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Development of a waste stream-specific roadmap for the circular economy Zambia

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Sub report Output 2
Baseline assessment and analysis of existing circular economy initiatives and key players in Zambia

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This research evaluates the status quo of Zambia's waste sector from the circular economy perspective as part of the larger CTCN Technical Assistance study on circular economy in waste management in Zambia. The ultimate output of this project is a pilot concept for a specific waste project and a roadmap towards a more sustainable and circular waste system for one specific waste stream. It will contribute to tackling identified waste management subsector challenges.

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Executive Summary

Waste is collected in Zambia by the local government or several private organizations. Almost every municipality, town, and city council's planning department is the focal point for waste management services. The planning department's public health management sector is responsible for waste collection, transportation, and disposal. Furthermore, all collected waste is carried out without segregation in all Local Government Authorities (LGAs). At least half of the LGA's waste is collected on their behalf by private companies. Cities have simplified this process by establishing zones where each private player is allotted a zone and charges the residents a fee.

In addition, local governments confront considerable obstacles in collecting waste, such as a lack of funding and infrastructure. As a result, several private firms or Community Based Enterprises collect the vast majority of waste (in high-density areas). The majority of the waste collected is dumped in open dumpsites under the jurisdiction of local authorities—informal waste pickers who operate in these dumps and landfills sort and collect various valuables. Lusaka is home to the country's only constructed landfill. A considerable volume of waste is not adequately treated or managed, putting people's health in danger while degrading the environment and depleting resources. Apart from modest organic waste separation for residential composting and a low degree of plastic separation (primarily by private players directly from higher-income households), adequate separation at the source is nearly non-existent. Different types of waste get polluted due to a lack of waste stream separation, decreasing the possibility of downstream recycling. According to local authority estimates, waste generation (waste collected by the local authorities) ranges from 100 to 10,000 tonnes per month, with an average of 0.6 kilograms of waste per person each day.

When it comes to waste generation, organic waste makes up the majority of residential waste, accounting for 51% on average. Plastic is the second most common waste source, accounting for around 14% of all waste. Paper, metal, and glass make up 6%, 9%, and 4% of total home waste in Zambia, respectively. Although being the biggest waste stream, organic waste has essentially no market. It is not commonly collected due to the nature of the waste (smelly, moist). Plastics have an established market when compared to other waste sources. Plastics may be made into various items, and their use has become widespread. Nonetheless, in Zambia, most plastic items are still created from virgin resources. Metal recycling is mostly focused on steel recycling and artisanal usage on a small scale. There isn't any large-scale structural recycling accessible. Currently, the major circular activities on glass focus on deposits on glass bottles for re-use. This is also standard practice in other nations. There are numerous ways to recycle paper, the most common of which is cardboard; however, these are not explored wide and are generally pursued by local firms.

In Zambia, a large amount of waste is not handled or managed sustainably, putting people's health at risk and causing environmental degradation and resource depletion. Apart from some organic waste separation for domestic composting and a low level of plastic separation (mainly organized directly from higher-income households by private players), proper separation at the source is almost non-existent. Because of the lack of separation of different waste streams, different types of waste become contaminated, reducing the potential for downstream recycling. Estimates from the local authorities show that waste generation (waste collected) is between 100 tonnes to 10,000 tonnes per month, with an estimation of 0.6 kg of waste per person each day.

The collection and transportation of waste are handled by council vehicles in rural LGAs. Open dumping sites are used by 93 percent of local authorities. The only LGA having an engineered landfill is Lusaka, while the others have open dumpsites. The main reason for not establishing a landfill for waste disposal is a lack of resources (budgetary and land). In Lusaka, the public sector collects less than 10% of the

waste, while the private sector collects almost 60% of the waste generated. Most private organizations (franchise contractors) work under a formal franchise agreement with municipal governments to collect waste. This is mainly due to the local authorities' severe lack of capacity to provide consistent waste services. The study shows that Luska City Council collects 14% of the waste generated in the city while CBEs and private sector players collect 41% and 43%, respectively. The collection frequency in Zambia greatly differs per area. Of all respondents surveyed, 49% indicated that waste is collected weekly. However, respondents from middle and high-income areas stated that they received waste collection services from private waste collection companies. On the other hand, almost 33% indicated that waste is never collected. In terms of preference, most respondents indicated that they would prefer a collection frequency of once in two days (almost 44%), while 40.5% would be satisfied with once a week.

Based on the household survey of the respondents, 26.5% indicate that their waste is collected by private players, while 18.6% of the respondents indicated that the public sector collects their waste. 20.9% reported that they transport their waste to a disposal site (however, this probably also includes informal dumps that are not official) with their transport, and 18.6% indicated that there is no collection at all and that they dispose of their waste at informal dumpsites. Only 33% of respondents were willing to pay more for waste collection services, while 51% were not. 9% of respondents neither agreed nor disagreed with the proposed increase in the service rate. According to the total calculations, 58 percent of respondents were unwilling to pay more, while 33 percent were willing to pay more. It was observed that a willingness to pay more might be related to a low level of satisfaction.

Waste recycling in Zambia is not very common. Apart from some organic waste separation for domestic composting and a low level of plastic separation (mainly organized directly from higher-income households by private players), proper separation at the source is almost non-existent. Because of the lack of separation of different waste streams, different types of waste become contaminated, reducing the potential for downstream recycling. Furthermore, local governments face significant challenges in collecting waste, such as a lack of budget and infrastructure. Local authorities collect 59% of waste. A few big players are involved in recycling various waste streams; however, these are mostly foreign-owned companies. Small-scale home industries are also active in the manufacturing of products from waste.

Zambia’s Constitution recognizes the right to a clean and healthy environment and environmental rights. The constitution promotes long-term economic and social development. It envisioned the constitution creating the opportunity for businesses aligned to supporting the establishment of a clean and healthy environment in supporting the citizens to enjoy their rights. In terms of the underlying policy framework, the issue is not so much a lack of policies but more the practical implementation. Although an EPR scheme is in place, it is not fully enforced. This is primarily due to a lack of adequate funds for establishing a sound waste system and a lack of integration among governmental institutes on integral solid waste management.

There is considerable potential for scaling and expanding circular activities among Zambia's value chains. Understandably, the current policy framework is not as dedicated to circularity as possible, as many of the policies have been drafted from health and, to some extent, environmental issues. Reconsidering policy and finance frameworks by the government plays a critical role in alleviating the current waste management issues and establishing sound waste management systems. The research findings reveal that Local Government Authorities (LGAs) are aware of the circular economy, with 80% developing waste management strategies. 42% of the local authorities observe that their waste management strategies have mainstreamed the circular economy principles. According to the findings, the majority of the LGA collect waste at least once a week.

The average collection frequency by the local authorities is 5.1 per month. Despite the overall low level of circularity in the formal economy of Zambia, it is interesting that 'circular behavior' is implicit in low-income areas (rural areas, densely populated areas): goods are used intensively and are not easily discarded. Recognizing and appreciating such behavior is important when discussing circular ambitions.

List of Acronyms

CBOs	Community-Based Organisations
COPWASTE	Copperbelt Waste Management Co. Ltd
CTCN	Climate Technology Centre and Network
EPR	Extended Producer Responsibility
EU	European Union
E-Waste	Electronic Waste
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HDPE	High Density Poly Ethylene
KEPSA	Kenya Private Sector Alliance
LCC	Lusaka City Council
LCC	Livingstone City Council
LDPE	Low-density polyethylene
LGA	Local Government Authorities
MGRE	Ministry of Green Economy and Environment
MLGRD	Ministry of Local Government and Rural Development
MOGEE	Ministry of Green Economy and Environment
MOU	Memorandum of Understanding
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MTP	Medium Term plan
NDCs	Nationally Determined Contributions
NDE	Nationally Designated Entity
NGO	Non-Governmental Organisation
PET	Polyethylene Terephthalate
PP	Polypropylene
SDGs	Sustainable Development Goals
SIB-K	Sustainable Inclusive Business
SNV	Netherlands Development Organisation
SWM	Sustainable Waste Management
SWMU	Solid Waste Management Utility
TA	Technical Assistance
TNO	Netherlands Organisation for Applied Scientific Research
UNDP	United Nations Development Programme
VNR	Voluntary National Review
WASH	Water Sanitation and Hygiene
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Corporation

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1 Introduction

1.1 Background and Context

Zambia is a landlocked country in Southern Africa with a current population of 18 million[1]. The country's population growth rate stood at 2.8% between 1980 and 2010. The rapid increase in population has resulted in urbanization, increasing demand for natural systems, and a strain on the existing water and waste management infrastructure. Lusaka City Council (LCC) reported in 2017 that around one million tonnes of garbage is generated in Lusaka each year, with just around half of the waste being brought to the landfill[2]. Research conducted by UN-Habitat in 2010 indicated that Zambia generates about 0.52 kg[3] of waste per person each day, so about 9.776 tonnes (for a population of 18.8 million). Although this can appear moderate compared to the 1.2 kg per person generated in developed countries, most waste in developing countries is poorly managed due to inadequate infrastructure and insufficient waste management budgets. Just about 3% of that material is reused or recycled, causing environmental degradation, rising GHG emissions, severe health problems, and loss of resources that could otherwise be valorized. As the economy is expected to develop, this increases the population falling into the middle-income group, growing consumption patterns, leading to an even faster increase in waste generation, exposing Zambia to even more solid waste challenges.

As one of Africa's fastest-growing economies, with a growing middle class and shifting consumption and production patterns, waste generation will increase in the coming years, exposing Zambia to increased environmental degradation, rising GHG emissions, and health concerns. Zambia has a linear economy, largely based on its natural resources, including significant copper mining and processing, building, agriculture, and textiles. As a result, the country has specialized in economic activities based on the extraction and partial processing of these resources, resulting in significant environmental impacts. There is still much less attention to industrial activities that generate added value through reuse and recycling. Yet, a circular economy could provide ample economic opportunity for the country, decreasing its dependency on imports of non-domestic resources, circulating them within its economy.

In addition to the circular economy framework, including a specialized gender perspective is crucial for sustainable development, as gender equality is critical for SDG 5 on gender equality and SDG 12 on responsible consumption and production. The transition from a linear to a circular economy must be inclusive and collaborative in every way, encompassing both men and women. Taking a gender-inclusive approach to the transition to a circular economy creates new opportunities. In addition, the behavior of a community facilitates the shift with the adoption of appropriate best practices in the disposal of waste. To support this transition, Zambia filed a request with CTCN for a Technical Assistance (TA) project on a circular waste system to tackle the challenges of waste and loss of resources and take dedicated steps towards a more circular economy. The ultimate goal of the TA project was to develop a waste stream-specific national roadmap for a more circular management system, including the conceptualization of a pilot project.

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1 ZAMBIA (2010) CENSUS OF POPULATION AND HOUSING NATIONAL ANALYTICAL REPORT: Published by Central Statistical Office

2 As of 2017, Lusaka City Council (LCC) indicates that the city of Lusaka generates approximately a million tons of waste annually and only about half of that is collected

3 UN-Habitat (United Nations Human Settlements Programme) 2010. Solid Waste management in the Worlds Cities: Water and Sanitation in the Worlds Cities. Earthscan Limited press, London

1.2 The objective of the study

The project focused on developing a national waste stream roadmap, including creating a pilot project for a more circular waste management system. The project has specific objectives, and these include:

1. Assessment of the status quo of waste management practices for the six waste streams (plastics, metals, glass, paper, household waste, agricultural waste), identifying and developing an up-to-date guide to key stakeholders, existing public and private sector initiatives as well as policies and insights in waste generation and processing.
2. Identify potential opportunities and barriers to shifting to a more circular waste management system executed for each waste stream.
3. Selection of a prioritized waste stream showing the highest potential for transition to a more circular management system based on the comparative analysis of objective two and a dedicated assessment matrix.
4. The development of a detailed strategic national roadmap for the selected waste stream serving as a management tool for the implementation phase, aimed at creating new businesses, innovation, and technology transfer, and this roadmap includes short, medium, and long-term recommendations for, among others, appropriate technologies, legal reforms, policies and regulations, and market engagement.
5. The conceptualization of a pilot project will include potential benefits in economic, social, institutional, and environmental terms.

1.3 Scope of the study

The assignment centered on the waste sector, focusing on the following waste streams: domestic inorganic waste (plastics, metals, glass, and paper) and organic waste (Household waste, (small scale) agricultural waste). The analysis prioritized the waste streams listed above, created a roadmap with recommendations and pathways for improving the waste system for the chosen stream, and identified a potential pilot project within the prioritized waste stream. The following waste streams were excluded from this study: hazardous waste, industrial waste, liquid waste (wastewater), and e-waste.

1.4 The circular economy framework

This study aims to analyze the possibility of circular economy routes for Zambia's waste system. The Technical Assistance Report employs the following definition of the circular economy:

A circular economy is an economic system of closed loops in which raw materials, components, and products lose their value as little as possible, renewable energy sources are used, and systems thinking is at the core.[4]

The research adopted the Ellen MacArthur Foundation paradigm, which explains the various pathways within a circular economy from the perspective of organic materials and resources (left side of the butterfly) and non-organic, technological materials and resources (right side of the butterfly) (right side of the butterfly). As shown in figure 1, the various arrows present the pathways or activities that can be deployed to retain value or recover value from products or materials after their economic lifetime[5].

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[4] Circular economy: a definition and most important aspects (hetgroenebrein.nl)

[5] Wn https://www.ellenmacarthurfoundation.org/circular-economy/concept

The circular economy is thus much broader than waste management alone, targeting the reuse or repurposing of products before they become waste. This project is explicitly focused on *waste* streams and recovering or retaining as much value from these streams as possible, following the circular economy principles.

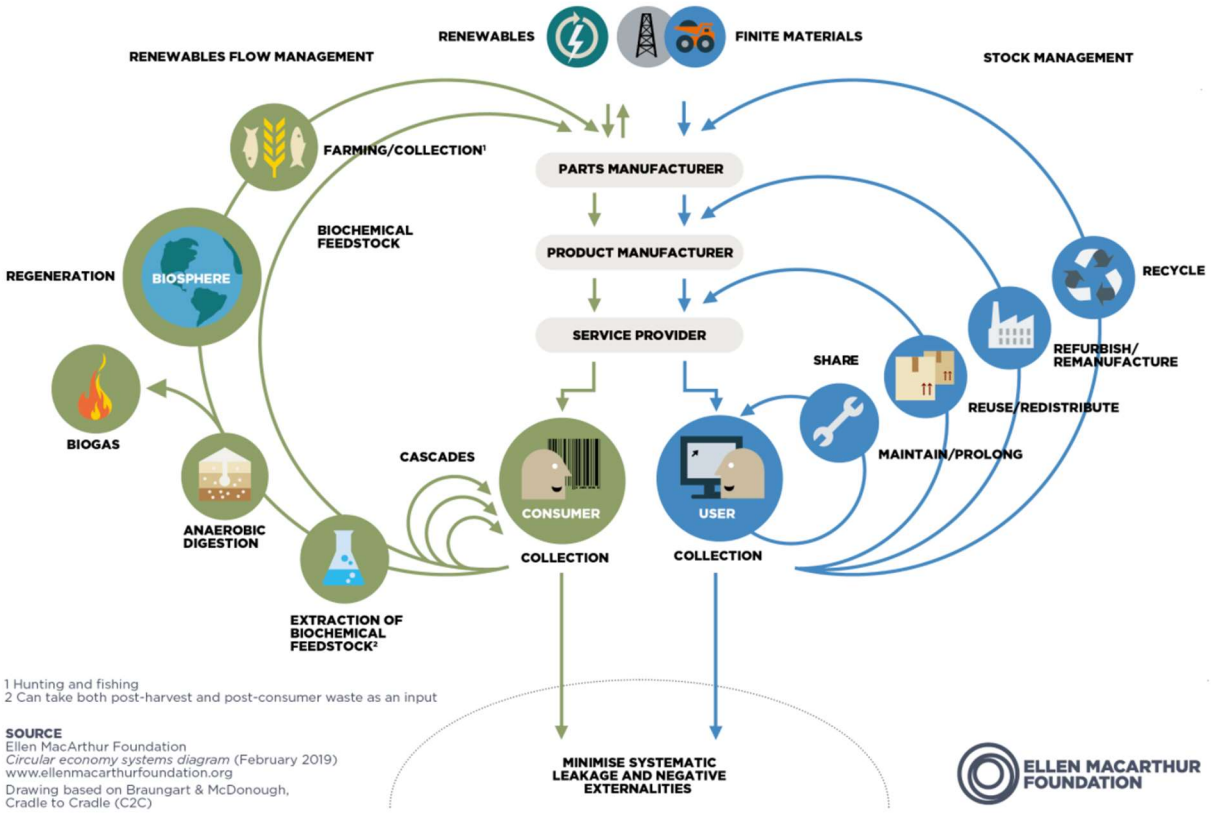

Figure 1 The Circular Economy Butterfly Diagram, Ellen Mac Arthur Foundation

1.5 Demographic and economic context of Zambia

Zambia is a sparsely populated and resource-rich land in the centre of Southern Africa. It shares its border with eight countries (Angola, Botswana, Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania, and Zimbabwe) that serve as an expanded market for its goods. Around 32% of Zambia's land is used for agriculture[6]. Major crops include maize, sorghum, and rice. The production of "traditional" food crops, mainly those less reliant on heavy rainfall, is an approach that has been heavily promoted to " achieve sustainable food production and enhance agricultural productivity"[7]. Hydropower accounts for most of Zambia's total installed electricity production (94 percent or 2,268 MW). Zambia Electricity Supply Corporation (ZESCO), the country's major power supplier, generates 99 percent of its electricity from hydropower. These outstanding figures point to an energy consumption system that is not overly reliant on CO_2 emissions. Diesel is the second-largest source, accounting for around 4% (92 MW) of the national energy supply. Solar and heavy fuel oil contribute 50 MW and 0.06 MW[8] , respectively. The government is constructing 11 new energy generation projects to increase.

6 The World Factbook, 2016
7 United Nations Department of Economic and Social Affairs (2016). Agriculture in Zambia. Retrieved from: http://www.un.org/esa/dsd/dsd_aofw_ni/ni_pdfs/NationalReports/zambia/Agric.pdf.
8 Energy Regulation Board (2016). Energy Sector Report. Retrieved from: https://www.erb.org.zm/downloads/esr2016.pdf

Most of these are hydropower plants, but two thermal plants (diesel-powered). This high population expansion can exacerbate poverty and burden the country's infrastructure, notably its ability to offer social services like waste management[9]. The literacy rate in Zambia is almost 87%. Zambia is experiencing a large demographic shift and is one of the world's youngest countries by median age (which is 17.6 years, making Zambia the country with the 5th most youthful population in the world), with 46% of the population below 14 years of age and 66% of the population below 24 years of age. Currently, Zambia's population stands at more than 18,870,000 people, according to the latest data from the Zambia National Bureau of Statistics. This equates to 0.24 percent of the global population, making it the 65th most populous country. Zambia is the world's eighth fastest-growing country, with 24.1 million people expected by mid-2030 and 41 million by mid-2050.

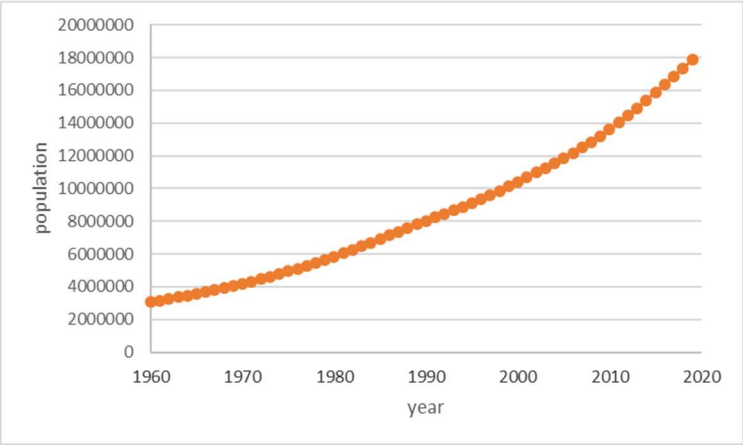

Figure 2 Population development of Zambia[10] (source: World bank)

Currently, the country's density stands at 25 per Km^2 (64 people per mi2). The total land area is 743,390 km^2 (287,024 sq. miles). Around 45% of the population lives in urban areas (8,336,381 people in 2020). This number is expected to rise as the population grows, and mainly, many young people move towards cities to acquire jobs, putting even more pressure on the demand for social services.

Zambia's economy has significant copper mining and processing, building, agriculture, and textiles due to its natural resources. Agriculture generated around 2% of Zambia's GDP in 2019, the industry contributed about 42%, and the services sector contributed about 50%[11]. Despite large growth in the manufacturing sector and other industries, much of the population, particularly in rural areas, are underemployed and dependent upon subsistence agriculture[12].

In 2020, Zambia's had a GDP of USD 18.53 billion[13]. Between 2000 and 2014, the annual GDP growth rate averaged 6.8%. The GDP growth rate slowed to 3.1% per annum between 2015 and 2019, mainly attributed to falling copper prices and declines in agricultural output and hydroelectric power generation due to insufficient rains and insufficient policy adjustment to control these exogenous shocks.

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9 Population Reference Bureau (2016). World Population Data Sheet. Retrieved from: http://www.prb.org/pdf16/prb-wpds2016-web-2016.pdf; and United Nations (2007a). UN Habitat, Lusaka Urban Profile. Retrieved from: http://unhabitat.org/

10 https://www.worldbank.org/en/country/zambia/overview

11 https://www.statista.com/statistics/457737/share-of-economic-sectors-in-the-gdp-in-zambia/

12 United Nations Development Programme (2016). Zambia Human Development Report 2016: Industrialisation and Human Development–Poverty Reduction Through Wealth and Employment Creation. UNDP Publishing. Retrieved from: http://www.zm.undp.org/content/dam/zambia/docs/hdr%20reports/ZHDR%202016.pdf

13 Zambia GDP, 1980-2020 - knoema.com

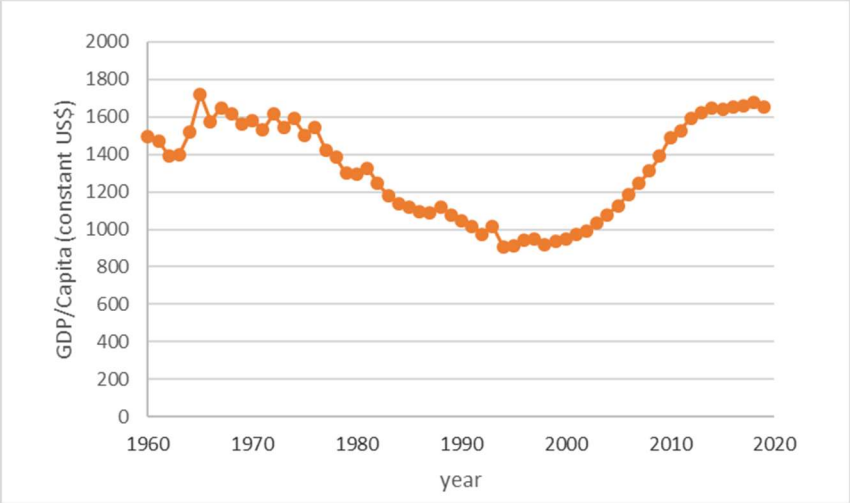

Figure 3 Development of GDP (in constant US$) for Zambia[14]

The COVID-19 (coronavirus) pandemic pushed an already-declining economy into recession owing to recurring droughts, decreasing copper prices, and unsustainable fiscal policies. In the third quarter of 2020, economic activity declined by 1.7 percent, as declines in industry and services outweighed improvements in agriculture. Mining and services were affected in early 2021 by lower global demand and social distancing measures, respectively. However, a relaxation of the lockdown measures in the second part of 2021 and a global surge in copper prices supported the revival of activity. Zambia's GDP is expected to have declined by 1.2 percent in 2020, marking the country's first recession since 1998. Throughout 2020, inflation stayed in double digits, averaging 15.7 percent, and peaked at 22.2 percent in February 2021. Moreover, Zambia is challenged by severe debt issues further exaggerated by the covid crisis, causing Zambia's public and publicly guaranteed debt to reach 91.6% of GDP in 2019 and 104% in 2020[15].

Zambia's capital is the city of Lusaka. The urban population is about 2.5 million people, while the total population covering the whole metropolitan area is 3.3 million. Lusaka is Zambia's capital and the only city with over 1 million people. Within Lusaka Province, there are eight districts, one of them being Lusaka District, which comprises the city of Lusaka. Lusaka district, Lusaka City Council (LCC), and the central government manage social and public affairs. The District Administration supervises, coordinates, and monitors the operations of Government Departments, parastatals, and co-operating NGOs and collaborates with the Local Authorities, which includes the formulation and implementation of development projects and programmes in developing the district.

It is estimated that at least 13% of Zambia's population lives in the urban centre of Lusaka District. The high-density residential areas are located on the city's outskirts, while the low-density residential areas are located in areas where most of the urban facilities are situated. Lusaka District hosts about 80 residential and industrial built-up areas. Residential areas and smallholding developments account for 30% of the total district, while 10% of the total area is used for cultivation and plantation. Because Lusaka concentrates on infrastructural amenities and job prospects, individuals from other districts have moved to the Lusaka District. The surge of people into Lusaka and other surrounding urban areas such as Kafue has put a strain on the already inadequate infrastructure, including a lack of acceptable housing and other essential facilities. As a result of the circumstances, unplanned and illegal settlements have sprouted, degrading the District's environment. Currently, there are around ten unplanned settlements in the Lusaka District. Lusaka has diverse ethnic or tribal groupings with

[14] https://www.worldbank.org/en/country/zambia/overview#3
[15] Zambia Economic Outlook | African Development Bank - Building today, a better Africa tomorrow (afdb.org)

corresponding Bantu languages. The most predominant spoken language of communication in the district province is Chewa and Nyanja[16]. Kitwe is the second-most populated city in Malawi, with 517,543 inhabitants, and the third-largest city in infrastructure development. With 475,194 residents, Ndola is Zambia's third-most populated city[17].

1.6 Introduction to this sub-report

This report offers a baseline evaluation of Zambia's waste system, concentrating on the six waste streams mentioned in the scope. This report provides information on the volumes and types of waste created, the collection, separation, and processing process, and a qualitative description of the waste system's active participants and who performs what. These findings are detailed in Chapter 3. In Chapter 4, we'll zoom out and take a helicopter perspective to see what the value chains look like for each waste stream and who the important stakeholders are in each of those value chains. The current policy and regulatory environment are discussed in this study (Chapter 5). Chapter 6 reviews previous and continuing programs connected to the circular economy and waste management. The findings of this report serve as the foundation for the rest of the Technical Assistance, offering a complete assessment of the gaps and possibilities in the present waste system. These conclusions are detailed in Chapter 7.

[16] Road Development Agency Environmental and Social Management Unit, *Environmental Project Brief for LusakaChirundu Road*, 2009. https://documents1.worldbank.org/curated/ar/988061468170064202/pdf/E21740v20P106510EIA0Lusaka0Chirundu.pdf

[17] Population of Cities in Zambia (2021) (worldpopulationreview.com)

2 Baseline assessment of the waste system in Zambia

2.1 Methodology

The waste sector's circularity was analyzed by identifying and analyzing significant efforts, policies, strategies, and players associated with circular economy principles such as reuse, recycling, and resource recovery. The research focused on non-industrial agriculture and domestic solid waste as described in the scope.

2.2 Research Methodology

The study used a cross-sectional design with qualitative and quantitative methods. Samples were collected at the household level. Desk reviews, key informant interviews, and questionnaires issued to local governments, government agencies, waste management businesses, business groups, and agricultural societies were used to collect primary and secondary data. The study also sought to validate household waste generation and waste characterization.

2.3 Sampling

Purposive sampling was utilized to identify important informants from national government and agencies, local governments, waste companies/enterprises, civil society groups, and academia. The stakeholders engaged in this project were drawn from the predetermined categories defined in the project plan. Furthermore, a list given by the Nationally Designated Entity (NDE) was utilized to identify additional significant players in Zambia's waste system. The stakeholders were chosen using an influence-interest analysis. Secondary data was collected through desk research primary data through key informant interviews, household, and focus group discussions.

- **Key Informants -** The stakeholders involved in this project were based on the predefined categories of stakeholders defined in the project plan. This included national government & agencies, local authorities, companies/ enterprises in the waste sector, civil society organizations, and academia. In addition to this list, desktop research and a list shared by the NDE were used to identify other key stakeholders in the waste system in Zambia. These stakeholders were either interviewed or surveyed.

- **Households**- This study looked at three Zambia cities: Lusaka, Kitwe, and Livingstone. Households were put into three clusters (High Income, Medium Income, and Low Income). A sample of household questionnaires was administered randomly in each selected cluster. 90 waste samples were collected and characterized from randomly selected households in the respective three clusters. Data on waste in rural areas were collected through telephone interviews of a sample of households.

- **Focus group discussion** – Focus group discussions were held with different organizations to determine the issues with gender relating to waste management and circularity in Zambia. In addition, the sessions aimed to assess the policy space.

The three cities were chosen with major economic activity, representing different types of activity (Kitwe – mining, Livingstone – tourism, Lusaka – capital city). The residential areas were chosen to reflect one low, one middle, and one high per city. The residential area selection was partially based on the access the enumerators had to the area to conduct the study, given the COVID-19 lockdown restrictions:

Table 1 Study areas for the waste characterization study

City	Residential areas	Economic status
Lusaka	Chainda	Low income
	Chelstone	Middle income
	Avondale	High income
Kitwe	Chimwemwe	Low income
	Miseshi Mindolo	Middle income
	Parklands	High income
Livingstone	Linda	Low income
	Police Camp	Middle income
	Highlands	Low income

Table 2 presents an overview of the stakeholder surveys (Appendix A2 provides a more detailed overview of stakeholders).

Table 2 Stakeholder questionnaires and interviews

STAKEHOLDERS	Tools used	Number
	Local Authorities	
Town/Municipal/City Councils	*Questionnaires*	15
	Subtotal Local Authorities	
Government Departments/ Institutions	Interviews/Questionnaires	2
NGOs	Interviews/Questionnaires	4
Academia	Questionnaires	1
Companies	Interviews/Questionnaires	19
Household Waste Samples collected and characterized (* Used Data Collectors)	Sampling kits	90
Household questionnaires administered (*Used data collectors)	Questionnaires	273
	Gender focus panel group	
Lusaka City Council	Discussions	9
Plastic manufacturing company	Discussions	1
Waste collection company	Discussions	1
Government Agency	Discussions	1
Development Partner	Discussions	1
	TOTAL	**417**

As shown in Table 2, waste generation and management data come from local authorities, the waste characterization study, national government, companies, or literature review. However, a lower response rate was observed than expected from stakeholders (the assumption being that the study overlapped with the electioneering period). Nonetheless, additional data was obtained through the review of literature.

2.4 Data collection

Interviews and surveys were conducted both online and in person. Each city's households (Lusaka, Livingstone, and Kitwe) were divided into high-income, middle-income, and low-income groups. Data

was gathered from a random sample of households. In addition, to verify the secondary waste generation and composition data obtained, a convenience cluster and random sampling were utilized to survey a sample of households. Data on waste generation and composition were obtained from houses in the selected clusters at random. Gender-related themes were incorporated into the household questionnaire.

Data was collected during COVID, when movement was restricted, which may have influenced the data acquired. Several factors, including consumption patterns and regular stays at home, have potentially influenced the findings. Nonetheless, the numbers were not expected to change significantly. Great effort was made to guarantee that the data was accurate. The purpose of the study was to address a research gap: the time gap. As a result, while evaluating changes in waste generation, population change is a factor to consider.

2.5 Characterization of waste

The characterization of household waste was carried out, and it comprised two parts: household surveys and waste categorization. The surveys were carried out to assess waste storage and handling at the source, validate current solid waste management expertise and evaluate (the quality) of waste management services. The number of residents in each participating residence had to be calculated to assess the rate of waste generation. At the home level, 273 surveys were distributed. The locations of the samples were Lusaka, Kitwe, and Livingstone.

Data was obtained from local authorities such as Lusaka City Council and Livingstone City Council in order to estimate Zambia's waste generation. To validate secondary waste production and composition data received from key stakeholders, sample households were polled. The households in Lusaka, Kitwe, and Livingstone were sampled. Households were divided into three groups (High Income, Medium Income, and Low Income). In each cluster, a random sample of home surveys was distributed. A total of 90 waste samples from randomly selected houses in each of the three clusters were collected and categorized. Before sorting, the sample was weighed and recorded. After that, the sample was divided into organic, paper, plastic, glass, metal, textiles, and other categories. Waste fractions were separated into containers and weighed separately on hanging scales (which could weigh up to 25 kg and were accurate to 0.1 kg). The weight of each fraction was then recorded, and the data collectors made certain that the scales were always set to zero before weighing the fractions.

3 Discussion of Findings

This chapter provides a general background to the waste management system in Zambia, based on literature and substantiated with results from the interviews and questionnaires. The subsequent sections will present the results of the waste characterization study.

3.1 Background to waste management in Zambia

The Government of Zambia, like many other developing countries confronted with massive Municipal Solid Waste (MSW) challenges in urban areas, acknowledges that its urban local authorities (cities, municipalities, town councils, district councils, and local boards) face significant challenges in managing MSW, which are exacerbated by rapid population growth. The majority of Zambia's local governments are unable to keep up with the growing amounts of waste created by the general populace.

Municipal solid waste management (MSWM) is a severe challenge facing urban environments in Zambia. Taking the Lusaka situation as a reference point, less than 14 %[18] of the waste generated in the urban centres finds its way to the disposal sites. Next to being unsightly, these practices foster a breeding ground for disease-carrying vectors, pollute the atmosphere, land, and water, and generate greenhouse gases that contribute to global warming. MSW concerns in Lusaka manifest in surface and groundwater contamination due to MSW dumping in rivers and untreated leachate from dumpsites. However, the problems are not confined to Lusaka since disposal sites are either absent or poorly maintained in all districts and towns. Zambia presently has just one engineered waste landfill site in Lusaka, which has significantly deteriorated. Only a small portion of the waste created in metropolitan areas makes its way to official disposal facilities, and if it does, it is primarily through private waste management processes. The storage capacity of the designed MSW dumpsite is estimated to be reached in the next five to ten years. This necessitates the need to rethink future solid waste management alternatives and the operational models for the facilities.

As in many other nations, local governments are in charge of waste management in Zambia. Out of the 15 local authorities sampled by the study, the average collection rate stands at 59%. A case example of Lusaka, the council's coverage area comprises 7 constituencies and 38 wards where they collect waste at public spaces (Market, intercity bus terminus, and the CDB). Franchise companies collect waste in the city on behalf of the council, and the Community Based Enterprises (CBE) collect waste in high-density, peri-urban areas due to inadequate infrastructure for bigger trucks. They apply through open tenders and are awarded a contract to supply waste collection services. Applicants who wish to provide these services pay an annual fee of $850 and an $850 franchise fee. The provision of services is governed by a service charter developed by the local authority.

Many other cities also rely on a mix of public and private actors to service low-density urban zones and some markets due to their limited capacity to provide related waste services such as collection. Councils often maintain authority over the profitable central business district (CBD). Furthermore, community-based enterprises (CBEs) are common in city councils, serving the high-density, less profitable peri-urban areas difficult to access by larger franchised corporations. The study findings show that over 100 CBEs collect waste from these poorer areas in Lusaka City Council, while five CBEs collect waste in Livingstone City Council[19].

[18] https://wedocs.unep.org/bitstream/handle/20.500.11822/9104/-National%20Solid%20Waste%20Management%20Strategy%20for%20Zambia-2004National%20Solid%20Waste%20Management%20Strategy%281%29.pdf?sequence=3&isAllowed=y

[19] Acting Director for Public Health in Lusaka and Senior Health Inspector in Livingstone.

With limited financial support from the national government, councils' own-sourced money covers most, if not all, of the budgets for council waste collection. Their revenues cover the monthly bill for salaries, with subsidies from the government being less than a quarter of the monthly wage[20]. Citizens' reluctance to pay for waste or the difficulty of doing so leads to the insufficiency of the council waste budget. Most towns require subscribers to pay for publicly provided services by paying a monthly visit to the council offices. Several governments send revenue officers to collect the fee door-to-door if citizens fail to do so[21]. Those who use franchised private companies' services must also pay directly at their offices. Some companies use a revenue collector to collect money from residents who are unable to access the pay site. In Lusaka, a pilot plan was started in a few complexes where waste collection fees were combined with water tariffs so that a portion of water payments went towards waste collection[22].

Political influence is also extremely noticeable. On the Copperbelt, it was widely considered that "waste management service issues are usually characterized by political interference[23]." This is partly due to the fact that ward councilors are subject to citizen censure through elections; residents criticize councilors when rates rise per person or when rubbish is not collected, which spurs their intervention[24]. Some ward councilors are often opposed to requiring disadvantaged households to pay for waste collection, which council administrators lament because these revenues are required to organize the waste system.

The Zambia Cabinet approved the introduction of a bill in 2018 to establish an independent Solid Waste Management Utility (SWMU) in response to the issues experienced by local governments in collecting waste. This proposed agency would be responsible for incorporating solid waste management corporations, outlining their tasks, overseeing their licensing, and regulating, building, and maintaining landfills and other disposal facilities. The councils' duties for trash management would be decreased in this way. However, the SWMU is not yet operational.

3.2 Waste generation

3.2.1 *Total waste generation*

Estimates from the local authorities show that waste generation (waste collected) is between 100 tonnes to 10,000 tonnes per month, with an estimation of 0.6 kg of waste per person each day. The study discovered that residents of high-income areas create much more waste than low- and middle-income areas in terms of weight per income level. The percentage of the weight of waste from the households in the sample for the three income levels is given below from the waste characterization study for Lusaka, Livingstone, and Kitwe. Findings show that waste generated in low and middle-income households is comparable. In contrast, waste generated per high-income household is significantly higher. This corresponds to international trends showing an increase in waste volumes with increases in income levels[25].

[20] Interview with Department of Public Health, Lusaka City Council.
[21] Interview with Chief Health Inspector in Lusaka Province.
[22] Town Clerk, Lusaka.
[23] Department of public health, Copperbelt Province.
[24] Ward councillor, Lusaka.
[25] Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. World Bank Publications.

Table 3 Percentage of waste generation per income level in Lusaka, Livingstone and Kitwe

City	Total weight in percentage (7 days)		
	Low-income households	Medium-income households	High-income households
Lusaka	29%	30%	41%
Livingstone	27%	25%	48%
Kitwe	25%	34%	41%

3.2.2 *Waste characterization*

The specific composition of household waste varies by area and economic level. However, it can be deduced that organic waste is the most prevalent stream accounting for 51% of the waste generated. In cities, organic waste is primarily food and kitchen waste; on average, plastic waste is the second-largest stream, accounting for around 14 percent of total waste. Glass and paper provide just a minor portion of overall waste composition (4 percent by weight and 6 percent respectively). Metal is relatively substantial (mainly cans) and accounts for 9% of the overall waste content. Another significant component of waste in Zambia primarily consists of ash and diapers.

Figure 4 Waste characterization in Livingstone

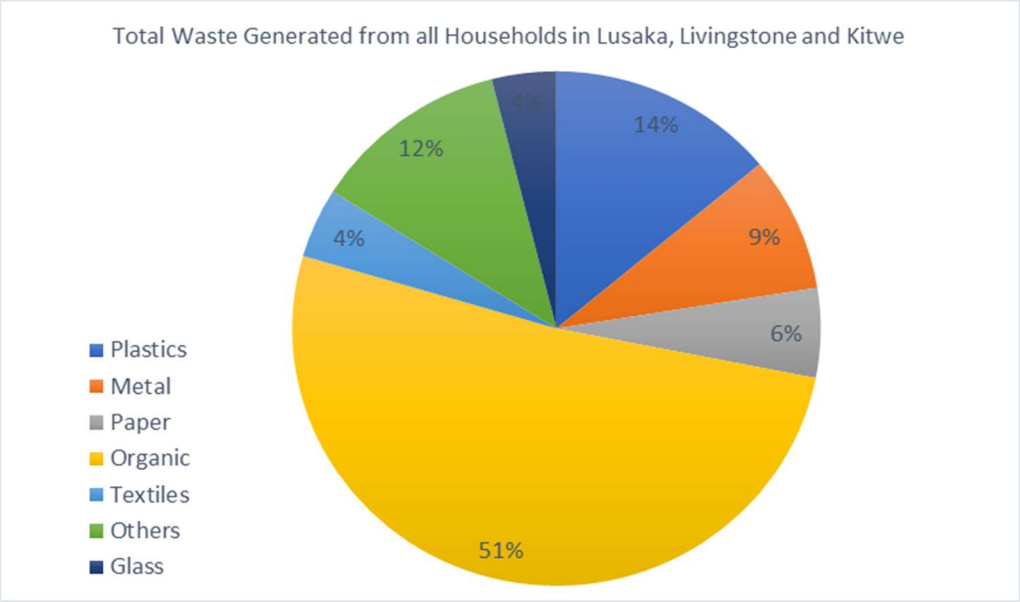

Figure 5 Waste composition in Lusaka, Livingstone, and Kitwe

Both business and governmental organizations have difficulties in collecting and maintaining waste records. Currently, few information sources describe the type of waste collected, much alone a definition of the category (e.g., PET or PP for plastics or aluminum or iron for metal).

3.2.3 *Differences per income level*

There was no significant change in waste composition when different income levels were compared. The weight of the 'other' category for high and especially medium income is the only noticeable change. This is most likely due to textile and diapers in the waste, which is less abundant in low-income communities' waste streams. While the average results no longer demonstrate a difference in plastics in waste, certain research locations revealed that low-income waste contains less plastic than middle and high-income waste streams (e.g., in Chainda). This is due, in part, to decreased use of plastics products, but it is also because it rarely becomes waste since it would be reused or repurposed.

The findings show that low-income communities produce more organic garbage than high- and middle-income ones, although this warrants additional examination. There is speculation that over 75%[26] of peri-urban families engage in home industry-based activities, leading to increased levels of waste. However, this contradicts the findings of this study, which show that higher quantities of waste are found in high-income areas rather than low-income areas.

[26] Kazimbaya-Senkwe, B., Mwale, A.H., (2001) Solid waste in Kitwe Solid waste characterisation study for the city of Kitwe, Zambia : Phase 1. HIS SINPA Papers SINPA NUMBER 28 / 2001 ZAMBIA https://repub.eur.nl/pub/32250/SINPA%2028%20Kazimbaya-Senkwe%20BH%20(2001)%20Solid%20waste%20in%20Kitwe.pdf

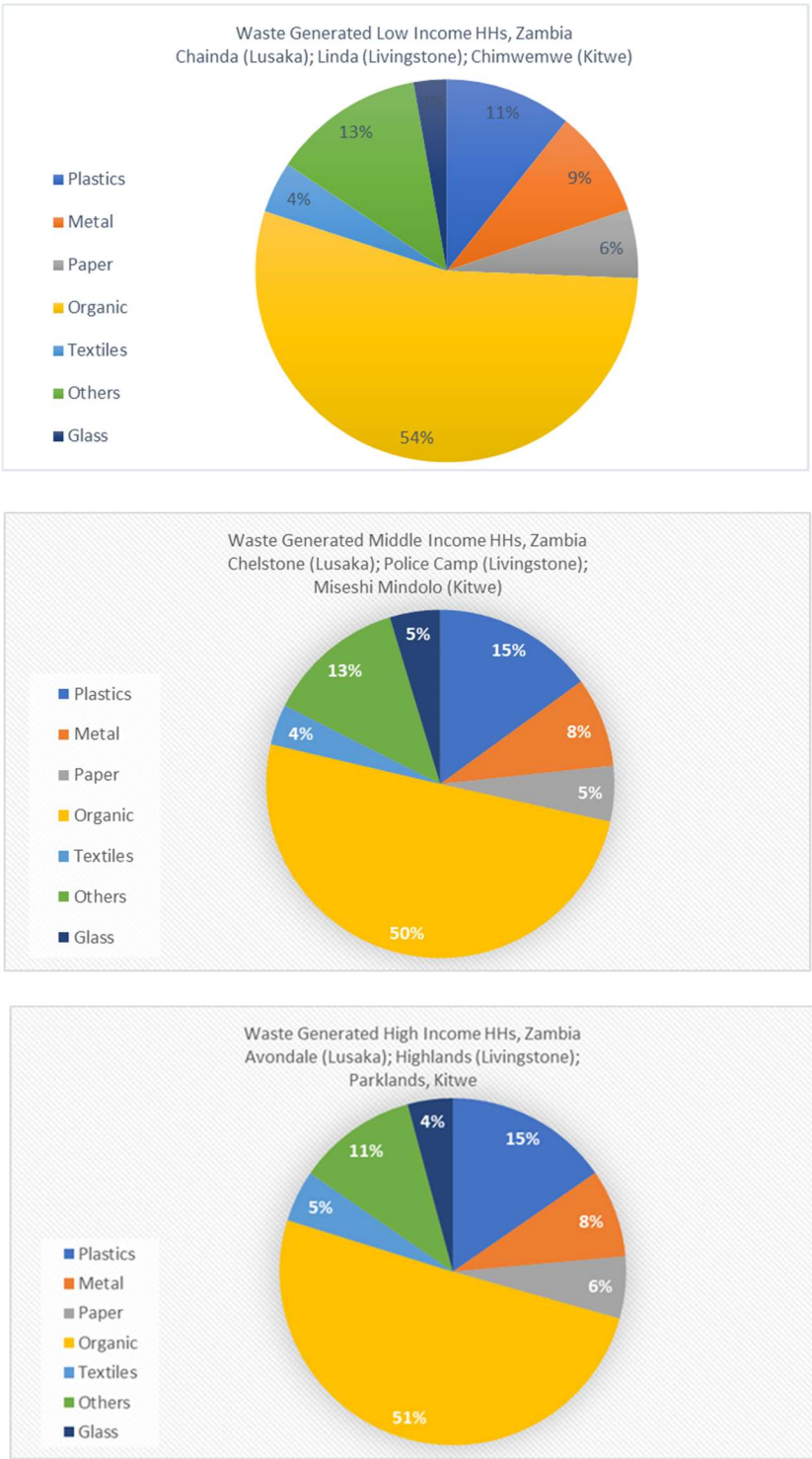

Figure 6 Waste composition in low, middle, and high-income areas in Lusaka, Kitwe, and Livingstone

3.3 Waste collection and separation

3.3.1 *Waste collection*

In Zambia, waste is collected by either the local authorities or several private companies. The planning department of almost every municipality, town, and city council serves as the focal point for waste management services. The planning department's public health management section is in charge of waste collection, transportation, and disposal. Furthermore, collected waste in all Local Government Authorities (LGAs) is transported without segregation. At least half of the LGA's waste is collected by private contractors on their behalf. Cities have simplified this approach by creating zones where each private player is assigned a zone and charges a fee to the residents who live there.

The collection frequency in Zambia greatly differs per area. Of all respondents surveyed, 49% indicated that waste is collected weekly. However, respondents from middle and high-income areas stated that they received waste collection services from private waste collection companies. On the other hand, almost 33% indicated that waste is never collected, meaning these people have no choice but to turn to illegal dumping. In these areas, the collection is usually much less frequent or non-existent. Some respondents indicate an infrequent collection, for example, once every two weeks or every month (about 18%). In terms of preference, most respondents indicated that they would prefer a collection frequency of once in two days (almost 44%), while 40.5% would be satisfied with once a week.

According to the findings, the majority of the LGA collect waste at least once a week. The average collection frequency by the local authorities is 5.1 per month. Waste collection is supplemented by a robust network of private waste collectors who are allotted zones to collect in Kitwe and Lusaka, two of the country's biggest cities. In addition, youth groups and organizations' waste collection initiatives have helped alleviate the LGAs' waste collection load. Lack of infrastructure (trucks, roads, transfer stations) was highlighted by rural LGAs as the biggest impediment to improving waste collection and disposal.

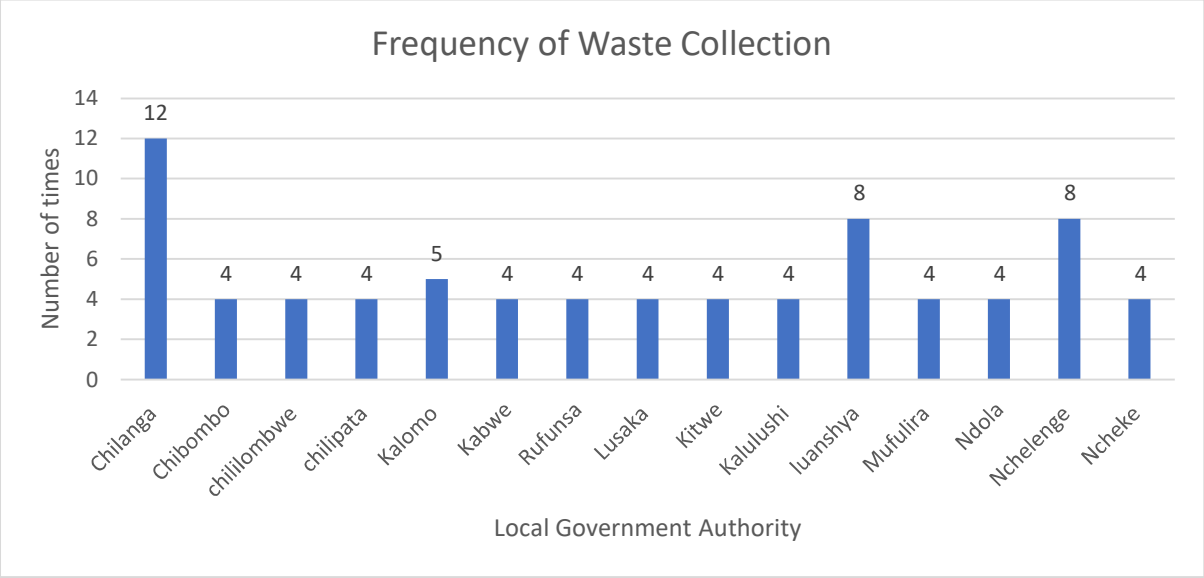

Figure 7: Frequency of Waste Collection by the Local Government Authorities

The collection and transportation of waste are handled by council vehicles in rural LGAs. Open dumping sites are used by 93 percent of local authorities. The only LGA having an engineered landfill is Lusaka, while the others have open dumpsites. The main reason for not establishing a landfill for waste disposal is a lack of resources (budgetary and land).

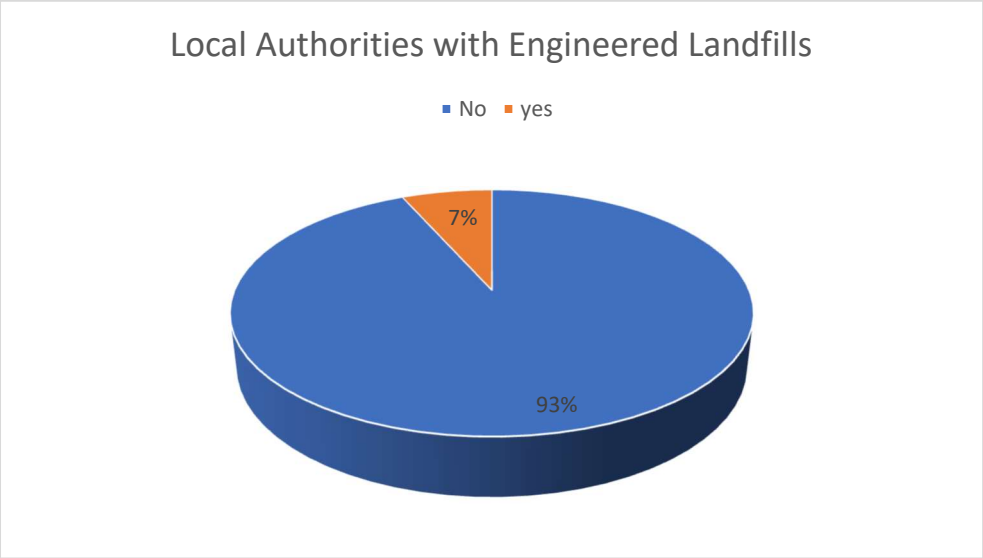

Figure 8: Local Authorities with Engineered Landfills

In Lusaka, the public sector collects less than 10% of the waste, while the private sector collects almost 60% of the waste generated. Most private organizations (franchise contractors) work under a formal franchise agreement with municipal governments to collect waste. This is mainly due to the local authorities' severe lack of capacity to provide consistent waste services. A case of two city councils was used to highlight the dynamics of waste collection, treatment, and disposal in Zambia. Lusaka City Council has franchise contracts with private companies. 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[27]. The franchise collector awarded with a franchise contract is responsible for setting and collecting waste fees for the services provided[28]. However, the fee is subject to a ceiling set by the council. The waste collector determines the type of waste receptacles (bags, bins, or containers), subject to approval by the council. The fees vary depending on the residential areas.

Furthermore, certain places are served by small Community-Based Enterprises (CBEs) that collect waste in low-income neighborhoods. The local authority licenses CBEs, but they are not formally regulated. Collection varies by region, with 49% of the respondents reporting weekly collection, 33% indicating no collection (33 percent). Households' proper source separation of numerous waste streams for waste collection is usually absent. The only source separation that appears to occur regularly is organic waste separation for residential composting and minor plastic separation. Even though homes provide distinct waste streams, local governments often combine waste during collection.

In Livingstone, the City Council is responsible for the collection of waste and charges a fee of K50/month for urban high-income households (equivalent to $4.20 per month), while in the peri-urban (lower income) areas, the waste collection fee was set by the Council at K30 (US$2.50) per month.[29]. The

[27] Nawa, D. (2017) Where does Lusaka waste go? Zambia Daily Mail Limited http://www.daily-mail.co.zm/where-does-lusaka-waste-go/

[28] Nawa, D. (2017) Where does Lusaka waste go? Zambia Daily Mail Limited http://www.daily-mail.co.zm/where-does-lusaka-waste-go/

[29] UNIDO, Waste Management Study – Livingstone, Zambia Assessment of Opportunities for the Reduction of Open Burning Practices. 2019. https://stopopenburning.unitar.org/site/assets/files/1097/zambi_livingstone_municipality_final_report_baseline_study-_march2019.pdf

Local Municipality manages waste collection in the central city and outsources the other collection to private contractors in designated zones. Registered and licensed companies pay monthly fees of $11 for collection, nonregistered individuals or companies pay $23 per month, and Lodges and hotels are charged $113 per month. In Livingstone, individuals are fined K100 for illegal use of the dumpsite, businesses are fined $28, and $508 is charged for illegal dumping[30]. In the Copperbelt (where Kitwe is part), several councils formed The Copperbelt Waste Management Co. Ltd (COPWASTE) is a subsidiary waste management company set up to cover part of the waste management and provide collection services. In Kitwe itself, waste is also collected by several private parties in addition to COPWASTE. They collect fees with households directly, charging residential households $0.57 per week and businesses $3.3 per week. Skip bins that are emptied are charged $36.7 per collection (CBE's need to pay the Local Authorities).

Solid waste collection in Lusaka is achieved through the Lusaka City Council Waste Management Unit (WMU) servicing the central city, nine private contracted companies servicing the industrial, commercial, mid and high-income residential areas, and Community Based Enterprises (CBEs) servicing the compounds and peri-urban areas. Contractors are designated to service-specific areas by the WMU, and all waste generators in the respective areas are required to pay the designated contractors. Collection fees are as follows: medium-income households: $3.3-$5, High-income households: $3.9- $7.3 Commercial: SME & NGO: $5-$8.4, Big business: $6.7- $11, and Industrial: $9.6- $16.9. The collection services in these high-income areas are generally effective.

Formal waste collection is more challenging in Lusaka's crowded, peri-urban settlements, where the paid-for collection service (Low-income households $0.85-$3.3) is carried out by community-based enterprises (CBEs) wheelbarrows, pushcarts, or bicycles [31]. The high-density, low-income peri-urban areas are often difficult to access by the larger franchised companies; infrastructure is lacking, meaning larger trucks cannot enter. This is particularly the case in unplanned low-income settlements, which generally do not have access roads. The WMU provides large waste skips, which are placed in strategic areas of the compounds, and the CBEs then pay the city council's Waste Management Unit to come and collect the waste once the skips are full[32]. However, as can be seen in the low contribution of the CBEs to the total waste collected, many people in the low-income areas are not serviced at all (although this number is quite dated, and the number of CBEs in Lusaka has increased over time, leading to increased coverage. How much exactly is unclear). There is usually a very high level of internal reuse and recycling of materials that are still of value to low-income households, fostering circularity out of economic necessity. This reduced the total amount of waste generated. Nevertheless, the low coverage means that for the non-valuable remaining waste, many people will have no other choice but to turn to illegal waste practices such as burning and dumping.

The prevalence of these CBE's differs per city. In Lusaka City Council, there are currently over 100 CBEs collecting waste from these poorer areas, while in Livingstone City Council, there are only five[33]. The CBEs are often not registered formally. In contrast to the contracted franchise collectors, the CBEs report to and are licensed by local councilors directly without being formally contracted or regulated. This contributes to the high uncertainty under which these CBE's work. The collection charges are very low and not fixed. The CBEs experience challenges with collecting service fees due to the low economic levels in the compounds, challenges with delayed collections of skips by the WMU (in Lusaka) and are, in addition, reliant on the positions of the local councilors as to where and how they can work and how

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[30] Luke Muller, Erica Ciaraldi, Andrew McNaught, Jonathan Allaire, and Abri Albertyn, Waste as A Resource: **Summary of Development Opportunities Within Zambia's Waste Value Chain and Management System.** 2017. ILO Zambia Green Jobs Programme

[31] Lusaka City Council (2012). Lusaka City State of Environment Outlook Report. Retrieved from: http://www.zema.org.zm/index.php/dloadspage/cat_view/42-publications/43-environmental-outlook-reports.

[32] Environmental Council of Zambia (2004). National Solid Waste Management Strategy for Zambia, 2004

[33] Acting Director for Public Health in Lusaka and Senior Health Inspector in Livingstone

much they can charge, which can change according to the political climate and will of the councilors. The local authorities, in general, are less politically driven and have more administrative power. It also impacts the quality of the collection in the low-income areas, as the checks that local authorities do only occur in the middle and high-income areas, while the low-income areas are left unchecked. The study shows that Luska City Council collects 14% of the waste generated in the city while CBEs and private sector players collect 41% and 43%, respectively.

Table 4 Waste collection per month in Lusaka 2022 (Lusaka City Council)

Type of Waste Collector	Weight (Kgs)	%
Lusaka City Council	1,300,800	14%
CBE	3,648,420	41%
Government Institutions	158,760	2%
Private Sector	3,877,360	43%
Total	**8,985,340**	**100%**

For Livingstone City Council, proper waste management is a major issue because of a lack of resources. The district is divided into zones, and a private or public collector serves each zone. However, they are unable to collect all waste efficiently and consistently. Furthermore, the city council has difficulty maintaining their equipment and vehicles, resulting in breakdowns with no way to restore operation. Because compactor trucks are prohibitively expensive for the private sector, regular vehicles are frequently used for waste collection. Except for two companies - Waste Masters and Keli Clean-up - there is almost no material recovery or valorization in Livingstone, especially since Waste Master is currently no longer in operation. One reason for the low levels of material recovery is that there is no market for materials in Livingstone as there are no processors or recyclers. This means materials must be bulked and shipped to Lusaka (or South Africa) for any valorization, which is prohibitively expensive given current gasoline prices. Because Livingstone is a small town (200,000 inhabitants), it is challenging for that industry to set up.

Households do not separate waste because there are no incentives and not enough off-takers. Although some hotels separate their waste as part of their green tourism initiative, waste is still mixed during collection because there is no capacity for separated collection. Livingstone has a dumpsite just outside of town that normally charges a fee for waste disposal; however, there are not always designated personnel present to collect the fee. Some waste pickers on the dumpsite collect mostly HDPE and a little LDPE. However, because Livingstone lacks a material recovery market, the number of waste pickers is limited. The waste disposal is ill-accessible during the rainy season, resulting in the appearance of several adjacent disposal sites.

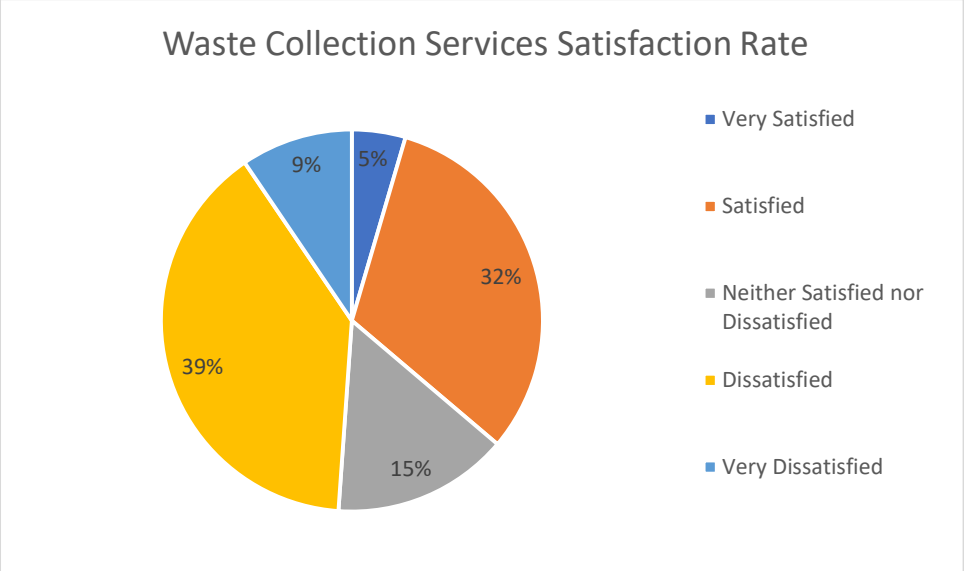

Figure 9 Waste Collection Services Satisfaction

According to the study's findings, 32% of respondents from households consulted were satisfied with waste collection services, while 15% were neither satisfied nor dissatisfied. In comparison, 39% reported being dissatisfied. The graph shows a dissatisfaction rate of 48% and a satisfaction rate of 37%. One of the factors influencing satisfaction is the frequency of collection.

3.3.2 *Waste Separation*

Based on the household survey of the respondents, 26.5% indicate that their waste is collected by private players, while 18.6% of the respondents indicated that the public sector collects their waste. 20.9% reported that they transport their waste to a disposal site (however, this probably also includes informal dumps that are not official) with their transport, and 18.6% indicated that there is no collection at all and that they dispose of their waste at informal dumpsites. The local authorities do not separate waste during collection, and this is due to the lack of infrastructure to support the collection of separated waste.

3.3.3 *Willingness to spend more*

Only 33% of respondents were willing to pay more for waste collection services, while 51% were not. 9% of respondents neither agreed nor disagreed with the proposed increase in the service rate. According to the total calculations, 58 percent of respondents were unwilling to pay more, while 33 percent were willing to pay more. It was observed that a willingness to pay more might be related to a low level of satisfaction.

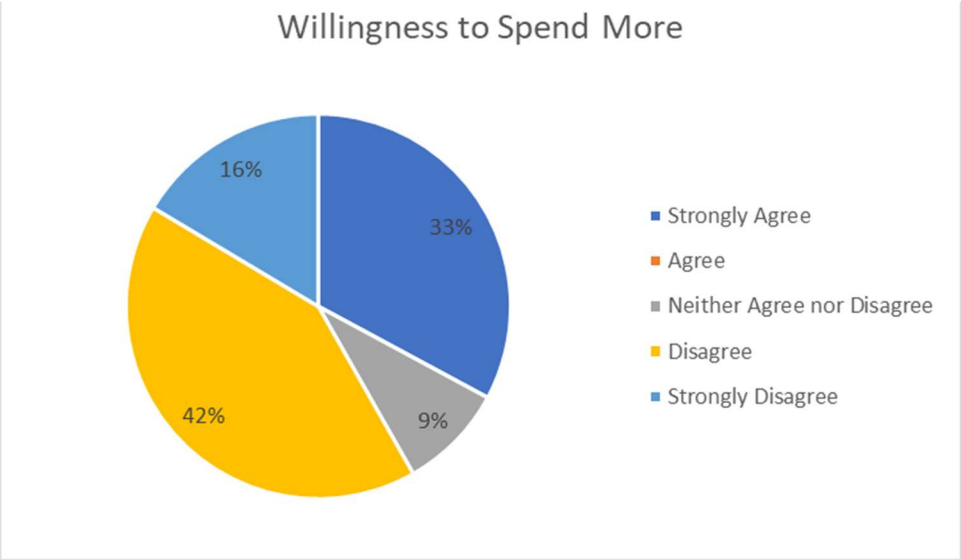

Figure 10 Willingness to Spend More

3.3.4 *Potential coverage*

As a proportion of the total area, the figure 11 below depicts how well the LGAs manage to collect waste in their jurisdiction. The LGAs unanimously affirmed that they are not participating in waste recycling. However, private sector assistance is limited and centered mostly on metropolitan towns, leaving rural municipalities to fend for themselves. LGAs cover at least 59 percent of their jurisdictional area (on average) with waste management services. Rural LGAs did not do well in this category, owing to infrastructural problems and indigenous circular economy activities such as composting and repurposing plastic or metal cans for household use.

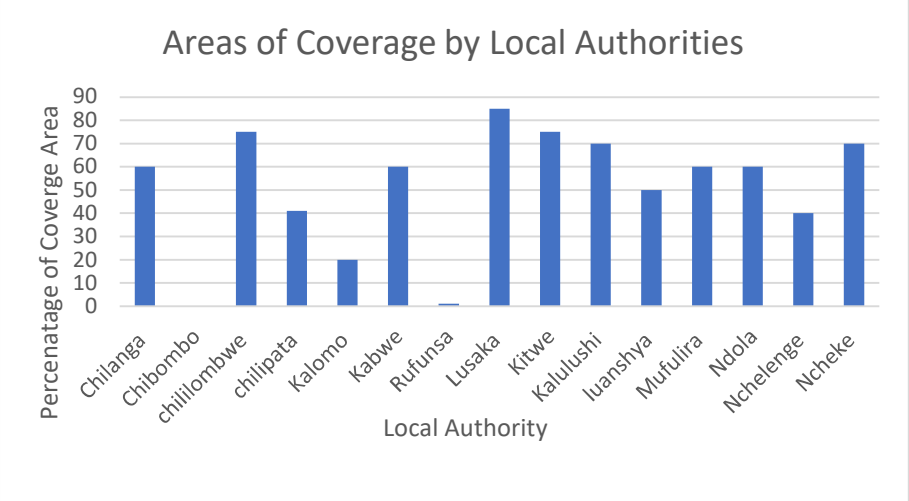

Figure 11: Area of coverage by local authorities

3.3.5 *Source separation*

In Zambia, source separation is uncommon. The majority of households stated that they did not separate any waste (82,8 percent). The remaining 17.2 percent of respondents who separate at the source indicate that they primarily separate organic waste and plastics, with some households separating both. Metal and glass are the least separated. Many respondents, however, indicated that they would be willing to separate waste more than they do now and divide it into three categories: one

for recycling (e.g., plastics), one for composting, and the remaining waste for landfills. As a result, if people are facilitated, there is potential for an increase in the levels of separation.

Nonetheless, the low level of source separation is due to a lack of contribution from households and a significant lack of capacity to manage separated waste by local governments and private players. Even when households separate, there is frequently no practical provision for segregation. The waste is mixed during transportation, especially if not packed in strong and secure bags. Some private contractors do collect waste separately. For example, Sunshine Group Zambia only collects waste that is offered separately. Moreover, several franchise parties collect recyclables directly for recycling purposes.

3.4 Waste disposal and recycling

There is only one engineered landfill in the country of Zambia. All of the others are open dumps. Every city has at least one dumpsite. The lined landfill is located in Lusaka. An open dump means there are no sanitary and environmental control measures in place, and leakage, pollution, and health issues can occur uncontrolled[34]. Lined landfills, also called engineered landfills, are designed including a composite or plastic liner to avoid leakage into the soil and protect the groundwater[35] (nevertheless, these landfills still have quite a substantial impact on the environment, predominantly regarding emissions, as due to the high organic waste component landfills usually still emit large amounts of methane, a very potent greenhouse gas[36]). Furthermore, there are numerous illegal dumpsites where people dispose of waste that has not been collected formally. As a result, the vast majority of waste collected by local governments ends up in open dumps. Informal waste pickers collect valuable components at dumps or landfills to separate them. Because the volumes are insufficient to trade directly, Waste Transfer Centres buy up the separated waste and aggregate until there are enough to sell to recyclers and producers. Plastics, paper (mainly cardboard), metal (primarily cans), and glass are the most common types of waste collected from landfills (primarily bottles). Plastic has the most developed waste market.

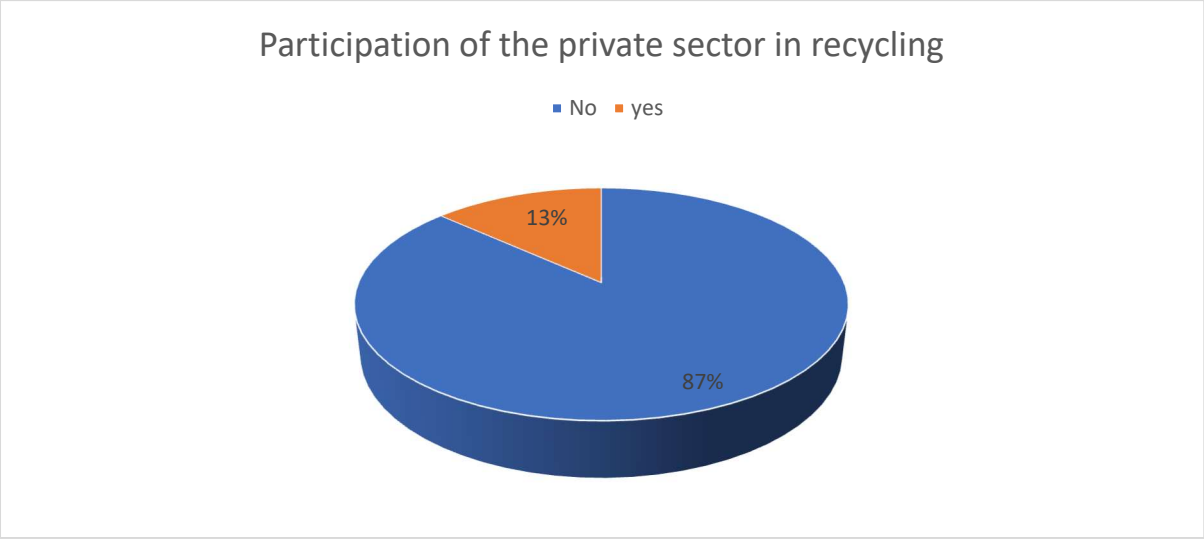

Figure 12: Participation of the private sector in recycling

[34] Ali, Cotton, Westlake (2020). *Waste Disposal in Developing Countries.* DFID Resource Centre for Water Sanitation and Health, Water and Engineering Developing Centre, Leicestershire, UK; KURIAN JOSEPH, D. R. N., & PALANIVELU, K. OPEN DUMPS TO SUSTAINBLE LANDFILLS.

[35] Municipal Solid Waste Landfills | US EPA

[36] Agamuthu, P. (2013). Landfilling in developing countries. Waste Management and Research, Volume 31, Issue 1.

None of the LGAs consulted were active in waste recycling. The lack of infrastructure to support this activity and its mandate are the key reasons. LGAs exist to offer supplementary services to residents and are not profit-making entities. Recycling makes more economic sense in cities than it does in rural regions. Due to the profitability and availability of a well-developed value chain that can provide waste products and markets for the valorized waste in major cities and towns, 13% of private sector actors have entered into partnerships with LGAs to expedite recycling expand the circular economy.

3.4.1 *Mixed waste disposal*

Once the waste has been collected from the cities, it is brought to one of the dumps or landfills in the country. The majority of waste collected by local authorities goes to the open dumpsites. Thus, compared to most other Sub-Saharan African countries, which bring 69% of waste to open dumps and 24% to lined landfills[37], Zambia performs worse in terms of waste disposal. Not formally collected waste is usually littered or burned illegally or brought to illegal dumpsites, of which many exist in the country (see picture for an example). Nevertheless, especially in low-income areas, only the uncollected waste that has no value is disposed of in such a way. Anything that has some value is used by the households themselves, showing rather high levels of circular activities such as reuse and repurposing.

Figure 13 Uncontrolled/illegal dumping of waste in Chainda, Lusaka. Source: Sunshine Group Zambia, 2021

Once the waste is brought to the dumps, informal waste pickers separate the valuable waste from the non-valuable wastes, often focusing on streams such as plastics (PET, HDPE, PP), metal, and cardboard. As waste pickers cannot gather sufficient waste volumes to sell on the market directly, an intermediary sector has emerged of waste aggregators. Aggregators are of different sizes in terms of the scale of operation activities and are also known by different names. Trashback, an NGO that stopped trading in Zambia in 2017, had an aggregator model called Buyback Centres, which were located in high-volume waste areas. The organization paid small tokens for recyclable waste that

[37] Kaza, Silpa, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden. 2018. *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-1329-0. License: Creative Commons Attribution CC BY 3.0 IGO

community members brought. Over and above being aggregators, some of the Buyback centres were large enough to be waste processing centres with equipment such as baling machines[38] built from the ground up with a focus on enabling and formalizing the informal sector[39]. Manja Pamodzi, a Zambia Breweries project which the Millennium Development Fund funded, promoted value chain linkages that included several community-based enterprises that collected separated waste and sold it to waste aggregators who, in turn, sold to recycling companies or manufacturers. Zambia Breweries Plc. also assisted aggregators with identifying land and setting up operations for aggregation sites, but still faced challenges procuring land for permanent sites and establishing electrical connections at sites[40]. Zambia Breweries Plc, through its Manja Pamodzi project, aimed to create a sustainable collection-and-recycling value chain for post-consumer packaging waste; formalize largely informal networks of collectors and aggregators (by providing them with the tools and capacity to collect greater quantities of recyclables), and reduce the amount of waste in Lusaka.

Figure 14 Manja Pamodzi Advertisement[41]

It is unclear how much is picked in total as different organizations have their own figures. For example, Manja Pamodzi reported figures shown in the diagram below in their final evaluation as collected during the programme period, with cardboard being the highest[51].

[38] Interview with Tandem Circular Economy Consultants Founder and Director, Andrew McNaughty, also one of the founders of Trashback

[39] Interview with Tandem Circular Economy Consultants Founder and Director, Andrew McNaughty, also one of the founders of Trashback

[40] Millennium Challenge Corporation. (2020) Final Evaluation Brief - Creating a Sustainable Recycling Value Chain in Lusaka: Continuous effort is needed to sustain an interconnected supply chain (2020). https://www.mcc.gov/resources/doc/evalbrief-072720-zmb-igp-breweries

[41] Millennium Challenge Corporation. (2020) Final Evaluation Brief - Creating a Sustainable Recycling Value Chain in Lusaka: Continuous effort is needed to sustain an interconnected supply chain (2020). https://www.mcc.gov/resources/doc/evalbrief-072720-zmb-igp-breweries

Figure 15 Manja Pamodzi waste picked during the project

The representation of cardboard as a waste stream that was collected the most was also shared by Trashback, who reported that at one time in 2017, they were reporting truckloads of 150 tonnes of cardboard being collected per month[42]. He, however, cautioned that the waste market in Zambia is dynamic and that at some point, the spike in demand was caused by a shortage in egg trays in the market, which in turn caused a high demand for recycled cardboard. White paper, on the other, had a demand in Zimbabwe where a manufacturer of bond paper and newsprint imported from Zambia.

At Chunga Landfill, which the Lusaka City Council maintains, a number of 230-240 garbage collectors are allowed to gather scrap metals, carton boxes, PET bottles, and other items before a layer of soil covers the waste. The collected waste is gathered in a location near the entrance. Additionally, open waste burning is occasionally utilized to decrease waste volumes. The Chunga Sanitary Landfill, completed in 2004 and expected to serve Lusaka for 25 years, is the city's only disposal facility. The landfill charges Waste Management Companies K20 for every ton of waste dumped. Even though it is a legally recognized landfill, poor administration and maintenance have converted the site into a waste dump. The site has pipelines for collecting methane gas, but incorrect waste distribution prevents the methane from being captured correctly, resulting in methane leakage and continual complaints from residents about landfill odors and air pollution[43].

[42] Interview with Tandem Circular Economy Consultants Founder and Director, who was also founder of Trashback

[43] Luke Muller, Erica Ciaraldi, Andrew McNaught, Jonathan Allaire, and Abri Albertyn, Waste as A Resource: **Summary of Development Opportunities Within Zambia's Waste Value Chain and Management System.** 2017. ILO Zambia Green Jobs Programme.

Figure 16 Sorting of waste at the Chunga landfill

About 15 aggregating businesses purchase the recovered waste from the collectors at the landfill. Nevertheless, there are more aggregators in the city, often located in low-income areas.

Examples of waste aggregators in Lusaka are:

- Kamwala Trading Centre, Lusaka[55] - Recovered materials collection point. Waste collected from the trading area and sold to aggregators included carton boxes, opaque beer containers, metallic cans, and PET/HDPE bottles. Most of the waste collectors are women.
- Recycle-mania, Chunga Depot, Lusaka - Aggregation point. The Depot has a belling machine and deals in opaque beer cartons and plastic bags. They operated in a rented area.
- L&N Depot in Chinika Industrial Area, Lusaka – Aggregation point. The depot has two belling machines and deals in opaque beer cartons, PET, HDPE, and aluminium cans. It is located in a rented warehouse.

In Livingstone, there are two dumpsites, one run by the municipality and the other by a local hotel (the Royal Livingstone). The official dump is poorly maintained, with open dumping on both sides of a 2.5kilometer-long dirt road. The dumpsite is also close to a stream's source, posing a significant risk of water pollution. Formally, the dumpsites are strictly for waste disposal, but waste picking is permitted unofficially, in small numbers.

The primary dumpsite in Kitwe is privately managed by COP-Waste. The dumpsite's gate is secured, and there is a per-ton fee for dumping waste. For one ton or less, dumpsite fees are K30, K60 for one to three tonnes, and K300 for more than three tonnes. Illegal burning or dumping is penalized by a K450 fine. The dumpsite is poorly managed, with no environmental safeguards in place and a large number of unlicensed waste collectors working in hazardous conditions. Despite this, a sanitary landfill is being developed to replace the current dumpsite. The City Council has received the title deed for a 20-hectare plot offered by Mopani Copper Mines. The Council is currently seeking a business partner to manage the landfill. ZEMA recently assessed the 20-hectare site as part of the project document review procedure. If no more concerns arise, construction of the new landfill could begin in the near future.

3.4.2 *Separated waste disposal*

In addition to waste being brought to the dumps, some of the waste that is collected from the households separately is brought to aggregators or producers directly. However, this number is negligible for households, as this is coming mainly from businesses.

3.4.3 *Waste recycling and current markets*

Waste recycling in Zambia is not very common. A few big players are involved in recycling various waste streams; however, these are mostly foreign-owned companies. Only the small-scale aggregators are local parties run by Zambians. However, these parties usually only aggregate and sometimes bale, but they generally do not have value addition activities. Moreover, there is a small to no local manufacturing market for many waste streams, meaning the domestic outputs to sell potentially recycled material are small. However, there are a few exceptions, including one of the social enterprises formed by Trashback, Separation at Source. The social enterprise has waste recycling centers around Lusaka which are growing a significant market share[44].

Trashback also facilitated the export of some waste to various countries, including PET to China, and other types of waste to South Africa and Tanzania[45]. But most manufacturing and large recycling companies are Chinse or Indian, for example, processing recycled plastics or paper as an addition to virgin materials in their production processes. The Waste as a Resource study by ILO (2017)[46] found that in 2020, the Lusaka City Council compiled a list of 14 recycling companies that operate in the city. Seven companies recycle paper (Zambezi Paper Mills, Asopalay, City Waste Solutions, Recycle It Zambia, Zalco Limited, Mr. Egg Tray, and Zambia Haiyu Paper Company), four companies recycle plastic (Tidy Hire Limited, H.Y. Investments, Recyco Global Ltd, and Wonderful Ceiling), two companies recycle computer parts (W & V Net Choice and Harrison), and one company recycles glass (L & N Matrix Limited). The Zambia Aluminium Copper Company, which recycles paper, cans, vehicle batteries, and other non-ferrous devices, and Good Time Steel, which recycles scrap metal, are two other national examples.

Plastics

The plastics value chain is rather well developed, with players positioning themselves strategically within the value chain. Nevertheless, huge volumes are still not being processed today, so even if there is quite some activity already, this can still be expanded greatly.

First of all, households have adopted creative ways to reuse plastic resulting in lower quantities from household waste; nevertheless, the volumes are still quite substantial. Most commercial plastic recycling operations are done manually because of limited technology and machinery in the recycling companies. However, technology is being introduced to sort plastics automatically, using various techniques. Plastics are sorted into polymer types and colors. Following sorting, the plastics are either melted down directly and molded into a new shape or melted down after being shredded into flakes and then processed into granules, called re-granulate.

Small-scale home industries are also active in the manufacturing of products from waste. An example of a company that manufactures recycled plastic products is M&F Packaging Industries, one of the leading producers of polyethylene plastic sheeting, household plastics, conduit pipes, air vents, and other plastic products. In Livingstone, regarding plastic waste markets, an informal market for PET bottles exists in low-income communities. Informal pickers are paid K0.10 per bottle by CBEs that refill

[44] Interview with Director of Separation at Source, Mr Misolo Sakala
[45] Interview with Founder of Trashback, Andrew McNaught
[46] Luke Muller, Erica Ciaraldi, Andrew McNaught, Jonathan Allaire, and Abri Albertyn, Waste as A Resource: Summary of Development Opportunities Within Zambia's Waste Value Chain and Management System. 2017. ILO Zambia Green Jobs Programme

the bottles with water for resale. LDPE plastics are also collected by informal pickers and used to make floor polish. Lusaka City Council also has a list of four plastic recycling companies operating in the city. Overall, 100% of Zambia's virgin plastics are imported. There are great opportunities for saving costs and resources if plastics could be recycled domestically to a larger extent.

Organic waste

Although this is the largest waste in quantity from households, this value chain is not very well developed. The nature of the waste (smell, damp, cannot be stored well) discourages collection. As a consequence, there is very little organic waste recycling in Zambia. Local authorities and private companies sometimes set up several small composting initiatives. Separation at Source is embarking on a venture to manufacture livestock feed using organic waste[47]. However, in general, the market for organic waste is very little developed. Some NGOs and Community Based Organisations (CBOs) are involved due to the waste negatively affecting health outcomes in unplanned settlements. Even though one of the most used sources for cooking in Zambia are briquettes, for which organic waste could be used as a resource, this potential is currently not tapped.

Metal waste

Scrap metal is a stream with quite high demand and is often collected by informal pickers and sold to private parties such as Kafue Steel. Some companies in Zambia recycle metal waste, mostly aluminium (cans), copper, and scrap steel. However, there are few large-scale recyclers. The potential for recycling is predominantly large for iron and steel. As there is no steel sheet production facility in Zambia, consumers and even steelmakers have to import finished and semi-finished flat steel products[48]. According to COMTRADE, Zambia imported almost US$159 million in steel and iron in 2020, compared to a little over USD 5$ million for copper. The domestic mining industries and thus the supply of virgin materials are much larger for copper than for iron and steel, plus the steel demand is more significant.

Glass waste

The market for glass waste is not very well developed, apart from the deposit schemes that exist. Beverage companies promote these beverage deposit systems, and households can return refundable empty bottles to places such as usually supermarkets. Collected bottles are mainly shipped to South Africa to be cleaned and refilled as most beverage companies, mainly breweries, are located there. Glass waste without a deposit is much less attributed. Most ends up in the mixed waste at the dumps and are not recovered. There are no glass manufacturing industries in Zambia that could use crushed waste glass in their production processes. At the time of this report, the only glass manufacturing company was reportedly closed. Zambia had a glass manufacturing company in Kapiri Mposhi called the Eagle Glass Manufacturing company. The company reported that the reason for closing was because they failed to cope with the pressure in the market because of cheap glass products imports and the impact of the Coronavirus[49].

Paper waste

One of the major paper companies in the country, Zambezi Paper Company in Kitwe, was partially destroyed by a fire that caused a paper shortage and a gap in the market for paper. This led to a shortage of egg cartons, spurring the demand for waste cardboard. But in addition to this temporary run for cardboard, the paper waste market is quite well developed in Zambia. Lusaka City Council lists seven paper recycling companies operating in the city, some outside of Lusaka. Regarding the type of waste they can use, it is estimated that mostly cardboard has a domestic market for the available recycling companies to process this well. A large share of the recycled paper products are also exported, for example, to Zimbabwe.

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[47] Interview with Director of Separation at Source, Mr Misolo Sakala

[48] Zambia Development Agency (2012) Sub Sector Profile: Iron and Steel

[49] Glassonline.com Glass Company in Kapiri Mposhi, Zambia, shuts down operations, 2021 https://www.glassonline.com/glass-company-in-kapiri-mposhi-zambia-shuts-down-operations/

3.5 Gender assessment of the waste system

A Gender Focus Group discussion was held with six organizations representing stakeholders from the government, non-governmental organizations, local governments, private waste collection companies, and private plastic manufacturing companies. An analysis was conducted from three perspectives: first, from the level of participation of women in waste value chains; second, from the level of participation of women in waste streams. On the participation of women in waste value chains, it was discovered that women are present in all waste value chains, but at certain levels, they are so few that they cannot be counted. This was especially true at the higher, more formal levels of the value chain, such as large aggregators, recyclers, and manufacturers.

According to the focus group discussion and some household interviews, waste is perceived to be "largely a male domain sector in Zambia." on the other hand, women are very active in the informal sector, outnumbering men significantly. There were many women working as waste pickers and small-scale aggregators; Zambian Breweries reported that recruiting female aggregators was difficult in their Manja Pamodzi project. Individuals or CBEs from low-income communities made up the majority of waste pickers. Trashback targeted homeless people with whom they collaborated to provide income for food and shelter. Women mostly ran small-scale aggregators in low-income communities.

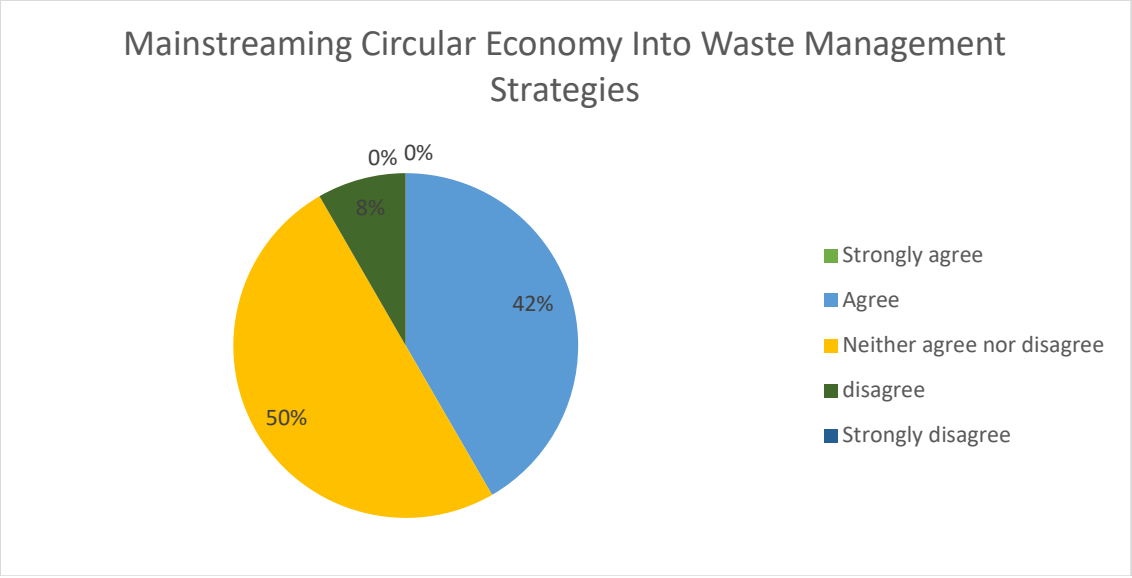
The study found one example of a manufacturing company founded by a woman who later partnered with a man to manage the perception that waste is a man's domain at the formal manufacturing level. It was observed that, while women are active in all waste value streams, the levels at which they participate do not provide them with income levels comparable to those of men. At the CBE level, however, good examples of home-based businesses, such as making floor polish from plastics, were found in the literature. Because their market was at the local level, they were not visible. As a result, to achieve gender parity, women's participation must reach at least 50%, and there is a need to move women up the value chain by exposing them to larger markets and improving their business operations through mechanization and access to more formal business premises. During the focus group discussion, it was also suggested that it was critical to raising women's awareness of potential waste to products businesses.

In terms of women's participation in waste streams, it was observed that women are primarily involved in plastic and paper waste streams because "they are not heavy and can be transported easily." It was ascertained that women are most active in sectors where they had ideas about the types of products they could manufacture and products related to their gender roles, such as floor polish. It was emphasized that the goal was not just to increase the number of women in the sector but also to improve their quality of participation by ensuring, for example, that they earned competitive wages with their male counterparts. The main issue identified is women's lack of knowledge about high-value waste-related businesses they could start, particularly waste-based manufacturing. Another critical issue is transportation.

3.6 Local Authorities with Waste Management Strategies

LGAs are aware of the circular economy, with 80% developing waste management strategies. The circular economy aims to replace the traditional development paradigm of take, create, and dispose with take, make, and reuse, which is based on renewable energy sources and biodiversity preservation. 20% of the LGAs (most towns and local councils) lack waste management policies.

Upon further investigation of their waste management policies, it was concluded that the majority (50%) neither agree nor disagree that their strategies have mainstreamed circularity. 42% of the local authorities observe that their waste management strategies have mainstreamed the circular economy principles. The overwhelming consensus on the need to move from a linear waste management system to a circular system has given the LGAs optimism. Continuous capacity building is required to keep the momentum going for LGAs to address waste management from a circular economy viewpoint.



4 Overview of the key stakeholders and waste value chains

The goal of this project was to create a roadmap for a specific waste stream that will allow Zambia to move toward a more circular waste system. It was, therefore, necessary to understand who the key players in the waste system are and the value chains of the various waste streams. This section provides an overview of the key players identified for Zambia's waste system, as well as a visualization of the value chain for each waste stream based on the results presented in the previous chapter, with a concise qualitative assessment of the gaps and opportunities within each of these value chains, as well as an overview of the waste-specific key players involved.

4.1 Overview of key players in the waste system

The stakeholders involved in this project were based on the predefined categories of stakeholders as defined in the project plan. In addition to this list, desktop research and a list shared by the NDE were used to identify other key stakeholders in the waste system in Zambia. The study either interviewed these stakeholders or surveyed them.

In addition to identifying, surveying, or interviewing the key groups and stakeholders per group, an analysis based on the Influence-Interest methodology was conducted (see Appendix A for a more detailed description of the method). The methodology helped identify and cluster relevant stakeholders based on their level of influence relating to a specific topic, project, or company, in this case, the waste sector. For the stakeholder analysis and engagement throughout the project, it was decided to exclude stakeholders that would not have an impact in line with achieving the objective of the waste assessment study (low-interest low influence). By taking this approach, it was possible to inform the selection of the appropriate stakeholders to assess their role in and relation to the waste management system and the circular economy, as well as the related management approach.

Table 5 Overview (non-exhaustive) of key players in the waste system in Zambia

Stakeholder Group	Relevant Key Stakeholders Department/Agency /Organization)	Relevant Waste Streams
National Government	Ministry of Water Development Sanitation and Environmental Protection (MWDSEP) Ministry of Health (MOH)	All
	Ministry of Mines and Minerals Development (MMMD)	Metals
	Ministry of Higher Education (MoHE) Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP) Ministry of Lands and Natural Resources (MLNR) Ministry of Tourism and Arts (MOTA) Ministry of General Education Ministry of Lands and Natural Resources (MLNR) Ministry of Commerce, Trade, and Industry (MCTI)	All
	Ministry of Works and Transport (MWT	• Plastics • Paper • Glass

Stakeholder Group	Relevant Key Stakeholders Department/Agency /Organization)	Relevant Waste Streams
	Ministry of Local Government and Rural Development (MLGRD) • Local Government Association of Zambia (LGAZ) • Lusaka City Council Ministry of Housing and Infrastructure Development (MHID) • Department of Public Infrastructure (DPI) Ministry of Finance • Zambia Revenue Authority	All
Private Sector Business ✓ Companies ✓ Enterprises	• Zambia Association of Chambers of Commerce and Industry (ZACCI) • Zambia Association of Manufacturers (ZAM) • Tandem Circular Consultants • CitiMop Ltd • Clean Fast Limited • Keli Clean Zambia • Professional Waste Solutions • City Waste Solutions • Separation at Source Zambia Ltd • Southern BioPower Ltd • Nostrum Investments Ltd • AST Recycling • Water Services Africa (PTY) Ltd • Atlas Incinerators ApS • Kapiri Glass Manufacturing • Newtech Recycling Limited • Shunya Enterprises Ltd • Charles Tembo (Individual) • Zorbit Waste Management • Greentech Innovation • Centre for Green Waste and Innovation in Africa • M & F Packaging • Xing Huo • Plastpave • Central African Renewable Energy Corporation Limited • Zambia Breweries / Manja Pamodzi Project	All
Non-Governmental Organisations (Civil Society)	• UNEP • BORDA Africa • Namati • Zambia Institute of Environmental Management (ZIEM) • International Labour Organization (ILO) • Wildlife and Environmental Conservation Society of Zambia (WECZ) • Non-Governmental Organizations Coordinating Council (NGOCC)	All
Learning and Research Institutions (Academia)	• The University of Zambia • Mulungushi University • Cavendish University • Copperbelt University • Mukuba University	All

4.1.1 *The informal sector*

Waste workers in the informal sector (defined by the ILO as individuals, small or micro-enterprises that intervene in waste management without being registered or formally charged with providing waste management services) are critical to waste management systems' effectiveness, managing an estimated 15-20% of waste generated (globally). These informal waste collectors serve the economy and the environment by recovering recyclable materials and lowering municipal solid waste management expenditures. The waste picking by informal workers is often seen in emerging countries. Informal waste activities are a key contributor to the current waste system in Zambia as well, in terms of collection (semi-formal CBE's), waste picking (separation of valuable waste at the dumpsites), and aggregation (semi- or informal waste aggregators that act as intermediaries between the pickers and recyclers or sellers). Moreover, it plays an important socio-economic role. According to a 2017 study by University of Zambia academics, waste picking provided an escape route out of poverty, particularly for many women who had no other options to generate income and sustain their children. The research found that most waste pickers had low educational levels and difficulties finding other work. Working circumstances are severe and unhealthy, and over half of them have experienced health problems due to their job at the dump, the most common of which are respiratory disorders caused by smoke and dust, as well as body aches from working long hours[50]. However, some waste pickers have managed to establish small businesses, such as 2012 founded social enterprise Recyclemania. It has purchased materials from the informal sector, given waste pickers a recycling outlet, and lobbied for the professionalization of waste picking[51].

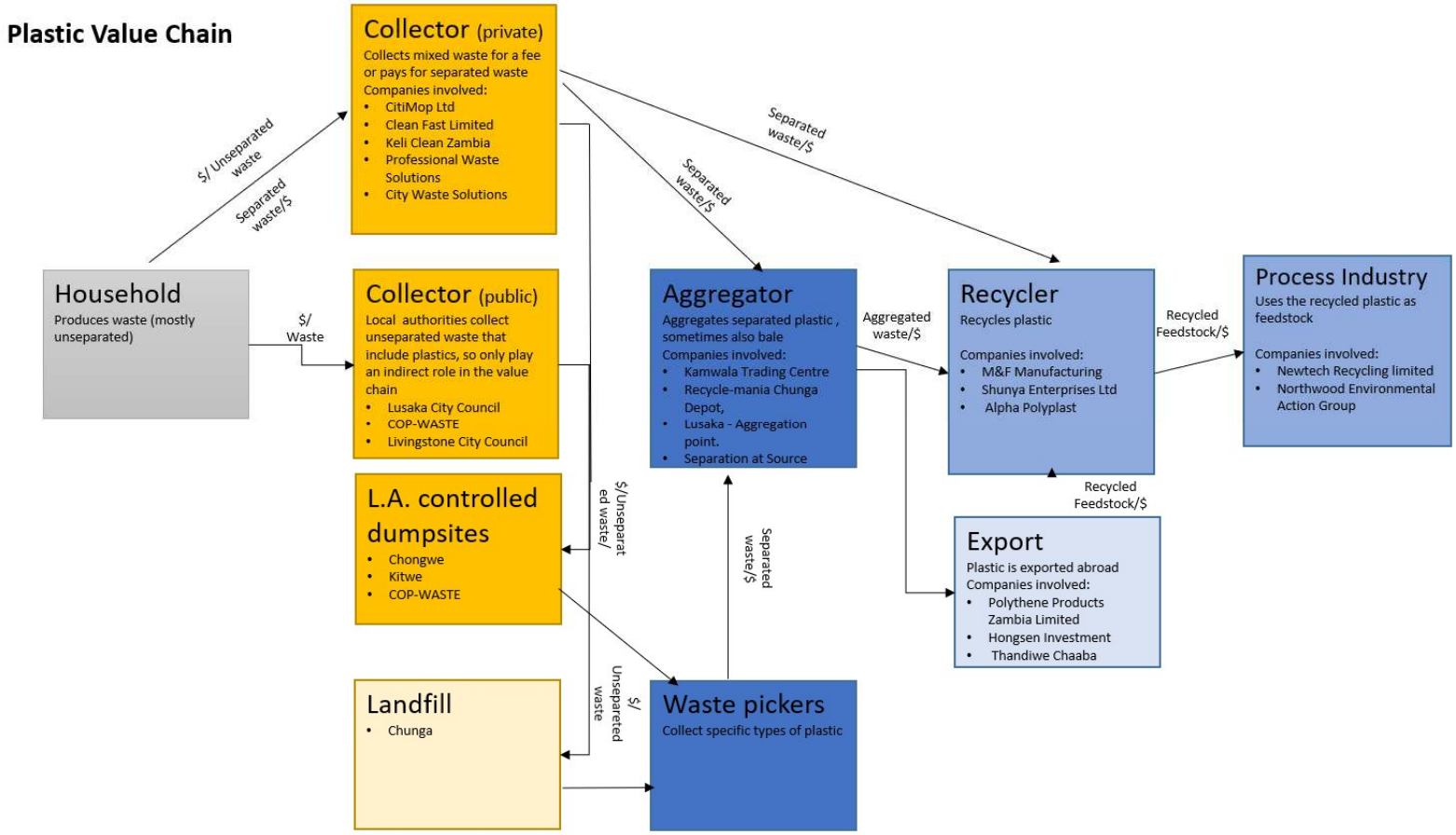
4.2 Overview of the value chains per waste stream

Below the value chains for the different streams are presented. The colour scheme indicates the following:

In the boxes examples are given of some of the most important players involved. These name lists are non-exhaustive. Yellow indicates all activities from waste generation to disposal. Blue indicates all activities aimed at value recovery or addition (from picking and aggregation to processing).

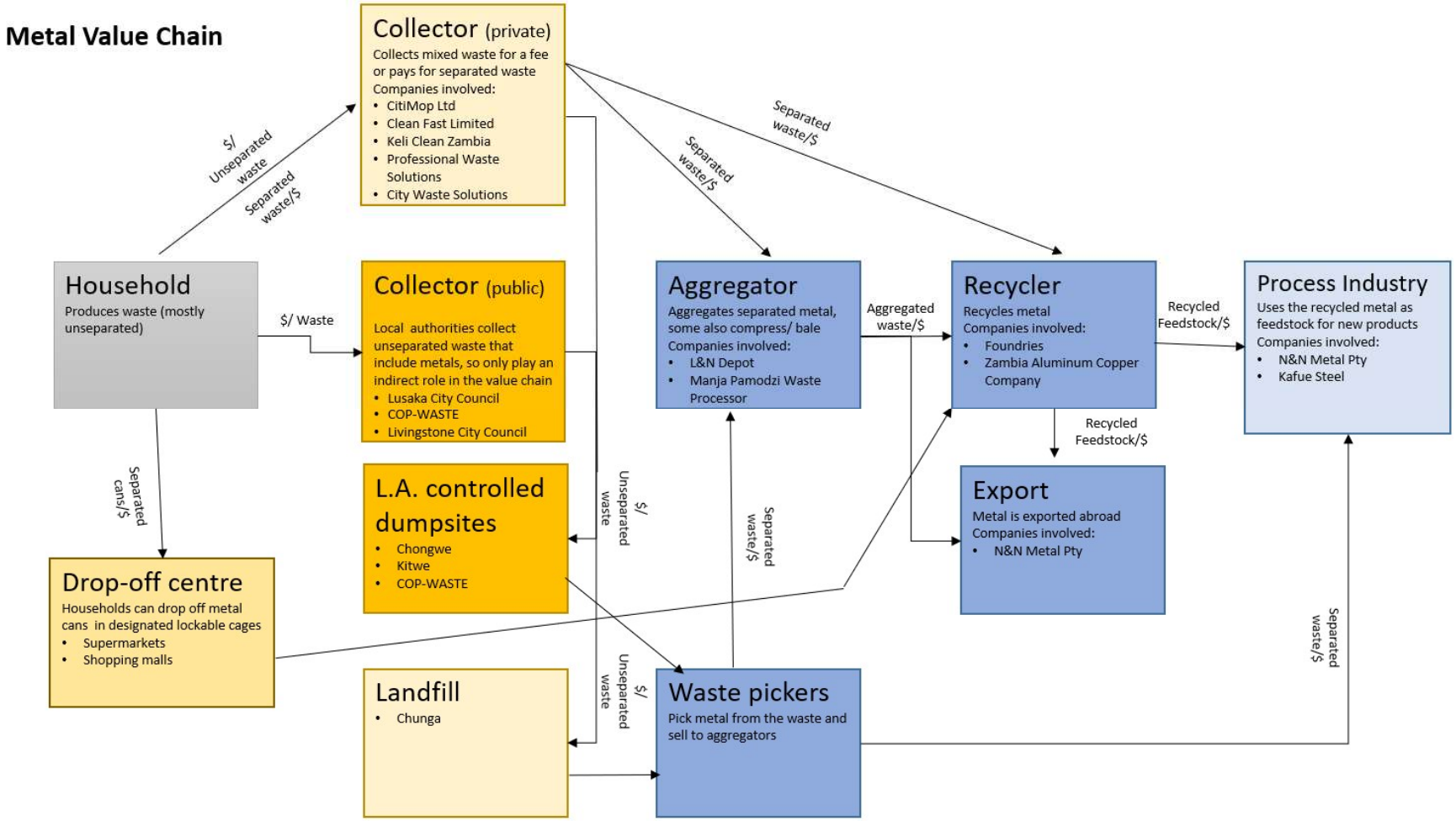
[50] Chileshe, B., Moonga, M. (2017): Alternatives for Dumpsite Scavenging: The Case of Waste Pickers at Lusaka's Chunga Landfill. In: International Journal of Humanities Social Sciences and Education (IJHSSE), 4/6, 44-51

[51] Mengo, V. (2018): *Booming waste scavenging business, its perils*. Zambia Daily Mail, 25.04.2018. (Online, last accessed: 10.04.2020)



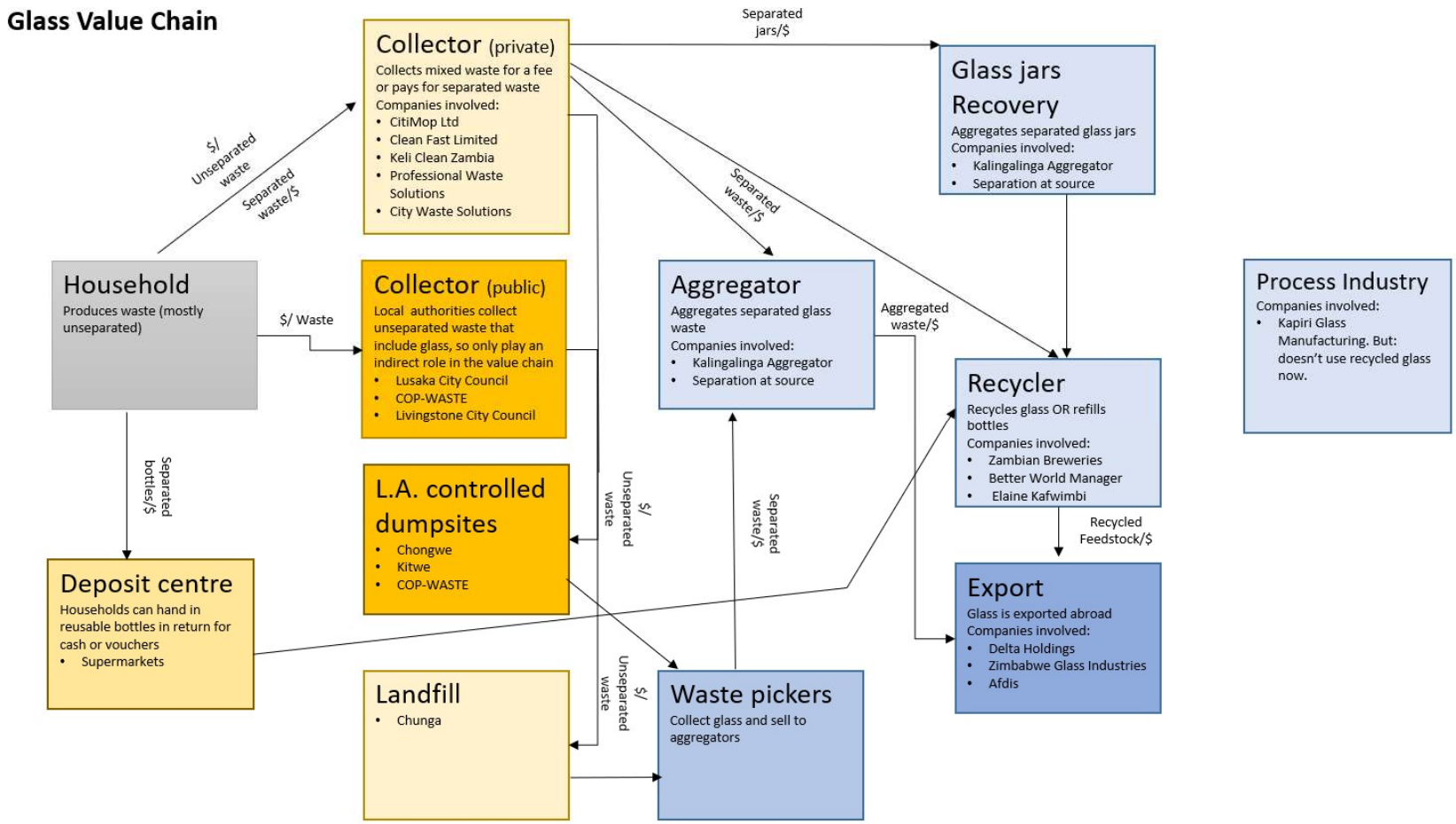
Findings

- Many private collectors collect plastic waste separately
- There are many waste pickers and informal aggregators active in the picking and collection of plastic waste.
- There are quite some recyclers of plastic who shred and pelletize. Some recyclers also produce new products, others sell to producers.
- There are quite some plastic producers in Zambia
- The market is largely domestic with not much plastics being exported



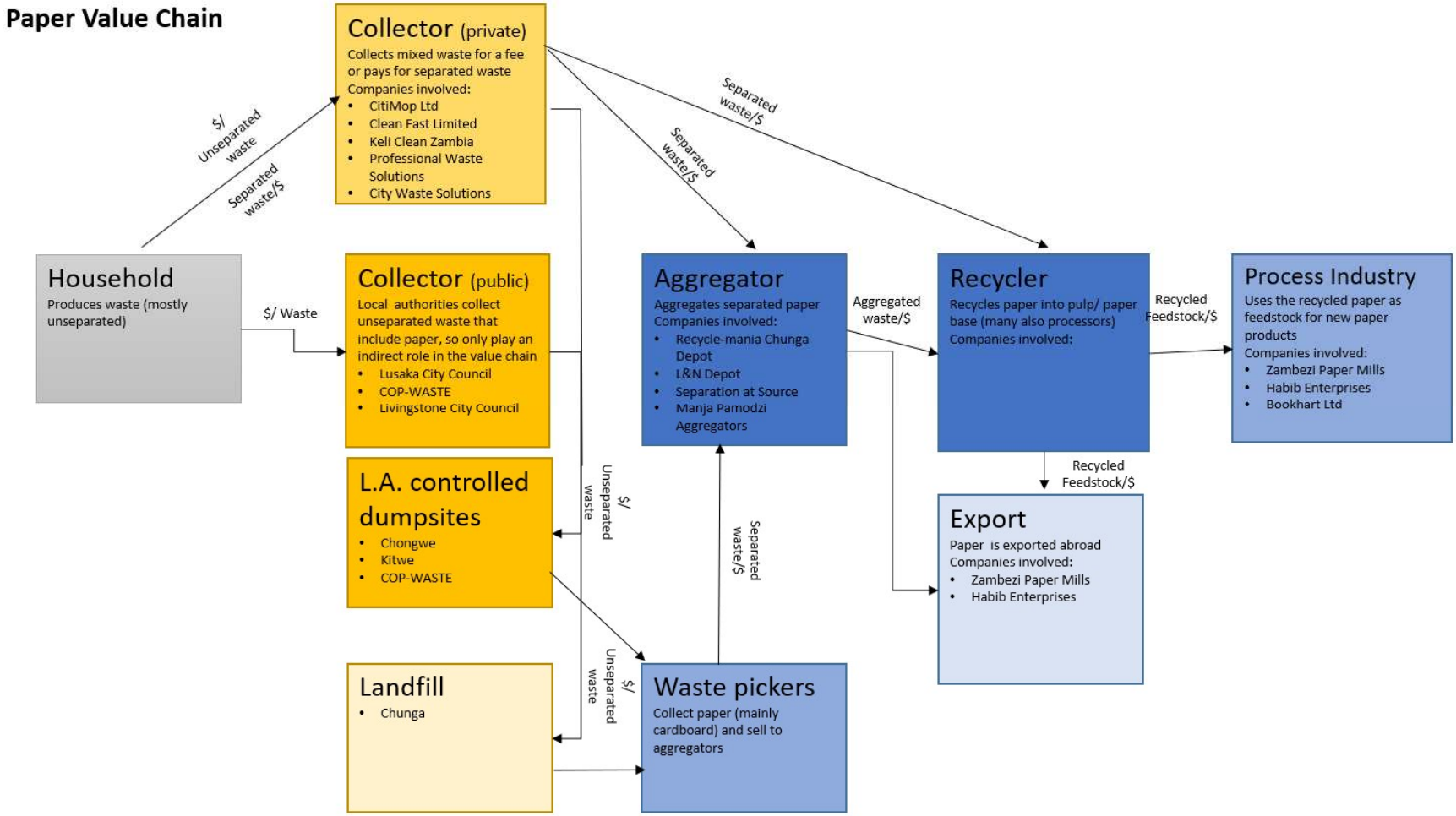
Findings

- A few private players are active in the separate collection of metal waste from households. Many more exist when also considering scrap metal waste from companies; however, this is not included in the scope.
- There current domestic market for metal waste is relatively small; there are more aggregators than recyclers and process industries.
- Most recycling is on cans and steel (smelting).



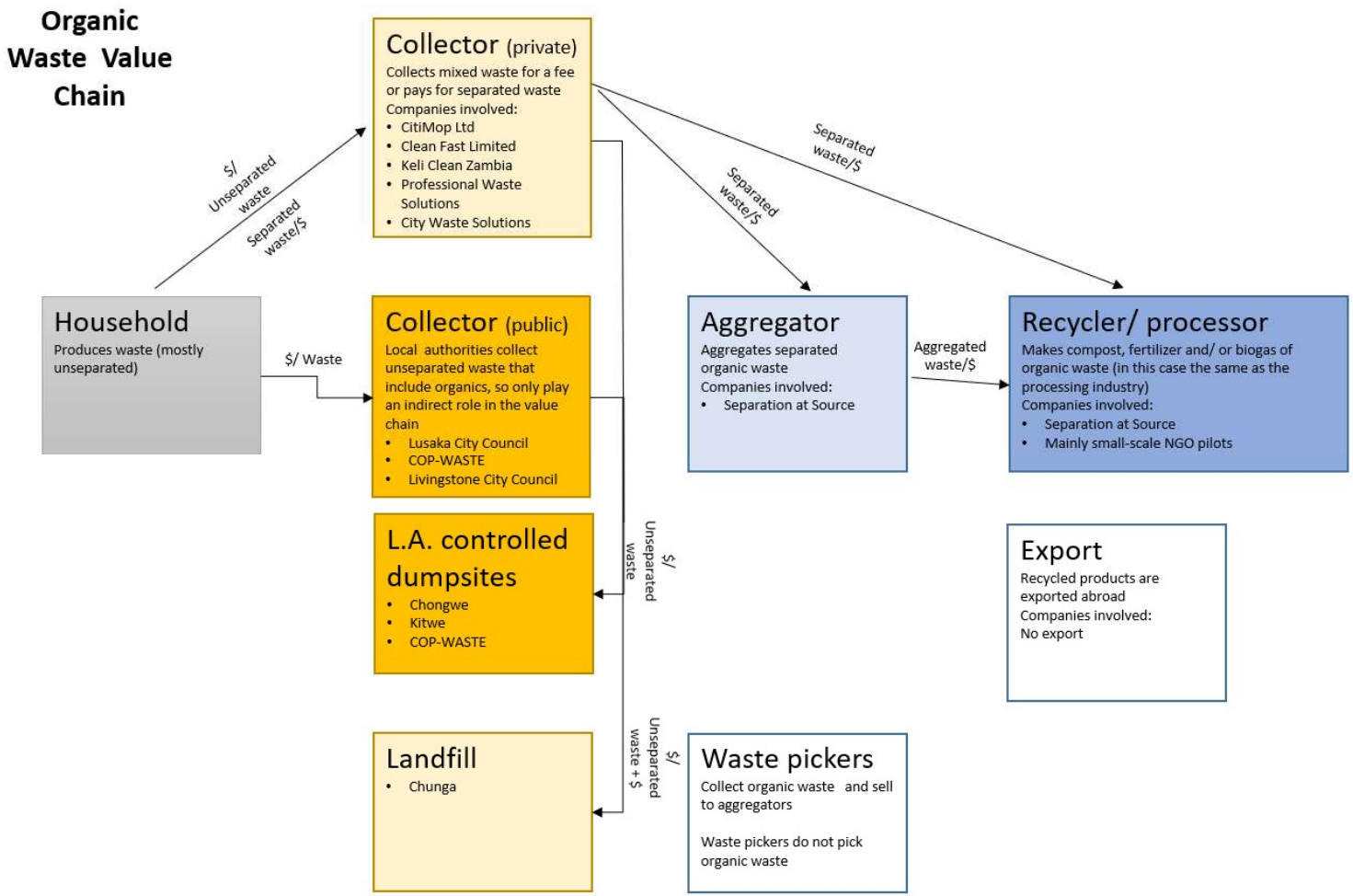
Findings

- There are very few players active in the separate collection of glass waste. Households deposit bottles and non-bottle glass usually mixed with the residual waste.
- There are no glass recyclers in Zambia, but there are some beverage companies who reuse and refill bottles acquired through deposit schemes (although this is mainly done abroad in South Africa)
- Separation at Source collects glass jars and resells them to recyclers
- There are no companies that produce glass as a raw material (no manufacturers)



Findings

- Some private parties collect paper waste separately
- There are many (small scale) players available who recycle paper waste, for example, into egg cartons
- There are quite some paper processers
- Some white paper is exported to Zimbabwe, but most of the cardboard remains within Zambia for processing



Findings

- There are not many players active in the separate collection of organic waste in Zambia
- Waste pickers generally do not pick organic waste. All organic waste that is processed separately is collected directly from households.
- There are only a few parties active in composting and producing fertilizer. The market is not yet accustomed to the product.
- Because so little is also produced, nothing is exported.

5 Policy and regulatory landscape

This chapter reviews Zambia's policies on waste management and climate change pertaining to the Circular Economy (CE), including their core targets and regulations. This section critically analyses the content of these policies. It also points out inconsistencies and gaps between CE principles and Zambian targets and policies implemented by its directives and regulations. As in most countries, there has not been a full implementation of a CE strategy in Zambia. The majority of efforts reported below are connected with waste treatment and recycling. The most notable characteristic of the country's waste management system is the promotion of 3R (reduce, reuse, and recycle) policies in parallel with waste management regulations. The first subchapter goes into the Zambian NDC's and commitment to the SDG's.

5.1 Relation to the NDC's and the SDG's

The Government of Zambia has presented its Intended Nationally Determined Contribution (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC)[52]. The Nationally Determined Contributions (NDCs) embody the efforts that each country has committed to reducing national emissions, in line with the Paris Climate Agreements of 2015. Zambia's NDE endorsed this project on the circular economy as a project to contribute to the INDC.

The first NDC actions of Zambia focused on three mitigation programs: Sustainable Forest Management, Sustainable agriculture, and Renewable Energy and Energy Efficiency. The agriculture program includes "implementing rural biogas plants and "Rural biomass electricity generating facilities", reducing indoor air pollution. But interestingly, such conversion to biogas is a core activity in circular activities related to biotic waste. In other words, the INDC supports circular activities. Though not mentioned specifically, the program focusing on renewable energy might also engage in biogas and electricity production in waste incinerators. The INDC gives two scenarios: limited international support is provided and one in which substantial support is provided. In the first case, a target is given to reach a 25% decrease in CO_2 emissions per capita by 2030, compared with the projected Business As Usual scenario. In case substantial support is provided, Zambia can achieve a 47% decrease in emissions in 2030 compared to the business-as-usual scenario in that year. These reductions represent 20 and 38 Mton of CO_2e, respectively.

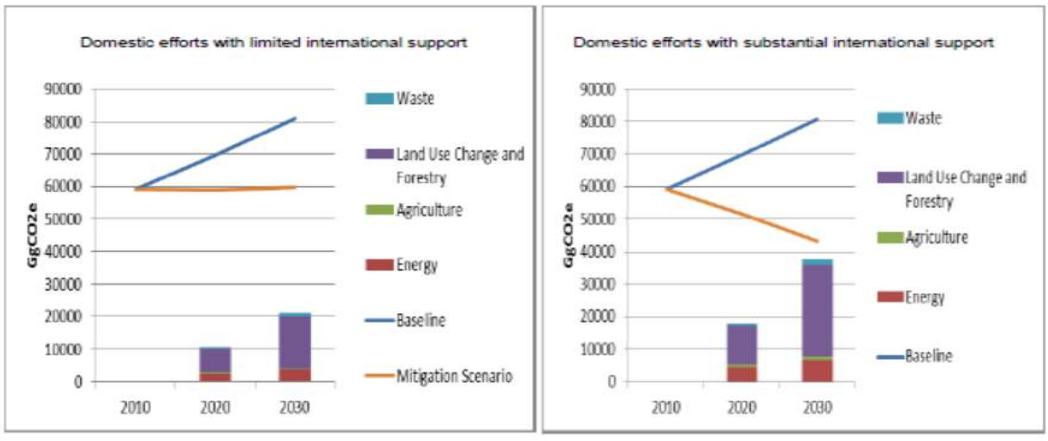


Figure 17. Scenarios for Zambia's GHG reduction

[52] Zambia's intended nationally determined contribution (INDC) to the 2015 agreement on climate change - ww4.unfccc.int/sites/ndcstaging/PublishedDocuments/Zambia%20First/FINAL+ZAMBIA%27S+INDC_1.pdf

Contribution to SDGs

This TA project also incorporates and supports Zambia's commitments to the Sustainable Development Goals, particularly SDGs 9, 12, and 13. These commitments can be extracted from the recent Voluntary National Review (VNR), published in June 2020. The activities that can be linked to the SDGs are set up in the framework of the so-called National Development Programs, which are developed as 5-year programs. In 2020 the 7th NDP was active (7NDP).

The VNR reports about progress on 14 out of 17 SDGs. Remarkably, reports on SDG 12 are left out because of insufficient data. This position for SDG12 is understandable: as the 7 NDP Strategic Development Pillars for Zambia show, the government's focus is on economic development for Zambia. It can be expected (and even hoped for) that the economic development of Zambia will lead to significant increases in domestic material consumption, thereby counteracting target 12.2: By 2030, achieve the sustainable management and efficient use of natural resources. Of course, in due time, the management of resources will play a bigger role as does the prevention of waste, but currently, the priorities lie elsewhere.

The data reported on SDG9 exclusively demonstrate the development of cargo and passenger transport by rail or air. The focus in the 7NDP is clearly on developing basic infrastructure in Zambia as a prerequisite for further development. Developments in the framework of waste management and circular economy will -as other industrial activities will do- benefit from such developments, but they are not the focus of development. The VNR reports that the share of manufacturing to GDP has grown per capita. Among the sectors contributing to this share reside "smelting and processing of metals and refining of copper, and manufacturing of construction materials, such as cement, window frames, doors, roofing materials, and nuts and bolts." Such activities in the national economy point to possibilities of a domestic recycling system, e.g., recycling ferrous- and non-ferrous metals.

SDGS 9, 12 AND 13

The Sustainable Development Goals are described by the UN (https://sdgs.un.org/goals) and comprise 17 goals that all-in-all show the forward for humankind. The TA Project for Zambia focusses in particular on SDGs 9, 12 and 13:
SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
SDG12: Ensure sustainable consumption and production patterns
SDG13: Take urgent action to combat climate change and its impacts

The data that show progress on SDG13 focus on data acquisition and warning systems at the household level. The potential link between SDG13 and waste management lies in generating electricity and biogas from waste incineration and the installment of biogas facilities. Such activities are not yet mentioned as priority activities in the 7NDP. The VNR attributes 2% of national emissions to waste. Though the TA focus is on the contribution to SDGs 9,12, and 13, Zambia's activities in the framework of the SDGs relate to a much broader set than these three. For instance, the VNR describes Zambia's activities on **SDG15 Life on Land**. Though activities are not yet identified, the VNR mentions "Pollution and poor waste disposal into ecological systems" as one of the challenges to be met by strengthening government and private sector relations.

Improved management of waste is specifically mentioned in the framework of activities related to **SDG 6 – Clean water and sanitation: Ensure availability and sustainable management of water and sanitation for all**. The following is mentioned among the required actions: "Assess the effectiveness of private sector involvement in the sanitation sub-sector, vis-a-vis environmental concerns of waste

disposal". The activities in this TA Project can support this action by assessing the private sector's potential involvement in improved waste handling and thus in preventing unmanaged waste disposal.

Waste management is also an integral part of Zambia's approach to **SDG11: Sustainable cities and communities**. Indicator 11.6.1 explicitly mentions this ambition: "Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities". The VNR quotes the 2015 Living Conditions Monitoring Survey. It was reported that "approximately 7 percent of households in Zambia (15 percent urban and 2 percent rural) had their refuse collected for disposal at designated sites". There is room for improvement here, and any 'circular' activity related to value creation with waste starts with improving this situation.

5.2 Policies and regulations

Zambia has a fairly comprehensive legislative framework for the management of solid waste. As one of the few countries in the region, Zambia released an Extended Producer Responsibility (EPR) Regulations Statutory Instrument No. 65 of 2018 (EPR Regulations), which came into force on 3rd August 2018. It places an obligation on producers of products that have the potential to pollute the environment to minimize waste through treatment, reclamation, re-use, recovery, or recycling, and regulates mostly packaging of specific materials. These types of packaging materials specified are:

i. Cartons
ii. Non-returnable glass bottles
iii. Non-returnable plastic bottles
iv. Plastic carrier bags and flat bags below 30 microns
v. Beverage cans
vi. Waste oils
vii. Waste lubricant containers
viii. Used lead-acid batteries
ix. Pesticides containers/packaging
x. Chemicals containers/packaging
xi. Expired chemicals
xii. Used tires
xiii. Near end of life or end of life electrical and electronics
xiv. Electrical and electronic equipment.

Nonetheless, the implementation and enforcement of the legislation is an area of improvement, and the EPR is currently not as effective as it could be.

The policy field relating to waste management is structured as shown in the figure below. On a national level, the Ministry guides matters policy through government agencies in the sector. Zambia Environmental Management Agency regulates the sector to ensure compliance with regulations and laws. The Inter-Agency Environmental Coordinating Committee (IECC) is an interactive platform for environmental and regulatory stakeholders.

Figure 18 Structure of the policy implementation in relation to the waste system (Adopted from ILO Green Jobs Report 2017)

It is observed that policies regarding the waste management sector in Zambia are fragmented. Several major waste management policies in Zambia are directed at the circular economy, including the Waste Management Policies, other environmental policies, energy and climate policies, and the NDCs.

In Table 6, an overview is given of all the policies and regulations that were included in this analysis. Note that only policies and regulations regarding domestic and agricultural waste were included. The section continues to discuss insights from the most important policies.

Table 6 Overview policies

Type of Policy	Name of Policy	Year developed/amended
Waste Management Policy; Strategy; Law	National Solid Waste Management Strategy of Zambia	2004
	Solid Waste Regulation and Management [No. 20 of 2018 353]	2018
	Legislation on Extended Producer Responsibility	
	Environmental Management Act No. 12 of 2011	2011
	Environmental Protection and Pollution Control Act no. 12 of 1990, amended in 1999	1990, amended in 1999, repealed in 2021[53]
	National Environmental Action Plan (NEAP) (1994)	1994

[53] https://www.ecolex.org/details/legislation/environmental-management-act-2011-no-12-of-2011-lex-faoc117523/

Type of Policy	Name of Policy	Year developed/amended
	Waste Management Regulations Statutory Instrument No. 71 of 1993	1993
	National Policy on Environment (NPE, 2007);	2007
Climate Change Policies; strategies; laws	National Policy on Climate Change	2016
	National Climate Change Response Strategy 2010	2010
	Intended Nationally Determined Contribution (INDC) 2015	2015
	National Adaptation Plan of Action (NAPA) 2007	2007
Renewable Energy Policies; strategies; laws	National Energy Policy of 2008.	2008
	Energy Regulations Act No. 23 of 2003	2003
Agriculture Policies	National Agriculture Policy of 2014	2014
	Second National Agricultural Policy	2016

The principal law on the environment is **The Environmental Protection and Pollution Control Act no. 12** of 1990, amended in 1999. This law provides requirements for handling waste, such as the licensing and permitting process on waste collection, transportation, treatment, and disposal. In addition, another important supporting legislation is the **Hazardous Waste Management Regulations Statutory Instrument No. 125 of 2001**, which provides regulations on the control of hazardous waste to manage the waste in an environmentally sound manner through waste prevention and reduction recycling incineration, and landfilling.

According to The Zambian Delegation on the Discussion on Waste Management During the Eighteenth Session of the UN Commission on Sustainable Development, the main challenges that Zambia faces in waste management are:

- Insufficient capacity for the recovery and recycling of various types of waste streams such as plastics;
- Insufficient capacity and equipment for municipalities to deal with the collection, transportation, and disposal of waste; and
- Inadequate awareness on sound management of waste and impact on human health and the environment.

According to the same delegation, Zambia's overall goal of solid waste management is to collect and dispose of waste generated by the population in an environmentally and socially sustainable manner. Therefore, the principal aim is waste collection and disposal, not separation at source, not recycling, not reuse of waste, and not the generation of energy from waste. Therefore, circularity is not promoted from a waste management point of view. Another key point that the Delegation makes is to enhance Zambian efforts to effectively manage waste from plastic packaging. The country is developing legislation (called Extended Producer Responsibility) to discourage the production of thin plastic packaging and encourage recycling.

The Solid Waste Regulation and Management [No. 20 of 2018 353] is the Act regulating solid waste management in Zambia. There are a lot of contradictions in the Act concerning supporting CE; two of those are discussed here.

- In Part III: Regulation of Solid Waste, the regulation provides regulations for the collection and disposal of waste in landfills and other designated places. It continues to provide regulations for sorting waste under Part III, section 28. However, this is confusing given that the assertion from section 23 on Solid waste categorization and handling, then sections 29, 30, and 31 (Collection of solid waste; Transportation of solid waste; Disposal of solid waste in landfill or another disposal facility, respectively) and there is no reference to the sorting of waste.
- In section 23, the categorization of waste is according to the source of origin, namely whether it is domestic waste, healthcare waste, construction waste, commercial waste, industrial waste, or agricultural waste. It does not provide for categorization according to the waste stream: plastic, paper, metal, glass, organic, or agricultural waste. Section 28, though, is more precise and states that "a waste generator shall sort, or cause to be sorted, various categories of solid waste into different groups or clusters, such as—organic waste; plastic waste; paper waste; glass waste; metal waste; or any other group or cluster that may be specified in regulations issued by the Minister.

Furthermore, the following regulations observed in the Solid Waste Regulation and Management act are worth highlighting:

- Section 31 on Disposal of waste states that (1) A local authority or licensed solid waste service provider shall dispose of solid waste in a landfill or other disposal facility, or recycle, treat, or compost or incinerate the solid waste or use any other prescribed disposal method, depending on the type, quality, and quantity of the solid waste.
- Part II: Solid Waste Management, section 19 provides regulations for Community solid waste management services, which is an interesting recognition of the value of community services in the waste management sector. According to Aparcana[3], Informal recycling can also produce significant cost savings for businesses and municipalities. For instance, in Lusaka, Zambia, the net cost of informal waste collection is USD1.60 per tonne, compared to USD10.40 per tonne for formal collections.
- Part V: Solid Waste Services Provision under sections section 52 provides regulations for energy recovery and generation; and section 64 states that the functions of a licensed solid waste service provider, self-service solid waste provider, or registered operator are to, among other things, recycle. In section 72(d), the Act states that a local authority, solid waste management company, a licensed solid waste service provider, self-service solid waste provider, or registered operator may serve a written notice on any person requiring that solid waste owned, possessed or under the control of that person— be made available for recycling in a manner stated in the notice.

Zambia's National Solid Waste Management Strategy was developed to ensure that Zambia develops and establishes a coordinated approach to sound solid waste management. The Strategy is a pro-circular economy and clearly articulates issues relating to the re-use and recycling of waste materials as a resource. It further requires the development of a database and a waste information management system for all types of waste. The strategy analyses the information gaps in waste management delivery, information on the quantities of every kind of waste, and the location of waste streams. These are considered to be the first strides in waste stream classification, which would hopefully lead to the separation of waste at the source.

The Strategy clearly articulates the situation in the waste management sector. It recognizes that, generally, the current waste management situation is bad. Waste generated from all sectors is currently not well managed, with a lot of domestic and industrial waste uncollected, especially in the major urban and peri-urban areas[4]. Disposal sites in almost all the districts are either not there or poorly managed. Taking the Lusaka situation as a reference point, less than 14 % of the waste generated in the urban centres finds its way to the disposal sites[5]. These include domestic, commercial, industrial, and hazardous waste. Currently, there is no available data on radioactive, agriculture, and chemical waste[6].

In addition, there is generally inadequate data for other waste streams, especially for areas outside Lusaka and the Copperbelt[7].

The Strategy aimed to reduce the amount of waste in landfills to safeguard public health and the environment. However, the Strategy was designed from a public health perspective and not from a perspective of boosting the market for secondary raw materials. Three key objectives of the Strategy are nevertheless pro CE development: (i) Waste minimization, and recycling, (ii) Establishment of a waste database and classification system, and (iii) Reduce the volume of waste requiring disposal and maximize the economic value of waste. Under section 4.3.3 'Storage', the Strategy states that the storage of waste should, among other considerations, provide for the opportunity to sort the waste and recover any useful materials for recycling. As such, one of the actions and measures is to separate and store waste of different nature and composition to enhance the recovery of useful materials and prevent cross-contamination. The promotion of source separation at the household level is explicitly required in the Strategy.

The Strategy clearly articulates the types of waste, the generated quantities per annum, particularly for Lusaka, the Copperbelt, and mining towns, and the waste management levels. The Strategy further requires all stakeholders to follow the waste management hierarchy system shown in the figure below[9].

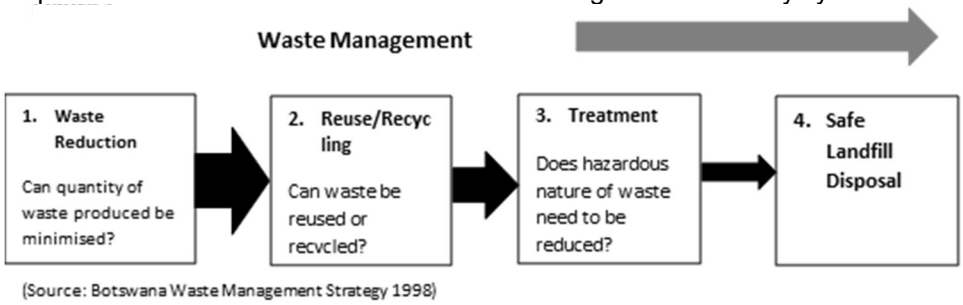


Figure 19 Waste management hierarchy system

This thinking is in line with CE principles, which state that in order from most favored to least favored options, reduce, reuse, recycle, recovery, and landfill should be considered for waste handling. The Strategy also promotes the Integrated life-cycle principle: The substances and products should be designed and managed to minimize environmental impacts during generation, use, recovery, and disposal. This thinking is also a common expected principle in CE development.

It was expected that the Strategy would lead to improvements in waste management encompassing all streams. It was also expected that the framework provided by Strategy would improve the provision of waste management services significantly through increased investment in equipment, infrastructure, and capacity building. However, in reality, waste management remains insufficient management, as enforcement of the Strategy is not well developed enough.

Sections 62 and 63 of the **Environmental Management Act (EMA)** layout the regulations around the separation, transportation, storage and disposal (via landfill or incinerators) of Zambia's waste[54].

These regulations build on those included in the National Solid Waste Management Strategy (NSWMS). First and foremost, it falls to ZEMA to educate all persons, enterprises, and industries that produce waste on the proper means of storing, collecting, and disposing of any class of waste. They are also responsible for classifying and defining waste categories (of which recyclables are not currently defined as a category), and determining which substances fall under those umbrella categories. Section 63 also

[54] https://www.unep.org/resources/report/environmental-management-act-2011-zambia#:~:text=An%20Act%20to%20continue%20the,provide%20for%20the%20preparation%20of

stipulates that waste must be physically separated into these categories by persons involved in generating, managing, or disposing of waste. Further, it prohibits the disposal of reusable, recyclable, and recoverable wastes (ZEMA, 2011)[55].

With regard to transportation, ZEMA mandates that all waste collectors must be licensed and adhere to a set of regulations, including that waste must be transported to a disposal site or another facility for the permanent disposal or storage of waste. Possession of a waste license also allows for the transit, trade-in, or export of (non-hazardous) waste (Ministry of Local Government and Housing, 2016c).

To prevent contamination and environmental degradation, additional regulations govern the monitoring and regulation of waste disposal sites. The NSWMS outlines specific steps to address final waste disposal, such as decommissioning environmentally unsound dumpsites, revising disposal site selection criteria guidelines, regulating waste picking at disposal sites, and including Material Recovery Facilities as part of a comprehensive disposal system (UNEP, 2016). There was little information in the literature about other approved treatment methods, such as incineration and composting. Dumping and burning are common informal disposal methods, but they are illegal and may be punishable under the EMA.

Finally, the NSWMS outlines several measures or strategies detailed above in various environmental regulatory frameworks to enhance recycling and reuse. To improve the provision and sustainability of SWM services, which local authorities no longer have the capacity to provide on their own adequately, the government must continue to work with a range of stakeholders, including local communities, the informal sector, and the private sector (UN-Habitat, 2007a).

Existing incentives (in the form of taxes are tariffs) are focused on larger-scale businesses and industries, which would benefit efforts such as recycling or waste to energy. There are no or limited incentives within the current framework for smaller businesses or small and micro enterprises looking to enter the waste management industry.

According to the **National Policy on Climate Change**, waste contributes the least to Climate Change in Zambia (0.8%); therefore, it is hardly discussed in the policy. Apart from that, the policy is completely silent on any waste-related issues – see Table 7.

The **National Energy Policy** mentions energy generation from agricultural waste, animal waste, sawmill waste, forest waste, and municipal waste.

In the **Zambia Intended Nationally Determined Contribution (ZINDC)**, waste is recognized as a source of greenhouse gases, specifically Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). The waste (i.e. Solid waste disposal, Solid waste open burning, Domestic wastewater handling, Industrial wastewater handling, and Human sewage), forest waste, and agriculture waste are mentioned. The INDCs also mention the generation of electricity from agriculture waste.

5.3 Policy Gaps

What stands out is that none of the policies and regulations discuss quality standards for recycled materials or the creation of job opportunities. Issues like gender inclusion and monitoring of waste management targets are also hardly discussed. The national policy on climate change and the INDC's do hardly include CE and waste management. This can be explained by the low contribution of waste to the greenhouse gas emissions of Zambia.

[55] https://www.ecolex.org/details/legislation/environmental-management-act-2011-no-12-of-2011-lex-faoc117523/

Another thing that stands out is that reinforcement of regulations is not extensively discussed, while many of the regulations fail to be applied and executed in practice. In that regard, one would expect advice on applying and enforcing regulations on various government levels.

Table 7 Matrix showing whether selected policies address certain CE parameters

Whether policy addresses issues On:	Name of Policy / Law				
	Solid Waste Regulation and Management [No. 20 of 2018 353]	National Solid Waste Management Strategy of Zambia	National Energy Policy	Zambia's INDCs	National Policy on Cilmate Change
Separation of waste	Yes	Yes	Yes	No	No
Retaining waste materials as resources for production / raw materials	No	Yes	Yes	No	No
Gender Inclusion	No	No	Yes	No	No
Extended producer responsibility	Yes	Yes	No	No	No
Solid waste management	Yes	Yes	No	Yes	Yes
Recycling	Yes	Yes	No	No	No
Reusing	Yes	Yes	No	No	No
Boosting the market for secondary raw	No	Yes	Yes	No	No
Renewable Energy generation from waste	Yes	No	Yes	Yes	No
Creation of job opportunities	No	No	No	No	No
Opportunities for Innovation	No	Yes	Yes	No	No
Financing and investment for waste	Yes	Yes	Yes	No	No
Incentives for waste management / CE	No	Yes	Yes	No	No
Fees, Fines and Penalties for waste	Yes	Yes	No	No	No
Quality Standards for recycled materials	No	No	No	No	No
Monitoring of waste management targets	No	Yes	No	No	No
Awareness raising of waste	No	Yes	Yes	No	No

In summary, four key issues are missing from all the policy documents that were reviewed, namely gender, job creation, generating energy from waste, and enforcement of regulations.

1. Gender – gender is hardly addressed in any waste management policies or climate change policies. It is only mentioned in the National Energy Policy and the National Climate Policy.
2. Generating energy from waste – In the National Solid Waste Management Strategy and other documents, this aspect is missing. However, it is covered in the National Energy Policy.
3. Enforcement of regulation – there is insufficient attention to how different government levels can implement and enforce regulations with limited budgets and infrastructure.
4. There is an EPR in place, however, its scope in terms of waste types does not include many of the streams included in this study. Moreover, enforcement is not yet fully in place.

6 Past and ongoing projects

An assessment was carried out of past and ongoing projects and initiatives on Zambia's waste management and circular economy. This included desktop research on strategic and project documentation from key government department institutions such as the Environmental Management Agency, local authorities, NGOs, companies, and business associations.

The full overview of the identified past and ongoing projects in Zambia can be found in the Appendix. The overview contains 19 projects and initiatives, among which companies initiated none. Most activities were funded by foreign agencies such as UNDP, USAID, and government-sponsored programs from Japan, the UK, and Finland. Most projects were general and aimed at all waste streams. A few (2) projects were aimed at valorizing plastic streams and another 2 at organic waste and biogas production.

Examples of concrete projects aimed at alleviating general waste management issues in (peri-)urban areas (such as COMEQS and the Wash'nSoul project by Borda, which has just begun) indicate that the basic infrastructure for solid waste management still needs to be built up. Capacity building and studying adequate tariff structures are characteristic of such projects. The Manja Pamodzi Waste program by Zambia Breweries demonstrates that setting up a basic supply chain faces many issues of insufficient and unpredictable supply resulting in a high level of 'drop-outs' in such experiments.

The example of Milk chilling with biogas in Kenya, Tanzania, and Zambia (SNV) shows the interest in such activities. In this project, the OPEC Fund for International Development will lower the investment barrier for the first 750 farmers in the upscaling phase. Similar activities are found in the project Energy for Agriculture, which supports the development of viable biogas markets, improving livelihoods through increased fuel savings and income generation. In addition to increasing consumer demand through promotion and access to finance, the E4A project also develops the supply of bio-digesters and productive appliances through skills development and results-based finance incentives. As in similar economies, the introduction of biogas receives attention here. SNV is an active player and should know more about the issues with scaling up in several cultures and in urban and rural areas.

As in other countries, several agencies stimulate young entrepreneurs to set up green jobs, often in waste-related areas. The UNDP Accelerator Lab Network supported Ten Youth-led Enterprises in Sustainable Waste Management and Recycling in Lusaka and Ndola, who were each awarded USD 4,000 each to address sustainable waste management challenges in Ndola and Lusaka districts. In the framework of our current project, it would be important to follow up on these activities: what were the initiatives (they are not reported), and how is the progress made and monitored? What are the topics? Another example is given by the Innovation Grant Program (Millennium Challenge Account): that states: "In total, the program launched two calls for grant proposals and ultimately financed 14 grants: two related to water supply ($2.4 million), five related to sanitation ($1.6 million), and seven related to solid waste ($1.9 million)." Though "Significant resources were put into ex-post monitoring and evaluation of the IGP overall as well as of several of the individual grants" an overview is currently lacking. However, it might provide valuable insights into the challenges of implementing start-up ideas.

In 2021, the World Bank provided sector-wide funds that are hoped to generate data on waste generated throughout the country.

7 Conclusions

It can be concluded that the circular economy is not developed to its full potential in Zambia. The circular economy has relatively naturally developed amongst low-income households, who demonstrate high levels of reuse and repurposing due to economic necessities. However, with the high levels of waste dumping leading to myriad and severe negative effects such as pollution, disease, and GHG emissions, moving towards more sustainable waste management is paramount for the country. Particularly given the expected increase in population and income level (leading to more waste generation), this challenge becomes more pressing by the day. The most waste still ends up at the landfill, legal or illegal dumps, or is burned. Moving towards more circularity, increasing reuse in the higher-income areas, and fostering recycling and recovery of valuable materials from waste can contribute to the economic and resource independence of the country and provide opportunities for job creation. Particularly also because all major recycling businesses in the country are foreign-owned, providing incentives to grow and fostering Zambia-based companies to develop. This can be identified in terms of value-adding activities, especially for plastics and paper. For glass, metal, and particularly organic waste, recycling has been very little developed. But even for plastics and paper, there is a large potential for a substantial increase in recycling percentages.

However, before any well-developed recycling or recovery for the waste streams can be set up, it is paramount also to establish a proper collection and separation infrastructure, allowing for the harvesting of the waste. Currently, collection only is already a major challenge in Zambia, with all local authorities struggling to provide the necessary services. Councils receive a low budget from the national government for waste collection (about 20-30%), which is too low to allow for proper waste collection. Therefore, many of the cities work through the contracting of private parties and CBE's. But still, large areas are not being serviced at all or very infrequently (mainly mid and low-income), particularly the separation of waste (which is important for any recycling opportunity) is very uncommon. Much separation that is being done now is facilitated by the activities of the informal waste workers, who provide for post-collection waste separation in the dumps and landfills. Moreover, even in the areas that are serviced, many are not very profitable, so these companies struggle with their business model. Business models where residents pay are difficult due to the unwillingness of the public, largely based on poverty, although sometimes also the inconvenience of having to go to the city council office to pay.

In terms of the institutional context in Zambia, there is quite some potential for more circularity, particularly because there is an EPR in place. Yet, the institutional capacity to enforce the EPR system setup is currently underdeveloped. Moreover, many relevant streams are not included. A similar challenge can be identified regarding the fairly comprehensive legal framework for solid waste management in Zambia. Although the policies could have a great impact, these are currently not properly implemented and enforced. Moreover, there are also some key institutional gaps. Although Zambia acknowledges its main challenges with waste management and circularity, the currently existing policy framework mainly focuses on socially and environmentally sustainable disposal. The aim is not separation at source, recycling, or reuse. Circularity is not promoted directly. The national solid waste management strategy was, understandably, designed from a public health perspective and not from a perspective of boosting the market for secondary raw materials. However, this now leads to an idle opportunity in terms of fostering circularity through the NSWMS and has resulted in fewer improvements than expected. In addition, within the current policy framework, incentives such as taxes and tariffs are only exist for large-scale businesses and industry, not for smaller businesses or social enterprises, while their services will be critical in improving waste management. Particularly given the fact that there are no Zambia-based larger recycling companies yet – the smaller ones will need support too.

A A detailed description of used research methods

A.1 Research instruments and Tools description

a. Interview guides –Interview guides were used to ensure that all topics are covered during stakeholder consultations. Guides were used so that all interviewees covered similar discussion topics, allowing comparison and analysis of results.
b. Matrices – Matrices were adopted to show relationships between study determinants. For example, a matrix was used to show the level to which waste management policies address gender.
c. Questionnaires – Questionnaires were used to collect information from respondents, where applicable. The data collected from a data collection questionnaire were both qualitative and quantitative. Questionnaires had a mix of close-ended and open-ended questions. Open-ended, long-form questions allowed the respondent to elaborate on their thoughts. In line with COVID19 restrictions and social distancing requirements, applicable online platforms like Google Forms were used to administer the questionnaire.
d. Case studies – These were used as examples to highlight innovations that are related to Circular Economy and are within the selected waste streams.
e. Registration forms for stakeholders – During stakeholder consultations and workshops/webinars, stakeholders were asked to complete registration forms with their details, including names, organizations, contact details, position in organizations, and type of organizations as well as their role in the Circular Economy. This information was often updated to develop and keep referencing a database of organizations.

A.2 Identification of stakeholders

The overview of stakeholders included in the report is based on predefined waste stream categories of stakeholders as defined in the project plan. See the table below for the overview of all included groups and their relation to the waste management system.

Table 8 Overview of stakeholder groups approaches and their relation to the waste management system

Category	Relation to the waste management system
National Government & line Agencies in Environment Sector	The Government Ministries are involved in the development of policies and regulations as well as assessing investment opportunities in the waste sector; therefore, they have a broad understanding of the sectors. The expertise of the ministries benefited the study by providing policy recommendations for the adoption of circular economy measures.
Local Authorities	As provided by the law, local authorities are responsible for waste collection and disposal
Companies	Targeted businesses included recyclers, producers, and logistic partners in the waste management value chain. Overall, the parties form the Company group, which focuses on the bigger organizations rather than SMEs. Therefore, these parties are part of the waste value chain and crucial pins in the potential transformation to more circularity.
Enterprises	Enterprises regard the smaller and medium parties that are involved in waste management. Many of these are also part of

Category	Relation to the waste management system
	the informal sector as they are not formally registered. Nevertheless, they play a crucial role in the waste value chain.
Civil Society Organizations	Civil Societies are important players due to their role as policy reviewers and lobby for change through evidence-based research and the provision of recommendations. Moreover, NGOs and the Civil Society have been instrumental in supporting the creation of innovations and businesses within the waste management value chain.
Academia	Parties from academia are important due to their role as knowledge providers, steering and directing the public debate and proposing directions for change.
Households	Households are crucial stakeholders as well, as prime waste generators and as victims of the negative consequences of inadequate waste management (health effects and pollution of their environment).

An Influence-Interest analysis matrix was used to analyze each stakeholder's level of influence and interest concerning the waste system in Zambia. This approach made it possible to inform the selection of the appropriate stakeholders and parties from the defined groups and assess their role in the waste management system and contribution to the transition to a circular economy.

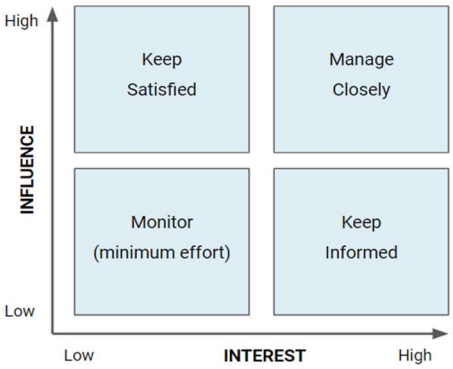


Figure 20 Influence - interest matrix

B Waste characterization data

B.1 Waste characterization methodology

Wastes are materials or objects that are discarded, disposed of, or intended for disposal. Solid wastes could be garbage or discarded substances and objects gotten from industrial, commercial, mining, agricultural, or general day-to-day activities. Most of the commonly known discarded wastes which make up the day to day items being disposed of by the general public are known as municipal solid wastes (MSWs), and it includes all substances or objects thrown away as products of packaging, lawn cuttings, furniture, clothing materials, bottles/glasses, food scraps, electric appliances, newspapers, paint, and batteries, etc. The selection and proper application of suitable methods, management policies, and technologies to achieve specific waste management objectives are termed integrated solid waste management (ISWM). Waste characterization studies have to be carried out to succeed in this system. Waste characterization is very important for appropriate MSW collection, selection of transportation equipment, energy transformation and its recovery, recovery of reusable matter, as well as the proper design and implementation of optimal disposal routes and methods. The changes in the trends of MSW generation and its composition have resulted from the differences in people's consumption behaviors coupled with rapid technological advances in the last decades. The quantity and composition of MSW also differ from one country to another, from one region to another, from one neighborhood to another, and even from one community to another. The differences could either be due to income level, socio-economic distribution, consumption habits, or disposal habits of people.

Waste characterization is how the composition of different waste streams is analyzed. Waste characterization plays an important part in any waste treatment that may occur. The biodegradable element of the waste stream is vitally important in the use of systems such as composting or anaerobic digestion. For the further development of new waste technologies, the developers of these technologies must consider what exactly waste streams do consist of to fully treat the waste.

Waste characterization is a manual process carried beside waste management plants in a process that consists of taking samples, in our case mostly at the household level, then, upon collection, separating and weighing the individual fractions of household waste or Municipal waste (MSW). In the waste characterization studies carried out on the household level in Zambia, the waste streams, the waste characterization methods for the collection were applied, and samples were commonly broken down into the following constituents:

- Plastics (LDOE, HDPE, PET)
- Ferrous metals
- Non-ferrous metals
- Glass
- Other" any remaining items which do not fit (e.g. textile)
- Paper & cardboard
- Organic/food waste
- Agricultural of green waste
- Fines (items below a certain screen size).

B.2 Results of residential waste characterization

Residential waste characterization was carried out over two weeks and comprised of two parts – household surveys and waste characterization. The surveys were carried out to assess waste storage and handling practices at the source, verifying available knowledge of solid waste management and (quality) rating of municipal services. It was also necessary to determine the number of residents for each participating household in order to calculate the waste generation rate.

During the first week, surveys and bag distributions were carried out, and collection and sorting took place in the second week. 90 household waste samples (30 per city) (typical sample size around 2 kg) were collected from the household level, with 273 questionnaires also administered at the household level. The areas in which the samples were selected were Kitwe, Lusaka, and Livingstone East, respectively (Figure 21). The interviewers chose sample households in the different areas at random but were as spread out as conveniently possible. The day that the households were administered the bags coincided with the normal refuse collection day so that residents did not mix old waste with waste intended for the study.

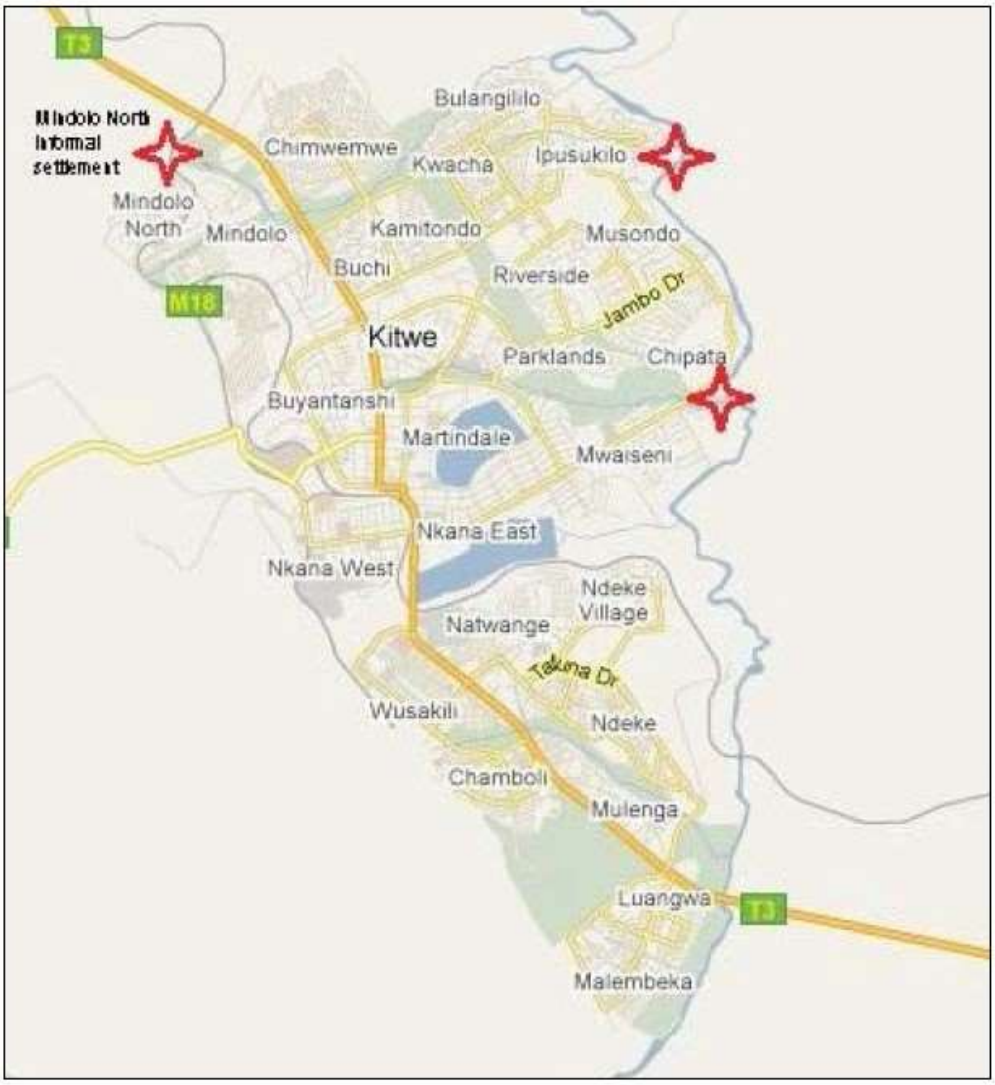


Figure 21 Map of Kitwe residential suburbs, indicating the location of sample households for the residential waste characterization study.

Residents were interviewed and then provided with 3 bags to separate and collect their waste. The bags were labeled with the sample number and the category for separation, which at this level were recyclables, organic and other. After 7 days the bags were collected and transported to the Sunshine Group Premises for weighing and sorting.

At the dumpsite, the total weight of the sample (organic and inorganic) was determined before sorting. The sample was then separated into organic, ash/soil, paper, plastic, glass, metal, disposable nappies, and others, and each portion was weighed separately using digital scales accurate to 0.05 kg.

C Policies, strategies and regulations

Analysis of policies, strategies, and regulations relating to waste management were analyzed and understood in relationship to circular economy principles. Desktop research was carried out to assess policies, past and ongoing projects, and initiatives on waste management and the circular economy in Zimbabwe. This included an online search of information from key government departments, institutions such as the Environmental Management Agency, local authorities, NGOs, companies, and business associations. Strategic documents and projects report were reviewed with an aim to assess the status quo in relation to waste management, scope, effect/ impact, stakeholders involved, and roles of sector players in supporting the transition towards circularity. Policies were assessed, keywords or parameters were grouped in thematic areas corresponding to the different conceptual components of the three circularity principles:

A. Recycling targets – the extent to which the policies promote recycling through targets by a specific year.
B. Reuse targets – preparing for reuse targets for municipal solid waste
C. Separation of waste at source – specifically in relation to household waste at the household level. The assessment sought to find out whether the policies promoted the separation of waste at source. In addition, the review investigated whether policies addressed the collection of separated household waste.

Other policy targets that have been included in the study are:

1 Monitoring of targets: the study was keen to assess if national targets are set regarding waste management and how the national government conducted monitoring through its agencies.
2 Gender and inclusion of women: the ambition to ensure inclusion is key for every policy document, and for this reason, the analysis of policies sought to understand how gender parity would be addressed in the sector.
3 Job creation opportunities – the study sought to assess the creation of decent jobs and whether the policies have targets for the CE, the waste management sector, or other sectors. This analysis explored the extent to which Zambia's policies recognize the potential for job creation in waste management as it relates to CE, and whether there are specific targets that the country aims to achieve.
4 Opportunities for eco-innovation: Innovations are key drivers to change in the sector and an essential part of ensuring quick wins. The study assessed the spirit behind policies in Zambia to support the adoption of innovations in managing waste.
5 Fees, fines, penalties for poor waste management: Setting fees and fines is considered a critical path to encourage behavior change. The assessment did look at the practical aspect of implementing the set fines, fees, and penalties for poor waste management.
6 Incentives for developing good waste management incentives – the study investigated whether the existing policies broadly encouraged pay-as-you-throw systems, fiscal incentives for food donations, deposit-refund schemes, ending fossil fuel subsidies, taxing virgin materials, and lower VATs on recycled, repaired, remanufactured or refurbished goods.

D Overview of past and ongoing projects

	Name of Project	Duration / Years	Areas covered	Funder	Implementing Agencies	Project Objectives
1	Waste Management Youth Project[1]	2020	Lusaka, Ndola	UNDP Zambia		Improve waste management and recycling practices in urban and peri-urban settings in Lusaka and Ndola, while creating opportunities and employment for women and youth led enterprises.
2	Opportunities for Youth Employment Project (OYE)	2020 -	All	SIDA	SNV Netherlands Development Organisation	Creates opportunities for employment and entrepreneurship for youths in the green jobs sector.
3	Peri-Urban Community-Driven Models for Equitable Services (COMEQS) Solid Waste Project	2014 - 2018	two peri-urban settlements of Lusaka District (Chipata and Ng'ombe)		Care International	To improve solid waste management through increased revenue for CBEs in targeted peri-urban settlements of Lusaka. To achieve this, the project primarily piloted the viability of two - revenue collection models, Tariff Bundling and Enhanced Direct Payment and provided recommendations on the best and most viable model to deliver SWM for scaling up to other areas.
4	WASH'n'soul Project[2]	2021 – 2024	Lusaka	soulbottles and Viva con Agua	BORDA Zambia	The project provides long-term solutions (infrastructure and behavior change) and establishes functioning processes and (social) businesses according to the community's specific needs. The project focuses on four pillars, namely water management, waste management, climate protection and social business.

	Name of Project	Duration / Years	Areas covered	Funder	Implementing Agencies	Project Objectives
5	Duckweed Field Trial in Zambia[3]		Lusaka		BORDA Zambia	At the Pestalozzi Education Centre in Lusaka, the BORDA Zambia team tested the duckweed plant for use in biological wastewater treatment modules.
6	UN Zambia Green Jobs Programme	2017	Lusaka, Livingstone, Kitwe, Ndola, Chipata, Solwezi	UNDP	ILO	Turning Zambia's Trash into employment opportunities
7	The Innovations Grant Programme	2014	Lusaka	USAID	Millennium Challenge Account Zambia	The programme empowered community organizations, entrepreneurs, NGOs, and businesses to propose innovations that would improve access to drinking water, sanitation and hygiene, and solid waste management services in Lusaka.
8	Manja Pamodzi Programme	2016	Lusaka	Millennium Challenge Account Zambia / USAID	Zambian Breweries	The initiative included a public education campaign about the value of recycling and the creation of sustainable value chains for post-consumer waste in neighborhoods in Lusaka.
9		2016	Lusaka	Millennium Challenge Account Zambia / USAID	Solid Technology	Establishing solid waste collection points in Lusaka
10		2016	Lusaka	Millennium Challenge Account Zambia / USAID	The Water and Sanitation Association of Zambia (WASAZA)	Citing poor sanitation conditions that affect students' education, WASAZA proposed to install bio-latrines that utilize bio-digestion technology to process organic waste at two schools in the Chazanga neighborhood of Lusaka.

	Name of Project	Duration / Years	Areas covered	Funder	Implementing Agencies	Project Objectives
11	Sustainable building with Eco-bricks	Ongoing	Livingstone	African Impact Sustainability Fund	African Impact	The project uses plastic waste/pollution collected during mass clean-ups to stuff into plastic bottles and turn into solid brick, which is used for construction. An EcoBrick is a plastic bottle that is stuffed with plastic pollution and turned into a solid 'brick'. Volunteers have used EcoBricks to build a compost bin, chicken coop and piggery, an ablution block, and benches for schools. Students can also swap the EcoBricks they build with stationary, toys and football jerseys.
12	Sitifuna Ma Plastic	2021			Citizen's Environmental and Social Concern (CESCo) and Centre for Zero Waste & Development (CZWD)	The project aims to review gaps in Zambia's EPR regulations, raise awareness on the associated dangers of single-use plastic items and document the illegal manufacture, sale and use of single use plastics.
13	Cities and Infrastructure for Growth (CIG)	2017 - 2022		UK – Foreign, Commonwealth and Development Office (FCDO)		The programme will provide technical support on city and regional interventions in 3 focus countries, Myanmar, Uganda and Zambia resulting in increased inclusive economic growth and job creation. The intervention will help city economies to become more productive, deliver access to reliable, affordable, renewable power for businesses and households, and strengthen investment into infrastructure services, including from the UK.

	Name of Project	Duration / Years	Areas covered	Funder	Implementing Agencies	Project Objectives
14	Energy for Agriculture (E4A) project		All provinces except Luapula and North-Western provinces		SNV Netherlands Development Organisation	Develops the biogas market in Zambia in order to increase access to renewable energy for households, public services and businesses.
15	Global Environmental Change Project		Lusaka		UNZA	
16	The Comprehensive Urban Development Plan (CUDP)	2009 - 2030	Lusaka	Japanese International Cooperation Agency (JICA).		CUDP in line with two legislations give effect to the waste management status and innovations in the City of Lusaka. The plan was launched in 2009 and was projected to guide the development of Lusaka City up to 2030.
17	Zambia Green Jobs Programme	2013 - 2017	All provinces except Western, Northern, and Luapula provinces	Government of Finland	Copperbelt /University School of the Built Environment	The Zambia Green Jobs Programme supported sustainable micro, small and medium enterprises (MSMEs) along the building construction value chain to become more productive and competitive; to grow, create green and decent new jobs, and improve the quality of existing existing ones jobs.
18	UNDP Solid Waste management Projects	2020 -2023		The GEF – Small Grant Programme		Promote plastics/solid waste management and circular economy