

*Addis Ababa
University*

(Since 1950)



Addis Ababa University

College of Development Studies

Center for Environment and Sustainable Development

Practice and challenges of plastic waste collection: The case of Addis Ababa

A thesis submitted to Addis Ababa University, College of Development Studies, presented in partial fulfillment of masters of art on environment and sustainable development

By: Habtamu Demissie

Advisor: Shimeles Damene (Ph.D.)

July, 2024

Addis Ababa, Ethiopia

Abstract

Plastic waste collection has become a vital economic activity in Addis Ababa, supporting the livelihoods of formally registered and informally operating waste collectors. This thesis explored their practices and challenges through a mixed-methods approach. Quantitative data were gathered from a sample of 174 collectors, comprising 44 formal and 130 informal plastic waste collectors, selected using stratified and simple random sampling methods. Complementary qualitative insights were also collected through focus group discussions (FGDs) with participants from both categories of collectors, along with key informants from government agencies, small and medium-sized enterprises, and plastic waste recyclers. The quantitative findings were analyzed using descriptive statistics, while qualitative data were examined thematically.

The study revealed that 90% of both group collectors focus on polyethylene terephthalate (PET) waste, mainly sourced from streets and ditches. Majority of formal waste collectors gather waste from households but face challenges with poorly sorted plastic waste. Informal collectors typically collect smaller quantities of plastic daily and work longer hours compared to formal plastic waste collectors. Significant discrepancies in resources and capabilities exists between formal and informal collectors; formal collectors have access to transportation more often than informal collectors, who usually transport plastic waste manually. Safety practices also vary widely, with 98% of formal collectors using personal protective equipment during collection and transportation of waste, compared to 19% informal collectors. Access to properly designated storage areas for plastic waste is among the significant challenges; formal waste collectors use public open spaces for storage, while informal plastic waste collectors store in relatively better private fenced areas. Many formal collectors are concerned about low unit and fluctuating plastic waste prices, which they often experience reduced income. Training opportunities and other forms of support are scarce for both groups, and relationships with buyers are largely transactional, with most collectors operating without any written or unwritten contracts. Inclusive training programs, the integration of informal collectors into the formal system, and fostering collaboration among government agencies and other stakeholders are essential recommendations to improve plastic waste collection practices and address existing challenges.

Keywords: formal, informal, plastic waste, waste collectors, waste management, recyclers, SMEs.

Contents

Abstract	i
List of Tables	v
List of figures	vi
Acronyms	viii
CHAPTER ONE	1
1. INTRODUCTION	1
1.1. Background of the study	1
1.2. Statement of the problem	2
1.3. Objective of the study	3
1.3.1. General objective	3
1.3.2. Specific objectives	4
1.4. Research questions	4
1.5. Significance of the study	4
1.6. Scope of the study	5
1.7. Limitations of the study	5
1.8. Ethical Consideration	6
1.9. Organization of the thesis	6
CHAPTER TWO	7
2. LITERATURE REVIEW	7
2.1. Conceptual review	7
2.1.1. Concepts and definitions	7
2.2. Theoretical Framework	10
2.2.1. Stakeholder Theory	10
2.2.2. Circular Economy framework	11
2.3. Empirical literature	13
2.3.1. Plastic recovery system	13
2.3.2. Relationship between actors	13
2.3.3. Factors affecting plastic waste recycling	14
2.3.4. Plastic waste collection and recycling	15
2.3.5. Solid waste management policy review	16
2.4. Conceptual Framework	18
CHAPTER THREE	19
3. MATERIALS AND METHODS	19

3.1. Description of the study area.....	19
3.2. Research Methodology.....	20
3.2.1. Research design and approach.....	20
3.2.2. Data sources.....	20
3.2.3. Sampling technique and sample size determination.....	20
3.2.4. Data Analysis.....	27
CHAPTER FOUR.....	28
4. RESULT AND DISCUSSION	28
4.1. Demographic characteristics of survey households	28
4.1.1. Age and sex composition.....	28
4.1.2. Educational level	29
4.1.3. Marital status and family size	29
4.1.4. Household monthly income and contribution	30
4.2. Status of plastic waste collection practice.....	33
4.2.1. Source and types of plastic wastes	33
4.2.2. Sorting and segregation practices	36
4.2.3. Quantity of plastic waste and frequency of collection	40
4.2.4. Working hours	41
4.2.5. Storage facilities characteristics	41
4.2.6. Transportation of plastic wastes	44
4.2.7. Plastic waste buying practice.....	44
4.2.8. Opinion of plastic waste collectors towards the plastic waste collection practice	45
4.3. Challenges of plastic waste collection activities	46
4.3.1. Lack of official recognition and support from local authorities.....	47
4.3.2. Competition between waste collectors	48
4.3.3. Poor segregation practice and utilization of waste bins	49
4.3.4. Price fluctuation and supply inconsistency	50
4.3.5. Sectoral integration and low enforcement practice	51
4.3.6. Accessibility of waste collection points	52
4.3.7. Inadequate storage spaces.....	52
4.3.8. Personal protective equipment (PPE) use practice of waste collectors	54
4.3.9. Access to training for waste Collectors	55
4.4. The nexus of plastic waste collectors and plastic waste buyers	56
4.4.1. Plastic waste supply and regular buyers	56

4.4.2. Payment period and modalities.....	60
4.4.3. Average monthly income.....	61
4.4.4. Impacts of price variation on collection practice.....	62
4.4.5. Contract arrangements.....	63
CHAPTER FIVE	65
5. CONCLUSION AND RECOMMENDATIONS	65
5.1. Conclusion.....	65
5.2. Recommendation.....	66
References.....	68
Annex	77
Annex I.....	77
Annex II.....	89

List of Tables

Table 2.1. Categories of Plastics.....	7
Table 3.1. Quantitative sample allocation.....	24
Table 3.2. Qualitative sample allocation.....	26
Table 4.1. Demographic characteristics of respondents.	30
Table 4.2. Profile of qualitative respondents	32
Table 4.3. Main types of plastic waste collected and plastic waste collection sites	33
Table 4.4. Plastic waste sorting practice at the source and waste collector sorting exposure.	38
Table 4.5. Practices of plastic waste collectors.....	43
Table 4.6. Challenges affecting plastic waste collection activities.....	52
Table 4.7. Plastic waste collectors' access to training and personal protective equipment.....	55
Table 4.8. Relationships between plastic waste collectors and their regular buyers	58
Table 4.9. Types of Support received by collectors from each regular buyer	59
Table 4.10. Payment mode and frequency of plastic waste collectors	60
Table 4.11. Types of contract plastic waste collectors receive from buyers	64

List of figures

Figure 2.1. Key factors influencing plastic waste collection and recycling	18
Figure 3.1. Map of Addis Ababa and Sub-cities.....	19
Figure 4.1. Types of plastic waste collected by the waste collectors	34
Figure 4.2. Utilization of dedicated collection bags by plastic waste collectors	37
Figure 4.3. Storage of formal plastic waste collectors (Unions): Gullele Sub-city, woreda 1	42
Figure 4.4. Storage of informal plastic waste collectors (SMEs): Bole Sub-city, woreda 12	42
Figure 4.5. Transportation methods utilized by plastic waste collectors for waste transport.....	44
Figure 4.6. Distribution of plastic waste collectors by source of purchase	45
Figure 4.7. Perceptions of plastic waste collectors regarding current waste collection practices	46
Figure 4.8. Breakdown of training sources for plastic waste collectors	56
Figure 4.9. Plastic waste market supply chain.....	58
Figure 4.10. Effects of price on the volume of plastic waste collected by collectors.....	63

Declaration

I declare that “**Practice and challenges of plastic waste collection: The case of Addis Ababa**” is my own work and that all sources that I have used or quoted have been indicated and acknowledge by means of complete references.

Habtamu Demissie

Signature: _____ Date: _____

Advisor

Shimeles Damene (PhD)

Signature: _____ Date: _____

Examiners

Ephrem Assefa (PhD)

Signature: _____ Date: _____

Ali Hassen (PhD)

Signature: _____ Date: _____

Acronyms

AACMA	Addis Ababa Cleansing Management Agency
CSA	Central Statistics Authority
EC	European Commission
EMF	Ellen MacArthur Foundation
FGD	Focus Group Discussion
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
HDPE	High-Density Polyethylene
LDPE	Low-Density Polyethylene
MEFCC	The Ethiopian Ministry of Environment, Forest and Climate Change
NGO	Non-Governmental Organizations
OECD	The Organization for Economic Co-operation and Development (OECD)
OSCALDC	Office of the Special Coordinator for Africa and the Least Developed Countries
PC	Polycarbonate
PET/PETE	Polyethylene Terephthalate
PP	Polypropylene
PPE	Personal protective equipment
PS	Polystyrene
PVC	Polyvinyl chloride
SBPDA	Sanitation, Beautification and Park Development Authority
SME	Small and medium-sized enterprises
SWE	Solid Waste Management
UNDP	United nation development program
WIEGO	Women in Informal Employment Globalizing and Organizing
WRAP	The Waste and Resources Action Programme

Acknowledgment

I would like to express my heartfelt gratitude to my advisor, Dr. Shimelis Damene, for his invaluable guidance and support throughout the writing of this thesis. Your insights on the subject matter and your remarkable patience played a crucial role in the development of this work. I am truly appreciative of the honor of working with you.

I would also like to thank the Center for Environment and Sustainable Development for the encouragement from the staff, which has greatly motivated me. I appreciate the resources and support provided, which were essential for my study.

Additionally, I am grateful to my family and friends for their unwavering support during this journey. Finally, I would like to extend my thanks to everyone who contributed to this thesis, either directly or indirectly. Your support has been a vital part of my achievements.

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Solid waste management has been a global concern for centuries; most importantly for several decades of the 20th and 21st centuries. Currently, over 2 billion tons of waste are generated in a year, which is expected to reach over 3.8 billion tons in 2050 (Silpa et al., 2018). Wilson (2015) also estimated an annual 20% per-capita increase by 2100. Consequently, the prevailing waste production requires effective management, which is increasingly considered a fundamental solution to ensure sustainable production and consumption in promoting the sustainable development of cities (Hondo, 2020).

Developing countries have very poor solid management practices. Only less than 50 % is collected compared to 98% of the collection rate in developed countries. Besides, in most cases they are characterized by inadequate and unorganized reuse and recycling practices; rather most of the wastes are disposed at the land fill or open dumpsites. Consequently, the residents of developing countries, particularly the urban poor, are more likely to suffer from waste-borne serious health, social, and environmental problems (Hoornweg & Bhada-Tata, 2012).

In Ethiopia, where the population size and also urban dwellers have been increasing each year, the waste generation has reached over 12000 tons per day in 2020 (Silpa et al., 2018). It's also estimated that the amount will be doubled in 2030. The World Bank (2021) reported that Addis Ababa has been producing up to 30 % of the nation's waste and the generation is rising at the rate of 5% per annum. According to UNDP (2020), plastics constitute the largest portion of solid waste generated in the city, exceeding that of any other region in the country. During the last three decades, the number of plastic products in Addis Ababa has increased rapidly, posing a threat to the urban environment. The annual plastic per capita increased from 0.7 kg in 2007 to a projected 3.8 kg in 2022 and Addis Ababa is consuming nearly twice as high as the national average; I.e.; 6.2 Kg (GIZ, 2021). Despite this rise, much of the increasing amount of plastic remains uncollected, making sustainable management more challenging for the city (Gelan, 2021).

However, plastic waste collection and recycling efforts in Addis Ababa are still underdeveloped and hindered by poor solid waste management practices (Nigatu et al., 2016). To address these challenges, Alhazmi et al. (2021) emphasized the need for sustainable waste management solutions tailored to an ever-growing population, which requires more efficient strategies for handling waste, particularly non-biodegradable plastics. Given the complexity of the issue, Abdel-Shafy and Mansour (2018) advocated for effective solid waste management that prioritizes prevention, reuse, and recycling as key solutions. Focusing specifically on plastic waste collection can significantly reduce environmental pollution. Therefore, the government and relevant environmental bodies should prioritize promoting plastic waste collection practices and increasing the efficiency and capacity of recycling industries.

1.2. Statement of the problem

Although there are different estimates, the study by Geyer et al. (2017) indicates that about 4.2 billion tons of plastic waste have been generated globally since 2004; of which only two third of the waste is managed to be collected. However, the remaining one-third of plastic waste has remained uncollected. According to Stahel (2016), a large part of the plastic waste is dumped in the landfill and ends up incinerated; accounting for just 9% of the total being recycled. Likewise, the rate is very low in Ethiopia (UNDP, 2020).

Studies implicated that, compared to 2011, plastic consumption has tripled in 2020. To address the root of the problem, some of the recommendations related to more sustainable solid waste management are the promotion of waste recycling and reuse (Silpa et al., 2018). Oberlin (2013) also affirmed that effective plastic waste management requires efficient waste recycling industries. However, Bjerkli (2005) stated that despite the persisting plastic resulting pollution, the recycling industries have registered low rates of growth in Ethiopia and Addis Ababa and mostly operated on small or medium scale.

The widespread use of plastic production and disposal has been increasing. The fact that such wastes are bulkier and non-biodegradable makes their disposal consume massive space in landfills (OECD, 2022). Dwivedi et al. (2019) insisted that plastics are unpreventable waste. Consequently, unless we avoid them at all, which is very difficult pending their wide spread usage, recycling them is the most ideal method to alleviate the environmental damage they are resulting. Babayemi

et al. (2019) indicated that recycling industry performance and raw material collection systems are inefficient in developing countries such as Ethiopia, hence plastics remained the most mismanaged among other types of wastes. According to Tesfaye (2020), the city's poorly managed plastic waste collection activities indicate that the collection and recycling industries have several underlining issues. Kihila et al. (2021) and UNDP (2020) emphasized that lack of effective waste management planning, shortage in supply, poor quality of recyclable plastics, limited financing, and insufficient regulatory support from the government are the factors challenging the plastic waste recycling industries. Furthermore, according to Yousefloo and Babazadeh (2020), the lack of economic incentives for those involved in plastic waste collection, specifically the low compensation for plastic waste collectors, represents one of the key factors hindering the sector's effectiveness.

Kihila et al. (2021) stated that Africa has suffered from insufficient strategies for best-model waste collection and segregation practices and a lack of feasible technologies for recycling and reusing plastic waste. Yu et al. (2010) also highlighted the weak regulatory system that fails to promote recycling. A study by Adefris et al. (2023) on solid waste management revealed that the lack of clear directive guidelines at the city level has challenged the effective implementation of solid waste management practices.

Various studies have revealed that households and institutions are among the primary sources of plastic waste, which constitutes a significant share of raw materials for the recycling industries (Berhanu, 2014). Consequently, factors that have positively or negatively impacted the success or failure of the industry, particularly those related to plastic collection, should be uncovered (Afullo & Odhiambo, 2009). In this regard, although there are few studies conducted on plastic waste collection and recycling, Kihila et al. (2021) acknowledged that implementing better waste collection practices and establishing waste recycling industries to reduce and recycle plastic waste remain unaddressed issues of the sub-Saharan African countries, that require further specific studies.

1.3. Objective of the study

1.3.1. General objective

The general objective of the study is to assess the current practices and challenges of plastic waste collection in Addis Ababa.

1.3.2. Specific objectives

- To assess the current plastic waste collection practice in Addis Ababa.
- To analyze the challenges associated with plastic waste collection activities in Addis Ababa.
- To describe the nexus between plastic waste collectors and plastic waste buyers.

1.4. Research questions

These are the research question to be addressed by the thesis;

1. What are the current plastic waste collection practices in Addis Ababa?
2. What are the challenges that hinder the current plastic waste collection activities in Addis Ababa?
3. What is the nature of the relationship that exists between plastic waste collectors and plastic waste buyers?

1.5. Significance of the study

Prior studies have more focused on assessing formal and informal solid waste management systems and in some ways the plastic recovery system. This study tried to explain the practice and challenge of plastic waste collection and activities. Therefore, the findings could indicate the city administration and other concerned government authorities to analyze the existing plastic waste management practices and strategies. It could also provide insights to researchers to evaluate the implementation of the overall waste management system; particularly in terms of indicating the factors that influence plastic waste collection and recovery.

Plastic waste collectors play a vital role in plastic waste recovery systems, contributing significantly to the promotion of recycling industries. Besides identifying various obstacles that this paper intended to present, would be an input to new investors and existing plastic waste recycling firms to understand the practice and the relation between actors involved in the sector. Stakeholders such as NGOs environmentalists and private plastic waste management enterprises could also refer to the findings to understand the plastic waste collection activities and prospects and play their part in the environmental safeguarding of the city.

There are few researches made on waste management systems that could provide sufficient knowledge in the area. The city municipality predominantly plans and concentrates on the collection and disposal of generated wastes; neglecting plastic wastes that could promote recycling activities. This thesis focuses on identifying the challenges specific to plastic waste collection, separate from general waste collection issues would relatively provide a better understanding to recognize the challenges that exist within the plastic waste collection sector.

1.6. Scope of the study

The spatial emphasis of this study is Addis Ababa city, which is divided into 11 sub-cities. The primary reason for this focus is that plastic waste collection is practiced across all sub cities and woredas, providing a comprehensive overview of the city's overall plastic waste collection practices.

Conceptually, since the research aims to examine the practices and challenges associated with plastic waste collection in the city, it was important to ensure broad coverage by including various stakeholders involved in the plastic waste collection value chain. Waste collectors who directly collect plastic wastes, SMEs and unions that buys and sells the wastes, recyclers that receive a bulk of plastic wastes to create recycled products and government cleansing management agencies that coordinate and manage the waste collection sector were included in the study.

Methodologically, sub-cities and woredas were clustered and grouped in the way that they represent the target population of the research. A random sampling method was employed to select a smaller, representative sample of plastic waste collectors from the formal and informal strata. Given the spatial extent of Addis Ababa, the approach balanced the need for in-depth analysis with budget and time constraints. Regarding to data analysis, the thesis employed descriptive and thematic analysis for quantitative and qualitative data respectively.

1.7. Limitations of the study

The study faced some limitations related to data collection. Obtaining data from the relevant government organizations took significantly longer time due to the disorganized database systems within these offices. Additionally, merging and utilizing the isolated data received from various government departments also posed challenges in retrieving and selecting the final sample. While

the study tried to include most stakeholders involved in plastic waste collection practices, some actors may have been excluded. In case any actor's worth being part of the study was missed, the exclusion was based on the intention of the thesis to explore the practices and challenges of plastic waste collection, focusing on the most relevant actors involved in the plastic waste collection value chain. Furthermore, the data collection was conducted over a short period, specifically in February (2023), which may not account for changes in plastic waste collection practices between the summer and winter seasons.

1.8. Ethical Consideration

Considering Creswell (2014) ethical consideration, the following safeguards were employed both in writing and verbally, to ensure the rights of the respondents. In the consent form, the informants acknowledged the objective of the study, the time required to complete the interview, their right to participate, and the anonymity of the informants. It was only after providing this information that all respondents decided to participate in the proposed study; without the consent of the respondent, none of the interviews were conducted. An ethical clearance has been issued by Addis Ababa University and approved by the advisor and the chair of the ethical committee to conduct the research.

1.9. Organization of the thesis

This thesis is organized into five chapters. Chapter one provides the background of the study and outlines the objective and significance of the research, the statement of the problem, and formulated research questions. Chapter two presents a review of related literature. The theoretical framework defines concepts related to plastic waste collection and recycling and also includes an empirical review and conceptual framework. The third chapter is dedicated to research methodology, describing the sampling techniques and the methods used to collect both primary and secondary data. The findings of the study are discussed in chapter four. Finally, recommendations and a summary of the findings are provided in the last chapter.

CHAPTER TWO

2. LITERATURE REVIEW




2.1. Conceptual review





2.1.1. Concepts and definitions

Plastic

Plastics are used for packaging and storing agricultural and industrial products. They always tend to be trendy, lightweight, flexible, cheap, and versatile when compared to any other material used for packaging (Derraik, 2002). Alhazmi et al. (2021) defined plastics as a group of semi-synthetic organic compounds which are conventionally synthesized from fossil fuels. These materials can have their properties significantly enhanced through the addition of suitable additives, allowing for variations in opacity, thickness, elasticity, and thermal characteristics. As a result, the vast majority of the world's plastic consumption consists of thermoplastics and thermoset plastics, which dominate the market due to their diverse applications and properties. Andrady and Neal (2009) classified synthetic polymers, often referred to as plastics, into five major categories: polypropylene, polyethylene, polyvinyl chloride, polystyrene, and polyethylene terephthalate. According to Alhazmi et al. (2021), plastics can be classified in more detail, as listed in the table below.

Table 2.1. Categories of Plastics

Symbol	Type	Abbreviation	Description	Example Use
	Polyethylene Terephthalate	PET/PETE	Polyester extruded and molded. Clear, strong, and lightweight	Plastic bottles (water, soft drinks) and packaging for many other consumer products
	High-Density Polyethylene	HDPE	Intermediate level of opacity, less stretchable compared to LDPE	Milk jugs, water bottles, shampoo bottles, motor oil containers, plant pots, buckets, toys
	Polyvinyl chloride	PVC	Strong, lightweight. Can be made more flexible by adding plasticizers	Plumbing pipes, doors, windows, credit cards, cable sheathing, garden hoses, toys

Symbol	Type	Abbreviation	Description	Example Use
	Low-Density Polyethylene	LDPE	High clarity and moderate stretch	Plastic bags, squeezable bottles, food containers, bubble wrap, disposable cups, coatings for paper cartons
	Polypropylene	PP	Durable with a smooth finish.	Bottle tops, yogurt, and margarine containers, drinking straws, hot food containers, car parts, disposable diapers
	Polystyrene	PS	Economical plastics with a certain rigidity	Disposable foam cups, take-out food containers, plastic cutlery, coat hangers, foam packaging
	Polycarbonate	PC	Transparent, high-impact resistance	Eye protection, shatterproof glazing, UV-resistant lenses, barriers, fences
N/A	Other	N/A	Any other plastics	Melamine, packaging made from mixed plastics

Source: Alhazmi et al. (2021)

Solid waste

Solid wastes are classified into biodegradable and non-biodegradable waste according to Bharadwaj et al. (2015). Those wastes generated and that can be completely decomposed through time in biological or physical processes are referred to as biodegradable waste; agricultural and kitchen waste are typical examples. Non-biodegradable wastes on the other hand are wastes that are not decomposable and take generations to decay and comprise recyclable and non-recyclable wastes. Plastics that are usually intended to be recycled or recovered to be reused have an economic value. Carbon paper and thermos coal are among the non-biodegradable wastes that are considered non-recyclable.

Solid Waste Management (SWM)

Solid waste management is one of the necessary functions of a municipality and refers to the activities that involve planning, collection, transportation, processing, and disposal of wastes to landfills or dumpsites in addition to incineration and recycling (Afullo & Odhiambo, 2009).

Formal sector

The formal sector operates in a large-scale, more structured production and service system. It is an entity that is registered, pays taxes and operates under government regulations and systems. The formal sector is characterized by pre-defined job responsibilities, working conditions, and environment (Sethuraman, 1981).

Informal Sector

The term ‘informal sector’ usually refers to economic activities operating outside the formal system, which are unregistered and unregulated by the government (OSCALDC, 1996). Sethuraman (1981) defined informal sectors as a small-scale unit engaged in the production and distribution of goods and services with the primary goal of getting or providing employment and income to their participants despite the capital, resource, and knowledge constraints.

According to Bjerckli (2005), in Addis Ababa, the distinction between formal and informal sectors is often small and weak; which Medina (1997) termed “the grey zone”. The actors have cooperative relationships between them and might have both formal and informal characteristics. i.e.: Plastic collection is operated informally and supplied to wholesalers, SMEs, or recycling industries (Bjerkil, 2005).

Recycling

Recycling refers to the process of transforming used materials into new products for various purposes, saving energy during production and reducing costs. This practice not only conserves resources but also protects the environment and provides reusable materials for manufacturing. A crucial step in the recycling process involves the collection of recyclable wastes, such as plastic bottles, bags, containers, and wrappers. These materials are subsequently cleaned, sorted, and processed into marketable raw materials through techniques like crushing, shredding, melting, or liquefying. These raw materials are then remolded into new products, which are validated and supplied to the market, completing the recycling loop. This circular system is integral to managing plastic waste efficiently, promoting sustainability, and supporting recycling industries (BPF, 2021; Ragaert et al., 2017).

2.2. Theoretical Framework

Several theories can be fundamental in developing a comprehensive theoretical framework for understanding the practices and challenges of plastic waste collection. Among them, stakeholder theory that concern about the interconnection between actors and circular economy framework which serves as a foundation for examining how value can be created through effective resource recovery and waste minimization while addressing the systemic challenges that the environment is facing (EMF, 2013; Kirchherr et al., 2017), are discussed below.

2.2.1. Stakeholder Theory

For decades, several scholars and practitioners have been developing management concepts and models that facilitate a comprehensive understanding of interconnectedness between actors. This has led to the emergence of stakeholder theory or stakeholder thinking, which is considered a narrative to understand how value is created and traded, providing insights into sustainable practice and ethical value creation (Freeman, 1984, Parmar et al., 2010). The word “stakeholder” first appeared in 1963, in an internal memorandum at the Stanford Research Institute (Ackoff, 1974). Freeman (1984), concisely defined a stakeholder as “*any group or individual*” that can influence or is affected by the activities and organization’s objective.

According to Freeman (1984), stakeholder theory, should be adopted as a unit of analysis, where the groups and individual that have stakes in the activities relate each other to deal with the problems and make up the business or the institution. For Jones (1995) and Walsh (2005), stakeholder theory is all about how employees, communities, suppliers, managers and government bodies interreact to collectively create and trade value. Phillips (2003) further asserts that while effective management of stakeholders assist in institutions and businesses to thrive, stakeholder thinking is also concerned about the ethical endeavor that consider the values, choice, capacity and benefits of communities and individuals. Freeman et al. (2020), stated that the ethical perspective of stakeholder theory relies on willing participation of stakeholders, recognizing the notion of mutually viable relationships.

Sturdivant (1979), studied the nexus between the managers and the active group members, emphasizing that the attitude gap that exist between different level of stakeholders can influence institutional effectiveness. Similarly, Post et al. (2002), argued that a failure to consider

stakeholder relationships from the moral and economic perspective will limit the efficiency of operations. To address such issues, Clement (2005), underscored the importance of cautious assessment to ensure that no any degree stakeholder is overlooked; highlighting that institutional objective can be easily disrupted by actions of unexpected groups. Hence, managers and government agencies must proactively engage all stakeholders to prevent the dominance of one group's interests at the expense of others and to ensure sustainability of practices (Sturdivant, 1979; Post et al., 2002).

2.2.2. Circular Economy framework

There are several schools of thought regarding circular economy framework; however, the shared consensus centered on better management of resources, particularly in urban environments where the concept is very crucial (EMF, 2016). The UN (2016) supported the idea, emphasizing that while cities only occupy 3% of the planet, they are responsible for 70 % of energy consumption and carbon dioxide (CO₂) emissions. Cohen and Muñoz (2016) also emphasized that this reality presents opportunities to understand the concerns and provides significant motives for a reduction in energy use, waste production, and greenhouse emission for sustainable production and consumption in cities.

According to Brundtland et al. (1987), it was during the 1970s and 80s that much of the world began to understand the environmental challenges facing our planet, prompting scholars to think beyond the current economic paradigm. Discussing the circular economy, Frosch and Gallopoulos (1989) emphasized the need to transform the linear industrial model into a more integrated industrial ecosystem. Their recommendation incorporated circularity, advocating that waste should be utilized as raw material for other processes or to produce different products. Similarly, Braungart et al. (2007) argued that linear economy approaches are unsuitable for creating eco-effective strategies. In contrast to the linear economy, the circular economy restores and regenerates the planet by restructuring the industrial economy.

Braungart et al. (2007) underlined the necessity for fundamental redesign and a shift from mainstream eco-efficiency (doing less bad) to eco-effectiveness (doing good). They stated that the eco-effective approach moves beyond the “zero-emission” strategy, as it focuses on maintaining or upgrading the quality and productivity of resources through many cycles of use rather than merely seeking to eliminate waste, which the reactionary eco-efficiency approach advocated.

(EMF, 2012) also emphasized that the goal of eco-effectiveness is not to minimize the flow of materials, but to generate a cyclical transformation of materials and their flows without degrading their quality. This approach enables materials to maintain their status as valuable resources, fostering a supportive relationship with the environment while promoting economic growth. According to McDonough and Braungart (2002), this restructuring has informed our policies in light of sustainable living and products, upon which the circular economy is founded. Ultimately, the (EMF, 2012) suggested that the circular economy (CE) should advocate for eco-effectiveness rather than eco-efficiency.

Circular economy and waste management

The main theme of the circular economy, according to (Pomponi & Moncaster, 2017), is to separate the use of resources from economic growth, enabling development and profitability without increasing pressure on the environment. McDonough and Braungart (2002) advocated for reducing, reusing, recycling, and regulating as mechanisms to achieve sustainable development and prevent resource depletion. Stahel (2013) emphasized that Reduce, Reuse, Recycle and Recover are essential approaches to achieve the environmental goals of circular economy. In circular economy each action represents a looping process, where materials such as plastics, metals, and papers are collected and recollected to be reused, repaired, and remanufactured. Rather than being discarded in landfills when consumers finish using materials, these resources are reintegrated into the economy. Consequently, circular economy minimizes waste and emissions, while enhancing environmental quality by keeping materials in circulation for as long as possible.

Pongrácz et al. (2004) argued that an effective waste management theory must provide clear definitions of waste-related concepts to achieve sustainable waste management, outlining four guiding principles. The authors stated that primarily, waste should be managed in a way that protects human health and the environment, emphasizing the necessity of addressing the impacts of hazardous waste. Second, conserving resources is crucial for reducing the demand for raw materials and minimizing environmental degradation. Thirdly, strategies should focus on reducing waste creation and encourage the production of goods with less waste output to enhance recyclability. And, lastly, innovative processes must be developed to convert waste into usable materials, which could, in turn, reduce landfill use and promote a circular economy.

According to Kalmykova et al. (2018), the circular economy is currently a prominent agenda for nations. From an economic perspective, the European Commission (EC, 2015b) and WRAP (2016) stressed that the integration of circular economy practices creates economic opportunities for various actors to participate in the circular economy. Sauvé et al. (2015) and the European Commission (EC, 2015a) stated that the circular economy focuses on reuse and recycling as substitutes for virgin raw materials promotes the development of waste collection strategies. This reduces material costs, mitigates price fluctuations, and enhances supply security. EMF (2013) emphasized that, by adopting circular economy principles, nations can develop systems that effectively tackle waste management challenges and significantly contribute to a cleaner, more sustainable environment.

2.3. Empirical literature

2.3.1. Plastic recovery system

Waste recycling industries get their supply from plastic collectors and scavengers which they sell to micro and small enterprise plastic collectors, individual traders, or wholesalers, which then will send the plastic waste to the recycling industries. The last group of collectors are scavengers at the municipal landfill, those who collect different kinds of materials at the landfill site. The quality of the plastics they deliver is much lower compared to those collected by plastic waste collectors and waste enterprises (Bjerkli, 2005).

In terms of the final linkage between collection and recycling, wholesalers and SMEs are the actors that have direct contact and supply recyclable plastics to the majority of waste recycling industries (Caroline, 2017). They are usually private waste enterprises formally registered and founded to receive plastic materials from individual plastic collectors and some small-scale enterprises. According to Bjerkli (2005), plastic waste collectors informally pledged to supply plastic waste usually at prices determined by the SME's and wholesalers. It's common for small-scale enterprises to be provided with working capital so that they can buy plastic materials from individual collectors and supply them to wholesalers.

2.3.2. Relationship between actors

Plastic collectors are the smallest unit but the most important actors in the value chain of the recovery system. Industries are the last in the system which encourages intermediaries such as wholesalers and SMEs to link them with collectors (Al-Salem et al., 2009). According to Bjerkli

(2005) assessment, most of the collectors have a gentlemen agreement with the SMEs and traders located around the collection sites. The arrangement was usually based on ethnicity, social class, or any other relevant relationships; that would ease the activities and allow them to access recyclable materials. Yet, some collectors are independent of any connections, and instead opt to sell to one of several SMEs that could provide the highest price.

On the other hand, plastic waste recyclers typically receive sorted and cleaned plastic materials from SMEs or wholesalers. In return, they are paid better compared to individual collectors, who are among the least-paid groups in the recovery system (Bjerkli, 2005). DiGregorio (1994) described the relationship between them as 'exploitative,' suggesting that it is not just anyone involved, but those who are ethnically or caste-related, or have other similar affiliations, who engage in this livelihood.

Research findings of Gelan (2021) and Adefris et al. (2023) indicated that the first level of plastic waste sorting in the recovery system is practiced at the household level. Waste collectors then segregate the various types of plastics to organize them for sale to SMEs and other buyers. Both formal and informal collectors quickly supply collected and segregated plastics since none of them have sufficient storage space or facilities to store the plastic waste.

Regarding transportation, the report by AACMA (2023) and the study by Berhanu (2014) indicated that recycling industries have two arrangements with the suppliers. In the first arrangement, segregated plastics are transported to waste recyclers at the expense of the recycling industries, or on the other hand, SMEs will use their logistics to transport the collected wastes, which the cost will be added to the original price of plastic wastes.

2.3.3. Factors affecting plastic waste recycling

Although Ethiopia is one of the leading importers of plastic in Africa and there is an increase in the volume of plastic waste, the practice of waste recycling remains underdeveloped (EOCD, 2022). Nevertheless, there are still insufficient and low-quality recyclable materials. Similar to other industries, the plastic recycling sector has suffered from technological gaps and dependency on the import of raw materials along with foreign exchange. On the other hand, according to GIZ (2021), the country has one of the highest recycling activities in East and Central Africa, suggesting, the recycling sector is granted with the prospects and also encountered with challenges (Silpa et al., 2018).

Plastic waste recycling industries are among formal organizations the bulk of their inputs are sustained from informal waste pickers. Related to this, another key challenge the recyclers posed has been the low quality of collected plastics, which need a lot of processing to clean them. The problem usually is a risk that could incur additional costs (e.g., cleaning chemical cost) which in turn increase the operational cost of the industries. Most plastic waste recyclers usually produce PET preforms and plastic bags. However, consumers prefer products made from imported raw materials due to the perceived lesser quality of recycled plastic waste (Bjerkli, 2005; UNDP, 2020).

Berhanu (2014) highlighted that the collection and sorting of plastics in Ethiopia and Addis Ababa has a big impact on the quality of plastic waste and the resulting end products. According to a study by Tesfaye (2020), recent year's plastic waste collection trend indicates that collectors are the main actors in separating the plastic from the remaining waste. However, Gelan (2021) argued households are the main actors responsible for sorting plastic wastes before individual collectors and SMEs segregate and send them to wholesalers and recycling industries. Luijsterburg and Goossens (2014) also argued that plastic waste collection methods have barely affected the quality of recycled products; rather, it's the sorting and processing techniques of collected plastics that heavily influence the quality of final recycled products.

Concerning the government, referring to Adefris et al. (2023) statement, the government has been reluctant to provide any kind of financial subsidy to the recycling industries and the actors involved in plastic recovery. In addition, the waste collectors didn't have temporary waste dumpsites to store recyclable materials. On the contrary, few emerging waste collection associations have been granted financial subsidies to warehouse the recyclables; which have priced out individual waste collectors and forced them to supply the collected recyclables at a cheaper price. Babayemi et al. (2019) indicated that the problem also persists in other African countries. For example, Nairobi city is affected by the huge volume of plastic bags released into the environment. The city collection and disposal of plastic waste facilities are inadequate and similarly, government agencies that manage solid waste systems are discriminative to subsidize the low-income waste collectors in favor of high-income waste collection unions.

2.3.4. Plastic waste collection and recycling

Different studies reveal that plastic wastes generated in the city are collected for reuse and mostly for recycling industries (Nigatu et al., 2016; Adefris et al., 2023; Berhanu, 2014). Several industrial

sectors in Addis Ababa also use recycled plastic products alongside imported ones. For instance, PVC (polyvinyl chloride) is widely used to produce plastic shoes for local markets, while mineral water and soft drink companies recover and reuse PET (polyethylene terephthalate) (Bjerkli, 2005). Besides, there are plastic waste recycling industries that could mold PET to manufacture different plastic products. Other recycling plants produce plastic bags that are made either of PP (polypropylene) or PE (polyethylene). However, these sorts of products are still posing a major threat to the city environment; they are disposed of after a one-time usage and they are not the most preferred plastic wastes for plastic waste collectors and enterprises (Bjerkli, 2005; Babayemi et al., 2019).

According to Kihila et al. (2021), recyclers have a big interest in buying plastic waste, yet access to sufficient recyclable materials remains a problem. Annually the city has been collecting over two million non-biodegradable wastes and the prevailing poor segregation practices at the household level have prompted the municipality to take action to manage the waste, which has, in turn, created job opportunities for many citizens. Unlike other valuable solid wastes, such as metal, households often provide plastic waste for free (Gelan, 2021; Adefris et al., 2023). Kihila et al. (2021) stated that this activity has benefited the plastic waste collectors and on the other hand, indicated the lesser amount of concern that the public has about the economic value of plastic waste. An assessment by Bjerkli (2005) reveals that most factories engaged in plastic waste recycling rely heavily on imported raw materials from Saudi Arabia and Belgium to manufacture durable plastic products. Unfortunately, the high cost of these imported materials leads to final products that are pricier than those produced entirely from collected plastic waste. This situation creates significant opportunities for industry participants, as locally sourced plastics from the city are increasingly in demand as a valuable input for recycling operations.

2.3.5. Solid waste management policy review

Different African countries have issued a policy to prevent and mitigate plastic waste-induced environmental problems. Senegal, Mali, Ghana, and Côte d'Ivoire among the Western African countries, and Kenya, Ethiopia, and Tanzania in the east have put in place strict bans and taxes on the use of plastic bags (Jambeck et al., 2017). However, the widespread presence of plastic bags suggests the implementation of the ban is ineffective, it has not prevented the country from being one of the leading importers of plastic in East and Central Africa (EOCD, 2022).

The Ethiopian Solid Waste Management Proclamation (513/2007 Act No 11(1) and Addis Ababa city revised Solid Waste Management Regulation No 100/2018 Act (4) both emphasize households' responsibility for the collection and segregation of non-biodegradable wastes from decomposable solid wastes. Proclamation No. 513/2007/1 further banned the importation of plastic bags with a wall thickness of 0.03 meters to encourage local manufacturing. Moreover, the Ethiopian Standard ES 6433:2021 discusses the importance of plastic waste segregation at the source, stating that solid waste should be segregated into categories such as paper, plastics, metals, and others to facilitate recovery and recycling. However, according to Bjerkli (2005), there are no regulations or quality standards to monitor and evaluate recycled products. As a result, the plastic products produced from recovered waste are usually inferior to the plastic material produced using virgin material.

According to the Ethiopian Solid Waste Management Proclamation NO 1090/2018, the Ministry of Environment, Forest and Climate Change and the regional state or city administration authority are responsible for managing generated hazardous waste. Under the 'cleaner production principle,' the proclamation stated the need for the collection and disposal of hazardous wastes and promoted recycling for recyclable plastic wastes. Adefris et al. (2023) highlighted the absence of practical implementation guidelines at the woreda and sub-city levels. Furthermore, these guidelines have not been effectively communicated to other relevant stakeholders. The gap has made the city cleansing management agency unsuccessful in providing effective and efficient solid waste management services to residents.

In general, concerning policy and regulatory frameworks, the reliance of developing countries on the manufacturing sector has led to the perception that implementing environmental policies often comes at the expense of economic growth. Hence, requires different stakeholders' integrated cooperation to support plastic waste collection and recycling and safeguard the environment from different kinds of pollution including waste management issues (Behuria, 2019). Ezeah and Roberts (2012) underscored that identifying appropriate policies and sound implementation strategies are the essential tools to venture capable solid waste management practices in cities of third-world countries.

2.4. Conceptual Framework

The conceptual framework for this topic is formulated based on a review of empirical studies and relevant literature. The figure illustrates potential factors that could impact the plastic waste collection and recycling. Various factors, including a lack of financial and recyclable resources, institutional weaknesses, government regulations, access to technology, transportation systems, and economic factor and other aspects, collectively influence collection practices and plastic waste recycling.

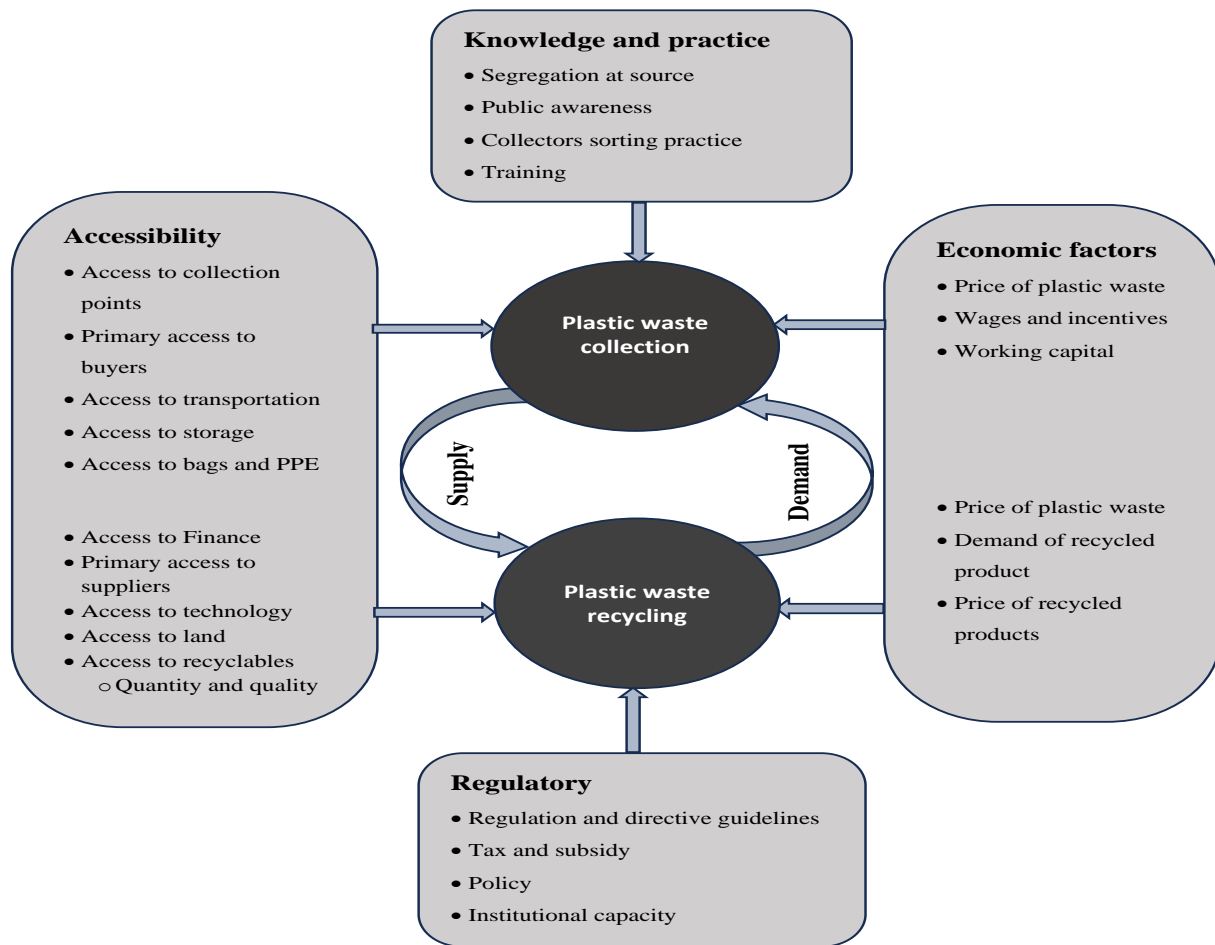


Figure 2.1. Key factors influencing plastic waste collection and recycling

Adopted from Bjerkli (2005)

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. Description of the study area

Addis Ababa is an important political, economic cultural, artistic, and administrative center and the largest city of Ethiopia. Central Statistical Agency (CSA, 2007) projected the population of Addis Ababa to be 3,273,000 in 2021. On the other hand, according to the UN population forecast, the population is estimated to be about 5,228,000, with an annual growth rate of 4.4%. Trade, manufacturing, and farming are the major economic activities. Surrounded by the Oromia region, the city is located at $9^{\circ}1'48''N$ $38^{\circ}44'24''E$ and lies at an average elevation of 2,355 Meters; which makes the city the highest compared to the capital city of landlocked countries. Addis Ababa has a subtropical highland climate, with a $17^{\circ}C$ average temperature. The city is divided into 11 sub-cities consisting of 121 woredas (NMA, 2017). The study area, randomly selected for this research, included Bole, Kirkos, and Gullele sub-cities, covering 65.6 km², 14.7 km², and 37.1 km², respectively (Soluap, 2023).

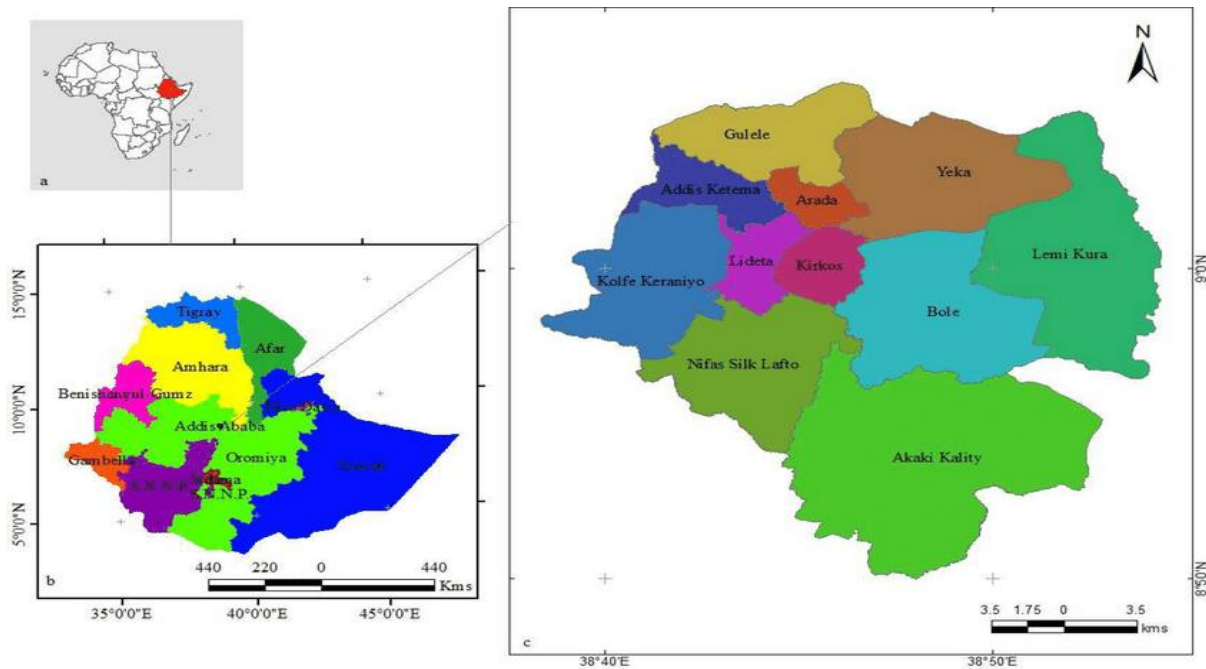


Figure 3.1. Map of Addis Ababa and Sub-cities

Source: Ethio GIS (2022)

3.2. Research Methodology

3.2.1. Research design and approach

For this study, particularly descriptive research design was used to gather, analyze, and understand research questions and draw a conclusion on the practice and challenges of plastic waste collection. Primary data was collected from plastic waste collectors. Information from waste collection unions and SMEs, recyclers, and different level government offices, particularly from cleansing and waste management agencies, as well as other stakeholders involved in supporting plastic waste collection and recycling, were incorporated. Both qualitative and quantitative methods were applied to get a comprehensive understanding of the problems.

3.2.2. Data sources

To allow some degree of possibility relatively structured; semi-structured and unstructured interviews were conducted to gather information from plastic collectors and other actors involved in the recovery. In addition to surveys, key informant interviews, and focus group discussions were employed to assess the practice of plastic waste collectors and enterprises, the challenges that persist in the current plastic waste collection activities, and the nexus of plastic waste collectors and other actors in the value chain which related each other. Some observations were also undertaken in the plastic waste collection areas, as well as in the storage spaces of SMEs and unions. Moreover, secondary data, such as documents and research papers that are relevant to the study; were analyzed to support the findings of the thesis.

3.2.3. Sampling technique and sample size determination

Quantitative data

According to Kaur (2021), quantitative research demands careful attention to sampling design and techniques that are required to test formulated hypotheses. Additionally, factors such as cost and timeline must be considered to achieve high precision in results. Thus, calculating and determining the appropriate sample size to be included in a study is an essential step of research methodology. Considering these, a combination of cluster sampling, stratified sampling, and simple random sampling techniques were employed to ensure all segments of the population were adequately represented.

Cluster sampling is a sampling technique where the entire population is divided into homogeneous groups. This sampling technique allows the researchers to form clusters and reach the desired and manageable size of the group. Clusters are selected randomly, and all observations from these clusters are included in the sampling frame to ensure unbiased and accurate estimations. The information collected from the samples is then utilized to make generalizations about the entire population. This method helps researchers gather data from diverse range of clusters, offering a comprehensive overview of the population and maintaining track of the research's costs and timeline (Singh & Masuku, 2014).

Stratified sampling technique was identified as an appropriate method for dividing a heterogeneous population into homogeneous subgroups (strata), ensuring adequate representation of key subgroups, and enhancing the ability to effectively compare different strata (Thomas, 2023; Taherdoost, 2016). Datta (2023) underscored that the stratified sampling technique is particularly important when estimates are required not only for the overall population but also for the subpopulations. Additionally, if the population is large and there are budget and time constraints, it is more convenient to sample from the individual strata rather than from the entire population. According to Bhandari (2023), if the population is homogeneous concerning the characteristics being studied, then a sample drawn using the simple random sampling technique is expected to be representative.

Random sampling technique, in which each unit included in the sample has an equal chance of selection, finally assists in determining the sample of randomly selected clusters. According to Thomas (2023), the technique has different calculating methods depending on the size of the population. If there is a small to moderate population, a standard random sampling formula is used to calculate the sample size of the target population. Therefore, the following formula (Eq. 1) was used to estimate the sample size.

Equation (1)

$$\text{Sample Size}(n) = \frac{[z^2 * p(1-p)]}{e^2} + \frac{[z^2 * p(1-p)]}{e^2 * N}$$

Where:

- n is the sample size

- z is the selected critical value of the desired confidence level,
- p is the estimated proportion of an attribute that is present in the population, $q = 1-p$ and
- e is the desired level of precision.

Selection Requirements

According to Addis Ababa City Cleansing Management Agency, there are micro and small waste enterprises that consist of several formal plastic waste collectors' members and on the other hand, the agency has also estimated informal plastic waste collectors operating in different sub-cities and woredas of the city.

Referring to the agency's information, the sub-cities were categorized as high, medium, and small based on the total number of plastic waste collectors operating in the area. Furthermore, it was also necessary to sub-cluster and select representative woreda from each of the selected sub-cities using a similar lottery method. The population in the selected woredas was then stratified to ensure effective representation among groups. Finally, simple random sampling was used to allocate a representative sample for each of the three selected woredas, based on the sample weight of each stratum.

All 11 sub-cities of Addis Ababa were included in the sample to make a selection. The data retrieved and from Addis Ababa city cleansing and waste management agency (Annex II) indicated that Akaki Kality, Lemi Kura, and Bole sub-cities comprised a larger number of plastic waste collectors; identified as the top three sub-cities. Lideta, Addis Ketema, Gullele, and Nifas-silk Lafto were classified as sub-cities with a moderate number of plastic waste collectors. Yeka, Kirkos, Kolfe Keraniyo, and Arada remained sub-cities with the smallest number of plastic waste collectors.

Therefore, Bole, Gullele, and Kirkos sub-cities were selected randomly using a lottery method to represent high, medium, and low plastic waste collectors' operation clusters respectively. After identifying the sample sub-cities, the next step was to sub-cluster the administrative woredas of each sub-cities into high, medium, and low plastic waste collector operating areas. Woreda 12 from Bole sub-city represents the high plastic waste collectors cluster, woreda 1 from Gullele sub-city on behalf of the medium number of plastic waste collectors, and woreda 8 from Kirkos sub-city was selected to represent the remaining low plastic waste collectors' groups.

Nominated Woredas: woreda 12 of Bole Sub-city has 153 plastic waste collectors, woreda 1 of Gullele Sub-city has 48, and woreda 8 of Kirkos Sub-city has 33 plastic waste collectors, resulting in a total population size (N) of 234. Accordingly, since the total population is considered small, the sample size was computed using the standard sampling formula.

$$\text{Sample Size}(n) = \frac{[z^2 * p(1-p)] / e^2}{1 + \frac{[z^2 * p(1-p)] / e^2 * N}{} } \quad [\text{Eq 1}]$$

Where:

- N = Population size, which means the number of total plastic waste collectors in the clustered woredas
- Z = Critical value of the normal distribution at the required confidence level, i.e.; at 99% confidence level is 2.58.
- p = Sample proportion, uncertain p = 0.5
- e = Margin of error, e = 5% or 0.05

$$n = \frac{(2.58^2 * 0.5(1-0.5) / 0.05^2)}{1 + \frac{(2.58^2 * 0.5(1-0.5) / 0.05^2)}{233}}$$

$$n = \frac{(6.6564 * 0.25 / 0.0025)}{1 + \frac{(6.6564 * 0.25 / 0.0025 * 233)}{233}} = \frac{1.6641 / 0.5825}{1 + 1.6641 / 0.5825} = 2.8568 + 1 = 3.8568$$

$$n = 665.64 / 1 + (1.6641 / 0.5825)$$

$$n = 665.64 / 3.8568$$

$$n = 174$$

After determining the total sample size, the sample was distributed to each woreda depending on the formula described below [Eq 2]. Subsequently, the allocated samples were stratified based on the type of plastic waste collectors (formal and informal) operating in each woreda.

$$n_h = \frac{N_h}{N} * n \quad [\text{Eq 2}]$$

Where:

N_h = Plastic waste collectors in each woreda,

N = Total plastic waste collectors of 3 selected woreda and,

nh = Total sampled plastic waste collectors.

In addition, the same formula was used to determine the proportional number of formal and informal plastic waste collectors for each representative woreda and the table below indicates the final sample size included for the thesis.

In this scenario:

N_h = Formal/Informal plastic waste collectors in each woreda,

N = Total plastic waste collectors of 3 selected woreda and,

nh = Sampled Formal/Informal plastic waste collectors.

Therefore, the final quantitative sample size included in the thesis is presented in the table below

Table 3.1. Quantitative sample allocation.

	Selected Sub city and Woreda	Number of plastic waste collectors		Total	Sample size (each woreda)		Total Sample size
		Formal	Informal		Formal	Informal	
1	Bole Sub-city _ Woreda 12	20	133	153	15	99	114
2	Gullele Sub city _Woreda 1	34	14	48	25	10	35
3	Kirkos Sub city _Woreda 8	6	27	33	4	21	25
Total		60	174	234	44	130	174

Since formal plastic waste collectors are members of unions, a lottery method was used to select the sample representative from the list. However, locating informal collectors using the same random selection method was not feasible due to time and cost limitations. Consequently, convenience sampling technique was considered the most ideal method to get the required number of waste collectors operating in the selected woredas. According to Neuman (2005), this sampling is a technique used to approach members of a sample who are difficult to trace within a given research timeframe, thereby selecting from the conveniently available pool of respondents.

Qualitative data

In qualitative studies, non-probability sampling methods are often the most practical, where subjective judgment is employed to select participants. Among this method, purposive sampling, which is one of the non-probability sampling methods, allows a researcher to answer the research question and effectively meet the objective of the proposed study. The sampling approach, sometimes known as judgmental sampling often used when the researcher wants to get particularly informative data that best explains the research problem (Neuman, 2005). Hence, the thesis employed a purposive sampling method to gather qualitative data.

Selection of Participants

According to Saunders (2016), to ease and avoid sample selection issues, it's crucial to identify the right target population. Bjerkli (2005) in her thesis stated that including plastic waste recycling, there were 150 -170 plastic manufacturing industries in Addis Ababa. The author has used Addis Ababa investment agency data, those were investment licenses provided to investors in the 2005 budget year. At the time it appeared to be the only viable option to select plastic waste recyclers from such a set of population. However, it was ambiguous whether the investors had implemented the proposed project for which they were licensed. Consequently, the researcher was only able to conduct very few of interviews from the available set of the sample, which probably affected the analysis and conclusions of the result.

Considering the years gap in between, the city administration has since established an agency to manage waste and the environment. According to recent data from the Addis Ababa cleansing management agency, 18 plastic waste recycling industries are operating under the city administration, with most concentrated in Akaki, Gelan, and Dukem. Due to the relevance of their data to this thesis, approximately 25% of the recyclers participated in the proposed in-depth interviews.

Plastic waste collectors, unions, and SMEs, which are an integral to the waste recovery system, are organized in two main forms. Most unions are formally established by the city's cleansing management agency to support waste collection activities. In contrast, SMEs are founded with the direct or indirect support of environmentally concerned NGOs' or affiliated bodies and the city cleansing management agency referred them as 'informal'. According to a pilot interview with Addis City cleansing and waste management officials, SMEs evolve into 'wholesalers' as their

businesses grow larger. Thus, ‘wholesalers’ in this thesis refers to large SMEs that operate as both buyers and sellers of bulk plastic waste, considered part of the SME sample. Taking all these into consideration, two key informant interviews were conducted in each of the selected woredas, one with formal and one with informal SME representatives, totaling six in-depth interviews.

Sounders (2016), suggested in-depth interviews to be limited to 5-30 interviews. Consequently, the thesis adhered to this recommendation for collecting qualitative data. Since exploratory research requires the involvement of all relevant actors and institutions, respondent selection focused on identifying stakeholders involved in supporting, financing, or monitoring plastic waste collection. A purposive sampling method was employed to identify the key organizations that were informative for the proposed in-depth interviews. The same strategy was applied to gather data from the city cleansing management agency and equivalent woreda departments. Hence, three interviews were conducted; one with the Addis Ababa cleansing management agency and two with the corresponding offices.

Moreover, focus group discussions (FGDs) were conducted with purposefully selected groups of collectors in each of the selected woredas. Three FGDs were organized, each with a distinct group: formal waste collectors from unions, informal plastic waste collectors from SMEs, and a mixed group comprising both. These discussions provided detailed insights into various aspects of plastic waste collection. For each FGD, six to eight heterogeneous participants were recruited, ensuring diverse perspectives (see profiles in Annex II). The total sample allocation for the qualitative study is summarized below.

Table 3.2. Qualitative sample allocation.

	Types of samples	KI	FGD
1	Recyclers	4	-
2	SME and Unions	6	-
3	Plastic waste collectors	-	3
4	Government cleansing management agency (offices)	3	-
5	Other stakeholders	1	-
	Total	14	3

3.2.4. Data Analysis

Relevant descriptive statistics, tabular analysis, and visualizations, including bar charts, were employed to effectively visualize and compare the quantitative data collected from both formal and informal plastic waste collectors. These quantitative data were pre-coded, then identified, categorized, cleaned, and organized before being analyzed using Stata 17. The results were carefully interpreted to draw meaningful conclusions, based on patterns observed within the data.

For the qualitative data, thematic analysis was applied to the information gathered through focus group discussions (FGDs), in-depth one-on-one interviews, and other similar methods. This technique ensured accurate representation and interpretation of the findings and provided deeper insights into the perspectives and experiences of the participants.

CHAPTER FOUR

4. RESULT AND DISCUSSION

4.1. Demographic characteristics of survey households

Respondent demographic characteristics for this thesis include gender, age, education level, family size, marital status, monthly income, the respondent's relation to the head of the household, and income contribution to the household. A total of 174 respondents were targeted for the study, and all participants were successfully engaged, resulting in a perfect response rate of 100%. Stratified by group, 44 formal and 130 informal plastic waste collectors have been interviewed for the study. The analysis below describes the plastic collectors' backgrounds and the contribution of plastic waste collection practices to the household of the respondents.

4.1.1. Age and sex composition

Based on the information illustrated in Table 4.1, most of the target population who are engaged in plastic waste activities are categorized in the young age group. Out of a total of 174 plastic waste collectors, 49% were within the range of 15 - 24 years. More than 21% were between 25 and 34. The latest Ethiopian labor law, Proclamation No.1156/2019 prohibits children less than 15 years old age from any kind of employment whether it is paid or with profit. However, a significant number of plastic waste collectors were found to be under 15 years old, indicating minors were well engaged in the sector.

Stratified by category, there were no minors involved in plastic waste collection among the members of unions. Rather, most formal plastic waste collectors were found in the age groups of 25 - 34 and 35 - 49, accounted 36% and 48 % respectively. The remaining 16% are between 15 and 24 years old. Besides, none of the respondents from this stratum were above the age of 49. On the other hand, all of the minors (17%) engaged in the activity were found to be informal plastic waste collectors. Furthermore, the larger (60%) constituents were between 15 and 24, followed by the second dominant group 24 - 34, which comprised 15% of the Informal's. Concerning the involvement of plastic waste collectors above the age of 49 years, a single observation was recorded from the informal segment. The overall result indicates plastic waste collection is a livelihood predominantly practiced by the productive age group.

The ratio of male to female collectors among the formal sample was 52% to 48 %, indicating a more gender-balanced engagement in the activity. In contrast, there has been a higher involvement of male collectors from the informal side comprising over 82% of the total. A gender dynamics study in the plastic waste collection sector in Ghana indicated that there were more male plastic waste pickers compared to females, constituting 35% (Odonkor, 2021). Although the majority are informal plastic waste collectors, the overall sample randomly selected for this study depicted the dominance of males (75%) in the sector.

4.1.2. Educational level

According to Saseanu et al. (2019), education plays a critical role in enhancing the knowledge of individuals, such as waste collectors, enabling them to adopt sustainable waste management practices. A study by Zurbrugg et al. (2012) also indicated individuals with better formal education are more inclined to engage in waste minimization efforts and exhibit recycling behavior. The educational background of the survey participants shows a contrasting result between formal and informal plastic waste collectors. The majority (76%) of informal plastic waste collectors had attended primary school. On the formal side, the finding revealed that a significant number of respondents, i.e., 43%, have never received formal education. 13% of informal collectors also fall into this category. Only a few respondents from both strata had joined secondary school. The overall low educational status probably highlights the need for targeted educational programs to promote sustainable waste management practice across both group collectors.

4.1.3. Marital status and family size

Considering the majority of the informal plastic waste collectors were below the age of 24, the statistics here also indicated more than 88% of them were never married. On the other hand, a bit less than half of the participants (43%) from the formal plastic waste collectors were married. In general, quite a lot of (77%) respondents were never married, followed by 19 % of married collectors and 4% of divorced and widowed respondents. The high rate of never being married among informal plastic waste collectors is most likely related to their predominantly young age.

According to Woldetsadik and Oumer (2021), informal waste collection sector is usually characterized by unstable and irregular working environment, which might not be suitable to settle and establish a family. This is supported by the finding that 75% of formal plastic waste collectors live alone. In contrast, nearly 90% of the formal plastic waste collectors were inhabitants of two

or more family-sized households. The median family size also suggested the formal collectors belonged to a larger family size (4) compared to the informal plastic waste collectors, who were either lone members or shared the household with only one family member.

4.1.4. Household monthly income and contribution

More than half of the respondents from both groups reported a monthly household income ranging from 2,501 to 5,000-birr, accounting for 59% of formal collectors and 55% of informal collectors, respectively. Few formal plastic waste collectors' households earn greater than 15000 birrs per month, whereas the highest income brackets the informal could receive was between 10000 and 12500 birrs.

According to Table 4.1, the majority of the plastic waste collectors who participated in this survey were the main breadwinners for their household. Related to the median household size, which is 1, 83% of informal plastic waste collectors generated 100% of their household income. Similarly, 75% of formal plastic waste collectors involved in this study were the main income generators of their families. Overall, 98% of the respondents contributed 50% or 100% of their household income. Furthermore, the table shows that more than 90% of the respondents were the head of the household for their family. Considering their significant share of their household monthly income, it can be inferred that plastic waste collection is a livelihood that many households rely on to sustain their daily life.

Table 4.1. Demographic characteristics of respondents.

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq (n=44)	%	Freq (n=130)	%
1	Sex	Male	23	52.3	107	82.3
		Female	21	47.7	23	17.7
2	Age composition	<15	0	0.0	22	16.9
		15-24	7	15.9	78	60.0
		25-34	16	36.4	20	15.4
		35-49	21	47.7	9	6.9
		>49	0	0.0	1	0.8
3	What is your educational background?	No formal education	19	43.2	17	13.1
		Primary education	16	36.4	99	76.2
		Secondary education	9	20.5	13	10.0
		TVET	0	0.0	0	0.0

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq (n=44)	%	Freq (n=130)	%
		College/university	0	0.0	1	0.8
		Higher education	0	0.0	0	0.0
4	What is your marital status?	Never married	19	43.2	115	88.5
		Married	22	50.0	11	8.5
		Divorced	1	2.3	4	3.1
		Widowed	2	4.5	0	0.0
5	What is the size of the household you live in currently?	1	5	11.4	98	75.4
		2	6	13.6	15	11.5
		3	5	11.4	8	6.2
		4	8	18.2	7	5.4
		5	10	22.7	1	0.8
		6	3	6.8	1	0.8
		7	3	6.8	0	0.0
		8	4	9.1	0	0.0
6	How much is your usual household monthly income?	<2500	3	6.8	25	19.2
		2501 -5000	26	59.1	72.0	55.4
		5001- 7500	4	9.1	23.0	17.7
		7501-10000	3	6.8	8.0	6.2
		10001-12500	3	6.8	2.0	1.5
		12501-15000	2	4.5	0.0	0.0
		>15000	2	4.5	0	0
7	Approximately, how much is your share of the household's monthly income?	100%	33	75.0	108	83.1
		75%	0	0.0	0	0.0
		50%	10	22.7	19	14.6
		25%	1	2.3	1	0.8
		<25%	0	0.0	0	0.0
8	What is your relation to the head of the household?	Head of the household	42	95.5	116	89.2
		Partner/Spouse	0	0.0	1	0.8
		Son/daughter	0	0.0	1	0.8
		Sister/Brother	2	4.5	11	8.5
		Mother/Father	0	0.0	0	0.0
		Relatives	0	0.0	1	0.8
		Other (specify	0	0	0	0

Source: Own survey (2024)

Profile of Qualitative Respondents

Another section of respondents for this thesis is the qualitative section, which includes several key stakeholder groups: waste collectors (informal, formal, and mixed), SMEs and unions,

government officials, recyclers and a partner. The table below categorizes the participants by type, with unique IDs and descriptions.

Table 4.2. Profile of qualitative respondents

Respondent Type	Unique ID	Respondent Description	Location
Waste Collectors (FGD)	FGD-1	Informal plastic waste collectors	Bole Subcity, Woreda 12
	FGD-2	Formal waste collector group	Gullele Subcity, Woreda 1
	FGD-3	Mixed group (formal and informal)	Kirkos Subcity, Woreda 8
SMEs and Unions	KI-1	Tarikua and her friend plastic waste collection union	Gulele subcity, woreda 1
	KI-2	Etalem and her friend's plastic waste collection union	Gulele Subcity, woreda 1
	KI-3	Amsalu Tadesse and his friend's plastic waste collection union	Kirkos Subcity, woreda 8
	KI-4	Itola and his friends Plastic waste collection enterprise	Kirkos Subcity, woreda 8
	KI-5	Moges and his friend's plastic waste collection enterprise	Bole Subcity, woreda 12
	KI-6	Tsehaynew and his friend's plastic waste collection enterprise	Bole Subcity, woreda 12
Government Officials	KI-7	Woreda cleansing management team leader	Bole Woreda 12
	KI-8	Woreda cleansing management team leader	Gullele Woreda 1
	KI-9	Woreda cleansing management team leader	Kirkos Woreda 8
Recyclers	KI-10	Shangal manufacturing Plc	Dukem
	KI-11	Zeru recycling plc	Addis Ababa
	KI-12	Baisheng fiber manufacturing	Dukem
	KI-13	Sinoalu manufacturing plc	Addis Ababa
Petco Ethiopia	KI-14	Program communication specialist	Addis Ababa

Source: Own survey (2024)

4.2. Status of plastic waste collection practice

Plastic waste collectors operate in multiple areas within the selected study sites. Consequently, the source and types of the plastic wastes, sort and segregation practice, quantity and frequency of collection, and ways of transportation and storage are outlined below.

4.2.1. Source and types of plastic wastes

Streets are reported as the main sources of plastic waste for both formal and informal plastic waste collectors, accounting for over 70% and 86% respectively. The data indicated plastic waste continues to be dumped on streets and in ditches and if it was not for the current active plastic waste collection activities, the streets would have been visibly polluted with plastic wastes. A focus group discussion with plastic waste collectors revealed that formal collectors primarily gather plastic waste from streets and feeder roads between districts, whereas informal collectors tend to focus on main roads and ditches.

Table 4.3. Main types of plastic waste collected and plastic waste collection sites

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq	%	Freq	%
1	Which type of plastic waste do you collect the most?	Polyethylene Terephthalate (PET/PETE)	39	88.6	114	87.7
		High-Density Polyethylene (HDPE)	2	4.6	6	4.6
		Polyvinyl chloride (PVC)	0	0.0	1	0.8
		Low-Density Polyethylene (LDPE)	3	6.8	9	6.9
		Polypropylene (PP)	0	0.0	0	0.0
		Polystyrene (PS)	0	0.0	0	0.0
		Polycarbonate (PC)	0	0.0	0	0.0
2	Where do you collect the majority of plastic waste?	Market area/Open market	0	0.0	1	0.8
		Dwelling area/ Door to door	9	20.5	5	3.8
		Streets and ditches	31	70.5	112	86.2
		Waste dumping site/Containers	0	0.0	3	2.3
		Institutions	4	9	8	6.1
		Hotels and restaurant	0	0.0	1	0.8
		Other (Specify)	0	0.0	0	0.0

Source: Own survey (2024)

Regarding to types of plastic waste collected, formal plastic waste collectors were engaged in collecting all types of plastic waste. Informal plastic waste collectors also collected the most types of plastic waste except for polystyrene (PS) and polycarbonate (PC). Based on their order of prevalence, polyethylene terephthalate (PET/PETE), low-density polyethylene (LDPE) and high-density polyethylene (HDPE) were the main types collected by the majority of the plastic waste collectors. The chart and the description below provide a visual representation of the types of plastic waste collected by formal and informal waste collectors, highlighting their relative prevalence.

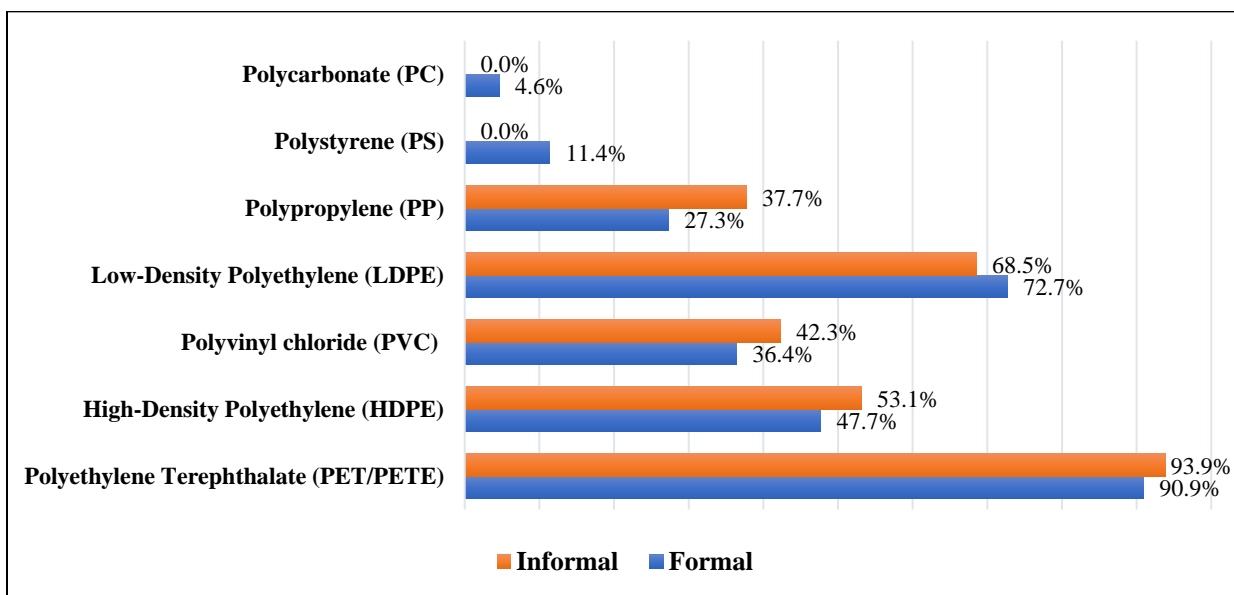


Figure 4.1. Types of plastic waste collected by the waste collectors

Source: Own survey (2024)

Polyethylene Terephthalate (PET/PETE)

Derived by the higher demand from the buyers and recyclers, more than 90% of both group collectors engaged in collecting polyethylene terephthalate (PET/PETE). It's also the most preferred plastic in the plastic waste value chain. FGD participants also stated PET is a highly demanded plastic-type in the market. Its availability assured a relatively consistent supply for the recyclers; SMEs and other actors involved in plastic waste collection activity widely prefer to buy PET among other types of plastic waste. Subsequently, more than 88% of the collectors primarily engaged in collecting PET.

Low-density Polyethylene (LDPE)

LDPE Shrink film can be made from several types of plastic types. The most common are polyvinyl chloride (PVC), polyolefin (POF), and polyethylene (PE). Polyethylene (PE) which has 3 different forms, i.e.: Low-Density Polyethylene (LDPE), Linear Low-Density Polyethylene (LLDPE), and High-Density Polyethylene (HDPE), is mostly used to wrap a bundle of items such as water bottles and soft drinks. Among those LDPE is the most sought-after for its low cost, high strength, and durability (Umendra, 1994).

For this study, LDPE Shrink film used to pack bundles of water bottles is categorized as Low-density polyethylene (LDPE). This type of plastic waste was the second most preferred, collected by 73% of formal and 68% of informal collectors. During the focus group discussions, both groups of collectors reported receiving up to 70 birr per kg for the waste. According to recyclers, these plastic waste types can be easily mixed with chemical additives, allowing them to be processed alongside PET and finally recycled into fibers and spandex.

Plastic bags that are made to carry groceries are one of the primary types of LDPE which remain the most frequently discarded plastic waste when disposed of. Qualitative findings indicated that formal waste collectors often collect low-density plastics (plastic bags) from various sources and disposed of them in landfills. The lack of demand from recyclers and plastic waste buyers also made informal plastic waste collectors deliberately avoid collecting these types of plastics. Consequently, they remain a big challenge to the environment. In Proclamation No. 513/1999, Ethiopia prohibited the production and importing of easily decomposable plastic bags less than 0.003 mm thickness. However, key informant interviews with government cleansing management officials and findings from FGDs indicated that there are still plastic bags in the market that fall below the designated thickness. Residents often mix those types of plastic waste with other dry wastes, and sometimes even use plastic bags themselves to carry the waste.

“There are many issues related to plastic bags. When they are dumped with liquids inside, they are likely to be mixed with compostable waste. On the other hand, when they are mixed with other dry wastes, they are sent to landfills and often burned with other types of dry wastes, which the smoke affects the environment.” (Retrieved from KI-7).

High-density Polyethylene (HDPE)

High-density polyethylene (HDPE) is also one of the plastic types that can break down easily under extreme heat (Ingabire et al., 2018). A significant proportion of both formal and informal waste

collectors were engaged in collecting these plastics, with 48% of formal and 53% of informal collecting. Focus group discussions from both groups indicated that collectors usually purchase jerrycans and other items made of HDPE from households. Notably, waste buyers have identified HDPE as reusable material that can be cleaned with chemicals and water and then resold to users.

Polyvinyl Chloride (PVC)

Another plastic-type collected by the waste collectors is Polyvinyl chloride (PVC). 36.4% of formal and 42.3% of informal plastic waste collectors were involved in collecting such types. Regarding Polypropylene (PP), 27% of the formal and 38% from the Informal's collect Polypropylene (PP) in addition to other plastic wastes.

Polystyrene (PS) and Polycarbonate (PC)

These types rank among the least available and the least demanded plastic wastes. Collected by less than 5% of formal collectors, none of the informal were engaged in collecting these plastic wastes. The findings from key informant interviews with government cleansing management officials indicated that recyclers typically hesitate to rely on certain types of inputs, primarily due to concerns about availability and potential challenges regarding the consistency of supply.

4.2.2. Sorting and segregation practices

Plastic waste segregation and sorting practices vary according to the plastic waste source. Figure 4.2 and Table 4.4, below provide information about the utilization of collection bags and the number of plastic waste collectors that were engaged in collecting plastic waste from each source, as well as the frequency of sorting plastic wastes.

Application of waste Collection bag (Segregation)

A stark contrast (See Figure 4.2) exists in the use of collection bags for different types of plastic waste. Segregation practices are notably low among informal plastic waste collectors, with nearly 80% having used a single collection bag for all plastic waste types collected. In contrast, 80% of formal plastic waste collectors have used different types of bags to separate recyclable and non-recyclable plastics. Kihila et al. (2021) emphasized the importance of waste segregation, stating that segregating waste at the source simplifies handling and processing. The practice promotes resource recovery, reuse, and recycling, and reduces operational costs.

“We collect PET in a bag designated for PET, never drop it in or mix it with other plastic types. We have different bags to collect LDPE, PETE, and other plastic types. Since we are responsible for segregating the wastes and loading them to allocated vehicles, dedicating different collection bags for each type of plastic waste is a compulsory activity for us.” (Retrieved from FGD-2)

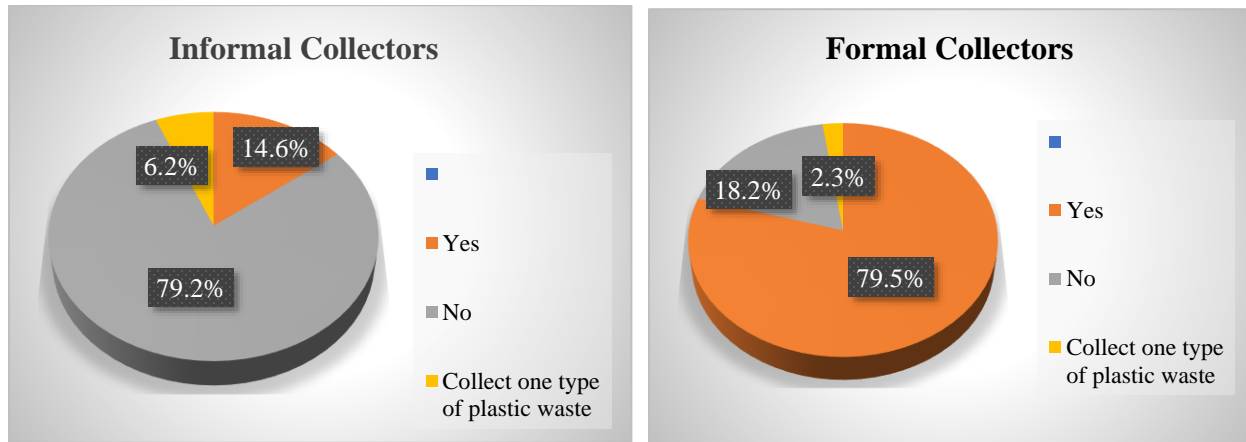


Figure 4.2. Utilization of dedicated collection bags by plastic waste collectors

Source: Own survey (2024)

Sorting practice correlated to the sources

Streets and ditches are the source of plastic waste for over 90 % of both group collectors. The community’s temporary waste dumping sites also served as a plastic waste collection spot for more than 84% of formal and 72% of informal collectors. Households and market areas (open markets) were supply sources for 84% and 59 % of formal plastic waste collectors, respectively. On the other hand, about 55% of informal waste collectors reported that households are not the source of their plastic waste. Similarly, open markets were visited by only 15% of informal collectors. Furthermore, a considerable proportion of informal plastic waste collectors, 68.5% for institutions and, 61.5% for hotels and restaurants, expressed a strong preference against collecting plastic waste from these locations.

Plastic waste collectors comparatively receive sorted plastic waste from marketplaces (open markets); discussions made with formal plastic waste collectors indicated that owners or supervisors of shops in open markets generally have a habit of sorting plastic waste. Within the union, 50% of members collected properly sorted plastic waste from this source. Practices among residents appeared to be inconsistent, with 39% of formal plastic waste collectors indicating that the plastic waste during door-to-door collection was well sorted by type. A similar number of 36%

of formal waste collectors reported that they usually have to sort plastic waste themselves due to households' poor sorting practices. Several studies implied that solid waste sorting at the household level is often poor. A study by Yoada et al. (2014) in Accra, Ghana revealed that only less than one-fifth of the households engaged in sorting solid wastes at home. Beka and Meng (2021), also found that only 28.6% of households have separate solid waste at source.

Given the absence of ownership, it's logical to conclude that plastic wastes sourced from streets and ditches are intended for sorting by plastic waste collectors. Approximately 77% of formal and over 91 % of informal plastic waste collectors stated that they regularly have to sort plastic waste they collected from streets and ditches. Despite few collectors who gather sorted plastic waste from the streets, participants in the focus group discussions noted that street sweepers occasionally separate plastics from other types of waste and put them on the roadside for collection by the formal waste collectors.

Related to the dumping site where the community disposed of waste in a temporary site, it's difficult to find the waste sorted in type. Thus, 50% of informal and 66% of formal waste collectors either occasionally or regularly have to sort plastics from other types of dry waste.

Table 4.4. Plastic waste sorting practice at the source and waste collector sorting exposure.

No	Source of plastic waste	Do you collect from this source?	Rate of segregating/sorting	Formal		Informal	
				Freq	%	Freq	%
1	Market area (open markets)	Yes	Regularly	3	6.8	3	2.3
			Sometimes	1	2.3	6	4.6
			Rarely	0	0	7	5.4
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	22	50	3	2.3
1	Market area (open markets)	No	Do not collect from this source	18	40.9	111	85.4
2	Dwelling area/ Door to door	Yes	Regularly	16	36.4	15	11.5
			Sometimes	3	6.8	18	13.8
			Rarely	1	2.3	23	17.7

No	Source of plastic waste	Do you collect from this source?	Rate of segregating/sorting	Formal		Informal	
				Freq	%	Freq	%
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	17	38.6	3	2.3
		No	Do not collect from this source	7	15.9	71	54.6
3	Streets and Ditches	Yes	Regularly	29	65.9	106	81.5
			Sometimes	5	11.4	10	7.7
			Rarely	0	0	3	2.3
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	6	13.6	1	0.8
		No	Do not collect from this source	4	9.1	10	7.7
4	Waste dumping site/Containers	Yes	Regularly	21	47.7	21	16.2
			Sometimes	8	18.2	40	30.8
			Rarely	3	6.8	31	23.8
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	5	11.4	2	1.5
		No	Do not collect from this source	7	15.9	36	27.7
5	Institutions	Yes	Regularly	4	9.1	3	2.3
			Sometimes	6	13.6	17	13.1
			Rarely	8	18.2	18	13.8
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	5	11.4	3	2.3
		No	Do not collect from this source	21	47.7	89	68.5
6	Hotels and restaurant	Yes	Regularly	4	9.1	2	1.5
			Sometimes	5	11.4	24	18.5
			Rarely	6	13.6	23	17.7

No	Source of plastic waste	Do you collect from this source?	Rate of segregating/sorting	Formal		Informal	
				Freq	%	Freq	%
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	4	9.1	1	0.8
		No	Do not collect from this source	25	56.8	80	61.5
7	Others (Events (e.g. weeding), bazar, expo...and other events)	Yes	Regularly	0	0	1	0.8
			Sometimes	2	4.5	6	4.6
			Rarely	3	6.8	5	3.8
			Segregated/sorted from the source (Collectors did not perform any segregation or sorting)	0	0	1	0.8
		No	Do not collect from this source	39	89	117	90

Source: Own survey (2024)

4.2.3. Quantity of plastic waste and frequency of collection

The study indicated that 95% of both formal and informal plastic waste collectors engage in collection activities daily. For the remaining collectors, those who do not collect daily still gather plastic waste at least twice a week. The trend emphasizes plastic waste collection is consistently practiced livelihood by those involved. With 10 - 20 kg of median daily quantity of plastic collected for each group, there is relatively little variation in the daily quantity of plastic waste collected. Overall, 90% of the informal plastic waste collectors collect no more than 20 kg of plastic waste per day, with nearly 50% of them collecting less than 10 kg of plastic waste per day. From the formal side, 30% of them collected less than 10 kg, and another 30 % collected between 10 - 20 kg of plastic waste per day. A significant number of union members (23%) reported collecting more than 50 kg of plastic waste during the collection day. According to the information from the focus group discussion, the formals benefit from their role as the primary waste collectors from households, hotels and restaurants, and institutions. Particularly, those assigned in areas where these sources are concentrated were able to collect a substantial quantity of plastic waste.

4.2.4. Working hours

As illustrated in Table 4.5, the majority of both group collectors had engaged more than 4 hours per day to collect plastic wastes. With a median working time of 4 to 6 hours, 48% of the formal collectors reported completing their daily tasks within this time frame. 41% of informal plastic waste collectors take an additional 2 hours to finish their tasks, working 6 to 8 hours. Furthermore, another significant group of informal waste collectors regularly overwork, often spending more than 8 hours looking for plastic waste. Similarly, 20 % of formals also fall into this category. A report by MEFCC (2018) indicated that plastic waste collectors in Ethiopia typically work over 12 hours a day without adequate benefits. During the discussion with the informal plastic waste collectors, they mentioned that the competitive nature of the work usually forces early morning starts, with many beginning their plastic collection rounds as early as 4:AM EAT. In comparison, formal collectors, whose collection areas are defined by local woreda authorities, typically start their activity later, at 6:AM EAT.

It's a routine that my alarm clock is set to wake me up at 9:30 AM every day so that I can be ready to start plastic waste collection at 10 AM. As an informal plastic waste collector, I must get up early, to increase my chances of collecting a substantial quantity of plastic waste. If I fail to do that and arrive late, I will risk missing out on the best opportunities to collect plastic wastes” (Retrieved from FGD-1 and FGD-3)

4.2.5. Storage facilities characteristics

Among many other criteria, the National Centre for Waste Management (2023) guidelines stated that temporary waste storage areas should be clearly designated and securely contained, always kept clean and free from any litter and remnants of waste. The space should be delineated and secured by a fence. Recyclables such as HDPE, PET, and LDPE should be stored in a separate bay separated by walls with appropriate resistance (National Centre for Waste Management, 2023). However, the storage facilities for plastic waste collected in Addis Ababa appear to be inadequate, particularly among formal waste collectors.



Figure 4.3. Storage of formal plastic waste collectors (Unions): Gullele Sub-city, woreda 1

Source: Own survey 2024



Figure 4.4. Storage of informal plastic waste collectors (SMEs): Bole Sub-city, woreda 12

Source: Own survey 2024

The finding indicates that the majority of formal waste collectors (61%) store plastics in public open spaces, leaving the waste unprotected. In contrast, 76% of informal plastic waste collectors accumulate the waste in private fenced open spaces. None of the respondents have accessed a “designated” ventilated warehouse specifically built to store plastics. Key informant interviews with SMEs and unions revealed that the government has provided unions with unfenced public open spaces. On the other hand, most SMEs reported that they are operating in a fenced private

open space. As shown in the figures' plastic wastes were visibly scattered throughout the storages. Although the conditions do not meet the standard specified by National Centre for Waste Management (2023) guidelines, the storage spaces of informal plastic wastes collectors that are guarded by a fence, are found slightly better than the storage of formal waste collectors in public open spaces. Overall, the observations suggested that plastic waste storage conditions of both unions and SMEs are very poorly organized and in adequately constructed, highlighting the gap in plastic waste management infrastructure.

Table 4.5. Practices of plastic waste collectors

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq	%	Freq	%
1	How frequently do you collect plastic waste?	Daily	42	95.5	123	94.6
		More than once in a week	2	4.5	7	5.4
		Weekly	0	0.0	0	0.0
		More than once in a month	0	0.0	0	0.0
		Monthly	0	0.0	0	0.0
		Less than once in a month	0	0.0	0	0.0
2	On average how many Kg of plastic waste do you collect in a day?	< 10 kg	13	29.5	63	48.5
		10 – 20 kg	13	29.5	52	40.0
		21 – 30 kg	4	9.1	11	8.5
		31 – 40 kg	4	9.1	1	0.8
		41 – 50 kg	4	9.1	3	2.3
		>50 kg	10	22.7	0	0.0
3	Regularly, how many hours in a day does it take you to collect?	< 1 hour	0	0.0	1	0.8
		1 - 2 hours	1	2.3	2	1.5
		2 - 4 hours	1	2.3	7	5.4
		4 - 6 hours	21	47.7	14	10.8
		6 - 8 hours	12	27.3	53	40.8
		> 8 hours	9	20.5	53	40.8
4	Where do you store collected plastic waste?	In a dedicated warehouse	0	0	0	0
		In a fenced compound; open space	17	38.6	99	76.2
		In public open space; unfenced	27	61.4	31	23.8
5	Do you buy plastic waste from any source?	Yes	12	27.3	25	19.2
		No	32	72.7	105	80.8

Source: Own survey (2024)

4.2.6. Transportation of plastic wastes

Formal plastic waste collectors transport the collected plastic waste to the designated storage facilities and the buyers. Informal waste collectors also transport collected plastics to their buyers. However, the mode of transportation varies significantly between the two types of collectors. 55% of formal plastic waste collectors utilize one of the buyer or recycler's vehicles or a rented third-party vehicle to collect and sell plastic waste. In contrast, transportation has been a big concern for the informal collectors. The result indicated that 95% of plastic waste collectors manually carry the waste to the buyer's location, with only 6% having access to the waste collection vehicle. The logistical disparities between formal and informal plastic waste collectors highlight structural differences in their operations, with formal collectors benefiting from resources provided by their union. As noted in section 4.2.3, a formal group focus group discussion with formal plastic waste collectors revealed that access to transportation is one of the reasons why some formal collectors collect significantly more plastic waste per day.

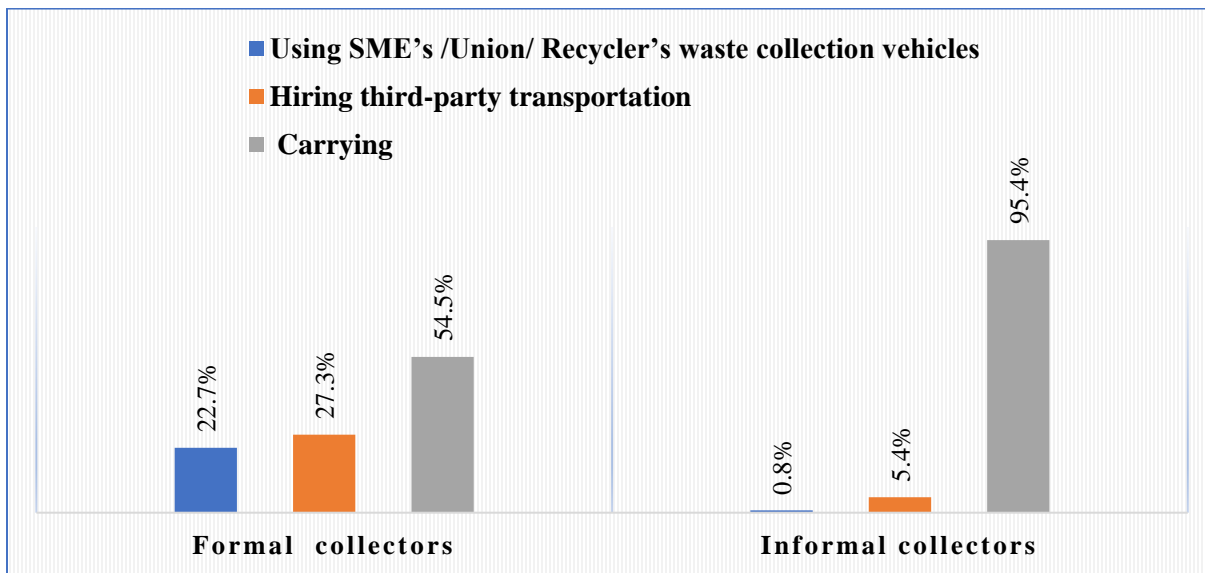


Figure 4.5. Transportation methods utilized by plastic waste collectors for waste transport
Source: Own survey (2024)

4.2.7. Plastic waste buying practice

As illustrated in Table 4.5, both formal and informal waste collectors sometimes buy plastic waste from various sources. 27% of the formal and 19% of the informal collectors' purchase plastic waste from different suppliers. For informal collectors, the main sources of plastic waste are dwellers,

hotels, and shop owners. Institutions and street sweepers are the primary suppliers of plastics for the formal. During the focus group discussion (FGD), participants revealed that it is profitable to purchase plastic waste at a discounted price, typically half of the market price. Plastic waste collectors buy the plastic waste and then sell it to buyers.

There are very few households that collect plastic bottles to sell to us. We usually estimate the quantity, pay them a small amount, and then sell it for a significant profit, 11-14 birrs per kilogram to the SMEs. (Retrieved from FGD-1 and FGD-3)

Hirpe and Yeom (2021) indicated that collectors sometimes buy plastics from households. Individual traders, commonly known as “Koralews,” typically purchase metals, glass bottles, and other resalable materials, including reusable jars and recyclable plastics, which they then sell to private SMEs and other buyers. The column chart below shows the number of plastic waste collectors who occasionally purchase plastic waste from various sources.

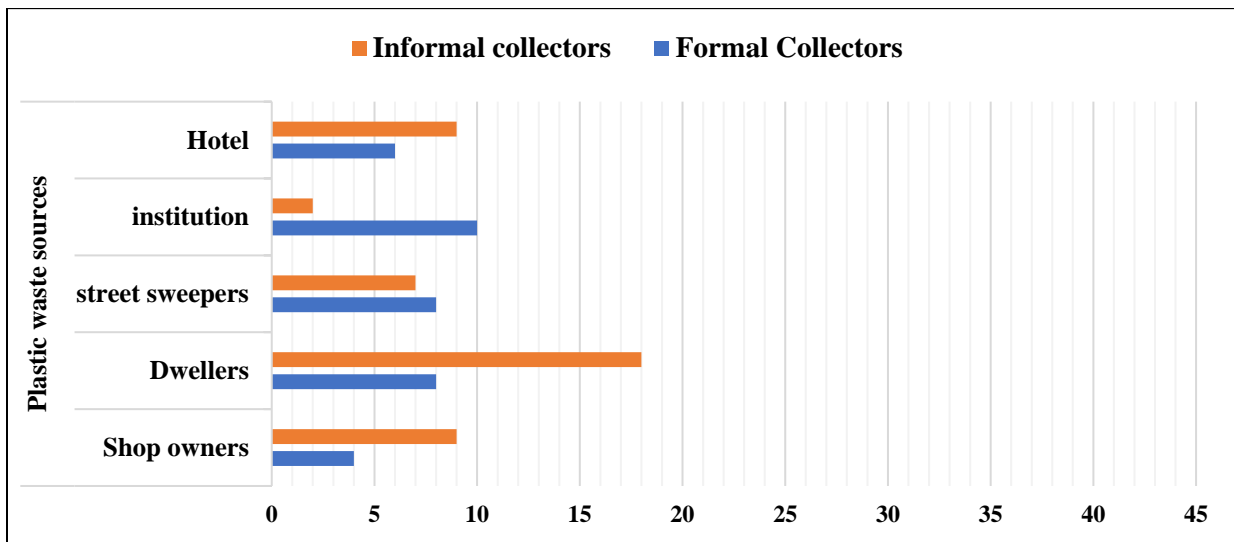


Figure 4.6. Distribution of plastic waste collectors by source of purchase

Source: Own survey (2024)

4.2.8. Opinion of plastic waste collectors towards the plastic waste collection practice

Plastic waste collectors were inquired about their opinion regarding the importance of plastic waste collection activities. Ninety-five percent of both groups of collectors mentioned that waste collection activities are a source of income that supports many livelihoods. A significant number of waste collectors consider plastic waste collection the best job for them. Over 50% of informal and 30% of formal collectors stated that plastic waste collection comparatively offers better

earnings than other jobs they could engage in. This belief among the collectors, particularly formal collectors, likely indicates that plastic waste collection is financially rewarding compared to other similar employment options and can be seen as an indicator of their commitment to sustainable plastic waste collection activities. Regarding the role of plastic collection in preventing environmental issues, formal plastic waste collectors possessed slightly more awareness than informal collectors. More than 90% of formal and 71% of informal collectors regarded plastic waste collection activities as important from an environmental point of view. One-fifth of both groups of collectors highlighted the importance of the activity in raising the community’s environmental awareness. Correspondingly, 32% of each group of collectors described the benefit of plastic waste-related activities in promoting recycling. Even if it applies to some of them, both groups of collectors’ understanding of the broader environmental implications could suggest that these waste collectors may serve as potential actors in promoting environmental awareness within their communities.

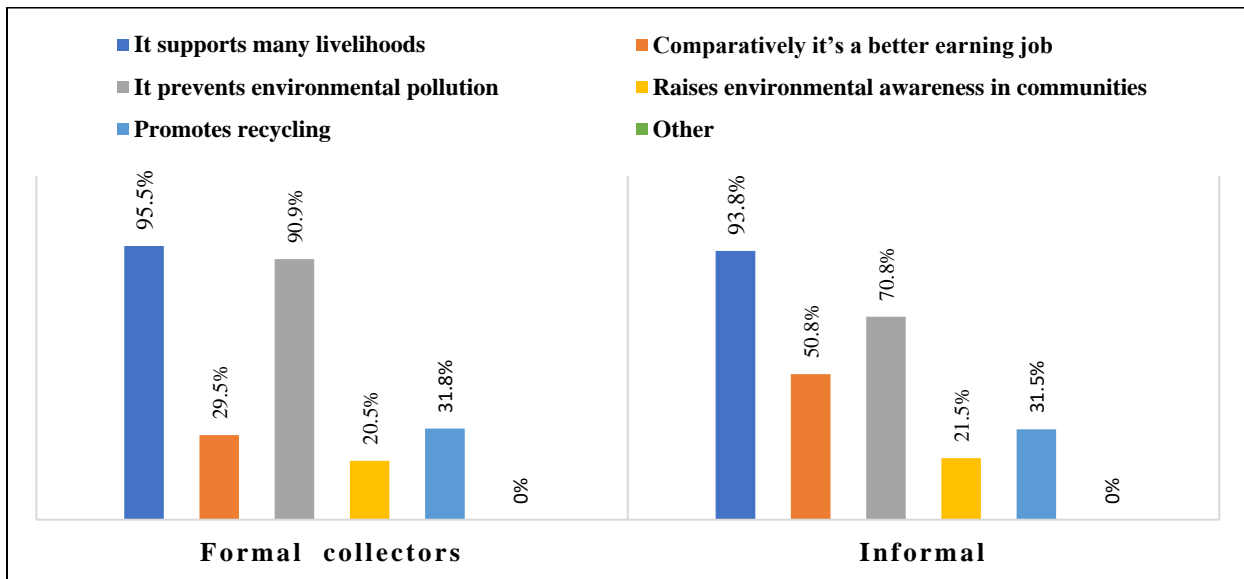


Figure 4.7. Perceptions of plastic waste collectors regarding current waste collection practices

Source: Own survey (2024)

4.3. Challenges of plastic waste collection activities

Plastic waste collection faces several significant challenges, including inadequate storage facilities, insufficient personal protective equipment (PPE) for collectors, and difficulties accessing designated waste collection points. Furthermore, institutional challenges arise from

insufficient support from local authorities, lack of official recognition, and weak sectoral integration for implementing directives. Although the analysis in Table 4.6 addresses various obstacles, mainly most critical challenges hindering the activities of plastic waste collectors are discussed below.

4.3.1. Lack of official recognition and support from local authorities

The Addis Ababa city integrated solid waste Regulation (Regulation No. 100/2018) prohibits individuals and organizations from collecting, accumulating, or transporting recyclable or reusable waste without the agency's permission. Hence, informal plastic waste collectors, who operate independently without formal registration or recognition, likely face challenges in receiving support and recognition from the local government. Over 40% of informal collectors indicated that lack of support and official recognition hinders their plastic waste collection activities. Formal plastic waste collectors also feel they are not receiving the necessary support from the government. Despite receiving full government recognition, 45% of formal plastic waste collectors also specified that insufficient support from local administration is likely to impede their activities. Specifically, cited their concerns about inadequate training, personal protective equipment and protection against theft.

The absence of operational freedom also posed a significant challenge for informal plastic waste collectors. A March 2018 World Bank report indicated that informal waste workers are often ignored and actively prevented from participating in waste collection activities. Despite their widespread presence, government cleansing management agency officials interviewed for this thesis stressed the crucial role informal plastic waste collectors play in collecting plastics from rivers, sewer systems, ditches, and other hard-to-access locations. During the focus group discussions, the waste collectors emphasized the importance of recognition; they explained how the lack of formal recognition and licenses left them vulnerable to various risks. Their hard-earned plastic waste might be seized by the local militias and some have even been arrested. They are perceived differently from the formal waste collectors, which sometimes exposes them to discrimination that leads to physical harm, calls to security guards, being chased away from collection areas, or even bullying by residents. These multifaceted issues suggest the need for the government to consider including informal plastic waste collectors into the formal waste collection system.

Morocco was the first country in Africa to include 20,000 informal waste collectors in its formal waste management system. The measurement significantly improves the plastic waste value chain and recycling rates with better working conditions (World Bank, 2016). According to WIEGO (2013), formalization should incorporate all the informal waste collectors. Otherwise, if only fractions of informal collectors are integrated, those remaining may lose access to waste and their livelihood will be at risk. Formalization would be also a problem if the informal plastic waste collectors join unions or cooperatives at lower wages and hostile working conditions. The mayor of Dakar, Senegal, experienced challenges when incorporating informal youth into the city's waste management system. The lower wages and benefits led waste collectors to lose interest and quit their jobs. The instance highlights the importance of cautionary planning when considering such initiatives. In the case of Addis, the similar household median income of formal and informal plastic waste collectors, as discussed in section 4.1.4, indicates that formalization could improve the value chain and increase the volume of recyclable materials collected.

4.3.2. Competition between waste collectors

A Study by Boampong et al. (2020), infers that the relationship between formal and informal waste collectors in Accra, Ghana, as complementary. Lissah et al. (2020) also argue that the competition between formal and informal waste collectors is insignificant, stating informal collectors track areas underserved by the formal waste collectors, playing a critical role in the urban waste circular economy value chain particularly through material recovery. As indicated in Table 4.6, the inter-competitions between formal collectors and the threat they pose to informal plastic waste collectors are minimal or nonexistent. Formal group focus group participants revealed that the criteria set by the government for the formal collectors to establish unions legally and operate in the designated districts assigned by the woreda, resulted in much smoother operation and decreased unforeseen competition. On the contrary, more than 50% of the informal group respondents expressed that the presence of too many informal collectors made collecting plastic waste a difficult task and resulted in reduced income for the participants. Since there are no specific requirements or conditions set for informal plastic waste collectors, individuals are free to engage in the activity without restrictions on location. Qualitative findings emphasize this absence of requirement has led to plastic waste collection hubs being overcrowded with a large number of collectors.

“Back in time, 3 years ago, I used to collect up to 30 - 40 kg per day. We didn't have to wake up early in the morning, walk long distances, or stress out to get plastic waste, as we were very few.

The daily income was also very satisfying. Currently, things have changed; the involvement of too many plastic collectors made it difficult for us. It would have been beneficial if the local government allowed us to operate legally with a designated district, preventing informal collectors from trespassing into the assigned area. I also think that it's the presence of too many plastic waste collectors that fluctuates the price of plastic waste, resulting in buyers dictating the unit price of plastic waste.” (Retrieved from FGD-1)

Plastic wastes theft

Cleansing management agencies at both the city and woreda levels viewed informal plastic waste collectors as a direct threat to formal collectors. They believe these informal collectors intercepted income that would typically have gone to formal waste collectors. Moreover, this intense competition for plastic waste not only undermined the revenue of formal collectors but also contributed to increased theft, which discouraged formal waste collectors from engaging in the activity.

“Informal plastic waste collectors, who usually come from where plastic wastes are sold in bulk, such as “Merkato” often steal plastic wastes stored by the formal collectors. Compared to formal plastic waste collectors who operate under licensed unions, informal collectors are difficult to trace due to their traveling nature of operation. The unions frequently report incidents of plastic waste theft, which we have taken steps to address. As part of our effort, we confiscated stolen plastic waste and expelled them from the area. In case of repeat offenders, we have also made few arrests.” (Retrieved from KI-8)

Jha (2021), also indicated that informal waste pickers might steal plastic waste from formal waste collectors’ storage sites before it is transported to recycling plant, which could negatively affect the income of formal waste collectors. During the discussions, formal plastic waste collectors highlighted that the absence of fencing makes plastic waste storage vulnerable, making it an easy target for theft by informal plastic waste collectors. Several incidents of theft are committed by the informal.

“Informal waste collectors are fearless, disregarding police and local militias. They can be as aggressive as gangs, and if they find the storage unguarded or if only women are present in the plastic waste storage area, they may forcibly take the stored plastic waste.”

(Retrieved from FGD-1)

4.3.3. Poor segregation practice and utilization of waste bins

A study by Adefris et al. (2023), highlighted the poor solid waste segregation practices of households, emphasizing that households neither prepared different containers nor had the necessary materials for segregating waste. During the focus group discussion (FGD), formal

collectors indicated that many households in their district usually sort plastic waste from other dry waste. The Woreda (district) cleansing management agency officers also evaluated the sorting practices as “satisfactory.” However, the problem arises when it comes to further identification. Both collectors and agency officers observed that households routinely mix all plastic types and store them in a single container or plastic bag. As a result, formal waste collectors are typically presented with unsegregated plastic waste.

“It’s a regular that we find sanitary pads, plastic bags, and other types of plastic wastes mixed with plastic bottles and other types of plastic wastes. We also found instances where thrash bags were infested with ants and other insects because of the residual liquids inside the plastic bottles. Another persisting issue is the use of thin plastic shopping bags as a makeshift waste bin for plastic waste. These bags easily tear and make it difficult to transport waste.” (Retrieved from FGD-2 and FGD-3)

On the flip side, recyclers emphasized that plastic waste segregation practices among collectors were poor. Furthermore, the plastic waste supplied was often unclean, sometimes containing residual liquid. Recyclers who participated in this study stated that this issue could increase production costs due to the extra labor it incurs. SMEs also shared a similar stance, indicating that segregation practices among collectors were inadequate.

“We are using PET for recycling and sometimes the products we receive are unclean and unsorted. Although the problem arises from the household’s waste management practice, collectors are also negligent in providing clean PETs to the micro and small enterprises. There are PET bottles that come up with liquid inside (e.g. urine) etc. The chemicals we will use to clean those PETs are very expensive; which increases the production cost.” (Retrieved from KI-10, KI-11, KI-12, KI-13)

4.3.4. Price fluctuation and supply inconsistency

Price fluctuation is one of the primary challenges hindering the activities of plastic waste collectors. Approximately 60% of formal plastic waste collectors expressed concerns about the low unit prices offered by buyers for plastic waste, as shown in Table 4.6. Despite having agreements with both unions and SMEs, recyclers perceive these agreements as ineffective. Unions and SMEs are often drawn to the highest current market price, disregarding the terms of the agreements. This situation has made it difficult for recyclers to rely on contracted suppliers, who tend to favor immediate financial gain over consistent supply and the development of long-term sustainable partnerships.

“We have two options for sourcing plastic waste. Directly from Unions, SMEs or through wholesalers. Most of the time the smaller SMEs prefer to sell the plastics to the wholesalers that

would pay them better price per unit. Therefore, forcing us to buy from the wholesalers, which usually use brokers to sell the plastic wastes.” (Retrieved from KI-11 and KI-13)

Brokers, as described by Alemu (2017), are middlemen involved in supplying recyclable materials to various recycling factories in and around the city. Often regarded as informal salespersons by recyclers, SMEs, and government cleaning management agency officers, they pose a challenge in the plastic waste value chain. Recyclers who participated in this survey explained that these intermediaries search a market for SMEs, facilitate transportation, and set the buying and selling price of plastic waste. However, their primary focus is maximizing their commission fee which usually inflates the market price and creates artificial demand.

“There are brokers in between recyclers and suppliers. These suppliers often use brokers to find the best price for plastic waste. As a result, the price of plastic waste is inflated and we sometimes find ourselves purchasing less than our demand. The incident resulted in the lower price paid per unit of plastic waste to collectors, unions, and SMEs.” (Retrieved from KI-10, KI-11, KI-12, KI-13)

4.3.5. Sectoral integration and low enforcement practice

Addis Ababa city government revised Integrated Solid Waste Management, Regulation No 100/2018, under the “Power and Duties of Woreda solid waste management office” clearly outlines the need for other sectoral bureau collaboration. The regulation emphasized the necessity of collaboration between various sectoral offices, including the Trade Bureau, Police, Code Enforcement Office, and other several offices, to integrate and cooperate for the improvement of the city’s waste management system. However, despite this mandate, government waste management and cleansing agency officers report a significant lack of collaboration and integration between these agencies. The lack of effective collaboration consequently, challenges their ability to enforce corrective measures on households and organizations that fail to store, sort, and dump solid wastes properly.

“We always encounter problems when communities couldn’t collect and properly handle plastic waste. For instance, some residents flush down the toilet to the sewerage system. This creates difficulties in plastic waste collection activities, particularly exposing collectors to health issues. The directive states that those who deliberately mismanage waste should be penalized for their actions. However, the mandate to implement these falls to the district militia and security offices, which are often reluctant to take action. As a result, it becomes a lengthy process for the cleansing management agency to implement the directive. In order to take the necessary measures that can provide a lesson to the community members, it is mandatory to write a letter to the district code enforcement office and go through some bureaucratic processes.”

(Retrieved from KI-7, KI-8, KI-9)

Furthermore, according to Proclamation No. 985/2016, under the federal cooperative agency, it's the woreda cooperative office's responsibility to facilitate the establishment of unions. The proclamation emphasized that individuals who live or work in a given area and are engaged in a specific profession, with a number of members not less than fifty, can form a union, provided that the group consists of at least fifty members. Government cleansing management agency officers stated that this criterion is one of the obstacles in bringing informal waste collectors into the formal plastic waste arena. Additionally, the frequent movement and temporary work arrangements of informal plastic waste collectors make it difficult to meet the requirements set by the proclamation.

4.3.6. Accessibility of waste collection points

Largely related to unhealthy competition and lack of official recognition, accessing waste collection points has been pointed out as a problem by the informal collectors. 32% of this category respondents indicated that their income is highly or moderately affected by limited access to waste collection points. Informal group FGD participants described that the waste collection points around residents are solely accessed by the formal collectors, and the presence of high competition between the informal also creates a slight difficulty in accessing plastic wastes from sources like streets and ditches.

4.3.7. Inadequate storage spaces

Storage which was discussed in section 4.1.6, is the main issue that hampers the activity of over 60% of formal plastic waste collectors, as they consider the storage facilities, they used to be insufficient and unprotected. In contrast to formal waste collectors, informal plastic waste collectors avoid storage concerns as they directly supply plastic waste to small and medium-sized enterprises (SMEs). As a result, storing and managing the waste becomes the responsibility of their partnered SMEs or plastic waste buyers.

Table 4.6. Challenges affecting plastic waste collection activities

	Challenges		How likely does it hinder your plastic waste collection activities?							
			Very likely		Likely		Slightly		Unlikely	
			Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
1	Lack of provision of personal	Freq	21	38	14	25	0	6	9	61

	Challenges		How likely does it hinder your plastic waste collection activities?							
			Very likely		Likely		Slightly		Unlikely	
			Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
	protective equipment (gloves/masks)	%	47.7	29.2	31.8	19.2	0.0	4.6	20.5	46.9
2	Lack of /Insufficient storage space	Freq	20	6	7	5	0	3	17	116
		%	45.5	4.6	15.9	3.8	0.0	2.3	38.6	89.2
3	Low prices paid for collected plastic waste	Freq	13	5	13	25	1	13	17	87
		%	29.5	3.8	29.5	19.2	2.3	10.0	38.6	66.9
4	Health issues from exposure to waste or Physical strain due to nature of work	Freq	5	8	18	26	8	14	13	82
		%	11.4	6.2	40.9	20.0	18.2	10.8	29.5	63.1
5	Lack of transportation for collected waste	Freq	5	10	4	8	1	5	34	107
		%	11.4	7.7	9.1	6.2	2.3	3.8	77.3	82.3
6	Lack of support from local authorities or lack of official recognition	Freq	3	39	20	13	5	7	16	71
		%	6.8	30.0	45.5	10.0	11.4	5.4	36.4	54.6
7	Difficulty in accessing waste collection points	Freq	3	18	3	23	3	7	35	82
		%	6.8	13.8	6.8	17.7	6.8	5.4	79.5	63.1
8	Lack of proper equipment for sorting/segregating the wastes (waste bins, collection bags)	Freq	3	8	2	19	0	9	39	94
		%	6.8	6.2	4.5	14.6	0.0	6.9	88.6	72.3
9	Competition from other informal waste collectors	Freq	2	33	6	42	1	7	35	48
		%	4.5	25.4	13.6	32.3	2.3	5.4	79.5	36.9
10	Competition from other formal waste collectors	Freq	2	4	4	7	1	8	37	111
		%	4.5	3.1	9.1	5.4	2.3	6.2	84.1	85.4
11	A limited number of plastic waste buyers	Freq	1	7	0	2	0	0	43	121
		%	2.3	5.4	0.0	1.5	0.0	0.0	97.7	93.1

	Challenges	How likely does it hinder your plastic waste collection activities?								
		Very likely		Likely		Slightly		Unlikely		
		Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	
12	Lack of knowledge on how to collect, sort, and segregate plastic wastes	Freq	0	2	0	5	1	3	43	120
		%	0.0	1.5	0.0	3.8	2.3	2.3	97.7	92.3
13	Other (please specify)	Freq	0	0	0	0	0	0	44	130
		%	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0

Source: Own survey (2024)

4.3.8. Personal protective equipment (PPE) use practice of waste collectors

Martin et al. (2000), emphasized that the protection of waste workers can be ensured by wearing personal protective equipment (PPE) such as masks, gloves, boots, caps, uniforms, goggles, and face shields. In this study, 98% of formal plastic waste collectors revealed they often take safety measurements when collecting plastic waste from various sources. During the focus group discussions, collectors stated that they frequently wear gloves, masks, and plastic jackets/overalls during collection. The personal protective equipment provided to union members is typically tailored to their dry waste collection services for the city municipality. On the contrary, a significant majority (81%) of informal plastic waste collectors do not take any safety measurements or wear at least one of the standard personal protection equipment.

Given the diverse types of waste, they manage alongside plastics; formal waste collectors expressed their concerns regarding to inadequacy of personal protective equipment. Moreover, neither the government nor the NGOs and other stakeholders are providing adequate support in this regard. Stats in Table 4.6 indicate that the lack of personal protective equipment is the biggest challenge affecting the activities of 80% of formal waste collectors. Around 50 % of informal plastic waste collector also reported that lack of PPE is a major issue, which is likely to hinder their operation. Specifically, gloves designed for waste collection are the most desired personal protective equipment for formal waste collectors. While overalls and gloves are the most required PPE for informal plastic waste collectors.

Table 4.6 includes additional challenges relating to PPE, where 50% of formal plastic waste collectors expressed the likelihood of health issues resulting from their routine exposure to waste.

Since they are collecting all types of waste, sorting different dry wastes and segregating plastics according to their type, with incomplete and insufficient personal protective equipment, had exposed them to physical strain. The Ethiopian Ministry of Environment, Forest and Climate Change (MEFCC) report also highlighted waste collectors are often exposed to hazardous materials and face significant health risks due to the lack of proper equipment and training (MEFCC, 2018). In contrast, informal collectors who focus exclusively on plastic waste collection are somewhat protected from physical strain. Over 63 % of this group of collectors believe they are not at risk of experiencing physical strain.

Table 4.7. Plastic waste collectors’ access to training and personal protective equipment

No	Variable label	Characteristics (value)	Formal collectors		Informal collectors	
			Freq	%	Freq	%
1	Have you ever taken training about the role of plastic waste collection on the environment?	Yes	15	34.1	2	1.5
		No	29	65.9	128	98.5
2	Do you take any kind of safety measurements when collecting plastic waste?	Yes	43	97.7	25	19.2
		No	1	2.3	105	80.8

Source: Own survey (2024)

4.3.9. Access to training for waste Collectors

The training assessment in this thesis covers topics such as safe plastic waste collection practices, sorting, transporting, and storing plastic waste, as well as managing a plastic waste collection business. It also includes any other relevant training targeted at plastic waste collectors. The findings indicated a significant training gap for both groups of collectors, particularly for the informal collectors; with a concerning 98% reporting that they have never received any training. Notably, out of 130 informal plastic waste collectors, only two of them had received training, sponsored by an NGO and Woreda cleansing management agency. From the formal side, 66% of them didn’t get any training from relevant bodies. The chart below illustrates the number of plastic waste collectors who received trainings from concerned organizations. Relatively, government was the primary provider, having trained 13 formal collectors, while NGOs delivered training for four formal waste collectors.

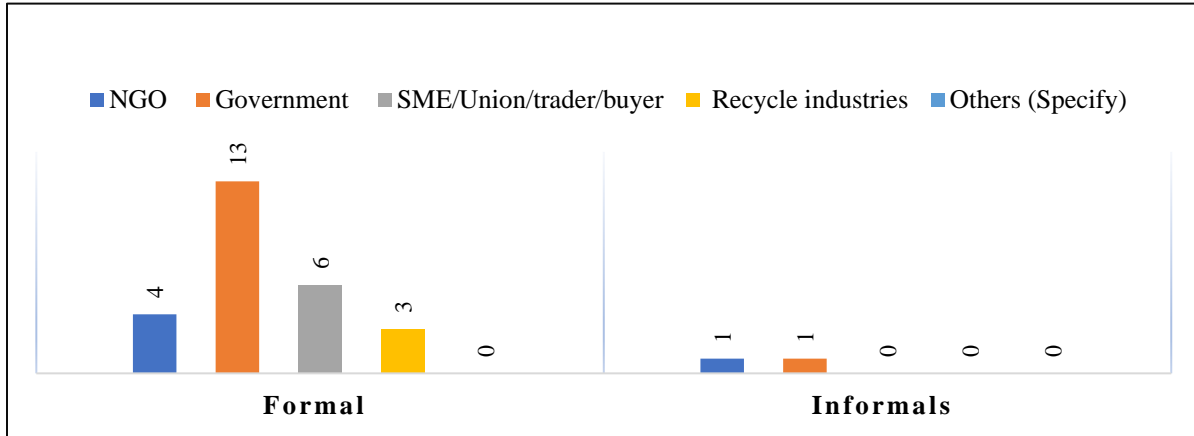


Figure 4.8. Breakdown of training sources for plastic waste collectors

Source: Own survey (2024)

The findings underscore a critical need for targeted training programs for both formal and informal plastic waste collectors. Despite the environmental issues it solves, both qualitative and quantitative analysis indicated that insufficient effort is made to capacitate the waste collectors, particularly informal plastic waste collectors, highlighting the sectors lack of attention from those focused on environmental issues. According to Woldetsadik and Oumer (2021), addressing the training gap increases operational efficiency and fosters more sustainable plastic waste management system.

4.4. The nexus of plastic waste collectors and plastic waste buyers

4.4.1. Plastic waste supply and regular buyers

Collectors primarily supply plastic waste to dry waste unions and SMEs, plastic waste recyclers, and wholesalers of reusable and recyclable materials. The findings indicate a clear distinction between the two groups in terms of plastic waste supply. Notably, 84% of formal plastic waste sellers sell their collected plastic waste to recyclers through their union. FGD sessions with formal plastic waste collectors disclosed that each member of the union stores the plastic waste in a designated storage area and it's the representative of the members of the union that transports and sells the items to recyclers. Informal plastic waste collectors on the other hand sell their plastic

waste to various buyers: SMEs purchase 49%, wholesalers acquire 32%, recyclers buy 3%, and other individual collectors referred as “itinerant junk buyers”, who primarily focus on metals and HDPE, purchase 16% of the collected plastic waste. Specifically, SMEs purchase 49%, wholesalers acquire 32%, recyclers buy 3%, and other individual collectors referred to itinerant junk buyers, particularly metals and HDPE, purchase 16% of the plastic waste collected. Additionally, although intermediaries do not directly buy or sell plastic waste, they facilitate transactions and earn a commission. According to the description provided in the proposed KI interviews with recyclers, intermediaries are brokers that exist between plastic waste sellers and recyclers. Wholesalers use these intermediaries to sell bulk quantities of plastic waste to recyclers, often at inflated prices. Additionally, intermediaries sometimes act as middlemen when SMEs or unions want to sell their plastics to wholesalers for a better price.

Drawing on DiGregorio (1994), Bjerkli (2004) also explored the structure of the waste recovery system. According to her study, the relationship between actors in the plastic waste value chain starts at the lower circuit and ends at the upper circuit. The lower circuit is primarily concerned with the collection of waste, featuring key participants such as plastic waste collectors and individual traders, commonly referred as itinerant junk buyers. In contrast, the upper circuit encompasses activities such as trading, processing, and recycling, with small and medium enterprises (SMEs), recyclers, and agents serving as the main actors. The flow chart below shows the value chain of plastic waste from the perspectives of formal and informal plastic waste collectors.

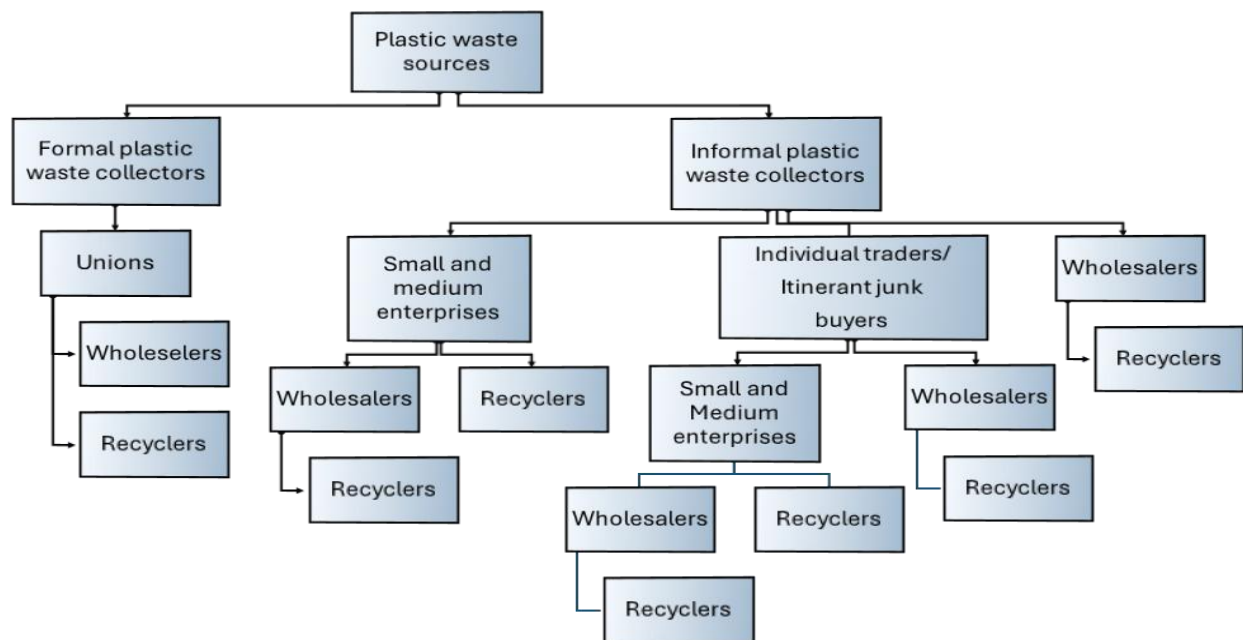


Figure 4.9. Plastic waste market supply chain

Source: Own survey (2024)

As indicated below in Table 4.8, the relationship between plastic waste collectors and buyers appears to be primarily business-oriented. The majority of plastic waste collectors (over 90%) have never received any support from their regular buyers. Out of 37 formal plastic waste collectors who sell their plastic waste to recyclers, only 2 of them have received training. Those who consistently supply plastic waste to SMEs and individual traders have not received any form of assistance. In contrast, informal plastic waste collectors who regularly supply to SMEs have received some support. Notably, 32% of informal plastic waste collectors who participated in the survey have supplied plastic waste to wholesalers, yet none of them received any assistance. Regarding the types of support provided, only a few plastic waste collectors (seven in total) had received personal protective equipment (PPE), advance payments, or incentives.

Table 4.8. Relationships between plastic waste collectors and their regular buyers

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq	%	Freq	%
1	For whom do you sell plastic wastes regularly?	SME	4	9.1	63	48.5
		Wholesaler	0	0.0	42	32.3

No	Variable label	Characteristics (value)	Formal		Informal	
			Freq	%	Freq	%
		Recycler	37	84.1	4	3.1
		Individual trader	3	6.8	21	16.2
2	What kind of supports did you receive from your regular buyer?	Training	2	4.5	0	0
		Provision of Personal protection equipment (PPE)	0	0.0	1	0.8
		Advance payment (working capital) for buying plastic wastes	0	0.0	1	0.8
		Incentivized/better payment	0	0.0	5	3.8
		Other(specify)	0	0.0	0	0
		None	42	95.5	123	94.6
3	Did you get any support from your regular buyer? <i>*(calculated based on regular buyer. i.e. (variable # 1)</i>	SME/Union	0	0.0	6	9.5
		Wholesaler	0	0.0	0	0.0
		Recycler	2	5.4	1	25.0
		Other individual buyers	0	0.0	0	0.0

Source: Own survey (2024)

The table below outlines the types of support received by plastic waste collectors, categorized by different groups: SMEs/unions, wholesalers, recyclers, and other individual buyers. The data reveals that there is a significant absence of support with most of the buyers operating without any assistance provided to their suppliers.

Table 4.9. Types of Support received by collectors from each regular buyer

Types of support	Regular buyer							
	SME/union		Wholesalers		Recyclers		Other Individual buyers	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
Training	0	0	0	0	2	0	0	0
Provision of Personal protective equipment (PPE) and	0	1	0	0	0	0	0	0

Types of support	Regular buyer							
	SME/union		Wholesalers		Recyclers		Other Individual buyers	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
Advance payment (working capital) for buying plastic wastes	0	1	0	0	0	0	0	0
Incentivized/better payment	0	4	0	0	0	1	0	0
Other(specify)	0	0	0	0	0	0	0	0
No Support	4	57	0	42	35	3	3	21

Source: Own survey (2024)

4.4.2. Payment period and modalities

The payment frequency indicated that 73% of the formal collectors receive their salary for sold plastic wastes monthly. 25% paid weekly and only 2% get a daily wage. In contrast, 81% of informal collectors receive a daily payment, 16 % take a weekly salary and the remaining 3% are remunerated monthly for the plastic waste they have collected. This quantitative analysis is similarly supported by qualitative insights. Since formal collectors are members of the unions, all the payments are made at the end of the month. Besides, the informal collectors supply plastic wastes to different buyers, which allows them to receive the payment during the time of delivery. Sometimes, if a wholesaler or buyer purchases plastic waste every week, the payment will be made at the time of each transaction.

Regarding payment modalities, 97% of informal plastic waste collectors and 61% of formal plastic waste collectors receive payment based on the quantity of plastic waste measured and sold in kilograms. Nearly 40% of formal plastic waste collectors, on the other hand, receive a monthly salary and this payment is only applicable to 3% of informal plastic waste collectors. According to qualitative insights gathered from government cleansing management experts and dry waste union representatives, formal waste collectors receive a monthly salary from the city municipality for their role as dry waste collectors. Additionally, the income generated from plastic waste collection is accumulated separately and paid to them at the end of each month.

Table 4.10. Payment mode and frequency of plastic waste collectors

No	Variable	Characteristics (value)	Formal		Informal	
			Freq	%	Freq	%
1	Payment Modality	Per KG	27	61.4	126	96.9
		Salary	17	38.6	4	3.1
		Other(specify)	0	0	0	0
2	Payment period	Daily	1	2.3	105	80.8
		Weekly	11	25	21	16.1
		Monthly	32	72.7	4	3.1
		Other(specify)	0	0	0	0

Source: Own survey (2024)

4.4.3. Average monthly income

The average monthly income of both groups of plastic waste collectors is determined by the amount of payment and the payment timeline. Additionally, the number of working days is considered based on whether the collectors receive daily or weekly wages. The analysis shows that formal plastic waste collectors earn a comparatively higher average monthly salary of 4,759.1 birr (approximately 84.9 USD). While informal waste collectors receive a slightly lower average monthly income of 4,574. 6 birr (around 81.7 USD). Both figures are calculated based on the average exchange rate from February 2024.

According to (CSA,2020), the national average salary in Ethiopia was around 5000 birrs, equivalent to 127\$ based on the average exchange rate of 2020. These figures indicate that plastic waste collectors in Addis Ababa earn less than the national average when converted to USD at the time of data collection (February 2024). Furthermore, the average monthly income highlights significant disparities compared to earnings in other countries. Although the studies go back a few years, plastic waste collectors typically earn around an average monthly income of 30\$ – 45\$ in Ghana and 30\$ - 130\$ in Nigeria (WIEGO, 2018; UNEP, 2018). In South Africa plastic waste collectors known as “recycling collectors” earn a somewhat better average monthly income, around 140\$ – 280\$ (WIEGO, 2018). A report by the International Labor Organization (ILO), indicated the average monthly salary of waste collectors in India in 2018 was around 110-137 USD. In Philippines and Indonesia, their monthly income was estimated to range from 160\$ -200\$ and 100\$ -137\$ respectively (BPS, 2020; PSA, 2020). In contrast, the median monthly salary of waste collectors in USA was around 3150 USD in 2020 (BLS,2020). Similarly, in the United

Kingdom and Germany, waste collectors earned average monthly salaries of \$2,800 and \$3,400, respectively (GOV.UK, 2020; Destatis, 2020). The comparison indicates plastic waste collectors' income is relatively competitive with waste collectors in some developing countries and highlights the economic opportunities of the waste recovery system for further development with the right support.

4.4.4. Impacts of price variation on collection practice

The quantity of plastic waste collected by informal plastic waste collectors is heavily influenced by the prices offered by small and medium-sized enterprises (SMEs) or buyers. A significant majority, 85%, of these collectors reported being motivated to collect more plastic waste when selling prices rise. In contrast, more than half (57%) of formal plastic waste collectors appear to be unaffected by fluctuations in plastic waste prices. Their collection quantity does not depend on the unit price of plastic waste, regardless of price changes. This is partly attributed to the fact that most of them receive monthly payments, which remain relatively stable and consistent over time. Which is very different from the experience of informal plastic waste collectors.

The involvement of brokers in the value chain usually fluctuates the selling price of plastic wastes. These intermediaries often buy plastic wastes from SMEs and wholesalers; any price they cut off for their brokerage service has made collectors receive a somewhat lesser price than the market value. Recyclers who were key informants for the thesis explained that the commission fee of intermediaries has forced them to pay an augmented price for each unit of plastic waste they purchase. They are concerned that in the long run, the issue will demotivate plastic waste collectors and drain the supply of plastic waste to the recycling plants.

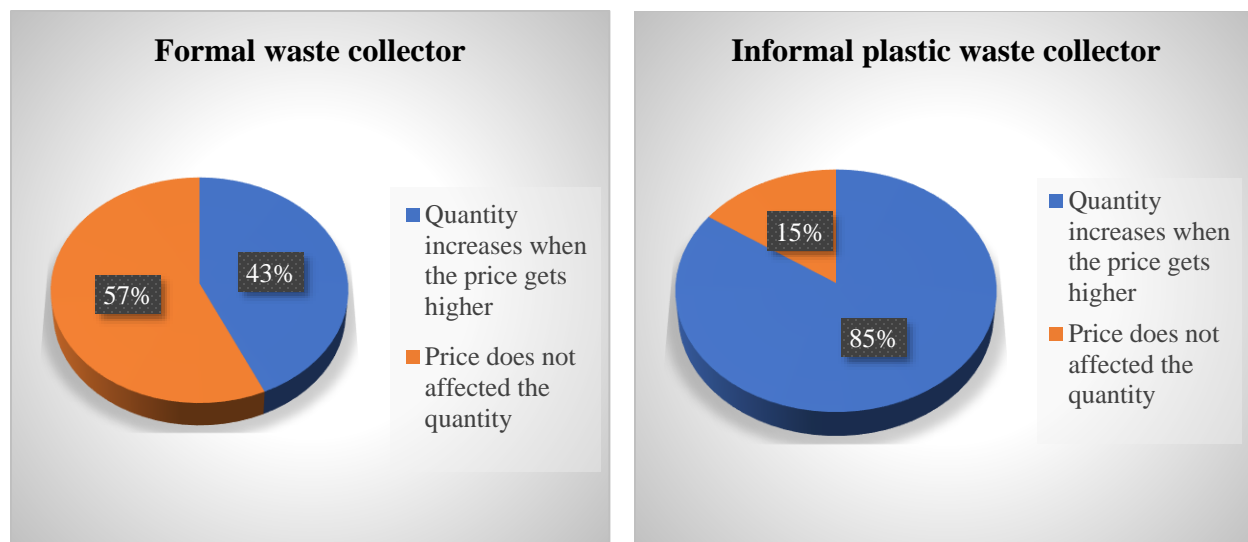


Figure 4.10. Effects of price on the volume of plastic waste collected by collectors

Source: Own survey (2024)

Several studies have emphasized that the involvement of brokers poses a challenge for waste collectors. Research conducted by DiGregorio (1994) and Bejerkli (2004) highlighted that interactions among actors in the waste recovery system illustrate a pattern of exploitation, particularly stemming from dependency on intermediaries for selling plastic waste. These intermediaries often control market access and influence both prices and supply, further aggravating the vulnerabilities faced by informal waste collectors.

4.4.5. Contract arrangements

It seems that there is no official arrangement between actors involved in plastic waste collection activities. 90 % of the total (97% informal and 70% formal waste collectors) have neither written nor unwritten contracts. A little more than a quarter of formal plastic collectors (27%) have written contracts with buyers through their unions. Informal collectors described their arrangement in FGD sessions, confirming they would rather prefer to be free and sell plastic wastes to the buyer that offers a better price. The current price fluctuation of plastic waste has discouraged them from pledging any commitment to buyers. Additionally, as illustrated in Table 4.10, majority of collectors are receiving payment calculated daily, which most buyers agree to but cannot promise to deliver. Besides, KI interviews with SMEs and wholesalers made clear that the absence of a permanent address didn't allow them to bind a contract with the informal plastic waste collectors.

From the total of 13 collectors with either written or unwritten a contract, more than half (53%) reported that the contract terms provided the upper hand to the buyers and resulted in irregular demand for their plastic waste. The other half felt they lost the bargaining power and received less price. Among the informal plastic waste collectors, there are only few waste collectors with contracts and all of them have indicated the arrangement has reduced their bargaining power, leaving them with little choice to negotiate a price. Additionally, they are required to work to avoid long-distance travel carrying the plastic wastes. Consequently, they would rather avoid contracts and enjoy the freedom to work with different buyers. A prior study by Bjerkli (2005) also noted that waste collectors commonly established gentlemen's agreements with their buyers, particularly SMEs and traders located in Merkato's "Minalesh Tera," to secure easier access to recyclable materials. Most of these arrangements were typically based on social class or kinship, highlighting the absence of formal contracts.

Table 4.11. Types of contract plastic waste collectors receive from buyers

No	Variable label	Characteristic (Value)	Formal Collectors		Informal Collectors	
			Freq	%	Freq	%
1	Do you have a contract?	Written contract	12	27.2	0	0
		Unwritten contract	1	2.3	4	3.1
		No contract	31	70.5	126	96.9
2	How did the contract influence you?	Irregular demand	7	15.9	0	0.0
		Lost bargaining power (Low prices paid)	6	13.6	4	3.1
		Forced long-distance travel to collect the wastes	0	0.0	0	0.0
		Other effects	0	0.0	0	0.0
		No contract	31	70.5	126	96.9

Source: Own survey (2024)

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The analysis highlighted that plastic waste is collected from various sources throughout the city, with streets and ditches identified as the primary sources for both formal and informal collectors. This finding indicates plastic waste continues to be disposed of elsewhere, underscoring the crucial role the activity plays in maintaining the city clean.

Plastic waste sorting and segregation practices are inadequate across various sources. A significant disparity exists between formal and informal plastic waste collectors regarding their plastic waste segregation. Informal collectors typically use a single bag to collect various types of plastic waste. Consequently, recyclers highlighted that this inadequate segregation raises their production costs, as they must invest time and resources to clean the mixed plastic materials.

Both unions and SMEs lack access to standard designated storage areas specifically designed for plastic waste. Most informal collectors store their plastic in privately fenced open spaces, while formal plastic waste collectors utilize public open spaces provided by the woreda. The absence of fencing in the storage areas of formal waste collectors made them vulnerable to theft by informal plastic waste collectors.

There is a notable difference in some practices between formal and informal plastic waste collectors. Unlike informal collectors, most formal plastic waste collectors operate while wearing personal protective equipment. In terms of transportation, unions offer self-owned or third-party rented vehicles for their members, facilitating easier access to transportation. Conversely, informal plastic waste collectors face difficulties in transporting collected waste, as they should carry the plastic waste to their buyers.

Informal plastic waste collectors are very important actors in the plastic waste collection value chain. Despite their widespread presence, the study reveals that they are often overlooked and actively excluded from participating in plastic waste collection. Strong terms in existing proclamations, coupled with the weak integration of government cleansing management agencies

with other related offices, remained a challenge to plan and incorporate informal plastic waste collection into the formal system.

The presence of intermediaries in the plastic waste value chain has inflated prices for plastic waste, resulting in lower payments for collectors and higher purchasing costs for recyclers. Additionally, the lack of formal arrangements between plastic waste collectors and buyers, coupled with weak connections between small and medium-sized enterprises (SMEs) and recyclers, facilitates the involvement of brokers, indicating the need for direct links between collectors and buyers.

To wrap up, the study implicates that plastic waste collection is a primary economic activity for many waste collectors who are in the productive age group. Despite its considerable impact on the city's waste management practice, the challenges associated with the activity and the relationship among the actors involved in the value chain indicate that the sector receives less attention than it deserves. This situation underscores the need for better efforts from the government and other stakeholders to address the issues effectively.

5.2. Recommendation

- Community mobilization and awareness programs: Implement targeted public awareness campaigns to educate the community about proper plastic waste management. Particularly, enhancing sorting and segregating practices are particularly crucial to reducing the amount of plastic waste disposed of in streets and ditches. Collaboration between the government's cleansing management agency and environmentally focused organizations is key for developing and executing effective awareness strategies.
- Promote training and support for plastic waste collectors: It is important to identify gaps and establish training programs for both formal and informal plastic waste collectors, particularly on effective sorting and segregation practices. Additionally, providing support such as personal protective equipment and standard waste collection bags will ensure more efficient and consistent waste collection practices.
- Provide designated storage facilities and transportation options: Create standardized, secure storage facilities for both formal and informal plastic waste collectors to mitigate theft and improve storage conditions. Furthermore, collaborate with NGOs, local organizations, and businesses to develop subsidized transportation solutions for informal collectors, enhancing their ability to transport waste effectively.

- Integrating informal plastic waste collectors and strengthening sectoral collaboration: Incorporating informal plastic waste collectors into the formal waste collection system is essential for improving their working conditions and providing access to necessary resources. The government should revise existing regulations to establish a more inclusive waste management framework that recognizes their contributions. The integration should include training and resource-sharing initiatives to enhance their participation in the plastic waste value chain and improve overall efficiency. Additionally, cleansing management and affiliated offices must collaborate more effectively to improve plastic waste collection practices and address related challenges.
- Establish a direct link between plastic waste collectors and buyers: Government should take the initiative and collaborate with stakeholders to create direct links that enable plastic waste collectors to engage with buyers, minimizing the involvement of intermediaries. This will ensure fair compensation and better economic opportunities for waste collectors. Additionally, recyclers, unions, and SMEs need to enhance communication to maintain a consistent supply of plastic waste and strengthen market linkages.

References

- Abdel-Shafy, H. I., & Mansour, M. S. (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorization. *Egyptian Journal of Petroleum*, 27(4), 1275–1290. <https://doi.org/10.1016/j.ejp.2018.05.007>
- Ackoff, R.L. 1974. Redesigning the future: A systems approach to societal problems. New York: Wiley.
- Addis Ababa Cleansing Management Agency. (2023). *Annual report* (Vol. 6, No. 07, February 2023).
- Adefris, W., Damene, S., & Satyal, P. (2023). Household practices and determinants of solid waste segregation in Addis Ababa city, Ethiopia. *Humanities and Social Sciences Communications*, 10, 516. <https://doi.org/10.1057/s41599-023-01982-7>
- Afullo, A., & Odhiambo, F. (2009). The primary solid waste storage gaps experienced by Nairobi households. *Ethiopian Journal of Environmental Studies and Management*, 2(3), 2009.
- Al-Salem, S. M., Lettieri, P., & Baeyens, J. (2009). Recycling and recovery routes of plastic solid waste (PSW): A review. *Waste Management*, 29(10), 2625–2643. <https://doi.org/10.1016/j.wasman.2009.02.007>
- Alhazmi, H., Almansour, F. H., & Aldhafeeri, Z. (2021). Plastic waste management: A review of existing life cycle assessment studies. *Sustainability*, 13, 5340. <https://doi.org/10.3390/su13105340>
- Babayemi, J. O., Nnorom, I. C., Osibanjo, O., & M. O. (2019). Ensuring sustainability in plastics use in Africa: Consumption, waste generation, and projections. *Environmental Sciences Europe*, 31(1), 60. <https://doi.org/10.1186/s12302-019-0254-5>
- Badan Pusat Statistik. (2020). *Statistical yearbook of Indonesia 2020*. Jakarta, Indonesia: BPS-Statistics Indonesia. Retrieved from <https://www.bps.go.id/en/publication/2020/04/29/e9011b3155d45d70823c141f/statistical-yearbook-of-indonesia-2020.html>
- Behuria, P. (2019). *The comparative political economy of plastic bag bans in East Africa: why implementation has varied in Rwanda, Kenya and Uganda*. (Global Development Institute Working Paper Series; No. 2019-037). University of Manchester, Global Development Institute. <http://hummedia.manchester.ac.uk/institutes/gdi/publications/workingpapers/GDI/gdi-working-paper-2019037-behuria.pdf>
- Berhanu A. (2014). *Prospects and challenges of solid waste management in Addis Ababa: The case of Bole Sub-City*. <https://api.semanticscholar.org/CorpusID:114853211>

- Bhandari, P. (2023, June 22). Multistage sampling: Introductory guide & examples. *Scribbr*. <https://www.scribbr.com/methodology/multistage-sampling/>
- Bharadwaj, A., Yadav, D., & Varshney, S. (2015). Non-biodegradable waste - its impact & safe disposal. *International Journal of Advanced Technology in Engineering and Science*, 3, 184–191.
- Bjerkli, C. L. (2005). The cycle of plastic waste: An analysis on the informal plastic recovery system in Addis Ababa, Ethiopia. July 2005.
- Boampong, O., Britwum, A. O., & Akorsu, A. D. (2020). Informal operators in waste management in Accra, Ghana: From neglect to recognition? *Oguaa Journal of Social Sciences*, 9(1), 25–36. <https://doi.org/10.47963/joss.v9i1.322>
- Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: Creating healthy emissions—a strategy for eco-effective product and system design. *Journal of Cleaner Production*, 15(13), 1337-1348. <https://doi.org/10.1016/j.jclepro.2006.08.002>
- British Plastics Federation (BPF). (2021). *How is plastic made? A simple step-by-step explanation*. London, UK. <https://www.bpf.co.uk/plastipedia/how-is-plastic-made.aspx>
- Brundtland, G. H. (1987). Our common future: Call for action. *Environmental Conservation*, 14(4), 291-294.
- Bureau of Labor Statistics. (2020). Occupational employment and wage statistics: Refuse and recyclable material collectors. U.S. Department of Labor. <https://www.bls.gov/oes/current/oes532021.htm>
- Clement, R.W. 2005. The lessons from stakeholder theory for U.S. business leaders. *Business Horizons*, 48: 255-264.
- Cohen, B., & Muñoz, P. (2016). Sharing cities and sustainable consumption and production: Towards an integrated framework. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2016.07.005>
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approach* (4th ed.). SAGE Publications.
- Datta, S. (2018). *Sampling methods*. <https://doi.org/10.13140/RG.2.2.22856.57605>
- DiGregorio, M. R. (1994). *Urban harvest: Recycling as a peasant industry in Northern Vietnam*. East-West Center Occasional Papers, Environmental Series No. 17.
- Dayal, U. (1994). High-temperature SEC coupled with MALLS detector for evaluating the end-use performance of LDPE. *Journal of Applied Polymer Science*, 53(11), 1557-1562. <https://doi.org/10.1002/app.1994.070531201>

- Derraik, J. G. B. (2002). The pollution of the marine environment by plastic debris: A review. *Marine Pollution Bulletin*, 44(8), 842-852.
[https://doi.org/10.1016/S0025-326X\(02\)00220-5](https://doi.org/10.1016/S0025-326X(02)00220-5)
- Diriba, D., & Meng, X.-Z. (2021). Rethinking the solid waste management system of Addis Ababa, Ethiopia. *Journal of Advances in Environmental Health Research*, 9(1), 7-22.
<https://doi.org/10.32598/JAEHR.9.1.1198>
- Dwivedi, Y., Rana, N., Jeyaraj, A., Clement, M., & Williams, M. (2019). Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, 21(1), 1-16. <https://doi.org/10.1007/s10796-017-9774-y>
- Ellen MacArthur Foundation. (2013). Towards the circular economy: Economic and business rationale for an accelerated transition. http://www.feve.org/OPENDAY-FEVE-2013/120130_EMF_CE_Full%20report_final.pdf
- Ellen MacArthur Foundation. (2016). Circular economy: Schools of thought.
<https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Circular-Economy-Schools-of-Thought-Report-2016.pdf>
- Ellen MacArthur Foundation. (2012). *Ellen MacArthur Foundation*.
<http://www.ellenmacarthurfoundation.org/>
- Ethiopian Central Statistical Agency (CSA). (2007). *National population abstracts projection report for Ethiopia*. Addis Ababa.
- Ethiopian Central Statistical Agency. (2020). *Report on the average monthly salary in Ethiopia*.
- Ethiopian Government. (2016). *Cooperative societies proclamation* (Proclamation No. 985/2016). Federal Negarit Gazette No. 7, 23 December 2016. FAOLEX No. LEX-FAOC183186.
- Ethiopian Ministry of Environment, Forest and Climate Change. (2018). *Solid waste management in Ethiopia: Challenges and opportunities*.
- Ethiopian Standards Institute. (2021). *Municipal solid waste management: Segregation, collection, and utilization at household for recovery and recycling (ES 6433)*.
- European Commission (EC). (2014a). Development of guidance on extended producer responsibility (EPR). Retrieved from
http://ec.europa.eu/environment/waste/pdf/target_review/Guidance%20on%20EPR%20-%20Final%20Report.pdf
- European Commission (EC). (2015). Single Market for Green Products Initiative. Retrieved from <http://ec.europa.eu/environment/eussd/smgp/>

- Ezeah, C., & Roberts, C. L. (2012). Analysis of barriers and success factors affecting the adoption of sustainable management of municipal solid waste in Nigeria. *Journal of Environmental Management*, 103, 9-14. <https://doi.org/10.1016/j.jenvman.2012.02.016>
- Federal Democratic Republic of Ethiopia. (1999). *Proclamation No. 513/1999: Proclamation on the prohibition of plastic bags*. Addis Ababa: Government of Ethiopia.
- Federal Democratic Republic of Ethiopia. (2007). *Solid Waste Management Proclamation (Proclamation No. 513/2007)*. Federal Negarit Gazeta, 13th year, 12 February 2007, pp. 3524–3531. FAOLEX NoLEX-FAOC095457.
- Federal Democratic Republic of Ethiopia. (2018). *Solid Waste Management Proclamation (Proclamation No. 1090/2018)*. Federal Negarit Gazeta, 24th year, 28th March 2018.
- Federal Statistical Office of Germany (Destatis). (2020). Earnings in the waste collection sector. https://www.destatis.de/EN/Home/_node.html
- Freeman, R.E. 1984. *Strategic Management: A Stakeholder Approach*. Boston: Pitman Publishing Inc.
- Freeman, R. E., Phillips, R., & Sisodia, R. (2020). Tensions in stakeholder theory. *Business & Society*, 59(2), 213-231.
- Frosch, R. A., & Gallopoulos, N. E. (1989). Strategies for manufacturing. *Scientific American*, 261(3), 144-152. <https://doi.org/10.1038/scientificamerican0989-144>
- Gelan, E. (2021). Municipal solid waste management practices for achieving green architecture concepts in Addis Ababa, Ethiopia. *Technologies*, 9, 48. <https://doi.org/10.3390/technologies9030048>
- Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science Advances*, 3(7), e1700782. <https://doi.org/10.1126/sciadv.1700782>
- GIZ. (2021). *Plastic consumption and recycling in Addis Ababa, Ethiopia: Natural resources stewardship programme*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. <https://nature-stewardship.org/wp-content/uploads/Plastic-Baseline-Study-Ethiopia.pdf>
- GOV.UK. (2020). *Waste management: A guide for local authorities*. UK Government. Retrieved from <https://www.gov.uk/guidance/waste-management-a-guide-for-local-authorities>
- Hondo, D., Arthur, L., & Gamaralalage, P. J. D. (2020). Solid waste management in developing Asia: Prioritizing waste separation. *Journal of Environmental Management*, 252, 109677. <https://doi.org/10.1016/j.jenvman.2019.109677>

- Hnatuyk, V., Pshenychna, N., Kara, S., Kolodii, V., & Yaroshchuk, L. (2024). Education's role in fostering environmental awareness and advancing sustainable development within a holistic framework. *Multidisciplinary Reviews*, 7, Article 2024spe012. <https://doi.org/10.31893/multirev.2024spe012>
- Hoornweg, D., & Bhada-Tata, P. (2012). *What a waste: A global review of solid waste management*. World Bank.
- Ingabire, D., Ntihemuka, F., Mugabo, G., Isabane, R., & Turatimana, T. (2018). Recycling high-density polyethylene (HDPE) into construction materials as a key step in plastic waste reduction: Case of Kigali City. *Rwanda Journal of Engineering, Science, Technology and Environment*, 1(1), 10–18. <https://doi.org/10.4314/rjeste.v1i1.2S>
- International Labour Organization. (2018). *Waste management and the informal economy*. International Labour Organization.
- International Labour Organization. (2019). *Decent work country profile: Ethiopia*.
- Jacob, M. K., Wernsted, K., & Kaseva, M. (2021). Waste segregation and potential for recycling: A case study in Dar es Salaam City, Tanzania. *Sustainable Environment*, 7(1), Article 1935532. <https://doi.org/10.1080/27658511.2021.1935532>
- Jambeck, J. R., Hardesty, B. D., Brooks, A. L., Friend, T., Teleki, K., Fabres, J., Beaudoin, Y., Bamba, A., Francis, J., Ribbink, A., Baleta, T., Bouwman, H., Knox, J., & Wilcox, C. (2017). Challenges and emerging solutions to the land-based plastic waste issue in Africa. *Marine Policy*, 96, 256-263. <https://doi.org/10.1016/j.marpol.2017.10.041>
- Jha, M. (2021). Plastic waste collection in India: A look at informal sector involvement. *Indian Journal of Environmental Management*, 12(2), 134-147.
- Jones, T. M. 1995. Instrumental stakeholder theory: A synthesis of ethics and economics. *Academy of Management Review*, 20: 404-437.
- Kaur, S. (2021). Sample size determination. *International Journal of Current Research*, 9, 48365-48367.
- Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). Circular economy: From review of theories and practices to development of implementation tools. *Resources, Conservation and Recycling*, 135, 190-201. <https://doi.org/10.1016/j.resconrec.2017.10.034>
- Kaza, S., Yao, L. C., Bhada Tata, P., Van Woerden, F., Martin, T. M. R., Serrona, K. R. B., Thakur, R., Pop, F., Hayashi, S., Solorzano, G., Alencastro Larios, N. S., Poveda, R. A., & Ismail, A. (2018). *What a waste 2.0: A global snapshot of solid waste management to 2050* (Urban Development Series). Washington, D.C.: World Bank Group. <https://doi.org/10.1596/978-1-4648-1404-6>

- Kihila, J. M., Wernsted, K., & Kaseva, M. (2021). Waste segregation and potential for recycling: A case study in Dar es Salaam City, Tanzania. *Sustainable Environment*, 7(1), Article 1935532. <https://doi.org/10.1080/27658511.2021.1935532>
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Lissah, S. Y., Ayanore, M. A., Krugu, J., & Ruiter, R. A. C. (2020). Psychosocial risk, work-related stress, and job satisfaction among domestic waste collectors in the Ho municipality of Ghana: A phenomenological study. *International Journal of Environmental Research and Public Health*, 17(8), 2903. <https://doi.org/10.3390/ijerph17082903>
- Luijsterburg, B., & Goossens, H. (2014). Assessment of plastic packaging waste: Material origin, methods, properties. *Resources, Conservation and Recycling*, 85, 88–97. <https://doi.org/10.1016/j.resconrec.2014.01.015>
- Martin, W. F., Lippitt, J. M., & Webb, P. J. (2000). *Hazardous waste handbook*. <https://www.elsevier.com/books/hazardous-waste-handbook/lippitt/978-0-7506-7135-4>
- McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*. North Point Press.
- Medina, M. (1997). *The world and scavengers: A World Bank report on scavenging for sustainable development* (UN/84/R-97/002). United Nations.
- National Centre for Waste Management. (2023). *Technical guidelines for temporary storage of waste* (Ref# TG-WM-07 Eng Vs.01). Retrieved from <https://kh.aquaenergyexpo.com/wp-content/uploads/2024/03/Technical-Guidelines-Temporary-Storage-of-Waste.pdf>
- National Meteorology Agency. (2017). *Climate of major cities: Addis Ababa*. Retrieved from <http://www.ethiomet.gov.et/climates/climate%20of%20city/3352/Addis%20Ababa>
- Neuman, M. (2005). The compact city fallacy. *Journal of Planning Education and Research*, 25(1), 11-26. <https://doi.org/10.1177/0739456X04270466/>
- Oberlin, A. S. (2013). Resource recovery potential: A case study of household waste in Kinondoni municipality, Dar es Salaam. *TaJONAS: Tanzania Journal of Natural and Applied Sciences*, 4(1), 563–574.
- Odonkor, S., & Sallar, A. (2021). Correlates of household waste management in Ghana: Implications for public health. *Heliyon*, 7, Article e08227. <https://doi.org/10.1016/j.heliyon.2021.e08227>
- OECD. (2022). *Global plastics outlook: Economic drivers, environmental impacts and policy options*. OECD Publishing. <https://doi.org/10.1787/de747aef-en>

- Office of the Special Coordinator for Africa and the Least Developed Countries. (1996). *Informal sector development in Africa: Locating Africa's informal sector*. United Nations.
- Pomponi, F., & Moncaster, A. (2017). Circular economy for the built environment: A research framework. *Journal of Cleaner Production*, *143*, 710–718. <https://doi.org/10.1016/j.jclepro.2016.12.055>
- Public Service Announcement. (2020). Waste management sector report. Philippine Statistics Authority. <https://www.psa.gov.ph/waste-management>
- Ragaert, K., Delva, L., & Van Geem, K. (2017). Mechanical and chemical recycling of solid plastic waste. *Waste Management (New York, N.Y.)*, *69*, 24–58. <https://doi.org/10.1016/j.wasman.2017.07.044>
- Regassa, N., Sundaraa, R. D., & Seboka, B. (2016). Challenges and opportunities in municipal solid waste management: The case of Addis Ababa City, central Ethiopia. *Waste Management*, *54*, 52-62. <https://doi.org/10.1080/09709274.2011.11906358>
- Saseanu, A. S., Gogonea, R.-M., Ghita, S. I., & Zaharia, R. Ş. (2019). The Impact of Education and Residential Environment on Long-Term Waste Management Behavior in the Context of Sustainability. *Sustainability*, *11*(14), 3775. <https://doi.org/10.3390/su11143775>
- Singh, A. S., & Masuku, M. B. (2014). Sampling techniques and determination of sample size in applied statistics research: An overview. *International Journal of Economics, Commerce, and Management*, *2*(11), 1-22.
- Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7th ed.). Pearson Education.
- SBPDA. (2004c). *Solid waste disposal*.
- SBPDA. (2004d). *Solid waste collection, transport, and transfer station*.
- Sethuraman, S. V. (1981). *The urban informal sector in developing countries: Employment, poverty and environment*. International Labour Office.
- Sauvé, S., Bernard, S., & Sloan, P. (2015). Environmental sciences, sustainable development and circular economy: Alternative concepts for trans-disciplinary research. *Environmental Development*. <https://doi.org/10.1016/j.envdev.2015.09.002>
- Stahel, W. R. (2013). Policy for material efficiency—Sustainable taxation as a departure from the throwaway society. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(1986), 20110567. <https://doi.org/10.1098/rsta.2011.0567>
- Stahel, W. (2016). The circular economy. *Nature*, *531*, 435. <https://doi.org/10.1038/531435a>

- Soluap. (2023). *Addis Ababa population and sub-city information*. Retrieved from <https://soluap.com>
- Sturdivant, F.D. 1979. Executives and activists: Test of stakeholder management. *California Management Review*, 22(1) 53-60.
- Taherdoost, H. (2016). Sampling methods in research methodology: How to choose a sampling technique for research. *International Journal of Academic Research in Management (IJARM)*, 5. <https://hal-02546796>
- Tesfaye, T. (2020). *Environmental impacts of disposable PET plastic bottles: The case of water bottling companies in Addis Ababa* (Master's thesis). Addis Ababa University
- Teshager Alemu, K. (2017). *Formal and informal actors in Addis Ababa's solid waste management system*. The Institute of Development Studies and Partner Organisations. <https://hdl.handle.net/20.500.12413/12870>
- Thomas, L. (2023, February 13). *Cluster sampling: A simple step-by-step guide with examples*. Scribbr. Retrieved from <https://www.scribbr.com/methodology/cluster-sampling/>
- United Nations. (2016). *Sustainable Development Goals - Goal 11: Make cities inclusive, safe, resilient and sustainable*. <https://www.un.org/sustainabledevelopment/cities/>
- UNDP Ethiopia. (2020). *Minalesh Tera: How Addis Ababa's informal recycling and reusing market supports formal waste management*. Retrieved from <https://et.undp.org/content/ethiopia/en/home/blog/2020/minalesh-tera-how-addis-ababas-informal-recycling-and-reusing-m.html>
- United Nations Environment Programme. (2018). *Assessment of waste management systems in Nigeria*. United Nations Environment Programme.
- Walsh, J. P., Taking stock of stakeholder management. *Academy of Management Review*, (Vol. 30, No. 2, 2005), 426–438
- WIEGO. (2013, June 26). *Association book: Diom des récupérateurs et recycleurs de Mbeubeuss*. Retrieved from <http://www.wiego.org/content/association-book-diom-des-récupérateurs-et-recycleurs-de-mbeubeuss>
- WIEGO. (2018). *Kayayo: The impact of informal waste collection on women in Accra, Ghana*. Women in Informal Employment: Globalizing and Organizing
- Wilson, D. C. (2015). *Global waste management outlook: Summary for decision-makers*. United Nations Environment Programme (UNEP).

- Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, 30(4), 797-808.
<https://doi.org/10.1016/j.habitatint.2006.05.001>
- Woldetsadik, T., & Oumer, S. (2021). The informal waste management sector in Addis Ababa: Challenges and prospects. *Ethiopian Journal of Environmental Studies and Management*, 14(1), 1-15.
- World Bank. (2016, February 16). *Morocco lets nothing go to waste*. Retrieved from
<http://www.worldbank.org/en/news/feature/2016/02/16/morocco-lets-nothing-go-to-waste>
- World Bank. (2018, March 27). *Solid waste management*. Retrieved from
<http://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>
- World Bank. (2021). *Extending operational support for waste management and delivery to cities in Ethiopia*. Retrieved from
<https://www.worldbank.org/en/news/feature/2021/06/08/extending-operational-support-for-waste-management-and-delivery-to-cities-in-ethiopia-tclc>
- WRAP. (2016). *WRAP and the circular economy*. <https://www.wrap.org.uk/content/wrap-and-circular-economy>
- Yoda, R. M., Chirawurah, D., & Adongo, P. B. (2014). Domestic waste disposal practices and perceptions of private sector waste management in urban Accra. *BMC Public Health*, 14(1), 1–10. <https://doi.org/10.1186/1471-2458-14-1>
- Yousefloo, A., & Babazadeh, R. (2020). Designing an integrated municipal solid waste management network: A case study. *Journal of Cleaner Production*, 244, 118824.
<https://doi.org/10.1016/j.jclepro.2019.118824>
- Yu, J., Williams, E., Ju, M., & Shao, C. (2010). Managing e-waste in China: Policies, pilot projects, and alternative approaches. *Resources, Conservation and Recycling*, 54(11), 991-999.
<https://doi.org/10.1016/j.resconrec.2010.02.002>
- Zurbrugg, C., Gfrerer, M., Ashadi, H., Brenner, W., & Kuehr, R. (2012). Determinants of sustainability in solid waste management: The Gianyar Waste Recovery Project in Indonesia. *Waste Management*, 32(11), 2126–2133. <https://doi.org/10.1016/j.wasman.2012.01.011>
- Parmar, B. L., Freeman, R. E., Harrison, J. S., Wicks, A. C., Purnell, L., & de Colle, S. (2010). Stakeholder theory: The state of the art. *Academy of Management Annals*, 4(1), 403–445.
<https://doi.org/10.1080/19416520.2010.495581>
- Phillips, R. (2003). *Stakeholder theory and organizational ethics*. Berrett-Koehler Publishers.
- Post, J. E., Preston, L. E., & Sachs, S. (2002). *Redefining the corporation: Stakeholder management and organizational wealth*. Stanford Business Books.

Annex

Annex I

Questionnaires

Quantitative Data collection

Plastic waste collectors.

Consent: Good morning/Good afternoon. My name is (____). I am MA student in Addis Ababa university. This questionnaire is developed as part of my master's degree on plastic waste collection in Addis Ababa. The study is aimed to gather information from plastic waste collectors, SME and, other stakeholders about the practice, challenges and opportunities of plastic waste collection. The information you will provide will be very valuable and kept confidential that will not be used for any purpose rather than being an input to this the proposed thesis. The interview will take around 15-20 minutes. Your participation is entirely voluntary; you have the right not to participate, skip any question you don't want to answer, or terminate your interview at any time you want. If at any point there are any questions you do not understand, please feel comfortable to ask explanation. Furthermore, after the interview, if you have any concerns you can call to +251911993475. Thank you in advance for your time and cooperation.

Do you consent to participate in the survey?

1. Yes
2. No

Resp Id = _____

Sample category: (Types of collectors):

1. Formal
2. Informal

Part 1. Social and Demographic status of respondents.

1. Name of respondent? _____
2. Age of the respondent?

- <15 = 1
- 15 to 24 =2
- 25 to 34 = 3
- 35 to 49= 4
- > 49

3. Sex of the respondent?

- Male = 1
- Female= 2

4. Respondent's marital status?

- Never married = 1
- Married = 2
- Divorced= 3
- Widowed = 4

5. What is your educational level?

- No formal education = 1
- Primary education (1-8) = 2
- secondary education (9-12) = 3
- TVET = 4
- College/University = 5
- Higher education = 6

6. What's the size of your household you live in currently? Male = ____, Female = ____

7. What's your relation to the head of the household?

- I am the head of the household = 1
- Partner/Spouse =2
- Son/daughter = 3
- Sister/Brother = 4
- Mother/Father = 5
- Relative = 6

- Other (specify) = 7

8. How much is your usual household monthly income?

- <2500 = 1
- 2501 -5000 = 2
- 5001- 7500 = 3
- 7501-10000 = 4
- 10001-12500 = 5
- 12501-15000 = 6
- >15000 = 7

9. Approximately how much is your share from the household monthly income?

- 100% (solely support the entire household) = 1
- 75% (contribute 3/4th of the household income) = 2
- 50 % (contribute 50% of the household income) = 3
- 25 % (contribute quarter of the household income) = 4
- <25% (Contribute less than quarter of the household income) = 5

Part 2. Main section

Section 1. Current plastic waste collection practice#

Now I would like to ask you about your current plastic waste collection practice.

1. From where do you collect the majority of the plastic wastes?

- Market area =1
- Dwelling area/ Door to door =2
- Streets and ditches =3
- Waste dumping site/Containers = 4
- Institutions = 5
- Hotels and restaurant = 6
- Other (Specify) = 7

2a. What type of plastic wastes do you collect? (Multiple option)

- Polyethylene Terephthalate (PET/PETE) = 1
- High-Density Polyethylene (HDPE)=2
- Polyvinyl chloride (PVC) = 3
- Low-Density Polyethylene (LDPE) = 4
- Polypropylene (PP) = 5
- Polystyrene (PS) = 6
- Polycarbonate (PC)= 7

2b. Which one do you collect the most? (single response)

- Polyethylene Terephthalate (PET/PETE) = 1
- High-Density Polyethylene (HDPE)=2
- Polyvinyl chloride (PVC) = 3
- Low-Density Polyethylene (LDPE) = 4
- Polypropylene (PP) = 5
- Polystyrene (PS) = 6
- Polycarbonate (PC)= 7

3. How often do you segregate/sort plastic wastes collected from _____ ((insert source)?)

	Regularly =1, Sometimes = 2, Rarely = 3, Segregated from the source (never did any segregation) = 4, Not applicable (don't collect from this source) = 5
Market area (open markets)	
Dwelling area/ Door to door	
Streets and ditches	
Waste dumping site/Containers	
Institutions	
Hotels and restaurant	
Others (specify)	

4. Do you use separate collection bag for different types of plastic waste?

- Yes = 1
- No = 2
- Not applicable (if only one type is collected) = 3

5. How frequently do you collect plastic wastes?

- Daily = 1
- More than once in a week =2
- Weekly =3
- More than once in a month =4
- Monthly = 5
- Less than once in a month = 6
- Other (specify) =7

6. On average how many Kg of plastic waste do you collect in a day? =.....

- < 10 kg = 1
- 10 – 20 kg =2
- 21 – 30 kg =3
- 31 – 40 kg = 4
- 41 – 50 kg = 5
- >50 kg = 6

7. Regularly, how many hours in a day does it take you to collect?

- < 1 hour =1
- 1 to 2 hours = 2
- 2 to 4 hours = 3
- 4 to 6 hours = 4
- 6 to 8 hours = 5
- More than 8 hours = 6

8. How do you transport the collected plastic waste to the buyer (SME/Union/wholesaler/recycling) storage location/facility? (Multiple)

- Using SME's /Union/ wholesalers /Recycler's dedicated collection vehicles =1
- Hiring third-party transportation =2
- Carrying (by foot) = 3

9. Where do you store or drop in the plastic waste collected? (Multiple)

- In a dedicated warehouse =1
- In a fenced a compound; open space = 2
- In public open space; unfenced = 3

10. Do you buy plastic wastes from the source?

- Yes = 1
- No =Skip to section 2

11. From whom/where do you buy? (Multiple)

- Market area (shop owners) =1
- Dwellers =2
- Street sweepers = 3
- Institutions = 4
- Hotels and restaurant = 5
- Others (specify) = 6

Section 2. Challenges and opportunities of plastic waste collection activities

<p>Q1. Associated with your plastic waste collection activities, have you ever faced the following challenges? Yes = 1, No = 2</p>		<p>Q2. How likely does it hinder your plastic waste collection activities? Very likely =1 Likely = 2 Slightly = 3 Unlikely = 4</p>
Lack of transportation for collected waste		
Low prices paid for collected plastic waste		
Lack of proper equipment for sorting/segregating the wastes (waste bins, collection bags)		
Limited number of plastic waste buyers		

Difficulty of accessing waste collection points		
Lack of /Insufficient storage space		
Competition from other informal waste collectors		
Competition from other formal waste collectors		
Lack of provision of personal protecting equipment (gloves/masks).		
Lack of knowledge on how to collect, sort and segregate plastic wastes		
Health issues from exposure to waste or Physical strain due to nature of work		
Lack of support from local authorities or lack of official recognition		
Other (please specify) _____		

3. Do you take any kind of safety measurements when collecting plastic wastes?

- Yes = 1
- No = 2

4. Have you ever taken any trainings about the role of plastic waste collection on the environment?

- Yes = 1
- No = 2 ... Skip to Q6

5. Who provided the training? (Multiple Option)

- NGO =1
- Government =2
- SME/Union/trader/buyer =3
- Recycle industries =4
- Others (Specify) = 5

6. In your opinion, what are the importance of the current plastic waste collection activity?
(Multiple option)

- It supports many livelihoods = 1
- Comparatively it's a better earning job=2
- It prevents environmental pollution = 3
- Raises environmental awareness in communities =4
- Promotes recycling = 5
- Other (specify) = 6

Section 3. The relationship between plastic waste collectors and plastic waste buyers

1. For whom do you sell the collected plastic wastes regularly?

- SMEs/unions =1
- Wholesalers =2
- Recyclers = 3
- Other individual buyers = 4

2. How frequent do you receive your payment?

- Daily= 1
- Weekly = 2
- Monthly =3
- Other =4

3a. What is the main payment modal?

- Per Kg = 1
- In Salary = 2
- Other (specify) = 3

3b. Typically how much do you receive? _____

4. Does the price paid by your buyer (MSE/Union/recycler...) affect the amount of plastic waste you collect?

- Yes, I collect more when prices are higher = 1
- No, the amount I collect does not depend on prices = 2

5. Do you have a contract or arrangement with plastic waste buyers?

- Yes, written =1
- Yes, unwritten = 2
- No = 3 Skip to 8

6. Did the contract or arrangement negatively affected your plastic waste collection activities?

- Yes = 1
- No = 2 ...Skip to Q8

7. How did the arrangement influence you? (multiple)

- Caused irregular demand =1
- Lost(took) bargaining power (Low prices paid) =2
- Forced long distance travel to collect the wastes =3
- Other(specify) = 4

8. What kind of supports did you received from your regular buyer? (Multiple)

- Trainings =1
- Provision of Personal protective equipment (PPE) = 2
- Advance payment (working capital) for buying plastic wastes =3
- Incentivized/better payment =4
- Other(specify) =5
- None = 6

Qualitative instruments

A. FGD Guide: For Plastic waste collectors

Background of Participants

<i>Name</i>	<i>Age</i>	<i>Sex</i>	<i>Address</i>	<i>Sample type</i> <i>(Formal/Informal)</i>

1. How long have you been in plastic waste collection job? What other job(s) do you do? From which job are you earning more? (Asses if plastic waste activity poses better income opportunity)
2. What type of plastic wastes do you prefer the most? Which ones is the least preferred to collect? why?
3. How and where do you sort plastic wastes?
4. What are your criterions to select collection/operation area or wordeda?
5. What methods do you use to collect and supply plastic wastes? (Most convenient collection time, the distance and time it takes to supply plastic wastes....)
6. what are the challenges encountered in storing and transporting collected plastic wastes?
7. What are the social, financial and regulatory constraints in plastic waste collection activities?
8. What kind of safety measurements do you take when collecting plastic wastes?
9. In relation to NGO's, government and other stakeholders involved in plastic waste collection, what do you think are the opportunities presented for your plastic waste collection activities?
10. How do you asses your relation with your buyers? Also, the existing contract or arrangement between

B. KI Interview guide: Small and Micro Enterprises/Plastic waste buyers

Name of SME: _____

Number of Members: _____, *Male* = _____, *Female* = _____

Name of respondent: _____, *Sex:* _____

Position: _____

1. What kind of solid waste activities do you carry out? Who are your suppliers?
2. How do you ensure the proper disposal of collected plastic waste? What do you do with the plastic waste collected?
3. What are the social, financial and regulatory constraints that affect your plastic waste collection activities and hinder sustainable waste management practice?
4. Where do you store the plastic waste collected? How do you evaluate the storage facility in light of environment pollution?

5. Is there any policies or regulations in place to promote or hinder the plastic waste collection activities? How?
6. How do you assess your relation with plastic waste collectors? What kind of arrangement do you have with them?
7. What kind of support or assistance do you think would be most beneficial in improving the relationship between plastic waste collectors and MSEs?
8. What are the potentials do you see within the plastic waste collection sector?

C. Recyclers

Name of the recycler: _____

Name of the respondent: _____

1. Considering the current practice, how do you perceive your role in plastic waste collection?
2. What challenges do you face in managing plastic wastes? Are there any specific types of plastic waste that are more difficult for you to manage or recycle? why?
3. How do you compare the quality and price of recycled products with similar new plastic products? Does it affect your recycling activities?
4. From your perspective, do you think you are getting adequate plastic wastes for your recycling activities? If not, why and how do you resolve it?
5. Do you currently have any partnerships or interactions with plastic waste collectors and suppliers? What are the arrangements?
6. What kind of support or assistance do you think would be important to improve plastic waste collection activities?

D. KI guide: For government cleansing and waste management and cleansing agency experts

Name of the expert: _____

Position: _____

1. What do you think is the positive impact of current plastic waste activities towards the city environment?

2. What are the social, financial and structural constraints in plastic waste collection activities?
3. How do you assess the role and relation between plastic waste collector, MSE and recyclers in the sector?
4. How do you evaluate formal and informal waste collectors? Is there a significance difference between them that could influence the plastic waste collection activities?
5. How do you evaluate the relationship between the government and other stakeholders in plastic waste collection? Is there any partnership? What are their prospects and constraints for the sector?
6. Which kind of supports do you provided to actors involved in plastic waste collection?
7. Which kind of changes do you think should the government implement for sustainability of plastic waste collection? What's expected from the waste collectors and other stakeholders?
8. Which plastic waste related direction, policies or regulation are difficult to implement? Why? What must be done improve the problems?

E. NGO's (Partners)

Name of the partner: _____

Name and position of the respondent: _____

Introduction question: In what way are you supporting plastic waste collection activities?

1. In your perspective how do you asses the current plastic waste collection; and the performance of the actors engage in the activities?
2. How do you assess your relation with MSE, collectors, government and recyclers in the sector?
3. According to your perspective what are the potential economic or environmental benefits of strengthening the relationship between plastic waste collectors, MSEs/ traders and recyclers?
4. How do you assess the environmental knowhow of the current plastic waste collectors? What are the challenges in educating them about environmental pollution?
5. What kind of support or assistance do you think would be most beneficial to improve the relationship between plastic waste collectors, MSEs and recyclers?

Thank you for your participation!!!

Annex II

1. Profile of focus group discussion participants

A. FGD 1

Study location: Bole Sub-City, woreda 12

Group: Formal plastic waste collectors

	Name	Sex	Age group	Marital status	Educational status
1	Participant 1	Male	15-24	Never married	Primary school
2	Participant 2	Male	15-24	Never married	Primary school
3	Participant 3	Female	15-24	Never married	Primary school
4	Participant 4	Male	<15	Never married	No formal education
5	Participant 5	Male	24-34	Never married	Primary school
6	Participant 6	Male	15-24	Never married	Primary school

B. FGD 2

Study location: Gullele sub-City, woreda 01

Group: Formal plastic waste collectors

	Name	Sex	Age group	Marital status	Educational status
1	Participant 1	Female	35-49	Married	No formal education
2	Participant 2	Male	35-49	Married	No formal education
3	Participant 3	Female	25-34	Married	Primary school
4	Participant 4	Female	35-49	Married	Primary school
5	Participant 5	Male	25-34	Married	Primary school
6	Participant 6	Female	25-34	Never married	Primary school

C. FGD 3

Study location: Kirkos Sub-City, woreda 08

Group: Mixed (Formal and Informal plastic waste collectors)

	Name	Sex	Age group	Marital status	Educational status	Type
1	Participant 1	Male	35-49	Married	No formal education	Formal
2	Participant 2	Female	25-34	Never married	Secondary school	Formal
3	Participant 3	Male	35-49	Married	Primary school	Formal
4	Participant 4	Male	15-24	Never married	Primary school	Informal
5	Participant 5	Male	15-24	Never married	Primary school	Informal
6	Participant 6	Female	24-34	Never married	Primary school	Informal

2. Number of plastic waste collectors in Addis Ababa (Retrieved in February, 2023).

Note: The data is collected from Addis Ababa cleansing and waste management Agency and organized by aggregating unstructured information to form the table. This data is subject to change over time based on the individuals involved in plastic waste collection activities.

Sub-City	Number of plastic waste collectors			Rank in #
	Formal	Informal	Total	
Akaki	145	669	814	1st
Gulele	117	119	236	6 th
Addis ketema	17	222	239	5 th
Arada	56	32	88	11th
Lideta	33	234	267	4 th
Kirkos	38	102	140	9 th
Kolfe	32	91	123	10th
Nifas silk	10	188	198	7 th
Bole	79	546	625	3 rd
Yeka	58	114	172	8 th
Lemi Kura	75	647	722	2nd
Total	660	2964	3624	