UGANDA BUREAU OF STATISTICS

SPECIALISED MUNICIPAL SOLID WASTE

SURVEY REPORT

September 2025

This report presents findings from the Specialised Municipal Solid Waste Survey undertaken by the Uganda Bureau of Statistics (UBOS)

Additional information about the Survey may be obtained from the Uganda Bureau of Statistics (UBOS), Plot 9 Colville Street, P.O. Box 7186, Kampala Uganda; Telephone: (256-414) 706000; Fax: (256-414) 237553/230370; Email: ubos@ubos.org; Website: www.ubos.org

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FOREWORD

A clean and healthy environment is a human right. In Uganda, the National Environment Act mandates urban authorities and district councils to effectively and properly manage waste from the point of collection to safe disposal. They are mandated, within their jurisdiction, to manage, make laws and bylaws to regulate various aspects of the environment & natural resources. However, many urban authorities are struggling to fulfill this mandate with the overwhelming waste generated as urbanization rates and economic activities grow especially in cities.

Poor waste management is a contributor to greenhouse gas emissions exacerbating the climate change problem, a threat to public health and the environment as a source of pollution in all forms (air, water and soil) affecting several livelihoods and economic activities. In recent years Kampala city and other urban authorities have experienced more flooding attributed to waste blockage of drainage channels.

Improving waste management addresses all these challenges. The pathway to improved waste management starts with a critical assessment of the existing situation in cities. However, reliable data and information on municipal solid waste remains a challenge, especially in cities of low and middle-income countries including Uganda.

This makes it very hard for cities to: identify what needs to be done; policy interventions needed; infrastructure required; appropriate technology; and overall cost for the intervention; leading to insufficient municipal solid waste management services.

The Bureau has undertaken a specialized study in four cities; Gulu, Fort Portal, Soroti and Masaka using the Waste Wise Cities Tool (WaCT) Methodology and the findings are shared in this report. The study provides some NDP IV and SDG indicators on waste and I encourage policy and decision makers to utilize the findings of this report to bring a clean and healthy environment to a reality.

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Glossary

Waste means any substance or object that is dumped, abandoned , discarded or disposed of or intended or required by law to be disposed of.

Municipal Solid Waste (MSW): Is waste generated within a local government, encompassing household waste and other similar wastes like commercial and institutional waste and street sweepings not including municipal sewage network and treatment, municipal construction and demolition waste.

Generation: Total MSW generated by the city is the total MSW generated by the population and their economic activities within the defined system boundary. It is the sum of the amount of municipal waste collected plus the estimated amount of municipal waste from areas not served by a municipal waste collection service.

MSW collected refers to the amount of municipal waste collected by or on behalf of municipalities, as well as municipal waste collected by the private sector. It includes mixed waste, and fractions collected separately for recovery operations (through door-to-door collection and/or through voluntary deposits).

MSW uncollected (UN-Habitat, 2020). This methodology shows that the MSW collected is either delivered to recovery or disposal facilities as shown in Figure 2.1.

Waste Recovery is any process whose major result is waste serving a beneficial purpose by replacing other materials that would otherwise have been utilized to complete a certain function, or waste being prepared to fulfil that function, in the facility or in the wider economy (UN-Habitat, 2020).

Recovery: Recovery means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Recovery facilities include any facility with recovery activities defined above including recycling, composting, incineration with energy recovery, materials recovery facilities (MRF), mechanical biological treatment (MBT), etc.

Recycling is any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel. It is imperative to note that not all waste that enters recovery facilities is used but some is either rejected or leaves the facilities as residues.

Apex traders collect recyclable materials from different sources and suppliers (in different cities across municipal or even national boundaries) and supply them to different end-of-chain recyclers (sometimes after pre-processing such as sorting, washing and bailing).

End-of-chain recyclers purchase recyclable material from suppliers such as apex traders and reprocess it into products, materials, or substances that have market value.

Waste Disposal means any operation whose main purpose is not the recovery of materials or energy even if the operation has as a secondary consequence, the reclamation of substances or energy

Disposal Facilities refer to sites which are regularly used by the public authorities and private collectors, regardless of their level of control and legality for example; Landfills, for the disposal of waste but excludes unrecognized places where waste is deposited occasionally in small amounts which public authorities may clean up from time to time (UN-Habitat, 2020). Both the recovery and/or disposal facilities can be categorized as either ‘controlled’ or ‘uncontrolled’ depending on the operational measures put in place to minimize the environmental, health and safety impacts from the facilities (UN-Habitat, 2020). The UN-Habitat (2020) recommends assessment of the control level of the recovery and disposal facilities/operations as a way of ascertaining compliance with best practices and standards.

CHAPTER ONE: INTRODUCTION

1.1 Background

Human populations and sectors in every economy involved in either production or consumption or both of goods and services to meet human wants and needs using resources from the earth, continually generate waste in the process, which are emitted either into the air or dumped back into or onto the earth (Meadows & Meadows, 1972).

Rapid urbanization, population growth, and economic development are responsible for the increasing generation of Municipal Solid Waste (MSW), and generally, the higher the economic development and rate of urbanization, the greater the amount of solid waste produced (World Bank, 2012). The global scale of urbanization and economic growth is creating a potential "time bomb" regarding the waste generated in the world. If not addressed now, the significant negative impact on human health and the environment will be felt by nations at all levels of development. An estimated two (2) billion tonnes of MSW are being generated annually, and this number is expected to grow to 3.4 billion tonnes by 2050 under a business-as-usual scenario (World Bank, 2018).

Globally, Solid waste management is one of the major challenges faced by cities and urban authorities of all sizes in both developed and developing countries (UN-Habitat, 2010); resultantly, a major environmental issue in that poorly disposed waste is a source of air, water, and land pollution.

Residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste. In low- and middle-income countries, waste is often disposed of in unregulated dumps or openly burned. These practices create serious health, safety and environmental consequences. Poorly managed waste serves as a breeding ground for disease vectors, contributes to global climate change through methane generation, and even causes flooding (World Bank, 2012)(Tsiko & Togarepi, 2012)(Remigios, 2013).

Uncontrolled disposal sites are a major source of Greenhouse Gases (GHG), and if we continue the current path, the waste sector, particularly food waste, is predicted to account for 8-10% of global anthropogenic GHG emissions by 2025. Additionally, every year at least 8 million tonnes of plastic find their way into the world's oceans (Jambeck et al., 2015).

The quantity of waste generated grows with socioeconomic development, and as the population in cities becomes denser, acute public health and environmental problems become more commonplace. Poor waste management results in agglomeration of uncollected waste, the build-up of rodent and insect populations, open waste burning with concomitant impacts on public health and pollution of air, soil, and water. Furthermore, unmanaged and mismanaged waste is the main source of marine plastic pollution.

On the other hand, when waste is well managed, it offers great opportunities: resource recovery, which lessens the dependency on resource imports and reduces natural resource extraction; enhances livelihoods and income for the urban poor through new business models; and improves quality of life for urban dwellers.

A global data collection and publication system through the UNSD/UNEP questionnaire on Environment Statistics has collected data on MSW collection and treatment since 1999. Data has been received from about 160 to 170 countries, including Uganda, covering both national and city levels.

In September 2015, the United Nations Sustainable Development Summit adopted a new framework to guide development efforts between 2015 and 2030, entitled "Transforming our world: the 2030 Agenda for sustainable development". The 2030 Agenda has 17 Sustainable Development Goals (SDGs), divided into 169 targets, which are informed by 247 indicators.

Uganda has a high-level commitment to SDG implementation and to "Leave No One Behind(LNOB)". The notion of LNOB places high data demand on countries. Strategies to strengthen national, regional, and global capacities to support data systems call for innovative approaches to data collection and statistics compilation.

In this regard, the Uganda National Development Plan (NDP) III provides a framework for achieving the country's long-term development objectives which are also aligned to the SDGs. The status of the foregoing obligations requires regular and consistent monitoring and evaluation which present key data requirements that call for setting up a well-planned and functioning statistical system for data collection, processing, analysis and dissemination to support evidence-based policy and decision making.

This paucity of evidence-based data hinders the development of waste management strategies and constrains investment decision-making in infrastructure and service expansion, leading in many countries to insufficient or absent MSW management services.

1.2 Problem Statement

In 2019, Uganda's progress on SDGs was ranked 140 out of 162 countries with a global index score of 52.6 per cent declining from 125th position out of 156 Countries in 2018. According to the SDG Global Index, Uganda's achievement is average, with moderate performance on SDGs 3, 8, 9, 13 and 15. SDGs 2, 5 and 6 have stagnated.

In addition, the number of cities has steadily increased in Uganda following the creation of 10 new cities by Parliament in 2019/20. Uganda, at only about 20 percent urban, is one of the least urbanized countries in Africa but with one of the fastest urbanizing rates at 5.2 percent, with Kampala being one of the world's fastest growing cities (Kampala Capital City Authority, 2020). However, many of Uganda's cities lack adequate data on waste generation, collection, recovery and/or safe disposal and management. Where the data exists, it is often not well-collected/structured, monitored, updated, and/or used for statistical purposes. Most notably, there is lack of complete data for computing SDG Indicator 11.6.1, rather the cities currently report data only on municipal solid waste collected, as a proxy for this SDG Indicator 11.6.1.

The paucity of evidence-based data hinders the development of waste management strategies and constrains investment decision-making in infrastructure and service expansion, leading to insufficient or absent MSW management services in Uganda.

Therefore, there's urgent need to undertake surveys in all the Cities in Uganda to address the indicator data gaps. However, prior to this, methodological testing is essential and to this effect, the UBOS is undertaking regional methodological studies in the four regions i.e. Central, Northern, Western and Eastern Uganda.

1.3 Objectives of the Study.

The main objective of the study is to test the applicability of the Waste Wise Cities Tool (WaCT) methodology for compiling various SDG waste Indicators in selected cities in Uganda.

Specific objectives of the study

i. Compile SDG Indicators:

   a) 11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated by cities

   b) 12.5.1: National recycling rate, tons of material recycled and;

   c) 12.3.1(b): Food waste generation

ii. Undertake a city waste characterization (composition).

iii. Map legal and illegal waste collection points

iv. Assess control levels of the disposal sites and recovery facilities

v. Develop Waste technical conversion factors for different waste transportation trucks to improve estimation of waste collected by cities.

CHAPTER TWO: METHODOLOGICAL APPROACH

2.1 Introduction

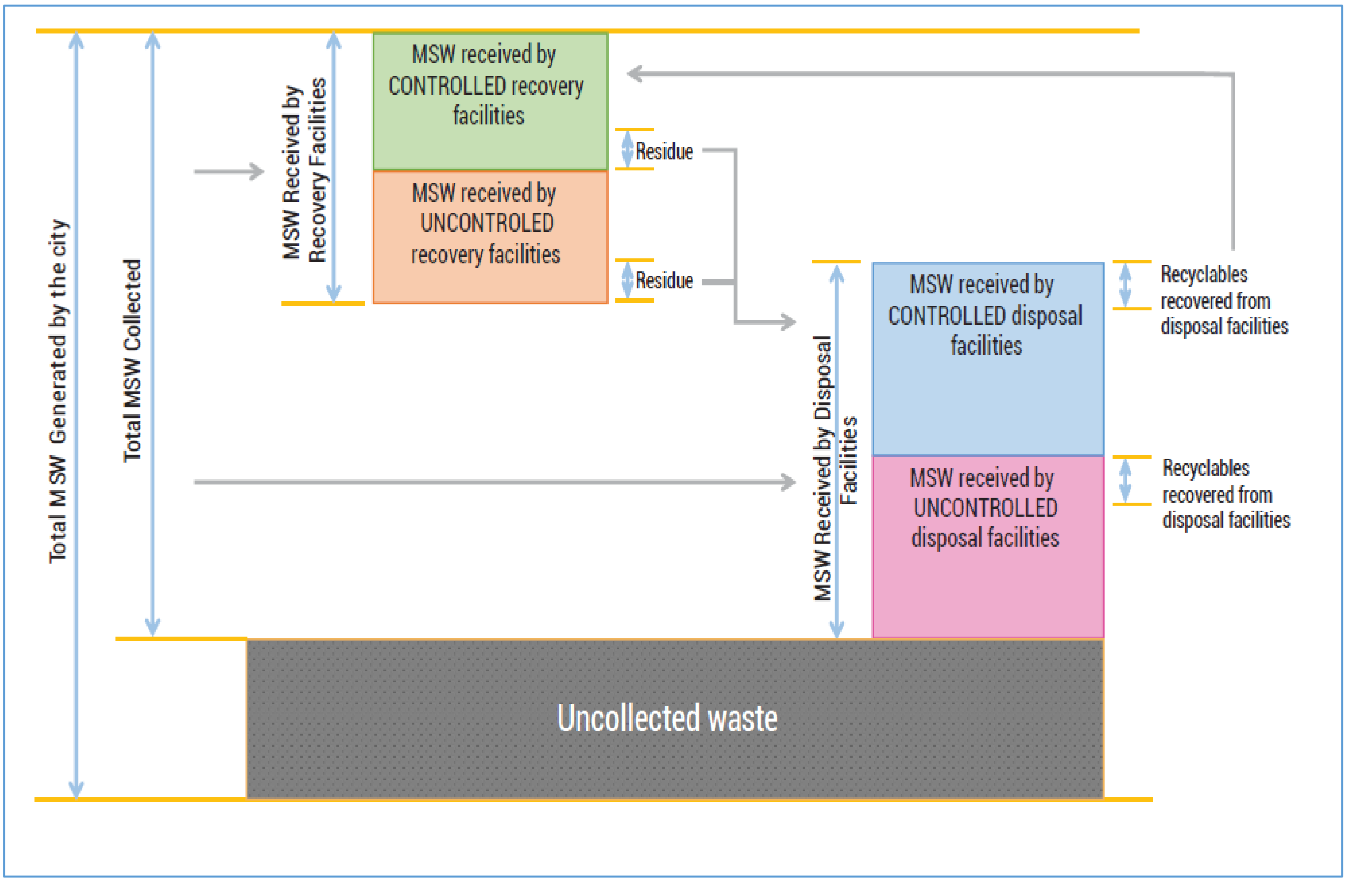
This chapter presents information on the conceptual framework adopted, scope of the study, data requirements, household and non-household sampling techniques, data collection and testing of the computation formulae of the different methodologies.

The UN-Habitat, the custodian of SDG Indicator 11.6.1 developed the **Waste Wise Cities tool (WaCT);** a methodology to support countries in the compilation and reporting of the indicator.

2.2 Conceptual Framework

Figure 2.1 summarizes the elements that were used to test the methodology for measuring the SDG indicator 11.6.1. These include Municipal Solid Waste generated, recovered and disposed of.

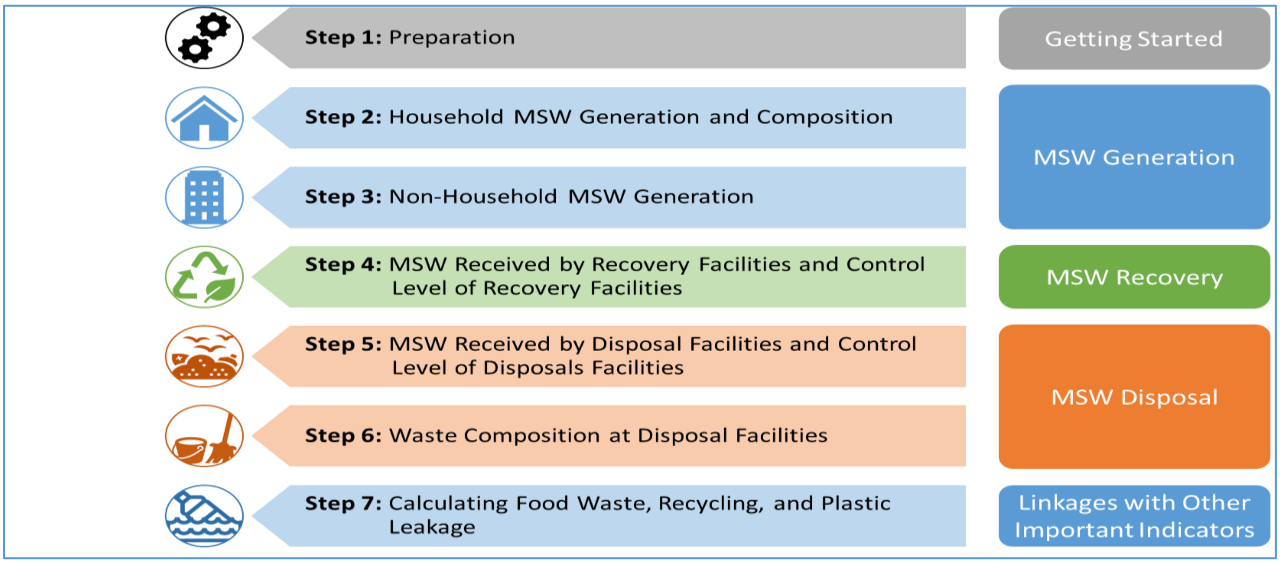
Figure 1: Concept of SDG indicator 11.6.1



Source: UN-Habitat, (2020)

The study worked through the recommended UN- Habitat (2020) steps for the Waste Wise Cities Tool (WaCT) as detailed in Figure 2.2.

Figure 2: Waste Wise Cities Tool Steps



Source: UN-Habitat, 2020

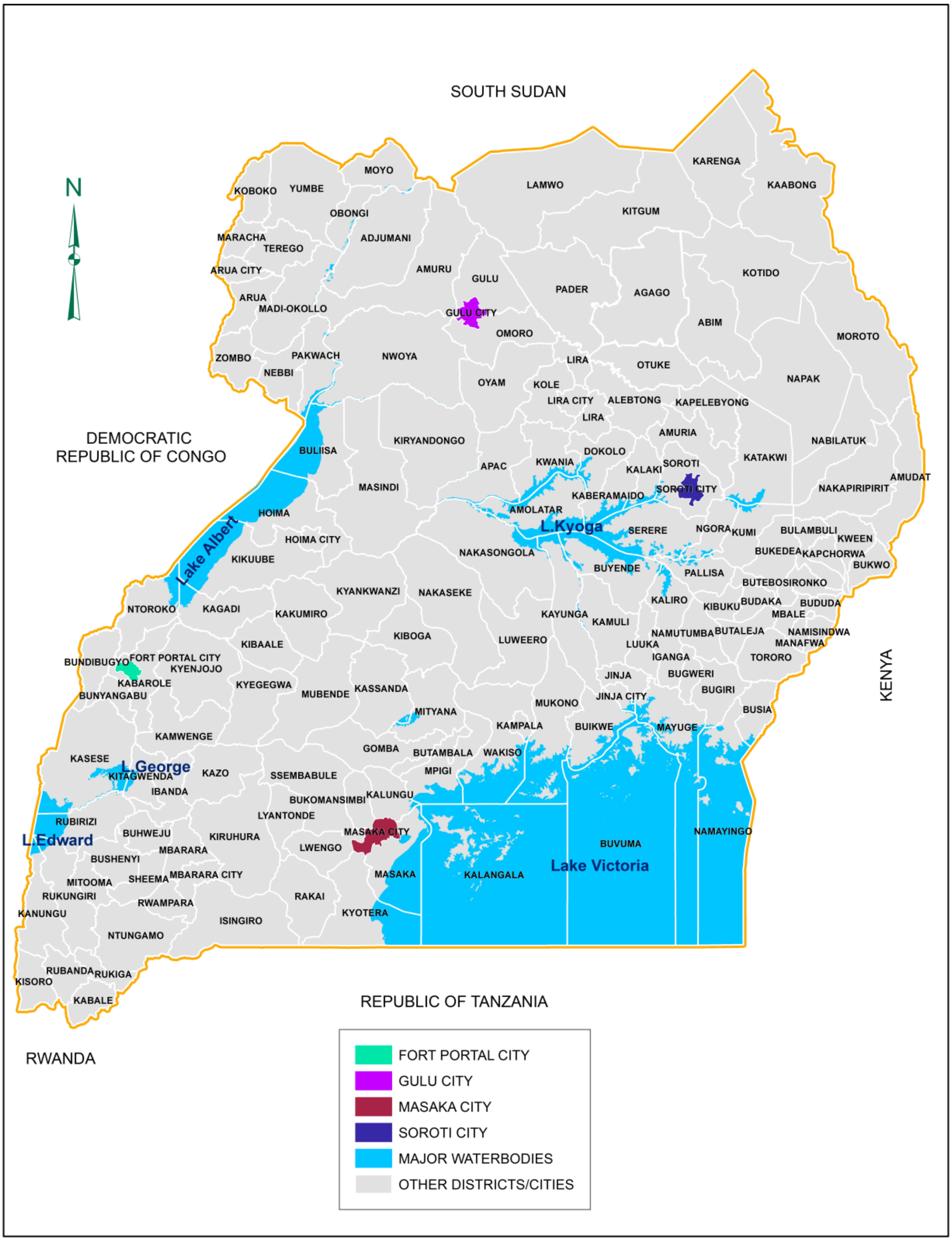
Note: *For this study, step seven (7) calculates food waste and recycling only.*

2.3 Scope and Coverage of Study

The study covered Gulu (Northern), Fort Portal (Western), Soroti (Eastern) and Masaka (Central) cities in Uganda.

The data was collected on MSW generated, recovered and disposed of. To determine the total amount of municipal solid waste generated, data was collected from both households and the non-household sector (markets, schools, supermarkets and shopping malls, hotels, restaurants, shops, health facilities, and offices). In addition, recycling facilities and disposal sites were visited, and other data was collected. All this was done in collaboration with the city environment officers.

Figure 3: Map of Uganda showing location of selected Cities



Data collection and Reference period

The study was conducted between December , 2024, and April, 2025 as shown in Table 1.

Table 1: Data collection and reference period by city

City	Data collection period	Reference period
Gulu	4th to 11th December 2024	4th to 11th December 2024
Fort Portal	6th to 13th January 2025	6th to 13th January 2025
Masaka	4th to 11th April 2025	4th to 11th April 2025
Soroti	4th to 11th April 2025	4th to 11th April 2025

As per the UN Habitat recommendation, Gulu, Fort Portal, Soroti, and Masaka were considered average cities and a sample of 90 HHs was selected from each[1] i.e. ten HHs selected from each village in each city. These nine villages are composed of three high, three middle and three low-income villages. The villages studied in each city are shown in Table 2.

Table 2: Villages covered in Gulu, Fort Portal, Masaka and Soroti Cities

Income Status	City			
	Gulu	**Fort Portal**	**Masaka**	**Soroti**
	Villages			
High Income	Layibi Central	Boma East	Kizungu	Akisim
	Commercial Road	Harukooto A	Town yard	Senior quarters
	Senior Quarters	Kagote A	Kimanya	Pioneer
Middle Income	Lukung	Mukubo	Gayaza	Kengere
	Gowan	Kibimba	Kyalusowe 'A'	Nakatunya
	Go Down	Karago A	Ssenyange 'A'	Central
Low Income	Ajuku	Kinyatuha	Kyabakuza	Acetgwen
	Lunaba	Kabirizi	Binyonyi 'A'	Moruaspeur
	Ngom Rom	Kagote B	Misaali	Kichinjagi

[1] The UN-Habitat (2020) recommends that for a city with a population ranging from 10,000 to 10,000,000 people, at least a sample of 370 to 384 is selected to achieve values within the 95% confidence level. However, considering that in many situations this is unfeasible and costly to collect waste samples from 384 households for 8 days, the methodology suggests to sample 90 households (10 households from 3 survey areas from high, middle and low income groups each) for cities and 150 households (10 households from 5 survey areas in high, middle and low income groups each) for megacities.

2.4 Survey design

The survey was designed to allow the generation of estimates for the cities under study. A Two-stage sampling design was used i.e. the country was stratified into four strata i.e. Northern, Western, Central, and Eastern regions. The villages were classified into high, middle, and low-income groups using satellite images[2] and this was supported by expert judgement. At the first stage, nine (9) enumeration areas (villages) were selected from each city i.e. three (3) per income group.

2.4.1 Household Sample

A total of 360 households were selected in the four (4) cities (i.e. 90 households (HHs) per City and 10 HHs per village). The first household, in each village, was determined randomly, while the remaining nine households were selected within a radius of 250 meters either vertically or horizontally from each other. Where the selected HH did not meet the basic characteristics of a particular income group, it was replaced with the nearby HH as guided by the standard housing characteristics provided in Table 3.

Table 3: Housing Types by Income levels and Average Monthly earnings

Income Level	Housing Type Example	Average Monthly Earnings (Ugx)
High	Luxury condominium, single detached house with garden, sophisticated alarm systems	Above 1,000,000
Middle	Apartments, single detached house without a garden	Between 300,000 and 1,000,000
Low or informal settlements	Slums, apartments with single rooms (apartments, mud houses, rent less than 5% of GDP per capita)	Less than 300,000

Source: UN-Habitat (2020)

2.4.2 Non-Household Sample

In each village one (1) market, one (1) health facility, one (1) Supermarket / shopping mall, two (2) schools, two (2) restaurants, two (2) hotels, two (2) offices and two (2) shops were sampled. During sample selection, if a high-income village had a non-household entity, like a school, but its characteristics did not fit the requirements for a high-income school, that school was ignored and not selected. All non-household

[2] Matching Geography Information System (GIS) & Remote sensing data.

entities were randomly chosen if they were inside the boundaries of the specified villages.

2.5 Data Collection on Municipal Solid Waste Activities

The (UN-Habitat (2020) requires that waste samples be collected for eight (8) consecutive days.

2.5.1 Data Collection from Households

All sampled households were each provided with waste bags for eight (8) days, in which they were encouraged to dispose of their waste. To ensure the accuracy of results, households were encouraged to only put the waste belonging to their household in the waste bags and not to mix waste of more than one day.

2.5.2 Data Collection among Non-Households

The UN-Habitat 2020 recommends that the total amount of municipal solid waste generated by non-household sector be collected otherwise utilize a proxy (for estimating non-household MSW) to compile the estimated MSW generated by the non-HH sector i.e. 30 percent of the total MSW generated is from the non-HH sector.

Recovery facilities. A questionnaire was administered to each facility to provide information on their sources of waste, how much it is recycled, the rejects/residues, and the degree to which the facility complies with environmental and human safety standards on waste management.

Disposal Site: A questionnaire was administered to disposal sites which provided information on how much waste was received in the last eight days, and how much as recycled/recovered from either a waste picker or private contractor.

Figure 4: Waste Weighing at Kiteeri disposal site -Fort Portal

Waste collection points: It is the mandate of every urban authority to collect and dispose of waste in an environmentally friendly manner. Therefore, skip bins are necessary to serve the population and to ensure effective waste collection, urban authorities gazette points for temporary waste collection by generators.

Waste data collectors were tasked to identify and map all the waste collection points in the villages, whether legal or illegal. Information on their location, the population it serves, and size was collected.

Weighbridges: Lastly, a questionnaire was administered to weighbridges in Masaka and Gulu cities, which were to provide a technical waste conversion factor to enhance waste collected quantity estimation. Measurements were taken of all the various waste transportation trucks, tricycles (tuk tuk), skip loaders, skip bins, compressor trucks, tippers (Mini-enhanced), and pick-ups. These trucks were weighed when empty and when filled with solid waste to obtain the net waste weight. The net waste weight was used to estimate the total waste collected per day per city.

CHAPTER THREE: FINDINGS

3.1 Introduction

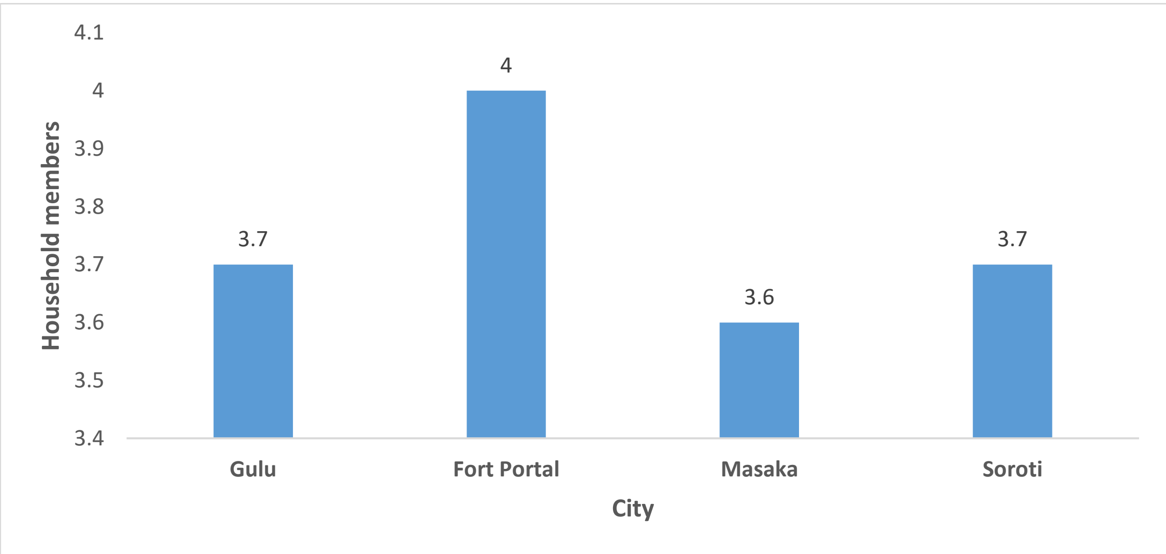
This chapter presents the findings of Gulu, Fort Portal, Soroti and Masaka Cities. First based on the NPHC 2024, the population of Gulu city was 233,271 people, Fort Portal city (137,549), Masaka city (294,166), and Soroti city (139,199) and the average household size was as follows: Fort Portal (4.0), Gulu and Soroti (3.7) while Masaka (3.6).

Table 4: Profile of Gulu, Fort Portal, Masaka, and Soroti City

City	Population as of 2024	Year of WaCT
Gulu	233,271	Dec 2024
Fort Portal	137,549	Jan 2025
Masaka	294,166	April 2025
Soroti	139,199	

Source: NPHC 2024

Figure 5: Average household size

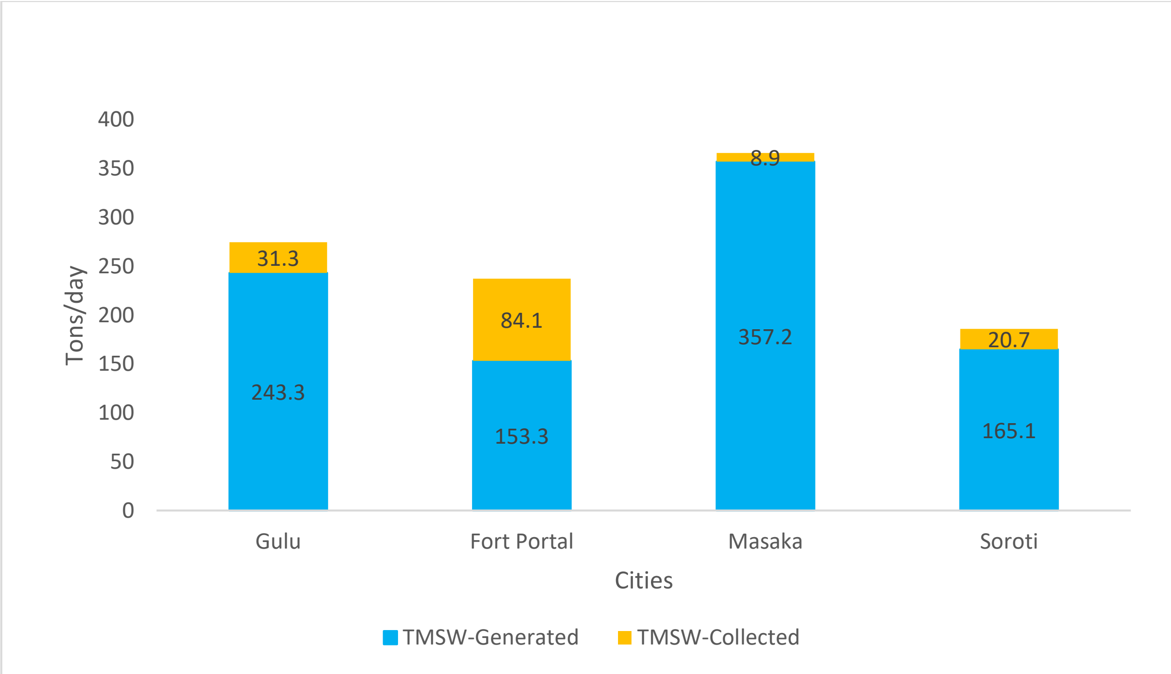


Source: NPHC 2024

3.2 Waste generated and collected by selected cities

Findings indicate that Masaka city had the highest waste generated per day, with 357.2 tons, followed by Gulu city (243.3 tons), Soroti city (165.0 tons) and Fort Portal city (153.3tons). Fort Portal had the highest waste collected per day with 84.1 tons, followed by Gulu city with 31.3 tons, Soroti city with 20.7 tons and Masaka with the least (8.9 tons) and See Figure 6.

Figure 6: Total Municipal solid waste generated and collected by the cities (t/day)



3.2.1 Waste generated by income group and sector (Household and Non-Household) by city

Findings indicate that Masaka city had the highest per capita waste generated of 0.85kg/cap/day, followed by Soroti city (0.83kg/cap/day), Fort Portal city (0.78kg/cap/day) and Gulu city with the least (0.73kg/cap/day). In all cities, on average a high-income household generated the highest waste generated per capita and a low income household generated the least. See Table 6.

Table 5: Household waste generated by city

City	Income Status	Average Household Waste Generated (Kg/Cap/day)	Total Population	Total MSW generated by households (t/day)	Total MSW generated by non-households (t/day)*[3]	Total MSW generated by City (t/day)
Gulu	High	0.83	NA			

[3] According to the UN-Habitat (2020), the proxy for estimating non-household MSW is set at 30 percent of the total MSW generated.

City	Income Status	Average Household Waste Generated (Kg/Cap/day)	Total Population	Total MSW generated by households (t/day)	Total MSW generated by non-households (t/day)*[3]	Total MSW generated by City (t/day)
	Middle	0.76	NA			
	Low	0.60	NA			
	Total	**0.73**	**233,271**	**170.3**	**73.0**	**243.3**
Fort Portal	High	1.11	NA			
	Middle	0.68	NA			
	Low	0.56	NA			
	Total	**0.78**	**137,549**	**107.3**	**46.0**	**153.3**
Masaka	High	1.09	NA			
	Middle	0.78	NA			
	Low	0.67	NA			
	Total	**0.85**	**294,166**	**250.0**	**107.2**	**357.2**
Soroti	High	1.19	NA			
	Middle	0.68	NA			
	Low	0.62	NA			
	Total	**0.83**	**139,199**	**115.5**	**49.5**	**165.0**

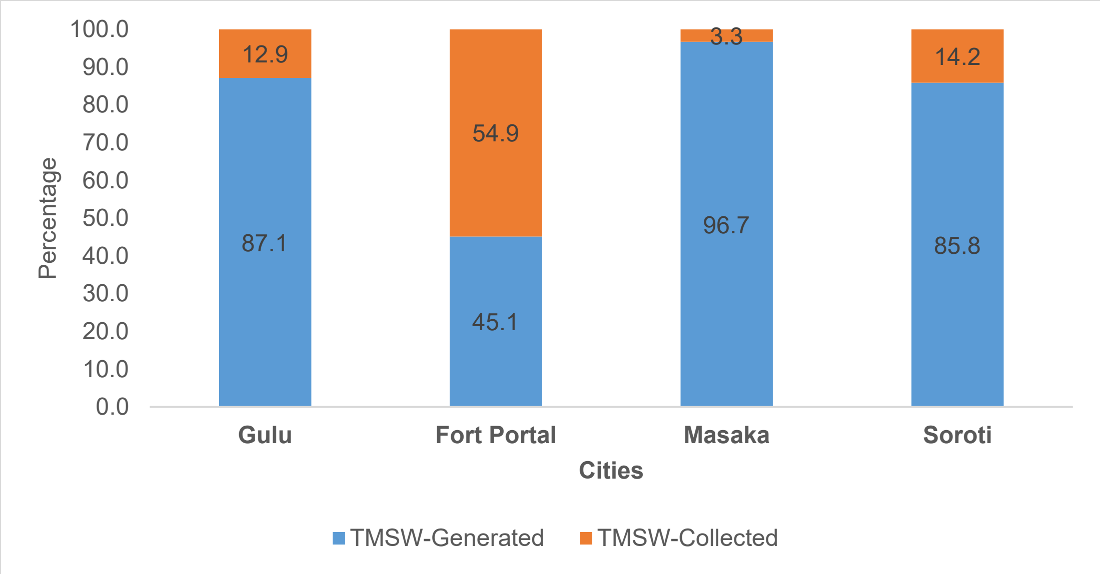
Computed using the 0.3 proxy as guided by UN-Habitat

3.3 Waste Collected

Overall, Fort Portal registered the highest percentage of MSW collected at 54.9 percent (84.1 tons), followed by Soroti at 14.2 percent (20.7 tons), Gulu at 12.9 percent (31.3 tons), and Masaka 3.3 percent (11.7 tons). Masaka waste was only deposited at Bulando site during the time of the study. See Figure 7

Most of the waste generated in Masaka city is organic and so most of what is collected is diverted to farms as manure/mulch (agricultural reuse). Masaka city and its surroundings engage in agricultural activities including coffee and banana growing that require use of such mulch/manure. This is relatable to a study conducted by Ministry of Energy and Mineral Development (MEMD) that discovered that waste collected and diverted in Masaka city was more than waste collected and deposited at the Bulando site (MEMD, 2023).

Figure 7: Percentage of Waste collected by city



3.3.1 Waste Collected and managed in controlled facilities (SDG Indicator 11.6.1)

The study focused on the estimation of the proportion of waste collected and managed in controlled facilities. For the four cities, only the waste recovery facilities had a certain level of control, unlike the disposal sites that had no control. Therefore, waste that the recovery facilities handled was considered as the waste managed in controlled facilities. Findings indicated that Fort Portal city had the highest waste collected and managed in controlled facilities with 3.8 tons (2.5%), Masaka city with 2.8 tons (0.8%), Gulu city with 2.1 tons (0.9%) and Soroti city with the least 1.2 tons (0.7%). See Table 6.

Table 6: MSW collected and managed in controlled facilities

City	Total Municipal Solid Waste generated (t/day)	Collected and managed in controlled facilities (t/d)	SDG 11.6.1 Proportion collected and managed in controlled facilities (%)
Gulu	243.3	2.1	0.9
Fort Portal	153.3	3.8	2.5
Masaka	357.2	2.8	0.8
Soroti	165.0	1.2	0.7

3.3.2 Food waste generated per capita

Food waste per capita was computed using as recommended by the UN-Habitat (2020) methodology for each of the income groups. For this study, food waste was extracted from Kitchen/canteen waste, and the food waste generated per capita was computed. High-income households generate the most food waste across all the cities while low-income groups generated the least.

Gulu city and Soroti city generated the highest food waste per capita of 0.10kg; Masaka with 0.07kg and Fort Portal with the least at 0.05kg. See Table 7.

Table 7: Daily Food waste generated per capita per income group and city (kg/cap/day)

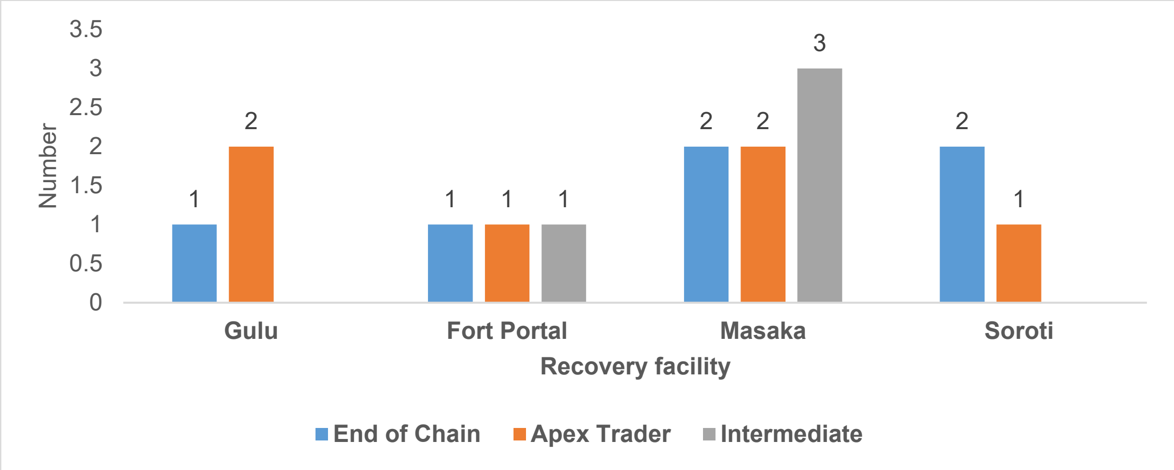
City	Income group				
	High	Middle	Low	Over all	Total HH Food generated (t/day)
Gulu	0.15	0.13	0.01	0.10	22.3
Fort Portal	0.12	0.03	0.005	0.05	7.1
Masaka	0.11	0.07	0.04	0.07	21.6
Soroti	0.14	0.08	0.06	0.10	19.5

3.4 MSW Recycling/Recovery

Recycling value chain involves several steps of the private recycling industry, which purchase, process and trade materials from the point where a recyclable material is extracted from the waste stream until it will be reprocessed into products, materials or substances that have market value. In many low and low-to-middle income countries, this involves informal waste pickers, many middlemen, traders, apex traders and end-of-chain recyclers (UN, 2025).

Much of the waste recovery is dominated by informal players; the waste recyclers mainly source their waste from informal waste pickers in the community. Findings indicate that all cities have at least one recovery facility. Masaka had the highest number of recovery facilities with seven (7). In addition, each city has at least one end-of-the-chain recovery facility. See Figure 8.

Figure 8: Number of Recovery/recycling facility



Findings indicated that Fort Portal city had the highest waste recovered with 3.8 tons, Masaka city with 2.8 tons, Gulu city with 2.1 tons and Soroti with the least (1.2 tons). About the recycling rates, Fort Portal city had the highest with 2.5%; followed by Gulu city (0.9%); Masaka city (0.8%) and Soroti city with the least (0.7%). See Table 8.

Table 8: Number of Waste Recovery Facilities and Total Waste Recovered Daily

Sn.	**City**	**Total Number of recovery facilities**	**Quantity (t/d)**	**TMSWG (t/day)**	**Recycling rate (%)**
1.	Gulu	5	2.1	243.3	0.9
2.	Fort Portal	4	3.8	153.3	2.5
3.	Masaka	8	2.8	357.2	0.8
4.	Soroti	3	1.2	165.0	0.7

3.4.1 Potential recyclables from household waste

Recyclable waste is waste that can be reused, repurposed, or turned into new materials. This includes Food waste, plastic film, and plastic dense, to mention but a few, as seen in Table 9 below.

Table 9: Potential Recyclables from Household Waste

Type of Waste	Recyclable waste generation from households (t/day)			
	Gulu	Fort Portal	Masaka	Soroti
Food Waste	22.3	7.1	21.6	19.5
Plastic dense	4.19	4.26	6.93	5.64
Paper and Cardboard	3.60	1.82	6.35	2.77
Glass	1.14	2.30	3.65	0.76
Metal	1.23	0.87	2.64	0.66
Total Potential Recyclables (t/day)	**37.2**	**20.1**	**52.0**	**38.9**

Findings indicated that Masaka city had the highest generation of household recyclable waste per day with (52 tons), followed by Soroti city (38.9 tons), Gulu city (37.2) tons and Fort Portal city with the least (20.1).

3.4.2 Waste Composition Analysis

3.4.2.1: At the household level for each Income group

The waste samples used were generated from households and aggregated at village levels in kgs/day. Twelve categories of waste recommended by the UN-Habitat (2020) were included in the analysis, that is; Kitchen/Canteen Waste, Garden/Park Waste, Paper & Cardboard, Plastics-Film Plastics-Dense, Metals, Glass, Textiles and Shoes, Wood (Processed), Special Wastes, Composite Products, and “Other”.

Overall, findings reveal that Kitchen waste constitutes the majority of MSW generated across the cities with Gulu at 63.6 percent, Soroti at 52.0 percent, Masaka at 48.8 percent and Fort Portal with the least 44.5 percent.

In Gulu city, the middle-income households generated the highest percentage of Kitchen waste, averaging at 71.4 percent followed by the high-income income with 71.0 percent while in Fort Portal City, the high-income households generate the highest percentage of kitchen waste averaging at 67.6 percent, followed by middle-income households with 46.3 percent. In Masaka City, the high-income households generate the highest percentage of kitchen waste, averaging 54.4 percent, followed by middle-income households with 49.3 percent. In Soroti City, the middle-income households generate the highest percentage of kitchen waste, averaging 68.3 percent, followed by high-income households with 52.8 percent. See Figures 10 -13.

Figure 9: Fort Portal City Composition

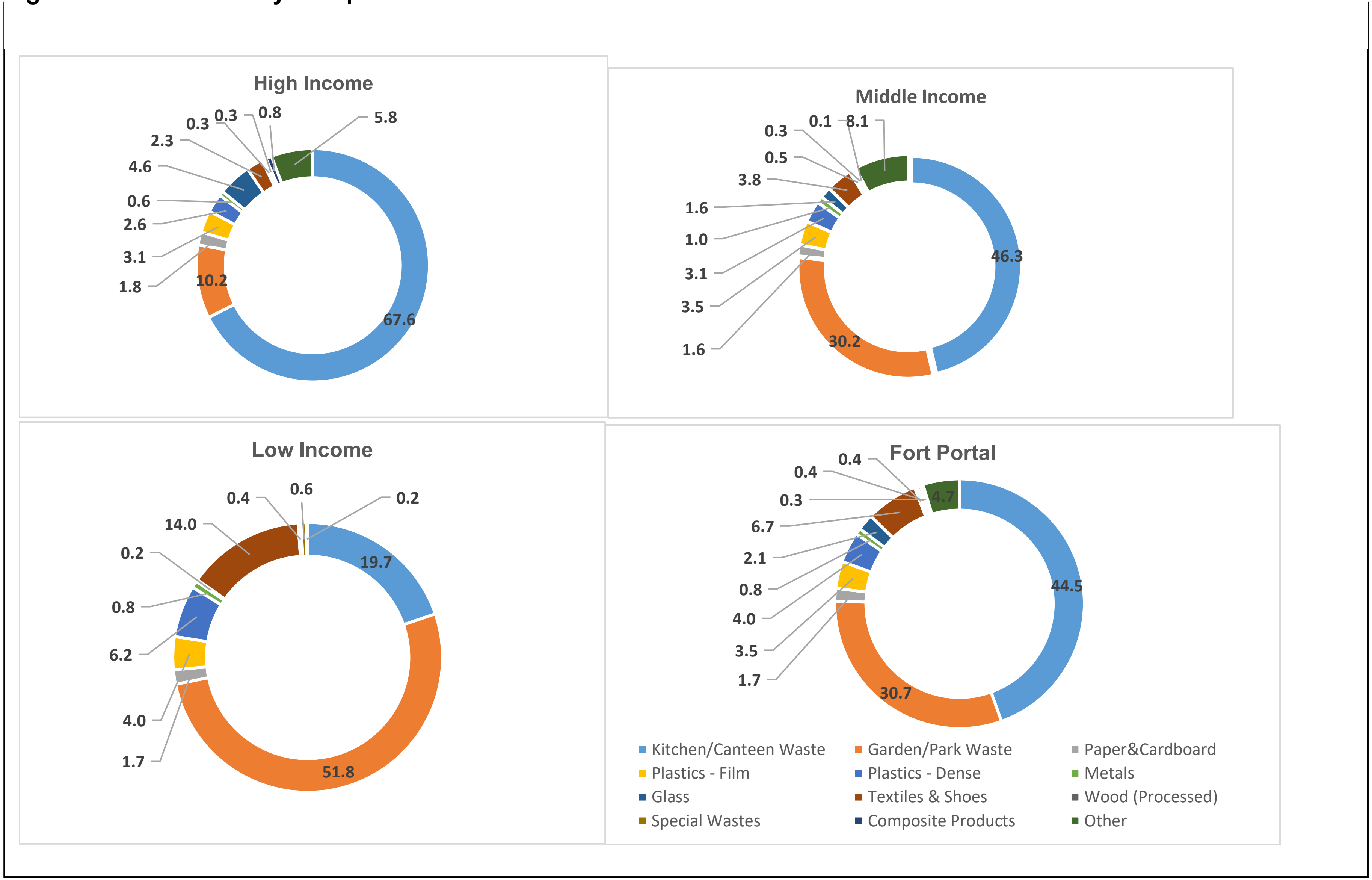


Figure 10: Gulu City Composition

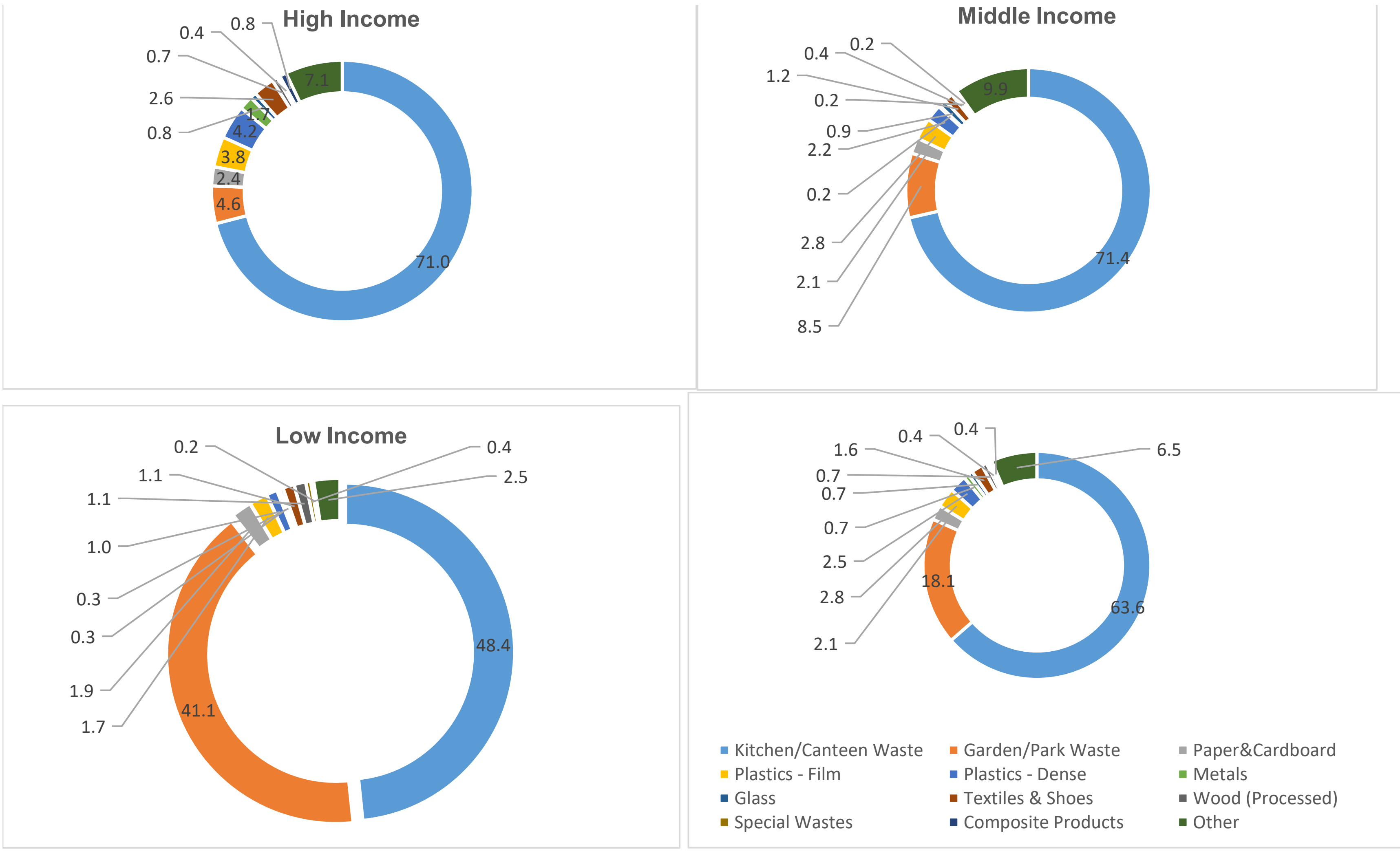
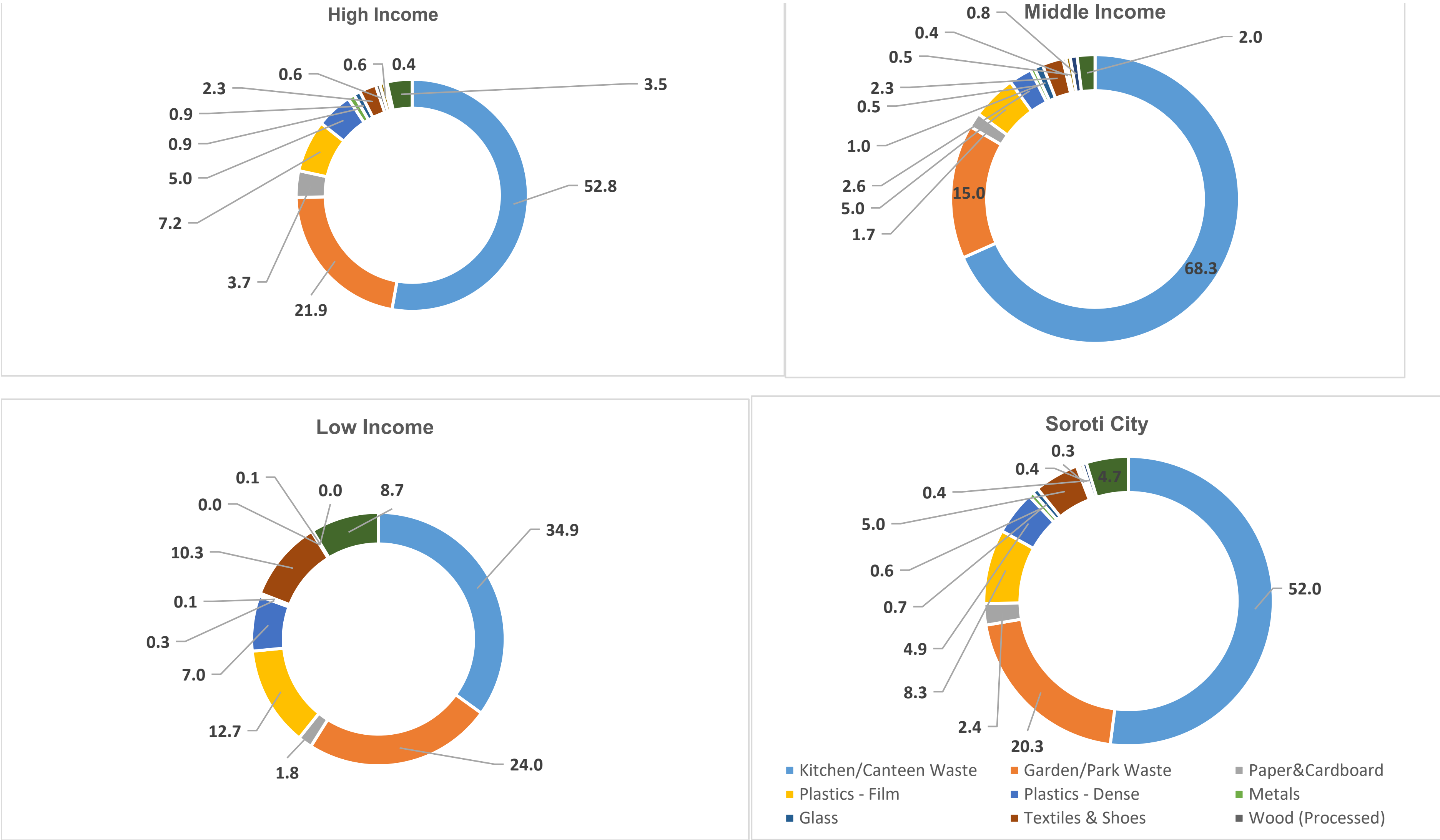


Figure 11: Masaka City Composition

Figure 12: Soroti City Composition

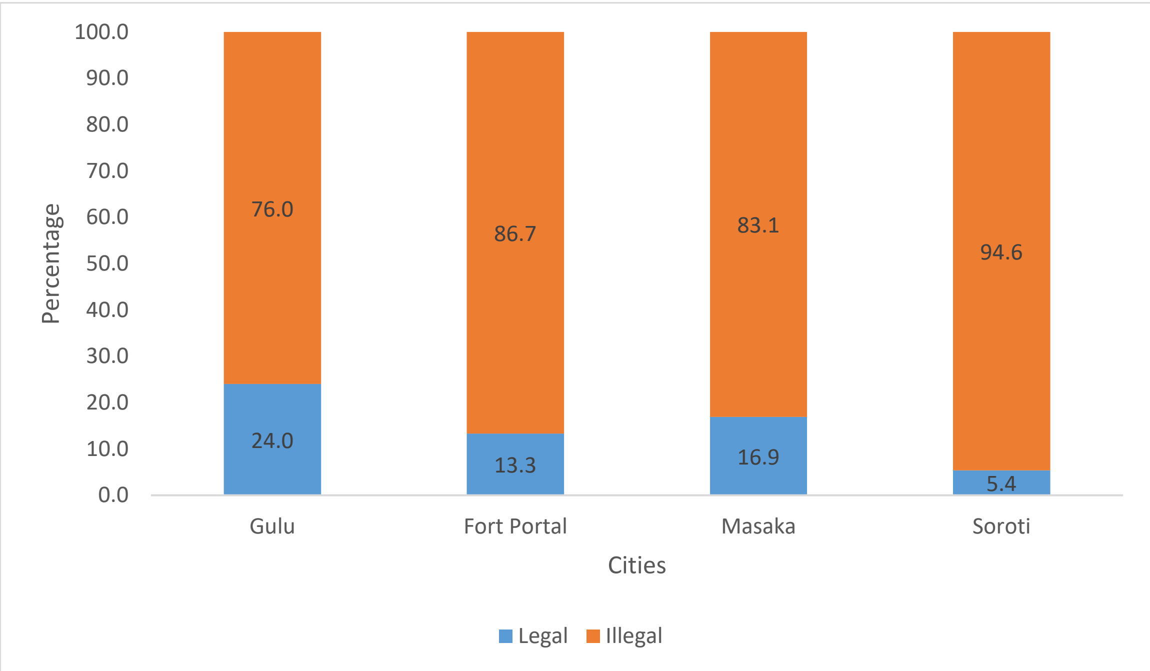


3.5 Waste Collection Points

Data was captured on the waste collection points in all three income groups and grouped as either legal, illegal or no disposal site in place.

In Gulu City, 76 percent of the waste collection points identified and mapped in the selected villages were illegal; Fort Portal City 86.7 percent of the waste collection points identified and mapped in the selected villages were illegal; Masaka City 83.1 percent of the waste collection points identified and mapped in the selected villages were illegal and Soroti city 94.6 percent of the waste collection points identified and append in the selected villages were unlawful. See Figure 13 below.

Figure 13: Percentage of Waste Collection Points in study cities



3.5.1 Disposal sites

Two disposal sites in Gulu were visited, that is Pabbo, which is city-owned, and Koro which is privately owned while one Site, Kiteeri, was visited in Fort Portal, which is city-owned; Bulanda was visited in Masaka city, and Aminit was visited in Soroti City. All the disposal sites that were visited had no control levels, implying that they do not comply with the best practices and standards as recommended by UN-Habitat (2020)

The sites are managed in a manner that is potentially dangerous to both nature and the human environment. The study also found overwhelming evidence of waste burning at the sites in all cities.

Figure 14: Pabbo Disposal Site in Gulu City

The study also took records of the waste vehicles and how many trips they make to each disposal site. See Table 10a, 10b, and 10c

Findings indicate that all cities have vehicles charged with the transportation of waste and cover weekly trips. These include compressor trucks, tipper mini, skip loaders, pickups, Tuk Tuks, Tractors, and Lorries.

Table 10: Waste transportation means, ownership status and number of trips made weekly by City

Gulu City

Sn.	Transportation means / Type of motor truck	Ownership status			Number of trips made (weekly)		
		City	Private	Total	City	Private	Total
i.	Compressor Truck	1	0	1	6	0	6
ii.	Skip Loader	4	0	4	26	0	6
iii.	Tipper (Mini)	0	3	3	0	16	16
iv.	Pick up	0	1	1	0	12	12
v.	Tuk Tuk	0	2	2	0	12	12

Table 10b: Masaka City

Sn.	Type of motor truck	Total number Owned/used for waste collection			Total number of trips collected (weekly)		
		City	Private	Total	City	Private	Total
i.	Compressor Truck	1	0	1	1	0	1
ii.	Tipper (Mini)	3	2	5	3	3	6
iii.	Lorry	1	1	2	1	1	2

Table 10c: Soroti City

Sn.	Type of motor truck	Total number Owned/used for waste collection			Total number of trips collected (weekly)		
		City	Private	Total	City	Private	Total
i.	Compressor	2	0	2	5	0	5
ii.	Skip loader	1	0	1	39	0	39
iii.	Tipper Truck	1	2	3	6	14	20
	Tractor	1	0	1	12	0	12

3.5.2 Waste Technical Conversion Factors

This study collected data that could be utilised to generate conversion factors. This was done by undertaking waste truck profiling, where records of it empty, loaded, and net weight were obtained, as seen below in Table 12.

Table12: Waste weight Conversion factors for Trucks used in Waste transportation

Type	Offloaded	Loaded	Net Weight
Compressor Truck	9.76	15.1	5.34
Skip Loader (Volumetric Capacity = 8 tons)	7.150	i. 9.1	i. 1.940
		ii. 9.4	ii. 2.270
		iii. 10.2	iii. 3.000
		iv. 9.4	iv. 2.222
Tipper (Mini-enhanced)	2.520	5.1 (Waste exceeding the bed)	2.58
		4.0 (Flatbed)	1.51
Pick Up	1.34	2.1	0.76
Tricycle (Tuk Tuk)	0.440	1.1	0.73
UD Croner	13.5	7.7	5.8
FAW Comp	26.4	15.8	10.6
Tractor	8.3	3.4	5.0
Fuso	11.9	5.1	6.8
Isuzu	9.3	4.3	5.0

CHAPTER FOUR: LIMITATIONS, CHALLENGES AND RECOMMENDATIONS

4.1 Introduction

This chapter presents the challenges encountered while undertaking the study and potential recommendations.

4.2 Challenges and Limitations

i. **Unusually high amounts of waste** : In some low-income areas of the new cities, especially those resembling rural settings, the results deviated from expected trends. These areas produced unusually high amounts of waste, in some cases exceeding that of middle- and high-income areas. This was largely due to garden waste generated during the harvest season, as many residents were engaged in agriculture.

ii. **Inadequate licensing registers/data**: Although data collection from non-household entities (establishments) followed the recommended methodology, the cities lacked reliable licensing registers, making it difficult to estimate waste generated by this sector.

iii. **Seasonality** impacted results, particularly in Gulu city, where the study coincided with the harvesting period. This led to inflated waste volumes from rural-like urban poor communities. To better understand seasonal effects, future studies should consider separating garden waste from total waste volumes.

iv. **Categorizing households** into economic classes based on UN-Habitat standards was difficult. A customized approach was used for the different cities.

v. On the first day of data collection, some households brought waste not only from their own homes but also from their neighbors, affecting the accuracy of individual household data.

vi. **Absence of weigh bridges** in some cities like Fort Portal and Soroti, the team to rely on outdated conversion factors for waste estimation.

vii. **Sorting food waste** from mixed waste bags posed a significant challenge. Items like rice and beans, once mixed, were difficult to separate, leading to difficulty in food waste estimation.

viii. **Kitchen waste used as animal feed**: Households that typically use kitchen waste (e.g., banana peels) as animal feed were hesitant to include such waste in the collection.

ix. **Limited record keeping:** Many recycling and recovery facilities lacked proper record-keeping practices and could only provide approximate figures.

x. **Absence of data clerks**: Only the Kiteeri Disposal Site, in Fort Portal City, had data clerk who could collect and provide the necessary information. Gulu City (Pabbo and Koro), Masaka City (Bulando), and Soroti City (Aminit) had no data clerks. To bridge this gap, the team hired data clerks for each site to support data collection over five days, and all clerks were provided with necessary facilitation.

xi. **Waste diversion for Agricultural reuse** especially in Masaka City (where this is very significant). These leakages limited proper estimation of the total waste collected.

4.3 Conclusion

Overall, the test results demonstrated that the methodology for compiling data and indicators for SDGs 11.6.1, 12.5.1, and 12.3.1b is feasible within urban settings and across all Local Governments, provided some adjustments are made to align with local contexts.

4.4 Recommendations

i. Conduct a nationwide study to generate national-level estimates of Municipal Solid Waste and to compile relevant Sustainable Development Goal (SDG) indicators and this will provide baseline data. This data is critical for designing effective waste management strategies and will play a key role in monitoring the progress of NDP IV and promoting Uganda's green growth and circular economy initiatives in the waste sector.

ii. Future studies should be mindful of seasonal variations that affect waste generation patterns.

iii. Government needs to support cities to acquire weighbridges for the gazetted dumping sites for effective monitoring of waste generated, collected and disposed of.

iv. Undertake national- wide waste recycling profiling, to ensure up-to-date databases.

v. Future studies should take into consideration tracking waste diversions/leakage paths to enable effective estimation of total waste collected. Waste diverted is considered waste collected although it never ends at the disposal site.

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The National Development Plan III

Testing Methodological for SDG Indicator: 11.6.1 Proportion of municipal solid waste collected and managed in controlled in cities; UBOS, 2021

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APPENDIX

Testing the Computation Formulas for the Indicators

2.9.1 SDG Indicator 11.6.1: Proportion of Municipal Solid Waste Regularly Collected and Managed in Controlled Facilities in the Cities

The formula for computing SDG indicator 11.6.1 is provided in equation (1):

$$PMSWCMF_t = \left(\frac{\text{Total MSW collected and managed in controlled facilities (t/day)}}{\text{Total MSW generated (t/day)}}\right) \text{ x } 100\ (\%) \qquad (1)$$

Where;

$PMSWCMF_t$, is the proportion of MSW collected and managed in controlled facilities out of total MSW generated by the cities.

To test the application of the above computation formula, the current study had to first establish the amount of MSW generated, MSW recovered, and MSW disposal. While the study successfully obtained data to test the process of establishing the amount of MSW generated and that which is collected for disposal in all the Cities. The data obtained on the MSW recovered was insufficient to run the test results. Nonetheless, this is an area that could be addressed with just extra effort.

Computation of Total MSW generation in all cities was tested using equations (2a & 2b),

$$TMSWG_t = MSWG_{hh} + MSW_{nh} \qquad (2a)$$

Equation (2a) would be rewritten as

$$TMSWG_t = Pop_t(PCMSWG_t\ ) + MSW_{nh} \qquad (2b)$$

Where;

$TMSWG_t$ is the total MSW generated in the city,

$Pop_t(PCMSWG_t\ )$ is the total MSW generated by households,

Pop_t is the current population of the city (2024 population figures for all the cities)

$PCMSWG_t$ is the Per Capita MSW generation from the 90 households covered per City

MSW_{nh} is the Non-Household MSW generation

$$PCMSWG_t = \sum_i^n \frac{HhSWG\ per\ day\ (kg)}{Pop_h(n_d)} \qquad (3)$$

Where;

$PCMSWG_t$ is the Per Capita MSW generation (kgs/day)

$HhSWG\ per\ day\ (kgs)$ is the Household SW generated per day in kilograms

Pop_h is the number of regular residents currently living in the household

n_d is the number of days waste is collected and weighed in the household

$i \sim n$ is from the first to seventh day

Accordingly, the UN-Habitat (2020) shows that the difference between Total MSW generated in the city and the total Household MSW should give total Institutional MSW generated as shown in equation (4)

$$MSW_{nh} = TMSWG_t - MSWG_{hh} \tag{4}$$

Where;

MSW_{nh} is the institutional MSW generated, $TMSWG_t$ the total MSW generated in the city, and $MSWG_{hh}$ is the total household waste

But with total MSW from households, the total MSW generated in the city was calculated as in equation (5)

$$TMSW_{hh+nhh} = \frac{MSWG_{hh}}{70\%} \tag{5}$$

Where;

$TMSW_{hh+nhh}$ is the total MSW generated in the city while $MSWG_{hh}$ is the total household waste

After obtaining data on the total MSW generated in the city, the study then calculated the sub-indicators of the SDG indicator 11.6.1 as shown below:

SDG indicator 11.6.1a: Proportion of MSW collected

SDG indicator 11.6.1b: Proportion of MSW managed in recovery facilities out of the total MSW generated in the city

SDG indicator 11.6.1a: Proportion of MSW collected was computed as in equation (6);

$$PMSWC_t = \left(\frac{\text{Total MSW collected (t/day)}}{\text{Total MSW generated (t/day)}}\right) \text{ x } 100\ (\%) \tag{6}$$

Where;

$PMSWC_t$, is the proportion of MSW collected out of total MSW generated by the city.

SDG indicator 11.6.1b: Proportion of MSW managed in recovery facilities out of the total MSW generated in the city would be computed as in equation (7), but the data obtained was insufficient to run the results.

$$PMSWMC_t = \left(\frac{\text{Total MSW managed in controlled facilities (t/day)}}{\text{Total MSW generated (t/day)}}\right) \text{ x } 100\ (\%) \tag{7}$$

Where;

$PMSWMC_t$, Is the proportion of MSW managed in controlled facilities out of total MSW generated by the city.

2.9.2 SDG 12.5.1: National Recycling rate

Data collected from material recovery flows from the Recovery Facilities can provide data for SDG Indicator 12.5.1 by providing the City's Recovery Rate (UN-Habitat, 2020). The formula for the City Recovery Rate is provided in Equation 8 below

$City\ Recovery\ Rate$ = $Total\ Recovered\ Materials\ (t/day)$ x 100(%) (8)

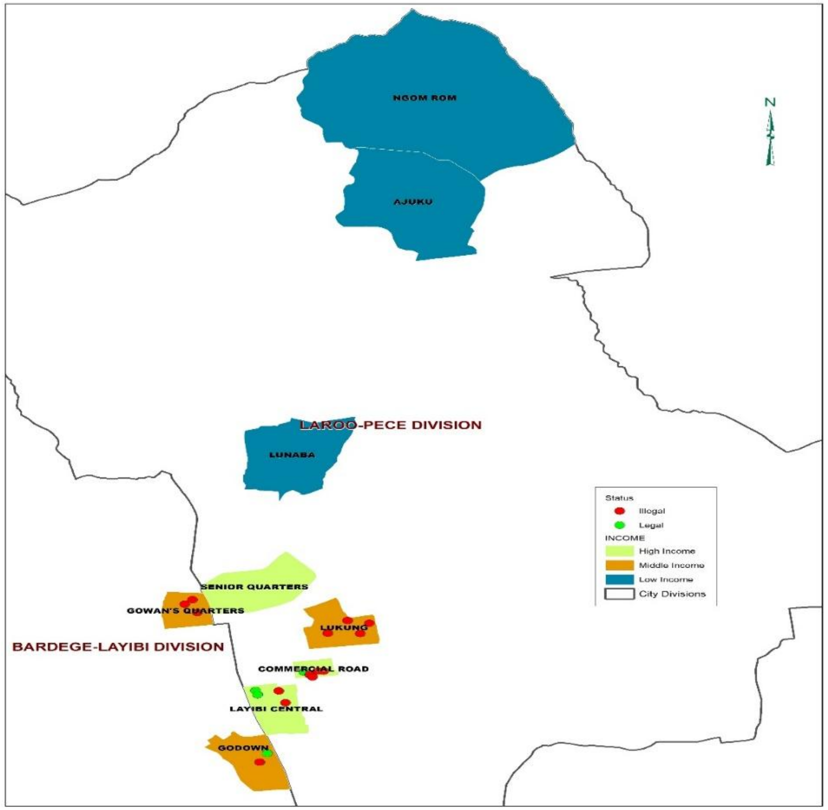
2.9.3 SDG Indicator 12.3.1b: Food Waste Index

Data collected from the Indicator 11.6.1 can be used to compile SDG Indicator 12.3.1b by providing the household food waste generation per capita. The formula is shown below in Equation (9).

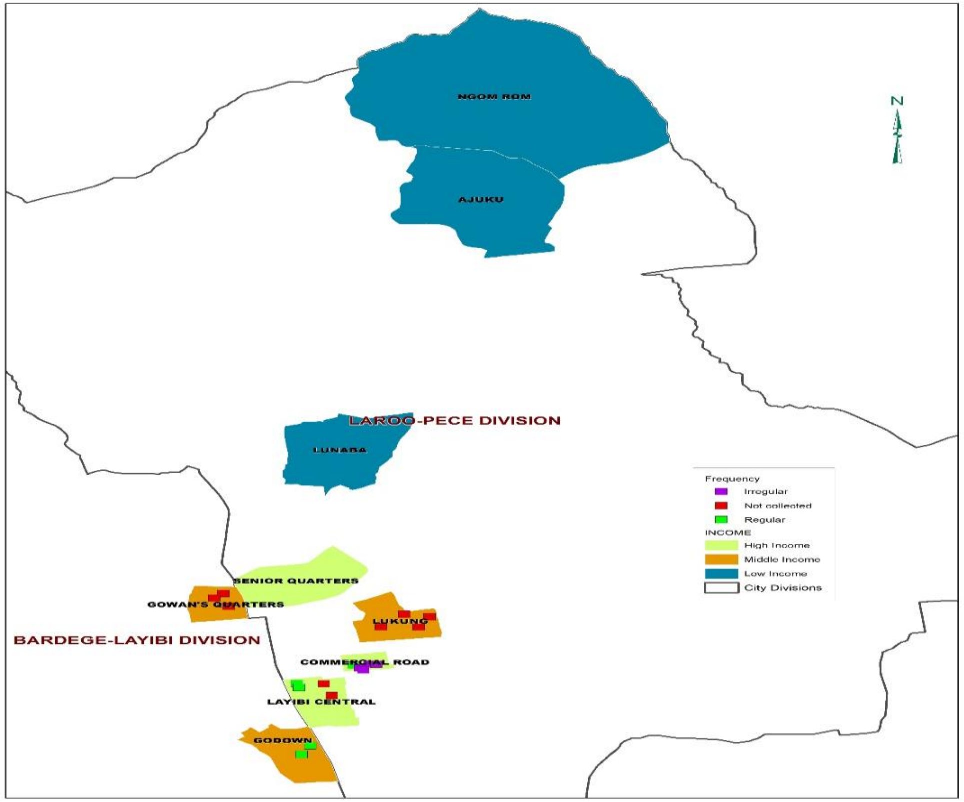
$Per\ Capita\ Household\ Food\ Waste\ Generation$ = $Per\ Capita\ MSW\ geration\ rate\ \ (kg/cap/d)$ x $Proportion\ of\ Food\ Waste$ (9)

Annex 1: City Waste collection points mapping
Gulu City

Status of waste collection points

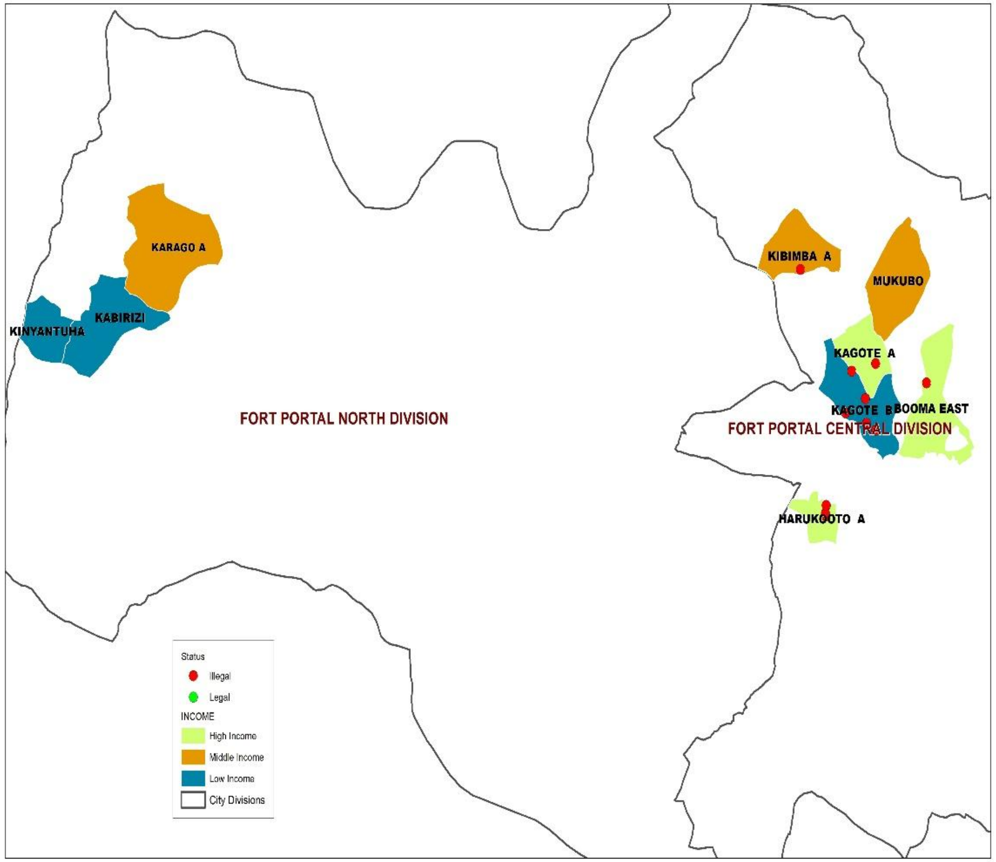


b) Frequency of waste collection at each collection point

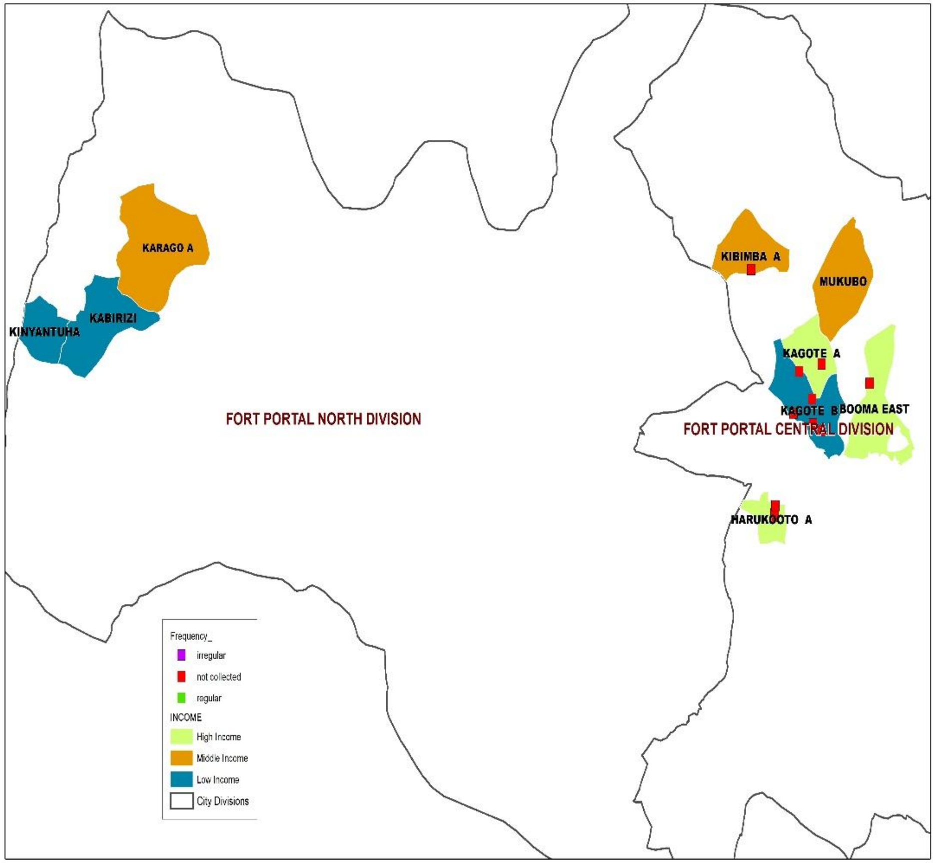


Fort Portal City Waste collection points mapping

a) Status of waste collection points



b) Frequency of waste collection at each collection point



Annex 2: Waste Collection Points by city

Table 11: Waste Collection Points in study Cities

City	Village	Income Status	Status of Collection Point		Total
			Legal	Illegal	
Gulu	Commercial Road	High	2	4	6
	Layibi Cental		2	3	5
	Senior Quarters		0	3	3
	Gowan Quarters	Middle	0	3	3
	Lukung		0	4	4
	Godown		2	1	3
	Ajuku	Low	0	1	1
	Ngom Rom		0	0	0
	Lunaba		0	0	0
	Total		**6**	**19**	**25**
Fort Portal	Harukooto	High	0	5	5
	Kagote A		0	1	1
	Boma East		0	1	1
	Kibimba	Middle	1	0	1
	Karago		1	0	1
	Mukubo		0	0	0
	Kinyatuha	Low	0	0	0
	Kabirizi		0	0	0
	Kagote B		0	6	6
	Total		**2**	**13**	**15**
Masaka	Kizungu	High	1	1	2
	Town Yard		4	7	11
	Kimanya		1	6	0
	Gayaza	Middle	0	0	0
	Kyalusowe 'A'		4	4	8
	Ssenyange 'A'		1	1	2
	Kyabakuza	Low	0	0	0
	Binyonyi 'A'		1	1	2
	Misaali			39	39
	Total		**12**	**59**	**71**
Soroti	Central	High	1	4	5
	Akisim		6	0	0
	Senior Quarters		1	8	0
	Nakatunya	Middle	1	7	0
	Pioneer		0	6	6
	Kengere		0	7	7
	Acetgwen	Low	0	1	1

	Moruaspeur		0	7	7
	Kichinjagi		0	8	8
	Total		**3**	**53**	**56**

Annex 3: Pictures

Activity photo and description

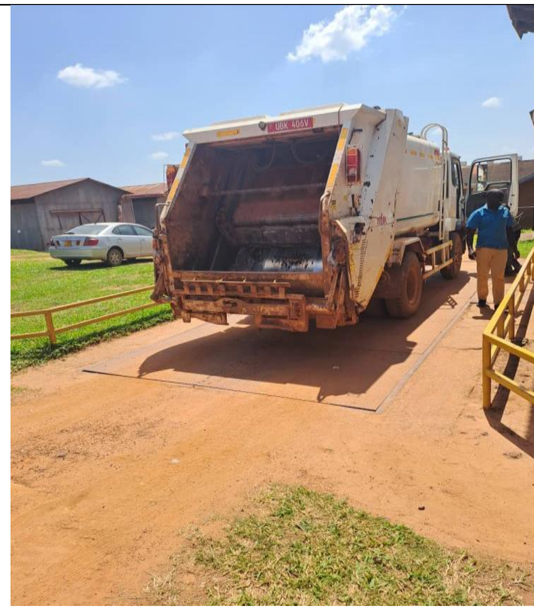
Preparatory meetings with city staff

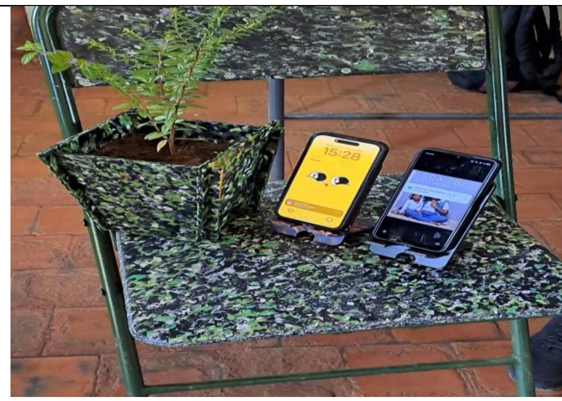
Preparatory meetings with city waste a recycler

Gulu training

Fort Portal Training

Determining pacing coefficients for data collectors	House hold selection exercise
 Low income household selection	 Middle income household selection
 Household data collection	 Supervision and validation
	

Weighing a skip loader full and later empty	Weighing a tri-cycle used in waste transportation
 Weighing a pickup	 Weighing a compressor truck
 House hold Waste sorting	 Waste sorting at the disposal site
 Disposal site data collection	

	Disposal site data collection
 Plastic waste recycling	 Plastic waste collection
 Plastic waste collection strategies utilised in Gulu city	 Products manufactured from recycled plastics at Taka Taka
 Legal and supervised waste collection point installed with a skip	 Illegal and un-supervised waste disposal point

 Bio-degradable waste recycling at HEWESA (Fort Portal)	 Bio-degradable waste recycling at HEWESA (Fort Portal)
Food Waste 	**Weighing waste** 

Annex 4: Vehicles for Transportation

Sn.	Type of Truck	Details
		**Compressor Truck**
		**Skip Loader** (Volumetric Capacity = 8 tons)
		**Tipper (Mini-enhanced)**

		**Pick Up**
		**Tri-cycle (Tuk Tuk)**