprise development. Unilever

Graph 1: Total waste collected by imagineIF since 2020 (in kg)



Graph 2: Total hard to recycle/low-value recyclable waste collected for processing



LESSONS LEARNT BY ImagineIF's SUCCESS

1. Empowering communities is key: The project's focus on training, skill development and livelihood creation fostered a sense of ownership and responsibility towards waste management within communities, particularly informal waste workers.
2. Waste can be a resource: The project showcased the immense potential of waste as a valuable resource. Transforming plastics into desks, creating jobs, and diverting large volumes of waste from landfills also demonstrates the economic and environmental benefits.
3. Partnerships are crucial: Collaboration between NGOs, government agencies, private sector companies and communities was instrumental in the project's success. Each stakeholder brought unique expertise and resources, creating a powerful synergy that amplified the impact.
4. The project didn't shy away from innovation and creative solutions like upcycling initiatives.
5. Providing wastepreneurs with comprehensive training in safety, health and environmental management not only protects them but also empowers them to become valuable assets in their communities, promoting long-term sustainability.
6. The project's focus on life skills like basic education, health awarenes and leadership development helped individuals not just as wastepreneurs but also as well-rounded members of their communities, fostering holistic growth and well-being.
7. Monitoring and collecting data on waste collection, job creation and environmental impact allowed the project to track its progress, adapt its strategies, and demonstrate its effectiveness to potential partners and funders.
8. The project's ability to adapt to challenges like COVID-19 restrictions demonstrates the importance of flexibility and resilience in implementing long-term waste management solutions.
9. The project's transition to a self-sustaining business model ensures its long-term viability and impact beyond initial funding, showcasing the importance of financial sustainability for community-based initiatives.

has supported the NGO since July 2020, PepsiCo since July 2022, and The Duzi uMngeni Conservation Trust (DUCT) since November 2021.

ImagineIF tackles municipal solid waste management challenges in the uMngeni Municipality with a multi-pronged approach. Over time, the NGO has also created and supported a network of "wastepreneurs" within the municipality. These wastepreneurs work as collectors, recyclers and entrepreneurs and help with material recovery. The NGO empowers these wastepreneurs by providing them with training in business management, marketing and finance. These wastepreneurs are further equipped with the knowledge them with knowledge of waste-to-product technologies, enabling them to create and sell

Residents participating in the clean-up campaign organized by the municipality

Municipal authorities getting waste cleared up from the riverbank in uMngeni

marketable products from collected waste. They've offered waste management training to 450 of them.

The efforts go beyond basic recycling, as ImagineIF along with WCT helps wastepreneurs find customers for their products, connecting them with local businesses, retailers and even tourists. Finally, ImagineIF monitors and evaluates the project's impact, tracking factors like job creation, waste diversion from landfills and income of wastepreneurs. This ensures the project remains effective and achieves its goals.

They operate the Midmar Material Recovery Facility (MRF), a licensed facility that sorts and processes recyclable materials collected from residents, businesses and communities.

The Midmar Recycling Depot was originally established by Wildtrust Recycling in 2010. Ezemvelo KZN Wildlife has enabled the operations of the depot since its inception through a rental-free lease on the facilities.

About 10 per cent of the material recovered was plastic-based, 36 per cent was paper-based, 4 per cent was metal-based and 41 per cent was glass. ImagineIF took over Wildtrust Recycling in July 2020. Since then, ImagineIF has collected 2,065,030 kg of recyclable waste.

ImagineIF secured support for waste recovery campaigns focused on hard-to-recover and low-value recyclable waste from DUCT and the NGO Amanzi Ethu Nobantu. The support enabled employment and operations of a team of 100 local community members between November 2021 and June 2022. Thirty members of this team were taken on for an extended period till October 2022. This team supported waste clean-ups, along with collection, sorting and processing of recyclables. They collected 49,138 kg of hard-to-recover/low-value recyclable waste.

REPLICABILITY

By adapting their core principles to local contexts, these two projects could become powerful tools for tackling waste management challenges, fostering economic opportunities and empowering communities across the continent. Their core principles—integrating low-income individuals and communities into the formal waste management system and empowering them as wastepreneurs by emphasizing training and fostering partnerships—can be adapted to diverse cities. Starting small and gradually scaling up allows for local adjustments and ensures long-term sustainability.

Local customs and traditions should be considered when designing outreach programmes and training informal waste workers. Existing waste management infrastructure, along with its strengths and limitations, must be factored into the implementation plan. Identifying and engaging relevant stakeholders—NGOs, government agencies, private sector—is crucial for building a strong support network. Exploring options like income generation through upcycling projects or waste collection fees can ensure long-term viability.

Examples of potential adaptation

1. **Rural communities:** The model could be adapted to focus on biodegradable waste management, composting and creating bio-fertilizers for sustainable agriculture.
2. **Coastal cities:** Plastic pollution in oceans could be addressed by training wastepreneurs in collecting and upcycling ocean plastics into handicrafts or construction materials.
3. **Informal settlements:** Wastepreneurs could play a vital role in improving sanitation and hygiene in informal settlements, collaborating with local authorities and, may also serve as a value chain business model within communities with limited resources.

TANZANIA

DAR ES SALAAM CITY COUNCIL

BEST PRACTICES:

- Community-driven model of sustainable solid waste management in Vingunguti ward
- Decentralized solid waste management by Nipe Fagio

Population
(in million, as per 2022 Census)
1.65

Area (sq km)
365

Number of households
458,614

Number of wards
36

Number of villages
159

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
1,320

Number of community bins
15

Percentage of households covered under door-to-door waste collection
60

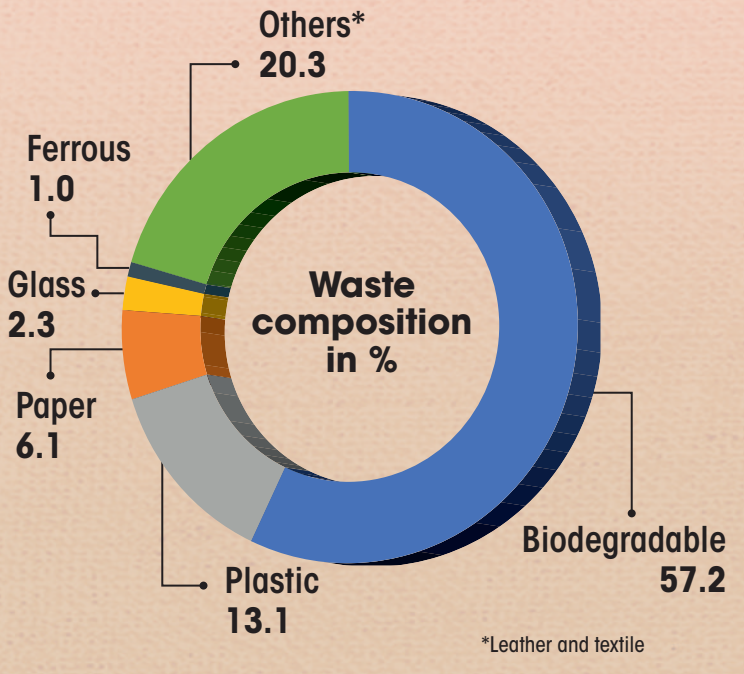
Percentage of waste processed
22

INTRODUCTION

Located on the Swahili Coast and home to the largest and busiest port in East Africa, Dar es Salaam is the largest city in Tanzania. A major centre for trade, finance and industry, it serves as the country's economic hub, contributing about 17 per cent to the national GDP. This rapid urbanization, coupled with industrialization, has led to a significant increase in the generation of solid waste. The composition of solid waste varies greatly according to the affluence of the neighbourhood. However, most of the waste generated is biodegradable in nature and in some wards can reach up to 75 per cent of total waste.

WASTE COMPOSITION IN DAR ES SALAAM

Total waste: **1,320 TPD**



*Leather and textile

COMMUNITY-DRIVEN MODEL OF SUSTAINABLE SOLID WASTE MANAGEMENT IN VINGUNGUTI WARD

THE TRANSFORMATION

Amidst the disarray in the city's solid waste management system, the Vingunguti ward under the Dar es Salaam City Council stands out as an oasis in the desert. Vingunguti, comprising six sub-wards with a population of 66,342, including 21,084 households, generates 40 tonnes of waste per day. Previously, most of this waste was dumped at the old Vingunguti dumpsite on the banks of the Msimbazi River, with no source separation or community engagement whatsoever.

Initiated by the Dar es Salaam City Council and spearheaded by Geophrey Zenda, the Environmental Health Officer of the city council in charge of Vingunguti, the ward has transformed. It has shifted from ad hoc dumping to a systematic waste management system that actively involves the community, including informal wastepickers. Geophrey successfully collaborated with representatives from city authorities, civil societies, NGOs, donors and, most importantly, with the citizens, creating a cleaner and better environment for the people of Vingunguti.

Geophrey shares that after receiving training from India's Centre for Science and Environment (CSE) on the importance of integrating informal waste workers and the role of community participation in solid waste management, he learned the necessary skills to engage the community effectively. He successfully implemented source separation with full community participation, integrated informal waste workers to secure their livelihoods, established a facility to process 1.8 tonnes of biodegradable waste daily, and significantly reduced the amount of waste going to the landfill, thereby mitigating environmental pollution.

Initially, officials from the Dar es Salaam City Council collaborated with local community-based organizations and conducted surveys to identify informal waste workers in the area, with assistance from community leaders. They discovered over 100 informal waste workers operating in the region. About half were involved in dumpsite remediation without adequate health and safety protections, while the other half were already collecting waste informally from various sources. These workers retrieved valuable items to sell to local vendors, with the remaining waste being dumped along the Msimbazi River or at the old Vingunguti dumpsite.

Their socio-economic conditions were dire, marked by poverty, irregular income, and a lack of job security, leading to instability and insecurity in their livelihoods. Exploitation was rampant at nearly every level of the hierarchy. The waste workers faced numerous health risks, frequent accidents and injuries, had no recognition for their labor, and received no acknowledgment for their contributions to solid waste management and recycling. They were socially stigmatized, unsupported by authorities and often criminalized.

In response, the team from the city council decided to implement a decentralized waste management system in Vingunguti ward. Once identified, they registered these waste workers under the Dar es Salaam City Council, providing them with training, PPE kits, push carts and waste cages. They then formed two groups: 'Pendezesha Vingunguti', with 24 members including one woman, consisting of waste workers who collected waste informally; and

'Wazalendo Mazingira', with 11 members including three women, who previously worked in the old dumpsite. 'Wazalendo Mazingira' received training in composting using Black Soldier Fly (BSF) technology and were employed to manage composting at the compost plant.

This initiative has transformed the waste management system in Vingunguti ward. By integrating the poor waste workers and providing them with job security, alongside increasing community participation and stakeholder collaboration, significant progress has been made. The project now diverts substantial amounts of waste from landfills and riverbanks. The community is cleaner, with many residents interested in home composting. In just a month, the project has processed 1.2 tonnes of biodegradable waste, converting it into valuable compost with almost no expense to the city.

HOW THE SYSTEM WORKS

In the third event of the Global Forum of Cities for Circular Economy (GFCCE) hosted by CSE, a group of delegates from 19 Global South countries including Tanzania visited India in May 2023. Geophrey Zenda, representing Dar es Salaam City Council was nominated from Tanzania to attend the event. During this visit, in addition to capacity-building sessions on sustainable solid waste management, the team visited Pune in Maharashtra, India, to learn how integrating informal waste workers into the city's mainstream solid waste management system can significantly improve source separation levels, collection efficiency and waste processing capacities. This integration also reduces the economic burden on the municipal corporation. Geophrey has been actively involved in numerous capacity-building programmes conducted by CSE over the years. Since its inception in 2022, he has been a dedicated member of GFCCE and has attended all its physical events in Tanzania and India.

Two of his key takeaways from CSE were the importance of integrating waste workers into the mainstream value chain of SWM and the significance of engaging the community in the solid waste management activities. He has implemented both the learnings in his field of work. Ha has so far trained more than 312 wastepickers and waste collectors from different wards of Dar es Salaam City Council (Vingunguti, Ukonga, Majohe, Pugu, Buyuni, Chanika

Training of wastepickers

New shredder handed over to the informal waste workers at Vingunguti

and Msongola). As an Environmental Health Officer from the domain of waste management, he plays a crucial role in connecting and supporting informal wastepickers, engaging with the community to establish effective solid waste management systems.

Geophrey further narrates that "Training programmes and capacity building like my training from CSE equips me with the knowledge and skills to train and support informal wastepickers enhance their skills, increase their income and improve their socio-economic status."

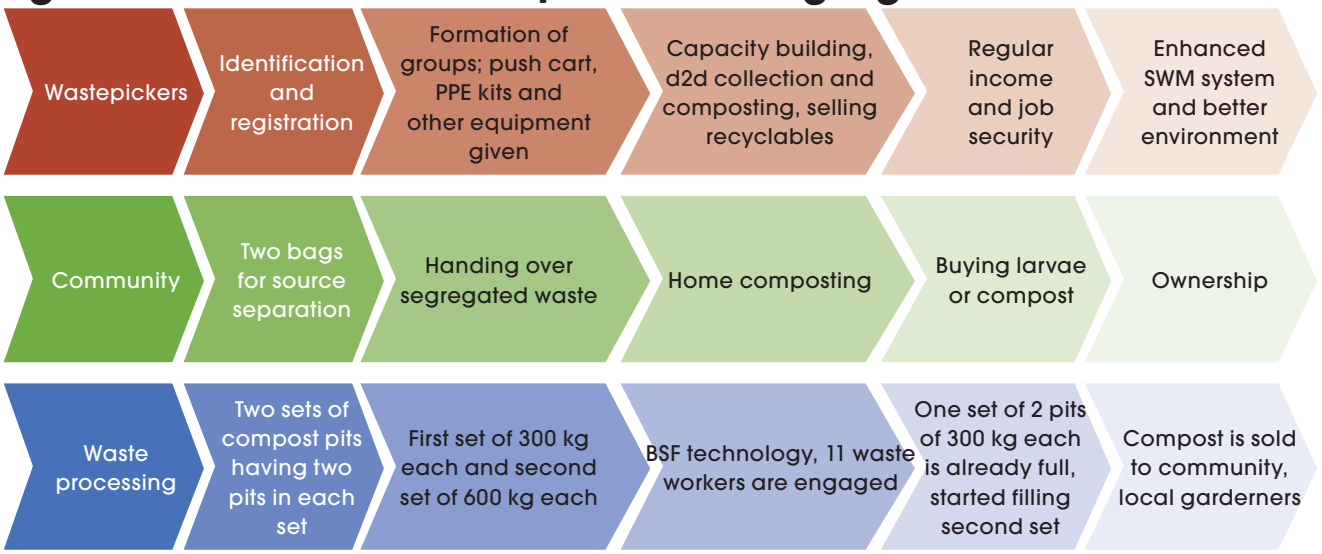
The plant

They have established two sets of compost pits containing two pits in each set. The first set has two pits of 300 kg each and the second set has two pits of 600 kg each. The total capacity of the plant is 1.8 tonnes. Eleven waste pickers have been trained to manage the unit, which uses Black Soldier Fly (BSF) technology to treat the compost. The plant opened on 19 June 2024, and within one month the first set of pits of 300 kg each has already been filled. Feedstock comes only from the community. Sources are households and nearby fruit vendors. The excess larvae are going to be sold as chicken and fish feed. Moreover, one of the donor organizations, 'Waste Protein Tech' is going to buy the compost for their palm cultivation once they start producing it in bulk.

Fund source and expenses

Geophrey successfully coordinated multiple community-based organizations and donors to establish the facility. Financial backing from 'C40 cities' enabled the installation of the plant. The space for BSF compost and MRF-cum-scrap shop was donated to them by benefactors. The project incurred total expenses of US $60,000 covering infrastructure, training, equipment and related expenditures. Mazingira Plus, Tanzania Alliance for Climate and Sustainable Society (TACSS), and Elico Foundation served as consultants and technical advisors throughout the project's implementation.

Figure 1: The transformation process in Vingunguti



WHAT HAS WORKED

- **Collaboration:** Engaging the community and starting a working collaboration between the government authority, CBOs, NGOs and other private players with a common goal of achieving sustainable solid waste management.
- **Financial investment:** Initial funding (from C40 Cities) supported in setting up the composting unit and training of the wastepickers
- **BSF composting technology:** A low-cost, high-impact solution, and easy to maintain. Apart from compost, larvae can also be sold.

CHALLENGES FACED

- **Land limit:** Vingunguti has dense population and informal settlements, hence it was difficult to get land to install the compost unit. Finally, two community members donated the land for the scrap shop cum MRF and the BSF compost plant.
- **Behaviour change:** Convincing residents to segregate and maintain waste is still challenging.
- **Infrastructure maintenance:** Ensuring efficiency of the plant requires ongoing investment which has to be regularized.
- **Scalability:** Only 10 per cent of the total waste generated in Vingunguti is being processed with this effort. To divert all the waste from going to the landfill or river bank, more such establishments are required, which would require land, funds and consistent effort.

LESSONS LEARNT

Cooperatives can advocate for better working conditions and legal recognition which can lead to safer and more dignified work environments, give them a collective voice which can lead to greater social inclusion, and open up new economic opportunities and pathways for growth and development.

Geophrey and his team envision establishing new treatment plants, and taking up opportunities to revise the rate of refuse collection charges (RCC) by bringing changes in the policy, thus increasing marketability of the compost and larvae.

Impacts

- **Behaviour change:** People have started source segregation, handing over waste to the authorized wastepickers, and some of them also are practicing home composting now. Waste generators have realized waste is also their responsibility.
- **Community participation:** Apart from households, some local fruit-sellers are also handing over their waste to the members of Pendezesha Vingunguti, who have been authorized to collect waste by the Dar es Salaam City Council in their area.
- **Diverting waste from going to the landfill and to waterbodies:** Four to five tonnes of waste is being collected daily by 24 wastepickers in a segregated manner. Biodegradable waste is being processed through composting and non-biodegradable waste is further sorted and the valuables are sold to the scrap dealer for recycling.
- **Revenue:** The plant is yet to produce compost and sell that. So, the group of wastepickers who run the compost plant are supposed to start earning from the end of July 2024 by selling the compost and the larvae. But the wastepickers engaged in door-to-door waste collection are earning from selling recyclables. They are accumulating 13 to 20 kgs per week and selling at the rate of 350–500 T shilling per kg.

He reiterates, "My plan is to scale up the identification, thus recognizing, registering and training more groups of informal wastepickers from Vingunguti ward and other wards, to secure funds for small MRF facilities in different parts of Dar es Salaam City Council. It also includes community engagement and education, formation and support of cooperatives, implementation of source separation, and promotion of home composting by conducting workshops and trainings, along with seeking financial support from governments and NGOs."

Fortunately, Mr. Michel, one of the members of the group Wazalendo Mazingira is going to donate another old house where Geophrey and his team are going to establish another compost unit. Therefore, in the near future, they would be able to manage more waste sustainably in Vingunguti and other parts of Dar es Salaam to be able to mitigate environmental pollution aligned with circular economy principles.

REPLICABILITY

The waste management system initiated in Vinunguti is easily replicable in other places. For that to happen, the government has to be proactive in creating the right infrastructure and getting the community together.

The success of Vinunguti is not due to any special circumstances. But only due to responsible leadership and a spirit of collaboration between the government and the community members. Vinunguti shows us that for waste management to be successful, all stakeholders must coem toegther and work as one, treating waste as a common resource and not an individual problem.

DECENTRALIZED SOLID WASTE MANAGEMENT BY NIPE FAGIO

THE TRANSFORMATION

Dar es Salaam is facing a critical challenge in managing its rapidly growing waste problem. It is projected to have a population of over 10 million by 2030, making it the third fastest growing city in Africa and the ninth fastest growing city in the world. However, infrastructure development in this rapidly growing metropolis has not kept pace with population growth, leading to challenges in areas like transportation, housing, sanitation and waste management. A drone mapping exercise in 2019 along eight rivers of the city identified 2,048 waste spots, in and along rivers. 1,350 of these were directly within the riverbeds.

One of the most significant challenges in Dar es Salaam is the lack of reliable waste collection services. About 70 per cent of Dar es Salaam's population lives in unplanned or underserviced areas. Less than 40 per cent of the households are estimated to have access to waste collection. The city's infrastructure is inadequate, and there are insufficient guidelines for separating waste at source. This results in a significant amount of waste being mixed together, making it difficult and expensive to recycle or compost.

The Local Government (Urban Authorities) Act No. 8 of 1982, Tanzania, empowers all urban authorities in the country to create by-laws for waste management within their jurisdictions. This Act delegates this power to local authorities, including the Dar es Salaam City Council (DCC) and its five constituent municipalities: Kinondoni, Ilala, Kigamboni, Ubungo and Temeke. The Dar es Salaam City Council (Collection and Disposal of Waste) By-Laws of 1994, established under Section 56 of the Act mandate the DCC to facilitate waste collection and disposal from residential areas and business premises.

The city currently generates an estimated 1,320 tonnes of solid waste daily. Solid waste generation rate is estimated to be about 0.8 kg per capita per day. Close to 60 per cent of this waste is either burned at the household level, dumped on the roadside and in drainage canals and sewers, or is buried, posing serious environmental and public health risks. Only about 40 per cent of the city's waste reaches the official dumpsite—Pugu Kinyamwezi, located 30 km from the city centre. However, this dumpsite lacks proper infrastructure for waste management, including gas collection and other mitigation measures.

The Dar es Salaam City Greenhouse Gas (GHG) Emissions Inventory by C40 Cities revealed that the waste sector, encompassing both solid waste and wastewater, was the primary source of GHG emissions in 2016, accounting for a staggering 40 per cent of the city's total emissions that year.

Private companies have been contracted by the city council as well as respective municipalities to collect and transport waste to the dumpsite. Most households rely on community-based organizations (CBOs) for collection of their solid waste. Collection frequency varies between once and thrice a week and the residents are expected to pay refuse collection charges (RCC) to CBOs for the services provided.

A small pool of close to 10 per cent households rely on informal workers to collect their waste at higher frequencies for a lower fee as compared to the CBOs. Informal workers play a crucial role in the city's waste management system. These self-employed individuals collect recyclables from houses and streets and work at the dumpsite, collecting an average of 20 kg per day.

Despite the challenges, there are promising initiatives emerging in the city. Organizations like Nipe Fagio are working to formalize waste collection cooperatives and promote waste separation at source. A 2019 study by the University of Dar es Salaam attributed a 15 per cent reduction in littering in specific neighbourhoods due to Nipe Fagio's interventions. Nipe Fagio, meaning "Give me the broom" in Swahili, began their journey in Dar es Salaam in 2013.

HOW THE SYSTEM WORKS

The Wakusanya Taka Bonyokwa Cooperative Society, set up by Nipe Fagio, is an inspiring example of a zero-waste model in action. It has successfully diverted more than 80 per cent of the waste generated in Bonyokwa, a low-income sub-ward, through composting, reuse and recycling. This vibrant community of 14,000 inhabitants in Ilala Municipality has transformed its solid waste management system through a community-owned material recovery facility (MRF) operated by a wastepicker cooperative.

Traditionally, wastepickers in the Global South face hazardous conditions working on dumpsites. Bonyokwa's MRF empowers these individuals, transitioning them into cooperative owners and operators, significantly improving their working conditions and providing formal recognition. They collect waste from all households six days a week, promoting community participation. Households sort their waste into four categories: biodegradable waste, non-biodegradable waste or recyclables, domestic hazardous waste, and remainder as residuals.

The MRF further sorts non-biodegradable waste (metals, various plastics, glass, cardboard, paper, electronics, textiles and shoes) for sale to recyclers. Unmarketable recyclables are creatively utilized—for instance, glass bottles are used for pavements, paper strengthens compost, etc. Biodegradable waste is composted and used to grow vegetables and nourish Black Soldier Fly larvae, which are then sold as chicken feed. This demonstrates a closed-loop system that maximizes resource recovery and minimizes waste.

The weight of waste is recorded and tracked to monitor trends and inform further improvements. Local leaders report high community participation in waste separation, with others catching on. The MRF is clean and organized, challenging the stereotypical image of waste facilities. The employees' pride in their work and ownership of the system are evident.

While challenges remain, these initiatives offer hope for a more sustainable future for Dar es Salaam. By investing in infrastructure, promoting waste separation, and supporting informal wastepickers and cooperatives, the city can develop a more efficient and environmentally friendly waste management system.

WHAT HAS WORKED

Nipe Fagio operates a comprehensive system that tackles waste management through various initiatives:

1. **Community engagement and education:** Conducting workshops, clean-up drives and educational programmes for both adults and children—over 15,000 individuals directly engaged. They utilize various platforms, including schools, community centres and social media. Nipe Fagio encourages community adoption of sustainable practices. They advocate for waste separation at source, encouraging residents to sort biodegradable waste, recyclables and hazardous materials into separate containers.
2. **Formalization of wastepickers:** Nipe Fagio helps informal wastepickers transition into formally recognized cooperatives. They directly support over 1,200 wastepickers—providing them with better working conditions, access to training and resources, and improved bargaining power for selling collected recyclables. Each wastepicker collects an

average of 20 kg of waste per day. By facilitating access to markets for recyclable materials and providing financial assistance, Nipe Fagio contributes to improving the livelihoods of informal wastepickers and their families.

3. **Waste collection cooperatives:** Nipe Fagio assists in establishing and supporting waste collection cooperatives within communities. So far, they have helped to establish over 15 such cooperatives, which are responsible for collecting and transporting waste to designated sorting centres. Cooperatives ensure efficient and organized waste collection, minimizing uncollected waste and reducing the burden on the city's waste management system.
4. **Innovative waste management solutions:** Nipe Fagio has established at least two composting facilities that convert biodegradable waste into nutrient-rich compost used for urban agriculture and landscaping, diverting waste from landfills and promoting sustainable waste utilization. They are exploring the potential for biogas production using biodegradable waste, which can be used as a renewable energy source. Nipe Fagio is also investigating the feasibility of implementing waste-to-energy technologies that convert waste into electricity, thus reducing dependence on fossil fuels and generating clean energy.
5. **Collaboration and advocacy:** Nipe Fagio collaborates with the government, private sector and other NGOs to develop and implement effective waste management strategies. They advocate for policies that promote sustainable waste management practices, such as mandatory waste separation at source and increased investment in waste treatment infrastructure.

Nipe Fagio plans to implement this model in three more areas of Tanzania. Two areas in Zanzibar are in the planning phase. The Bonyokwa story is a testament to the power of community-driven solutions and the potential of zero-waste models to improve lives, protect the environment and inspire others.

REPLICABILITY

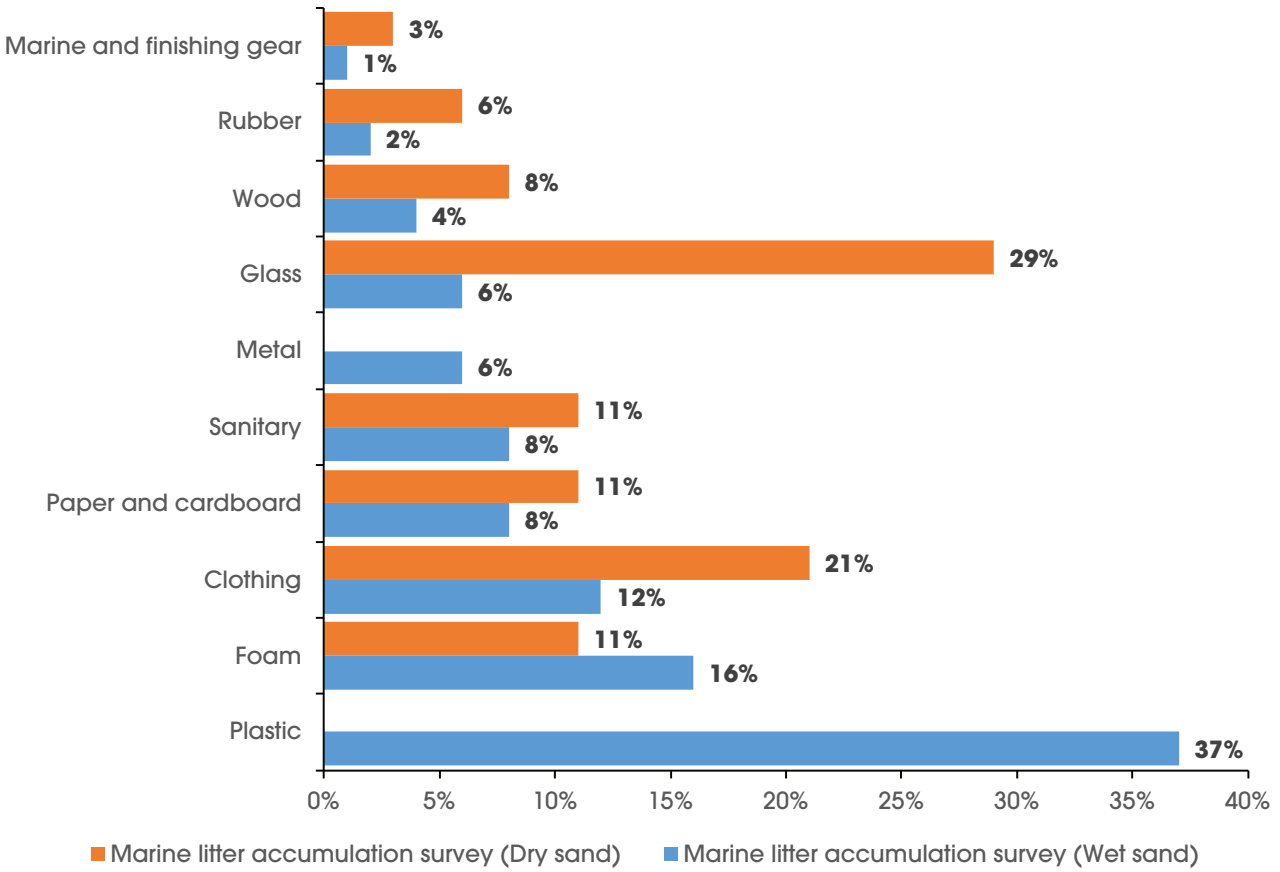
Nipe Fagio's comprehensive approach to solid waste management offers a valuable model for other cities to consider. Four core components that could be replicated are:

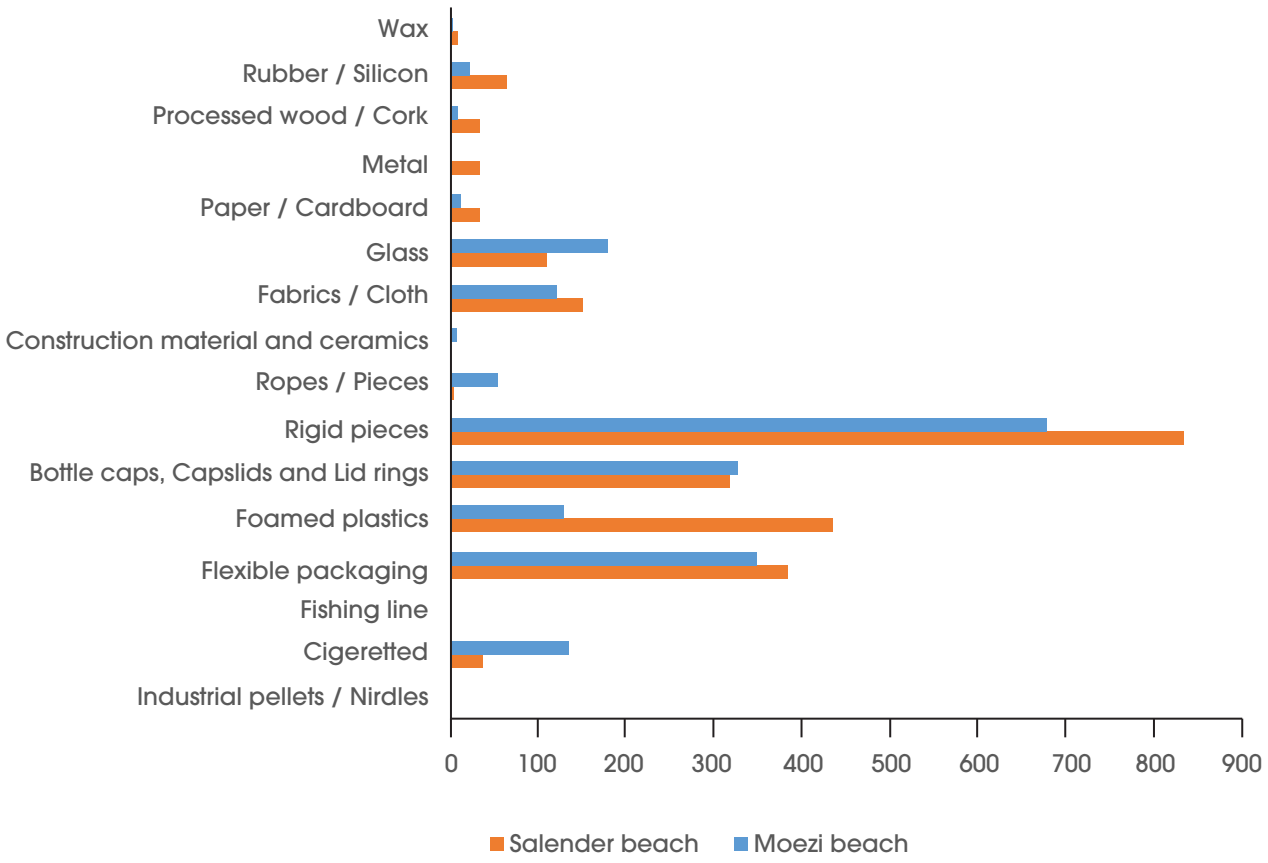
1. **Community engagement and Information, Education and Communication (IEC) initiatives:**
    - Organize workshops, clean-up drives, and educational programmes for all ages. Utilize schools, community canters and social media platforms.
    - Encourage residents to separate waste at source by providing designated bins for biodegradable waste, non-biodegradable waste and domestic hazardous materials.
2. **Formalization of wastepickers—collaborate with informal wastepickers to establish cooperatives that provide:**
    - Improved working conditions: Safety gear, hygiene facilities, etc.
    - Training on proper wastepicking techniques, safety protocols and sorting facilities.
    - Proper equipment, training and support for efficient waste collection.
    - Market access: Facilitate access to channels for selling collected recyclables.
    - Microloans or financial assistance programmes.
3. **Waste collection consistency:**
    - Setting up designated waste collection points within the community.
    - Scheduling regular waste collection across the community.
    - Transporting collected waste to designated sorting centres or disposal sites.

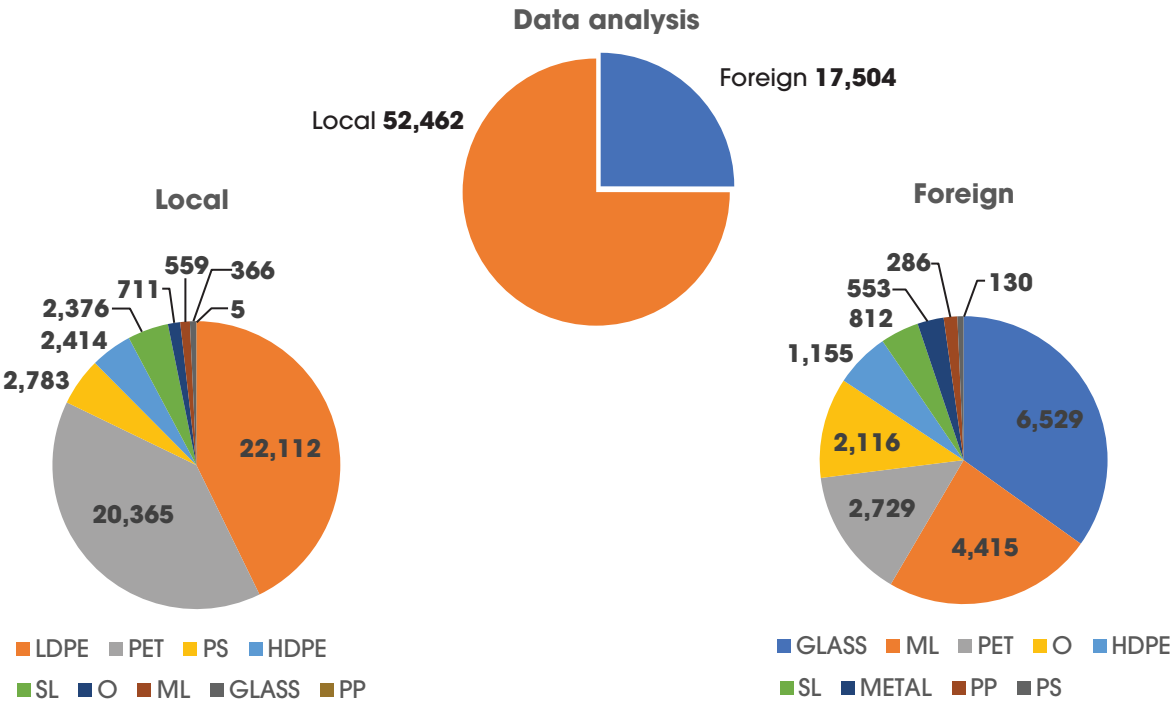
NIPE FAGIO'S WORK ON MARINE LITTER

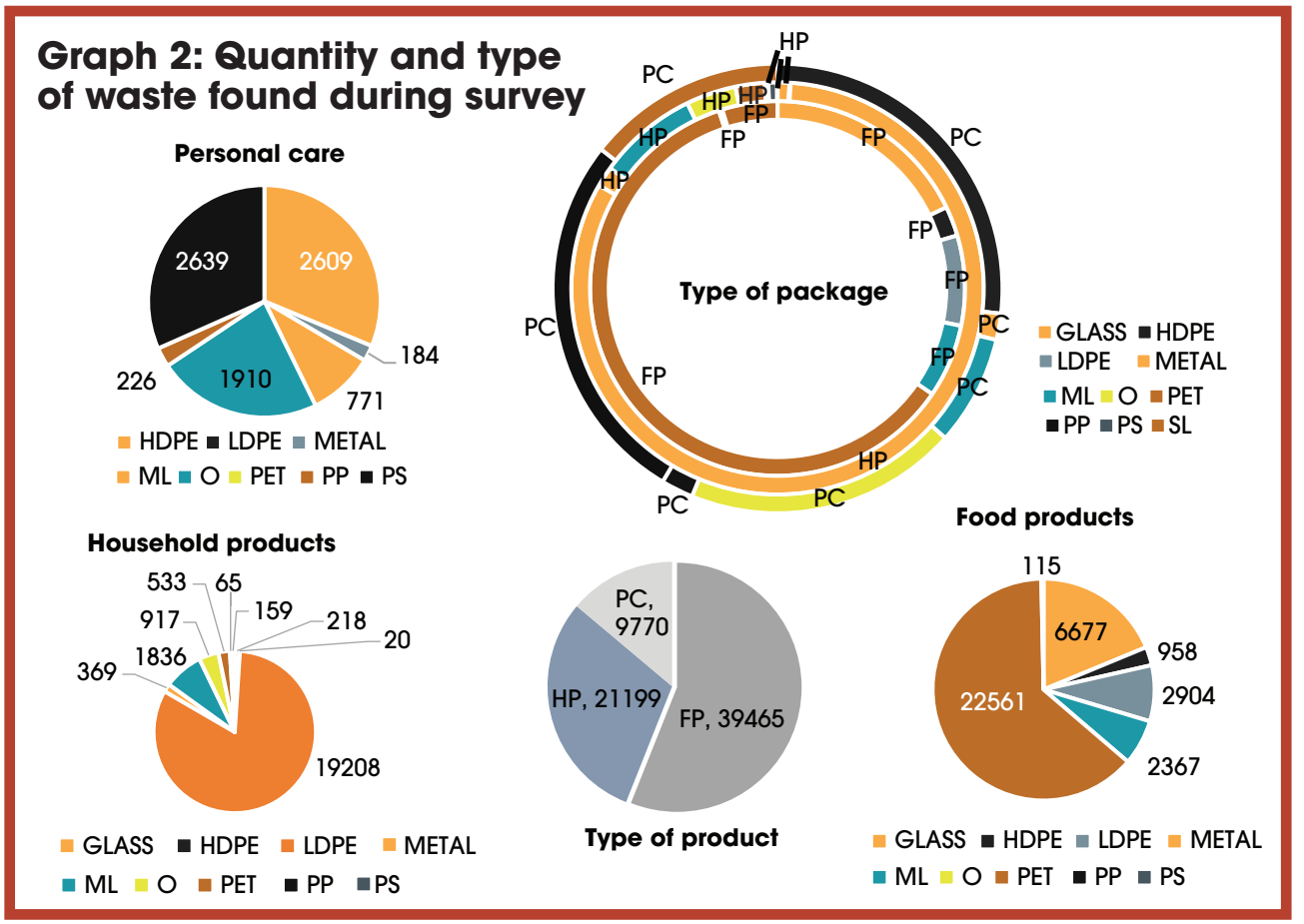
- From 6–17 March 2021, Nipe Fagio conducted a ten-day marine litter accumulation survey at two Dar es Salaam beaches: Mbezi and Selander. This initiative aligns with their ongoing efforts to identify pollution sources, minimize ocean-bound waste, and promote circular and sustainable solid waste management practices. The survey began with a two-day beach clean-up by youth ambassadors and volunteers. This was followed by daily monitoring of accumulated litter at both sites. The team meticulously documented the type, quantity, and weight of collected waste through audits and data sheets.
- The survey revealed interesting trends. There was an increase in biodegradable material on the shorelines and a decrease in litter on dry sand. Moreover, waste and brand audits conducted during the survey showed that plastic waste was the most prevalent type in wet sand, accounting for 37 per cent of all collected items. Conversely, glass objects comprised the highest percentage (29 per cent) of waste found on the dry sand at both Mbezi and Selander beaches.
- Nipe Fagio's work on marine litter is crucial for raising awareness of this issue and promoting sustainable practices to protect the marine environment. Their surveys provide valuable data that can be used to inform policy decisions and develop effective interventions to address marine litter pollution.

Graph 1: Marine litter accumulation survey









4. **Innovative waste management solutions:**
   - Composting facilities to convert biodegradable waste into usable compost for agriculture or landscaping projects.
   - Researching the feasibility of biogas production from biodegradable waste as a renewable energy source.
   - Investigating the possibility of implementing technologies that convert waste into clean electricity.
5. **Collaboration and advocacy—Partner with local government, NGOs and the private sector to:**
   - Advocate for supportive policies that encourage waste management practices like mandatory waste separation.
   - Invest in treatment and processing infrastructure.
   - Share knowledge and best practices through workshops and conferences.

For effective replicability of these core components, cities must adapt these strategies to the local context—consider factors like population size, waste composition and available resources; explore opportunities and secure funding from government grants, private sector partnerships and donor organizations; provide training and support for communities and wastepicker cooperatives to ensure long-term sustainability of the model; and track the effectiveness of the model by monitoring source separation, waste collection frequency, reduction of waste reaching the landfill and the impact on livelihoods.

By implementing these core elements and adapting them to the specific needs of a city, the Nipe Fagio model can be a valuable tool for establishing effective and sustainable solid waste management systems.

TANZANIA

KINONDONI MUNICIPAL COUNCIL

BEST PRACTICE:

Biodegradable waste management

Population (in million, as per 2012 Census)
0.93

Area (sq km)
321

Number of households
311,465

Number of wards
20

Municipal solid waste generation (in tonne per day or TPD, excluding C&D waste and inerts)
1,223.6

Number of sanitation workers
Over 50

Percentage of households covered under door-to-door waste collection
65

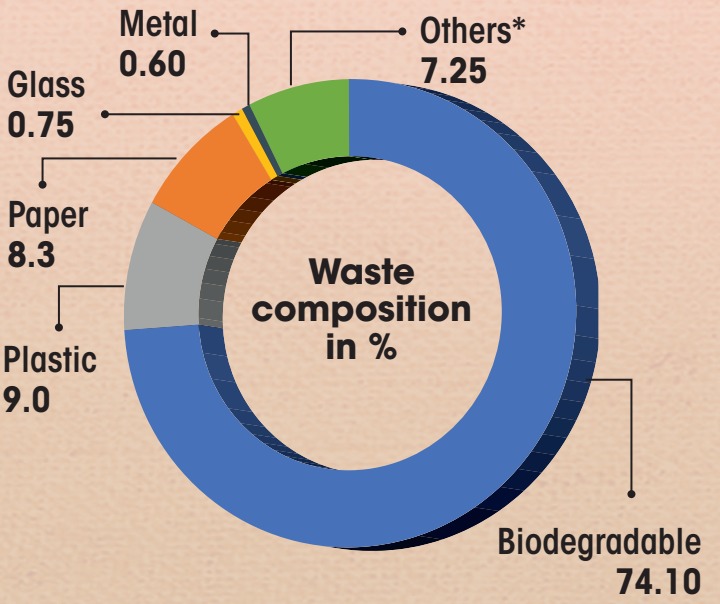
Waste management vehicle fleet size
10

INTRODUCTION

Kinondoni District, officially the Kinondoni Municipal Council (Halmashauri ya Manispaa ya Kinondoni in Swahili), is one of the five districts that constitute the Dar es Salaam region of Tanzania. Kinondoni is not only a modern centre of commerce but also home to one of the best-preserved medieval Swahili settlements, the Kunduchi Ruins. The district boasts a diverse landscape, bordering the Indian Ocean to the east, the invigorating Pwani Region (including Bagamoyo and Kibaha districts) to the north, Ubungo District (bifurcated from Kinondoni Municipal Council) to the west, and the bustling Dar es Salaam City Council (formerly Ilala District) to the south. Home to a vibrant yet densely packed population, Kinondoni grapples with a critical challenge—municipal solid waste management.

WASTE COMPOSITION IN KINONDONI MUNICIPALITY

Total waste: 1,223.6 TPD



*Leather and textile

THE TRANSFORMATION

Principally, waste management in Tanzania is directly the local authority's responsibility. The Local Government (Urban authorities) Act 1982 imposes on urban authorities the responsibility "to remove refuse and filth from any public or private place" (Sec 55 g) and to provide and maintain public refuse containers for the temporary deposit and collection of rubbish. Municipal councils are responsible for managing the municipal solid waste. Residents are required to cooperate in the waste management programmes and pay their "refuse collection charges".

Based on the Act, all urban authorities have the mandate to create by-laws enabling them to fulfil their waste management responsibilities within their respective administrative areas. The Kinondoni Municipal Commission (Collection and Disposal of Refuse) By-Laws of 2000 categorize waste into various streams—liquid or solid waste, domestic refuse or trade waste, and hazardous or bulk waste. The by-laws also give waste management responsibilities to entities other than the Kinondoni Municipal Commission, i.e. the Municipal Commission's registered agents or contractors. Non-compliance with these by-laws is a criminal offense and the offender is liable to a fine of not more than TSh 50,000 or up to twelve months jail or both.

About 67 per cent of the waste generated in Kinondoni finds its way into the formal collection system. The remaining ends up in drains, open spaces and illegal dumpsites. This unmanaged waste isn't just an eyesore; it poses serious health risks, breeding vectors for diseases and threatening the wellbeing of residents.

Informal settlements add another layer of complexity. The waste they generate remains largely outside the formal system, further straining the already overburdened infrastructure. Lack of adequate landfills, transfer stations and collection vehicles only exacerbates the problem.

Kinondoni Municipal Council, recognizing the gravity of the situation, has embarked on a multi-pronged approach. Public-private partnerships (PPPs) are being forged to bolster waste collection and disposal efforts. Community-based programmes—where residents sort waste, compost biodegradable waste and participate in clean-up campaigns—are fostering a sense of ownership and responsibility. Laws against illegal dumping and littering are being implemented, with stricter enforcement on the horizon.

However, the road to a cleaner Kinondoni is paved with hurdles. Ensuring the long-term viability of PPPs, sustaining community engagement, and overcoming resource constraints

Kinondoni Municipal Council, Dar es Salaam Region, Tanzania

are no mean feats. Yet, with unwavering commitment and a collaborative spirit, Kinondoni is overcoming these obstacles. One such project is the Mabwepande Composting Facility for market waste.

HOW THE SYSTEM WORKS

The Mabwepande Composting Facility for market waste was born in 2022. The Kinondoni Municipal Council, with financial support from the Free and Hanseatic City of Hamburg, planned the composting facility for biodegradable market waste in Mabwepande. Today, the site is fully operational. It is owned by the Kinondoni Municipality and run by the local company, The Recycler. The city of Hamburg provides most of the financing and receives carbon credits, or Verified Emission Reductions (VERs), in exchange.

Hundreds of tonnes of biodegradable waste is generated daily at food markets in the Dar es Salaam region, with more than half originating from Kinondoni markets. Previously, most biodegradable waste was either dumped uncontrolled at the Pugu dumpsite or left uncollected, leading to street waste accumulation and unpleasant odours in the city. With this pilot composting project, the municipality is making efforts to improve biodegradable waste management.

The new, controlled facility treats biodegradable waste—banana peels, orange rinds and other remains of fruit and vegetables—collected from several markets and hotels across the Dar es Salaam region. Fortunately, biodegradable waste from Dar es Salaam region's food markets is mostly free of contaminants like plastics or metals, making it ideal for composting and reuse as organic fertilizer for local agriculture after the decomposition process is complete.

The composting facility is built on a 2-hectare area, located on the outskirts of Dar es Salaam City Council in the Kinondoni district. A dirt road leads to the site, about ten kilometres from the nearest bus stop. It is a concrete-covered area with a large, open structure. Long, black piles cover the ground. Currently, the facility employs 50 sanitation workers. The area is mostly paved, and the entire section dedicated to the initial rotting process (controlled intensive rotting) boasts a safe drainage system. Each truck brings two to three loads to the site daily, which amounts to roughly 30 to 40 tonnes.

The fresh waste received undergoes a multi-stage process. First, the staff meticulously sort out any plastic or other non-biodegradable waste. Next, the biodegradable material is piled high for initial decomposition. Workers regularly turn and water the piles, ensuring air circulation and maintaining moisture. This step of controlled intensive rotting takes about

Entrance to the Mabwepande Compost Site owned by the Kinondoni Municipal Council

two weeks, after which the partially composted material is relocated to a maturation area. Underground drainage prevents uncontrolled liquid emissions into the environment.

The rotting process takes around 8–10 weeks in total, during which the waste is actively aerated to maintain the biological process. All these steps ensure climate-friendly decomposition with minimal methane emissions. After about ten weeks, the process is complete, transforming the waste into a valuable product—high-quality compost. This nutrient-rich fertilizer is then sold to gardeners and farmers to improve soil health and plant growth.

The composting site also cultivates Black Soldier Flies (BSF), protein-full insects ideally suited for animal feed. The site operator, The Recycler, along with their partner, the Tanzanian company Biobuu, use BSF larvae to create dog food and fish feed. This insect powder is a more sustainable and economical alternative to the meat traditionally fed to dogs and the soy often used in fish farming.

1. Waste is received at the facility, sorted, and the biodegradable material is left for initial decompostion

2. The rotting process takes around 8–10 weeks in total, during which the waste is actively aerated to maintain the biological process

3. Underground drainage prevents uncontrolled liquid emissions into the environment

4. Partially composted material is relocated to a maturation area

5. The composting site cultivates Black Soldier Flies (BSF)

6. The nutrient-rich fertilizer is sold to gardeners and farmers to improve soil health and plant growth

Financing

Waste services are financed through Refuse Collection Charges (RCC). RCCs were introduced in 1993 with the privatization of waste management (DCC by-laws). RCC was finally adopted in 2000–01 by the Kinondoni municipality. They are paid by the citizens monthly, ranging from a minimum to a maximum according to the average income of the areas, typically around TSh 1,150–2,300 per month. This is considered too low by private contractors, especially in low-income areas where only 30–50 per cent of citizens pay this monthly fee. For businesses, the fee is higher and negotiable according to size and location. The municipality also uses part of its general budget for secondary collection, i.e. transportation to Pugu Kinyamwezi from the garbage-vulnerable points in unplanned areas where community-based organizations (CBOs) operate in a limited way.

WHAT HAS WORKED

By constructing the composting facility for biodegradable waste in Kinondoni, the project partners addressed two main problems. Firstly, the composting facility produces organic fertilizer as a commodity. To achieve this, biodegradable waste from local markets is systematically collected, and there are efforts to maintain consistency is collection. Moreover, the facility is nearing profitability, even when The Recycler currently doesn't charge the markets for collecting their biodegradable waste. Secondly, the project avoids the production of methane and by doing so mitigates climate change. Apart from these direct benefits, the facility contributes to job and income generation and improves the livelihood of the poor.

Prior to the project, the municipality grappled with mountains of municipal solid waste clogging drains, suffocating streets with open dumping and burning, and releasing harmful greenhouse gases. Now, with a 50 TPD facility and over 50 per cent of market waste diverted to Mabwepande, the municipality and surrounding regions are experiencing a significant improvement. Clogged drains are becoming less of a problem, and the pungent odour of rotting waste has faded considerably.

The Mabwepande compost site aligns with and exemplifies broader efforts to promote sustainable waste management practices by reducing pollution and greenhouse gas emissions, supporting the productive use of waste materials, and bolstering local agriculture and landscaping needs. This is achieved by diverting biodegradable waste from reaching the Pugu dumpsite.

The success of the project hinges on certain key factors. It prioritizes the transformation of biodegradable waste into a valuable resource like compost. This nutrient-rich fertilizer benefits both agriculture and landscaping, promoting a sustainable cycle.

The project's strategic location grants it convenient access to a consistent flow of biodegradable waste materials from nearby markets. This steady supply stream allows for efficient processing and maximizes the project's impact.

The project thrives due to its strong partnerships with local stakeholders. Collaboration with the government and community groups fosters widespread support from various societal levels, ensuring the project's long-term viability.

Training on composting conducted at the site in Kinondoni District

The project also leverages technology to meticulously monitor the composting process, guaranteeing the quality and safety of the final product. This technology-driven approach fosters confidence in the compost and paves the way for wider adoption. Furthermore, it employs a closed-system approach, which significantly reduces unpleasant odours and minimizes environmental pollution while optimizing the entire composting process.

The project's success extends beyond its operational efficiency. It prioritizes community engagement and education. The municipality has also conducted several rounds of awareness generation programmes for the residents. Over time, residents have also started handing over segregated waste. While the segregation level has not yet reached 100 per cent and some challenges remain, the effort is commendable. By educating locals about responsible waste management practices, the project empowers them to participate actively in creating a cleaner environment. This fosters a sense of ownership and ensures the project's long-term impact.

The project's commitment to resource recovery is commendable. By forging partnerships with local businesses, it creates additional revenue streams while diverting waste from landfills. For instance, discarded flowers from a nearby farm are now utilized as valuable input material for the composting process. This innovative approach demonstrates the project's potential to be replicated and adapted by other communities, paving the way for a more sustainable waste management future.

LESSONS LEARNT

The Mabwepande Composting Project emphasizes the importance of partnership and community participation. However, there have been challenges in implementation, particularly financial constraints for daily maintenance of the facility as well as providing timely salary to the staff. In addition, expansion is also facing financial constraints.

By reaching out more broadly across the city, the project could have an even greater positive impact on environmental sustainability and quality of life for all residents. Partnering with other stakeholders to create new collection points for biodegradable waste would further expand the project's reach. Developing educational materials tailored specifically to different socioeconomic groups would empower residents with knowledge of sustainable waste management practices.

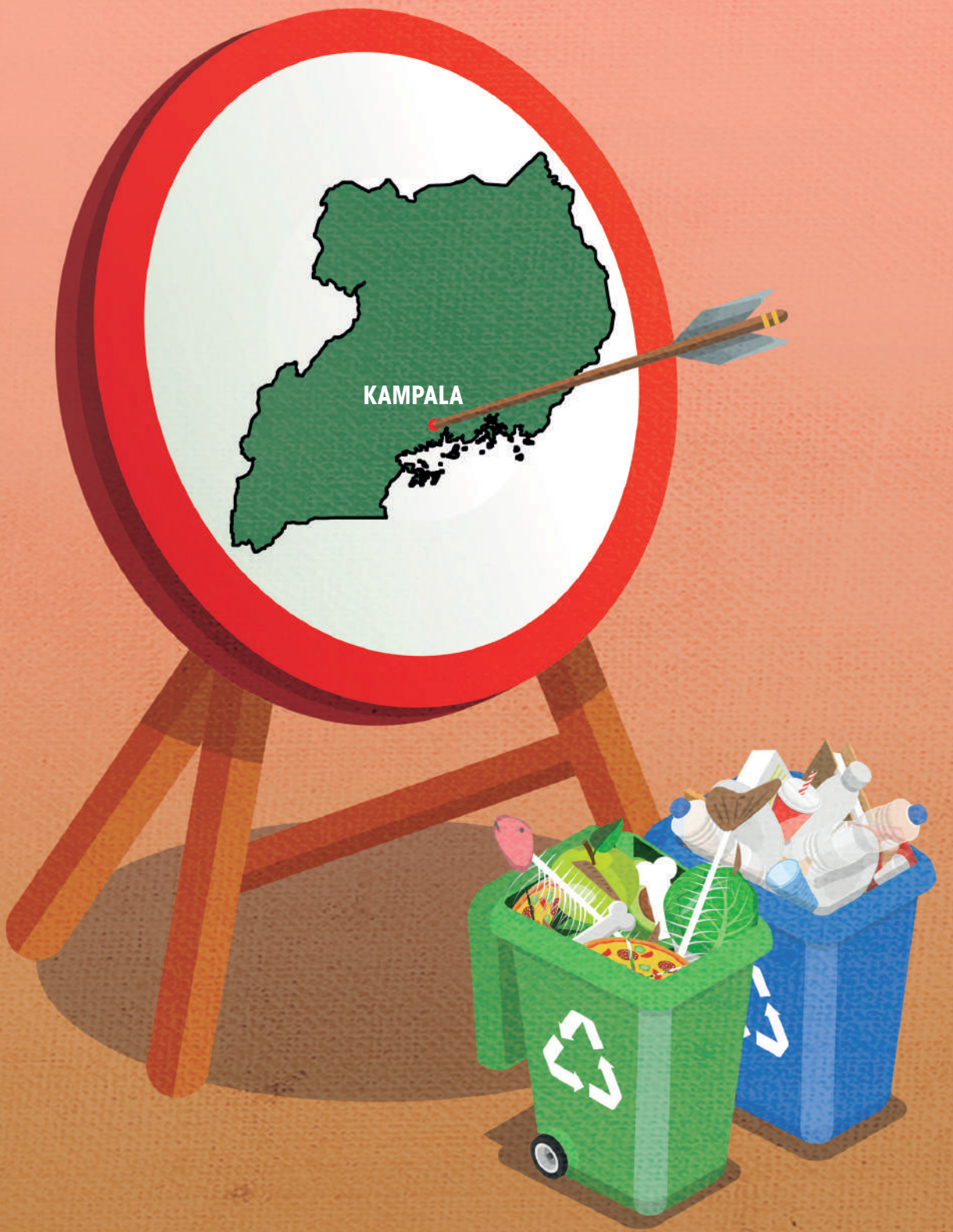
REPLICABILITY

The Mabwepande project's success extends beyond its local impact. It serves as a blueprint for replicating sustainable waste management practices in other cities. While robust infrastructure and cutting-edge technology are important, a successful replication strategy requires more. A fundamental change in mindsets is essential.

Strong partnerships with stakeholders, coupled with community education programmes on proper waste disposal, empower residents to actively participate and take ownership. Efforts to promote source separation and foster a culture of environmental consciousness are crucial for long-term success. The project's positive impact extends beyond environmental benefits. The jobs created, incomes elevated, and the livelihoods improved paint a picture of a community empowered by its own waste.

Recognizing the project's potential, the municipality plans to expand the Mabwepande facility's capacity threefold, from its current processing rate of 50 TPD to 150 TPD. Furthermore, The Recycler, the project operator, aims to construct a second composting facility in Mkuranga, south of Dar es Salaam. This expansion demonstrates the project's scalability and its potential to make a significant impact on a wider regional scale.

UGANDA



KAMPALA

BEST PRACTICE:

Biodegradable waste management using Black Soldier Fly

Population
(in million, as per 2019 Census)
6.7

Estimated floating population
(in million, dialy)
1.2

Area (sq km)
189

Number of households
(2019)
416,803

Number of parishes
99

Number of villages
1,285

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
2,000–2,500

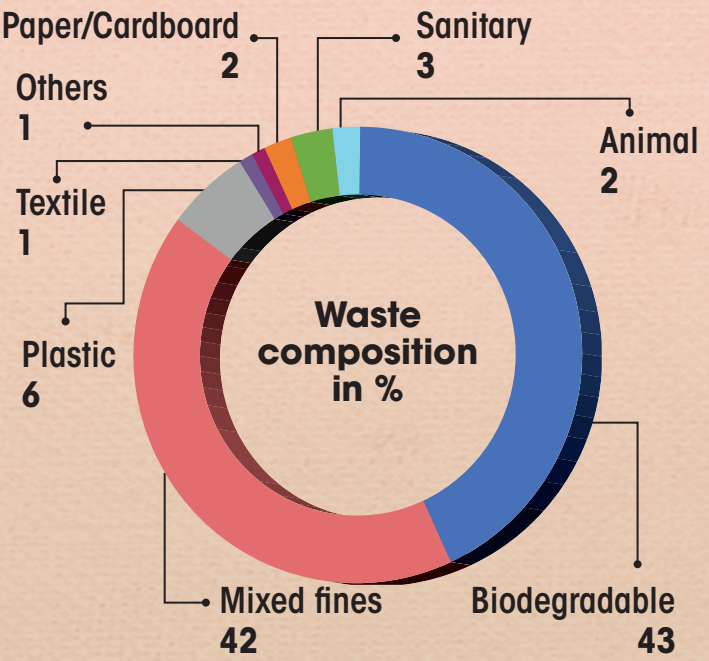
Number of sanitation workers
5,000

Waste management vehicle fleet size
145

INTRODUCTION

Kampala, the largest city in Uganda, is also the country's capital. With the population of the city estimated to be around 2 million and the population of the metropolitan area estimated to be about 6 million, it is among the fastest-growing cities in Africa with an annual population growth of about 5 per cent. Kampala accounts for more than half of Uganda's GDP and is regularly ranked amongst the best cities to live in East Africa. The city of Kampala covers a total area of 189 km^2 (73 square miles), comprising 176 km^2 (68 square miles) of land and 13 km^2 (5.0 square miles) of water. The Kampala Capital City Authority (KCCA) is a state agency under the Ministry of Kampala Capital City and Metropolitan Affairs (MKCCMA) that manages the capital city on behalf of the Ugandan central government.

WASTE RECEIVED AT KITEEZI LANDFILL



THE TRANSFORMATION

Kampala generates approximately 2,500 TPD of solid waste, about 50 per cent of which is collected and disposed of at Kiteezi Landfill on the outskirts of the city. According to the Uganda Bureau of Statistics, KCCA alone accounted for about 60 per cent of the total waste collected from all municipalities in Uganda in 2021.

About 480,000 metric tonnes of waste reaches the Kiteezi Landfill annually. Currently, the landfill is operating beyond its capacity. KCCA is struggling to set up a sanitary landfill in Dundu village further away from the city due to opposition from the residents of the Mukono district. KCCA formally started the safe closure procedures of the landfill site in 2021.

KCCA realized that landfilling was not a sustainable solution to manage municipal solid waste and is currently adopting sustainable solutions that

(i) Involve the reduction of waste that is landfilled
(ii) Promote segregation of waste at the source
(iii)Convert solid waste to a resource or a raw material to produce valuables

KCCA understood that city markets are bulk waste generators and that biodegradable waste, which accounts for more than half of the total waste by weight, can be better utilized. Therefore, KCCA partnered with Marula Proteen Limited to pilot the keeping of Black Soldier Flies (BSF) as a measure of converting biodegradable market waste into organic fertilizer and to produce protein-rich animal feed.

Waste compactor truck from Kampala city at Kiteezi Landfill

HOW THE SYSTEM WORKS

KCCA constructed the Wankoko Waste Recycling Plant in May 2018 to take biodegradable solid waste from markets and plastic waste from the general public and turn it into revenue-generating products.

In collaboration with Marula Proteen Limited, they started processing vegetables and other biodegradable market waste using Black Soldier Flies that generated natural manure (soil conditioners) and protein-rich animal feeds. In the partnership, KCCA oversees the

Waste from the Usafi market in central Kampala

KCCA Waste Recycling Plant in Wankoko

collection and transportation of sorted waste from the markets to the processing plant at Wankoko; while Marula Proteen is responsible for repurposing Kampala's market waste. KCCA employs the youth to clean and sort the vegetable waste in the market before transportation.

At the Wankoko processing facility, the quality of vegetable waste is first tested, and then additives are added to make a balanced diet for the larvae. The feedstock is then left to ferment for some days and later served to larvae.

The larvae feed on the waste leaving behind a high-quality soil conditioner in the form of compost. As they are about to reach the pupae stage, the larvae are harvested, dried and ground to make chicken feed which is nutrient-rich and high in protein. Both the manure and the animal feed are sold off to farmers. The larvae are also sold to the out-grower farmers. Marula also buys back some of the unprocessed larvae from these out-growers, making a good business out of it.

A part of the harvested larvae is provided with a conducive environment to hatch into flies, which are also kept under a controlled setting to lay eggs. These eggs are harvested back and incubated to hatch into new larvae, keeping a steady supply of Black Soldier Flies.

WHAT HAS WORKED

Kampala City has 83 markets, of which 14 are owned and managed by the government. Government-run markets together generate approximately 250 tonnes of waste per day. Currently, the larvae devour 10 tonnes of waste. Marula employs about 60 people and about 100 out-grower farmers are part of their network.

Management of biodegradable waste through Black Soldier Flies is an emerging concept, especially in East African Countries. It can significantly reduce the burden of urban local bodies. The following points elucidate what has worked in Kampala:

1. The segregation of biodegradable waste in the markets fostered further processing

BSF culture by Marula Proteen employees

2. KCCA employing the youth in cleaning and sorting biodegradable market waste creates employment opportunities and increases their engagement.
3. The cooperation between KCCA and Marula Proteen from collection to processing.
4. The Marula Team's expertise and network made it a successful business.

Further cooperation might ensure the scalability of the pilot to deal with the entirety of the market waste, increase employment of locals and higher reduction in overall GHG emissions from decaying biodegradable waste in the Kiteezi landfill.

REPLICABILITY

Processing of biodegradable waste through BSF has enormous potential because the larvae grown on the waste can become starting material for several commercial products such as animal feed, biodiesel, chitin as a biopolymer, and soil fertilizer. Insect-based waste treatment technology offers a viable solution for solid waste problem mitigation, which otherwise has been an arduous task for many parts of the globe, especially for developing nations.

Although sometimes considered a good alternative to well-established technologies such as composting or anaerobic digestion, BSF is still in its infancy and is highly dependent on a lot of factors. Cultured growth of Black Soldier Flies (Hermetia illucens) requires an optimal temperature of 30 °C, optimal moisture content of 65–90 per cent, pH between 6–8, humidity between 60–65 per cent, sunlight intensity at around 110μ mol $m^{2} s^{-1}$. Mimicking all these factors in a controlled environment is highly cost-intensive for build-up and operations.

Public perception of farming flies, regulatory gaps limiting the benefits of fly production, ensuring a steady supply of segregated waste and economic viability all currently go against the scalability of BSF usage in waste management. Despite all these challenges, replicability is certainly possible in the conducive conditions of Africa and Asia. The technology requires a holistic understanding and more working models like Kampala before it can be replicated in other parts of the world to deal with community and city-level biodegradable waste.

BSF larvae in the 6th Instar pre-pupa stage

ZAMBIA

LUSAKA

BEST PRACTICE:

Augmenting recycling through the PPP model

Population
(in million, as per 2022 Census)
3.1

Area (sq km)
360

Number of households
687,923

Number of wards
38

Number of constituencies
7

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
1,200

Number of sanitation workers
1,262

Number of garbage vulnerable points
4

Waste management vehicle fleet size
144

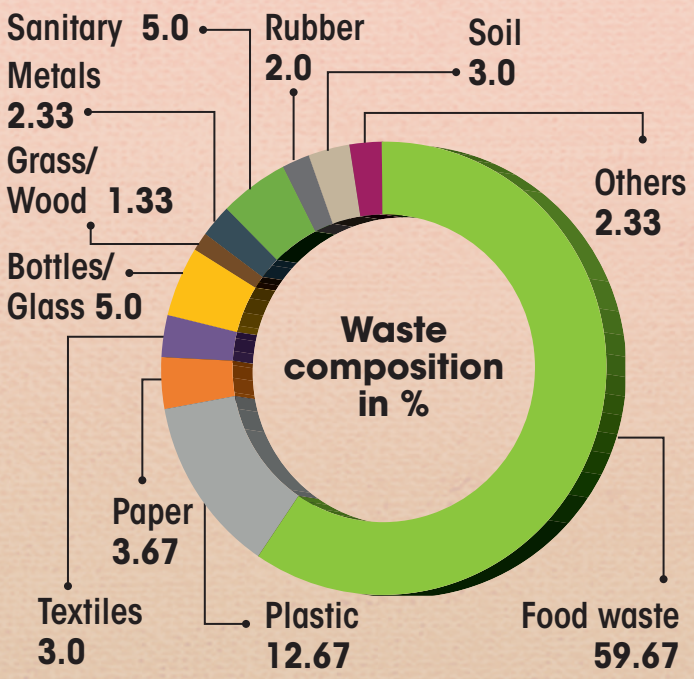
Percentage of waste processed
12

INTRODUCTION

Lusaka, the capital and largest city of Zambia, is one of the fastest-developing cities in Southern Africa. Situated in the central part of Zambia on the Central African Plateau, it lies at an altitude of 1,280 m above sea level. Since 2010, its population has increased at an average annual growth rate of 2 per cent. This steep rise in population has brought about typical urban challenges. Even though Lusaka's per capita waste generation is only about 387 g per day, waste management is a big challenge for the city due to underdeveloped waste management systems.

WASTE COMPOSITION IN LUSAKA

Total waste: 1,200 TPD



THE TRANSFORMATION

Zambia's solid waste generation rate stands at around 0.52 kg per person daily, which appears modest compared to the 1.2 kg per person in developed nations. However, in many developing countries, including Zambia, most waste remains uncollected due to issues like poor management, equipment failures and insufficient budgets. Consequently, this exacerbates the challenges related to waste management and sustainable disposal and treatment. Despite having a National Solid Waste Management (SWM) Strategy, the Zambia Environmental Management Agency (ZEMA) contends that the growth of the urban population and increased economic activities have led to a buildup of waste.

Zambia has prepared a national vision plan named Zambia Vision 2030. To implement that vision plan, Lusaka City Council has prepared the Solid Waste Management Improvement Plan 2022 - 2026 (SWMIP) in partnership with the Ministry of Local Government and Rural Development, Ministry of Health, People's Process on Housing and Poverty in Zambia (PPHPZ), WaterAid Zambia, ZEMA, Zambia Homeless and Poor People's Federation, Waste Management Association of Zambia, and the Natural Resources Stewardship (NatuReS). The SWMIP 2022 -2026 is being implemented by the Lusaka Integrated Solid Waste Management Company (LISWMC).

The SWMIP aims to collect 80 per cent of total generated waste and transport it to designated waste disposal sites. The other significant aims are: 1) Achieving 30 per cent recycling of all waste collected by 2026 through waste sorting at the generation point and establishing sorting stations for the same; and 2) Re-engineering Chunga Landfill to improve landfill management. In addition to these broad aims, strategic goals have been finalized and categorized into three types: Scenario 1 (most important and very urgent goals), Scenario 2 (important and urgent), and Scenario 3 (less important and not urgent).

According to the SWMIP, Lusaka city generates about 1,200 tonnes of waste per day. However, only about 30 per cent of this ends up at the Chunga Landfill which is the designated disposal site. This is largely due to the high prevalence of indiscriminate illegal dumping and littering by the public.

To ensure effective management of waste, the Lusaka City Council (LCC) under the provisions of the Solid Waste Regulation and Management Act No. 20 of 2018 has formed the Lusaka Integrated Solid Waste Management Company (LISWMC) to be responsible for undertaking all the solid waste management functions that were previously being done by the Lusaka City Council through its Waste Management Unit. The LISWMC works in partnership with private waste management companies, franchise contractors and community-based enterprises that service conventional and peri-urban areas in the city.

HOW THE SYSTEM WORKS

Currently, the city of Lusaka has 25 Waste Management Service Zones (WMSZs). Of these, 24 will be managed by private sector companies. The remaining one that covers the Central Business District (CBD) is managed by the Lusaka Integrated Solid Waste Management Company. The company also has an additional mandate to manage the Chunga Landfill.

A franchise system has been implemented in Lusaka that encourages the participation of the private sector in solid waste collection. A franchise contract provides a private waste collector with the sole right and obligation to collect and transport waste from all premises in a franchised waste management district to the dumpsite.

Community Based Enterprises (CBEs) have been given the mandate to collect waste in peri-urban areas. There are 183 CBEs across the city's peri-urban areas providing waste collection services. The modality of collection is either through direct collection from



Chunga Landfill, Lusaka

prospective residents, and tariff bundling that entails waste collection services being bundled with water bills.

Waste management initiatives are being supported through The Lusaka Clean City Project (LCCP) project of the Japan International Cooperation Agency (JICA). Waste collection and transportation are being optimized and many garbage vulnerable points are being avoided. Collection at community level is being done from common points of collection. JICA is supporting all this by formulating methodologies.

With the support of the LCCP, the LISWMC is developing guidelines that will be used for the improved Chunga Landfill management. There is also consideration for establishing a public- private partnership (PPP) model with the view of setting up a material recovery facility (MRF) at the landfill and transfer stations in collaboration with private partners. LCC will support the identification of suitable sites for transfer stations.

The LISWMC meets with recyclers at the end of every month to ensure recycling (of plastics) remains a high priority. Around 20 recyclers are working together in close collaboration with the Company. City Waste Solutions is one of the older waste recyclers working in Lusaka for the last 12 years.

Utilizing the Extended Producer Responsibility (EPR) Regulations established by ZEMA, the Manja Pamodzi Foundation Limited (MPFL), a CSR arm of Zambian Breweries Plc, a subsidiary of AB InBev, has started a recycling initiative, which has expanded its partnerships to include additional industry stakeholders such as British American Tobacco (BAT), Yalelo Fisheries and Java Foods Limited. This expansion aims to optimize the utilization of industrial waste while promoting better solid waste management.

WHAT HAS WORKED

Recently, there has been an increase in the value addition to the solid waste being generated in Lusaka city. Various forms of plastic waste are being reclaimed from the waste stream. With the involvement of some community-based enterprises, the LISWMC has been diverting some waste from the landfill towards extracting value through recycling and reuse by converting it into egg trays, chairs, electric pipes, plastics and other kind of papers.

Over the years, there has been an increase in the number of organizations engaged in plastic waste recycling in Lusaka city. This can be seen from the quantities of plastic waste recovered from the Chunga Landfill. On average, about 95 tonnes of plastic waste is recovered from the landfill every month, and this is broken down as follows:

i. PET: 30 tonnes
ii. HPDE: 30 tonnes
iii. LDPE: 35 tonnes

Among the many community-based enterprises, Manja Pamodzi is actively engaged in advancing the green economy initiative by raising awareness about the advantages of recycling post-consumer solid waste, including plastics, cardboard and paper. Simultaneously, it provides economic opportunities to local communities. In line with its name, Manja Pamodzi, which translates to "working together," advocates for collaborative efforts to promote environmentally friendly, clean and healthy cities in Zambia.

Manja Pamodzi reaffirms its dedication to raising awareness about recycling through a range of environmental initiatives and educational programmes conducted in partnership with various entities such as ZEMA, Lusaka City Council, educational institutions including the University of Zambia (UNZA), Evelyn Hone College, National Institute of Public Administration (NIPA), and others.

MPFL organizes district clean-up events, during which volunteers are grouped into teams and tasked with gathering recyclable materials within a set timeframe. Following the clean-up, top-performing collectors are recognized and compensated based on the quantity of recyclables collected. Individuals have the option to register as collectors and continue gathering waste independently even after the district clean-up events.

The MPFL project, funded collaboratively by the innovation grant given by Millennium Challenge Account – Zambia (MCA-Z) and Zambian Breweries Plc, with the backed by the Lusaka City Council, aims to achieve the goal of cleaning up Lusaka City within the next five years. This objective will be accomplished by encouraging the collection and recycling of materials, with a particular emphasis on recyclables like plastics, glass and paper, which already have established markets. In 2021, the recycling programme gathered more than six hundred tonnes of recyclable materials. This figure has the potential to double or even triple through collaboration with diverse stakeholders, pooling expertise and resources.

IMPACT

Manja Pamodzi acknowledges the significant influence of education and awareness in promoting waste segregation and recycling within communities, as well as enhancing hygiene and sanitation standards in townships. While waste is an inherent aspect of daily life, there is ample opportunity to mitigate or eliminate its negative impacts through further actions.

Since its inception in 2015, the Manja Pamodzi recycling initiative has expanded significantly, benefiting communities in Lusaka province. With over 10,000 direct beneficiaries across 13 townships, the initiative primarily impacts women and youth. MPFL envisions a future where recycling empowers more independent stakeholders to actively contribute as members of the Board of Directors and Management. This approach aims to drive the development of a greener, cleaner and healthier country.

REPLICABILITY

The story of Lusaka is a prime example of a working collaboration between government authorities, aspiring private players and communities. From this, other African nations can

Material recovery facility established at Lusaka city for increasing resource recovery

learn how to manage their dry waste, especially plastics. The integrated efforts are not only crucial for waste management within the territorial limits of a country but it also benefits in cross border management of wastes, which is necessary in dealing with issues like marine litter.

An additional body in the form of LISWMC, working on the principles of a private organization, has been instrumental in working out possibilities like establishing terms of references for PPP models. That is an ideal example for robust management of complex issues for other countries of the same region. In addition to the management aspects, capacity building trainings should also be enhanced in parallel.

ZIMBABWE

HARARE

BEST PRACTICES:

- Integration of informal wastepickers by Zimbabwe Sunshine Group
- Budiriro Material Recovery Centre: Community-driven waste management

Population
(in million, as per 2006 Census)
1.6

Estimated current population
(in million)
3.0

Estimated floating population
(in million, dialy)
1.5

Area (sq km)
982.3

Number of households
(2006)
653,562

Number of wards
46

Municipal solid waste generation
(in tonne per day or TPD, excluding C&D waste and inerts)
798

Number of sanitation workers
1,458

Waste management vehicle fleet size
83

Percentage of households covered under door-to-door waste collection
68

Percentage of waste processed
5

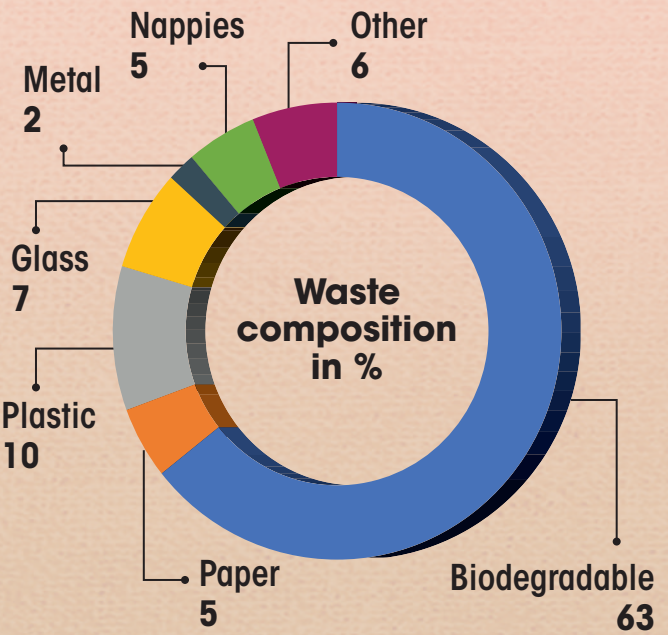
Percentage of households segregating waste
10

INTRODUCTION

After Zimbabwe gained its independence from the British in 1980, mass migration from rural to urban areas happened for better livelihood opportunities. The population of major urban centres in Zimbabwe grew at a high rate of 5 per cent per annum. Since 2000, Harare has seen massive population growth of 6–8 per cent per annum. Simultaneously, the city is facing impoverishment. Most of the population in Harare is employed informally which means they don't pay taxes for the urban services they enjoy. Moreover, the Harare city government relies heavily on central government transfers, which do not increase in tandem with the rise in population. Waste management has emerged as one of the biggest challenges for Harare, as the population grows but the means to deal with the waste don't.

WASTE COMPOSITION IN HARARE

Total waste: **798 TPD**



INTEGRATION OF INFORMAL WASTEPICKERS BY ZIMBABWE SUNSHINE GROUP

THE TRANSFORMATION

The Zimbabwe Sunshine Group started as a social club in 2007 when some young people got together for community clean up ventures. After working in the Mabvuku community for a while, they realized that they were not being able to achieve any long-term results. Then they started looking for more sustainable solutions for the waste problem in Zimbabwe, rather than performing mere cleanup activities.

The programme revolves around international instruments like Sustainable Development Goals (SDGs) and Zimbabwe's National Development Policy 1 (2021–25). They are trying to enhance and enrich already-existing assets within the communities by building and strengthening social infrastructure and emphasizing livelihood generation.

Over time, they have managed to grow into a national association which helps foster upcoming community-based organizations in Zimbabwe and Southern Africa. Tafara Sunshine Group is one of the projects which has been supported by them from scratch. It has grown to provide women and youth an opportunity to earn decent livelihoods through waste management in the scheme called "Beyond Women and Youth".

The Zimbabwe Sunshine Group assists the programme with visibility by featuring them on their website and social media platforms. It also provides them funding to support women and youth with capacity building to enhance their performances and enable them to support their families more efficiently. Zimbabwe Sunshine Group not only empowers communities by covering Tafara, Highfields, Harare Exhibition Park and other catchment areas, it is also spreading waste collection and recycling facilities throughout Greater Harare. For example, whenever families in Tafara gather a substantial amount of recyclable waste, they call the Zimbabwe Sunshine Group to sell their waste and earn money. In this way, the problem of plastic leakage in the environment can also be arrested.

HOW THE SYSTEM WORKS

Tafara is situated in the eastern region of the capital city Harare. It is nearly 17 km away from the city centre and next to it is Mabvuku. Initially, the project was limited to formalizing the work of women wastepickers from Mabvuku, Tafara and Caledonia. Gradually, these women showed interest in other activities to enhance their income even further. The Zimbabwe Sunshine Group did advocacy with the Environment Management Agency (EMA) to facilitate the process of land registration and evolve the Tafara Sunshine Group as a community-based organization with EMA.

The recycling centre in Tafara was started in 2019. The City Council provided the land on which the project was established for free. They also integrated their waste collection system for the immediate areas surrounding the centre with the activities that the wastepickers were doing at the centre. Collection schedules are now synchronized with a single drop off centre which is managed by the beneficiaries. The centre collects all kinds of waste, which is then segregated by the beneficiaries. The City of Harare now collects only 30 per cent of all waste that used to go towards Pomona landfill due to this arrangement. So, the Tafara recycling centre played a crucial role in diverting waste from going to the landfill.

The organization also took initiatives to bring behavioural changes in the local community in terms of waste segregation and handling. People in these communities are now in sync with the idea of not dumping waste in undesignated open spaces and keep their surroundings cleaner.

In the next phase of the initiative, they established a drop-off centre where residents from the nearby community can come and hand over the recyclables they gather within their households.

Integration of informal women wastepickers

A total of 67 informal women wastepickers have been integrated and organized into various groups through a programme called Beyond Women and Youth. They are part of the wider network of Zimbabwe Sunshine Group who are advocating for the integration of wastepickers in the solid waste management system.

Transformation in economic and social life of these women

Before collaborating as a group, these women earned a daily income of less than US $2 because they lacked bargaining power with the recyclers. Now they have a monthly income of over US $125 each, and this is increasing with all the other integrated activities. This additional income and financial independence have elevated their respect and status within the community.

The women are required to spend a minimum of two hours a day at the centre at least four days a week for a meaningful contribution. Ever since this group has been formed, there is an increase in the value of their product to the recyclers. Therefore, they are no longer

Wastepickers of the Tafara Sunshine Group

required to work as much as before. In terms of waste recovery activities, there is an average input time of four hours daily.

The women frequently affirm that they no longer struggle to pay their children's school fees or buy food. They credit their collective work for their increased income and the freedom it grants them to pursue other interests.

A member has introduced a better arrangement for the group by finding a pre-school. Women and others with young children can leave them here while they work. This arrangement allows them to increase their productivity and yield better results, compared to when they had to bring their children to unhealthy work environments.

Basic facilities within the workspace

The women wastepickers of Tafara Sunshine Group now have a designated space for segregating, sorting and storing the quantum of recyclables they collect. A new borehole was commissioned in order to provide water as the municipal utilities are not reliable. Not only the members of the recovery centre, but also other community members can now use the safe and clear drinking water from the tubewell installed here.

A solar system was installed, which allows them to have access to electricity throughout the day. The building was designed with a restroom and shower for the wastepickers to clean up after work before they leave for home.

They are now able to spend more time gathering the waste instead of walking to and from their houses to drop it off. Simultaneously, they can now participate in other social and economic activities that are done at the centre. This variation was made possible by funding sourced by ZSG from the Embassy of France in Harare and GEF-SGP.

Identity cards, cooperatives, safety gear, access to waste

These waste pickers are yet to receive their individual identity cards, but they are licensed under EMA CBOs, therefore the copy of CBO registration is their safety shell in case any unforeseen and unwanted situations come up.

They receive PPE kits yearly from Zimbabwe Sunshine Group and have received reflective vests identifying them as anti-litter monitors from EMA.

They have total access to the recyclables they collect and segregate, they sell the recyclables by themselves, sometimes with assistance on transport from ZSG.

Health benefits

These women are not yet part of any health benefit schemes but ZSG often takes care of the medical bills of these women when they fall sick, subject to availability of resources.

There is a pressing need to entitle them with some sort of health insurance, considering the hazardous nature of their job. By the end of 2024, most of them will be on-boarded on a legally registered health scheme. Until now, their poverty level was so acute that they did not even want to spend their earnings on their health.

Alternative livelihoods

As a parallel and alternative livelihood option, women in Tafara Sunshine Group are also sewing uniforms for the children of nearby schools on donated machines.

They also have a garden within the same land where they grow vegetables with the help of the compost they generate from biodegradable waste. They sell these vegetables to the nearby apartments who do not have a garden.

Women at Tafara Group have sewing as an alternative means of earning

WHAT HAS WORKED

The group has started building their own capacity in other initiatives such as sewing. They used the concept of "bring your old clothes and we'll sew a bag for you in exchange for 50 kg of recyclable material or equivalent of US $5.00". This has motivated the community more and eventually resulted in encouraging not just separation at source, but also discouraging illegal dumping.

Economy of the project

Total collection of the centre is 1.3 tonnes of mixed waste per day from households and 900 kg of separated recyclables from the waste pickers whom they have integrated. Depending on the household waste characteristics each week, the recyclables recovered from the drop offs amount to 450 kg.

The centre is currently operating at minimal expenditure costs averaging US $400 per month. It has made enough profits for the last 9 months for the women to divide it among themselves and have significant incomes.

If there were to be an effort to standardize all procedures and automate certain tasks in their daily operations, expenses would rise. Yet, the gains from their efforts would also increase.

Apart from the grant these women receive from Zimbabwe Sunshine Group and from the embassy of France in Harare, they also get some fund from Global Environment Facility Small Grants Program (GEF SGP) in Zimbabwe. The bare minimum operational cost is maintained through the profit they make through the sale of the recyclables. No refuse collection charges have been collected from the citizens. However, for bulk collection, some amount is being paid to them.

Future plan

The centre is currently receiving funding by UN Habitat to enable them to identify opportunities for scaling up. They are now focusing on strengthening internal competence

and expanding the programme for its sustainability. They are looking for a strong technical support base within the community. They have diverted their focus from mere waste management to adaptation, mitigation and sustainable entrepreneurship. Thus, Zimbabwe Sunshine Group has successfully embarked on the journey from waste to wealth for a sustainable and prosperous future for the generations to come.

LESSONS LEARNT

The Tafara Sunshine Project in Harare offers valuable lessons and insights for addressing waste management challenges and fostering community engagement in a sustainable manner. The integration challenges stemmed from a mistrust by the waste pickers that the model wouldn't work. This delayed progress in the first six months of implementation and the numbers expected were not rising in the timelines projected. However, the waste pickers who were the first to be on-boarded proved to work hard and with guidance, were able to double their earnings before the end of the year.

Community engagement and empowerment: The project demonstrated the importance of engaging and empowering vulnerable groups of the community, especially the women and youth in addressing waste management challenges. Involving and integrating them in the waste management services and making them a part of the decision-making processes have led to increased ownership and success.
Partnerships and collaboration: The project has successfully partnered and collaborated with the city council to be able to receive land required for establishing the recycling centre. Besides this, building partnerships with development agencies, embassies and donors has provided support and visibility to the project.
Diversification of livelihood: The success of the project is not merely limited to waste management, it also involved diversification of livelihoods of the community members, especially women and youth. This helped in enhancing their earnings. Initiatives such as sewing uniforms or cultivating kitchen gardens have two-fold benefits—increased income and attaining sustainability.
Integration of informal sector: Recognizing and integrating informal wastepickers into the waste management system is important to provide them dignity of work and safety in their working environment.
Adherence to Sustainable Development Goals: Aligning the project's goal with national and international frameworks such as SDGs and National Development Policy provided a strategic direction to the project.
Environmental awareness and education: The project emphasizes the importance of environmental awareness and education within the community.
Technical and financial support: The Zimbabwe Sunshine Group's support in terms of funding, capacity building and visibility have contributed to the project's growth.
Adaptation and sustainability: The project's shift from waste management to adaptation, mitigation and sustainable entrepreneurship reflects a paradigm shift from piecemeal development to a holistic sustainable approach focusing on internal competence, which ensures that the project can thrive and evolve over time.

REPLICABILITY

It is extremely important that in due course the wastepickers must establish their own association dedicated to advocating for fair treatment. Additionally, there is a necessity to replicate the model to accommodate other cities in and around Zimbabwe. Although the model initially took three years to develop, as it was a pilot project, but now that the results

have been attained and the process understood, others could achieve similar outcomes in considerably less time.

The replicability of this project hinges on the careful consideration of the local contexts, community dynamics and the availability of support from government institutions and external partners.

Key factors such as adaptability, inclusivity and a commitment towards long-term sustainability are essential for successful implementation of similar initiatives in other communities facing waste management challenges. The transformation from waste to wealth in Tafara Sunshine Group is a testament to commitment beyond immediate environmental improvements and contributing towards the broader goals of environmental conservation and social development.

BUDIRIRO MATERIAL RECOVERY CENTRE: COMMUNITY-DRIVEN WASTE MANAGEMENT

THE TRANSFORMATION

In 2019, recognizing the pressing need to address Harare's waste management challenges, a Material Recovery Centre (MRC) emerged as a beacon of change in Budiriro. This pioneering initiative was born from a collaborative effort involving the Environmental Management Agency (EMA), Zimbabwe Sunshine Group (ZSG), Econet, the City of Harare, and the local residents' association. Prompted by a cholera outbreak, the MRC was established as a pilot project with funding from Econet.

Since its inception, the MRC has made significant strides, recovering 340 tonnes of dry waste, subsequently generating a commendable US $37,000 through the sale of recyclables. The City of Harare has played a crucial role by providing the land for the MRC free of charge, demonstrating its commitment to supporting community-driven initiatives. However, the project encountered initial challenges, primarily stemming from the large size of the group involved, leading to conflicts and decreased productivity. Through mediation efforts led by EMA and partners like ZSG, the project underwent restructuring, resulting

Budiriro Material Recovery Centre

Recyclables brought to the facility for sorting and further processing

Recyclables brought to the centre are sorted into different types for ease of recycling

in a smaller, more cohesive group capable of sustaining its activities effectively.

Looking ahead, the group aims to secure grants to further enhance operations and transition towards a more commercially viable model. The significance of small community groups in driving behavioural change cannot be overstated, highlighting the importance of comprehensive support for such initiatives.

HOW THE SYSTEM WORKS

The MRC boasts a capacity to process 3 tonnes of waste per day, serving as a vital hub for waste management in the region. Currently, it receives an average of 0.4 TPD from 100 households and three commercial establishments in Budiriro, Wilowvale and Glenview. Nine dedicated workers operate the facility, ensuring its smooth functioning.

Waste undergoes meticulous separation before reaching the MRC, where project beneficiaries undertake tasks such as packing and label removal. Notably, the recovery rates are impressive, with approximately 10 per cent metal, 50 per cent clear PET and HDPE, and 40 per cent paper reclaimed from collected waste. Any discarded labels and rejects are carefully stored and eventually disposed of at the Pomona dumpsite.

Staff at MRC during a training session

WHAT HAS WORKED

- Successful restructuring of the group, mediation of conflicts, and sustained support from stakeholders were crucial for the project's success.
- Innovative approaches such as utilizing donated trucks, leveraging community-based transportation methods, and providing employment and training for project beneficiaries contributed to the project's effectiveness.
- The project's success can be attributed to its grassroots nature, with community members actively involved in decision-making and implementation.
- Flexibility in response to challenges allowed the project to evolve and overcome obstacles, demonstrating resilience in the face of adversity.
- By generating revenue through the sale of recyclables and seeking grants for further expansion, the MRC has laid the groundwork for long-term viability and growth.

LESSONS LEARNT

- **Importance of mediation:** Addressing internal conflicts early on and fostering a supportive environment are critical for project success.
- **Continuous engagement:** Sustainable change requires ongoing education and engagement efforts to maintain momentum and foster behavioural change.
- **Collaborative governance:** Effective partnerships between government, private sector and civil society are essential for addressing complex challenges like waste management in urban areas.

Challenges and opportunities

The Budiriro MRC finds itself at a critical juncture where revenue generation has become severely impeded due to ongoing challenges. Foremost among these hurdles is transportation, coupled with financial constraints, exacerbated by the necessity to purchase recyclables from the community. Additionally, to enhance product value and efficiency, essential machinery such as granulators and pelletizers are urgently required. While at one time it used to have a workforce of 200 community members, the MRC now operates with only nine.

REPLICABILITY

The Budiriro MRC serves as a model for community-driven waste management initiatives, demonstrating the potential for similar initiatives in other urban centres facing comparable challenges. While the MRC model holds promise for replication, it requires continued refinement and resource allocation to realize its full potential. By fostering community engagement and learning from past engagement errors, the model can serve as a blueprint for transformative waste management initiatives, inspiring positive change on a broader scale. Similar projects can be implemented to transform waste management systems and promote environmental sustainability by leveraging local resources, engaging stakeholders, and fostering innovation.

This compendium features diverse and inspiring examples of municipal solid waste management from across 11 African countries. From grassroots initiatives to large-scale infrastructure projects, these diverse range of approaches and practices offer insights into the unique challenges facing African cities and towns. Each success story provides both specific and general lessons, demonstrating the resilience and ingenuity of African communities and contributing to a deeper understanding of successful waste management strategies across the continent. This resource offers insights for policymakers, practitioners, and researchers, paving the way for a more sustainable and equitable future for Africa.

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