AKENTEN APPIAH- MENKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT

MPHIL THESIS

PUBLIC SATISFACTION WITH INFORMAL HOUSEHOLD SOLID WASTE COLLECTION IN GREATER KUMASI METROPOLIS, GHANA

BY

KWAKU POKU

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AKENTEN APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT

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KWAKU POKU

(8221930002)

A Thesis Submitted to the Department of Public Health Education of the Faculty of Environment and Health Education, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, in Partial Fulfilment of the requirements for the award of a Master of Philosophy degree in Environmental and Occupational Health Education.

October, 2025

DECLARATION

Candidate's declaration

I hereby declare that, except for references to other people's work, which have been duly acknowledged, this project work is the result of my work, and it has neither been presented in whole nor in part elsewhere.

Candidate's Name: KWAKU POKU

Signature: ……. **Date: …….**

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis were supervised under the guidelines on supervision of the thesis laid down by the Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development.

Principal Supervisor's Name: DR. KOFI SEKYERE BOATENG

Signature: …… **Date: …….**

Co-supervisor's Name: DR. DENIS DEKUGMEN YAR

Signature: ……..…….. **Date: …….**

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ABSTRACT

In the face of growing urbanization and inadequate formal waste management systems, informal household waste collectors (IWCs) have become pivotal in delivering services across the Greater Kumasi Metropolis, Ghana. This study aimed to assess public satisfaction with informal waste collection, determine the sustainability of the practice, and examine existing tracking mechanisms for Informal waste collection in the Greater Kumasi Metropolis. A mixed-methods approach was employed, utilizing both quantitative and qualitative methods to solicit information from participants. Quantitatively, a community-based cross-sectional study design was conducted, involving 617 respondents selected through a multistage sampling approach. Structured questionnaires were adopted to capture data on satisfaction levels with informal waste collection. Qualitatively, 10 in-depth interviews (IDIs) with informal collectors and five key informant interviews (KIIs) were conducted to explore themes related to sustainability and the mode of tracking for informal waste collection. Quantitatively, a logistic regression model was constructed, and the results were reported using odds ratios along with their corresponding 95% confidence intervals. The quantitative analysis was conducted using R Studio's statistical software, version 4.5.0, while thematic analysis was employed for qualitative data using Atlas. ti's software. Overall, 80.1% of respondents were satisfied with informal waste collection, citing politeness and perceived sustainability as key drivers. Satisfaction was negatively associated with higher education, unemployment, and dissatisfaction with the use of PPE. Additionally, 80.4% viewed the practice as economically, socially, and environmentally sustainable. However, challenges such as operational costs, irregular payments, and social stigma remain. Tracking systems were largely informal, non-standardized, and reliant on community networks, with both collectors and officials calling for formal, technology-driven monitoring. Informal waste collection in Greater Kumasi is widely accepted and fills critical service gaps, yet remains marginalized in policy and practice. Sustainability is feasible but threatened by economic instability and inadequate regulation. Current tracking mechanisms are insufficient. Therefore, MMDAs should support IWCs through fuel subsidies, dumping fee reductions, and inclusion in municipal fee structures; they must formalize and regulate IWCs through registration and licensing, and ensure that tracking systems and zonal operational frameworks are introduced.

DEDICATION

I dedicate this work to Sandra Yamoah for her financial support and encouragement throughout my studies. I am also grateful to my family for their support in various ways as I undertook this research work.

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CHAPTER ONE

1.0 Introduction

1.1 Background of the Study

Solid waste management is a growing environmental challenge driven by rapid urbanisation, industrial expansion, and rising consumption. Global waste generation exceeds 2.01 billion tonnes annually and is projected to increase by 70% by 2050 (Maalouf & Mavropoulos, 2023). One-third of this waste is poorly managed, causing air and water pollution, soil contamination, and disease (Shanta *et al*., 2024). These problems are most acute in urban areas, where open dumping and unsanitary landfills are common.

Sub-Saharan Africa faces added pressure from rapid population growth, weak infrastructure, and financial constraints. The region generates about 174 million tonnes of waste annually, but less than half is collected, and only a small fraction is recycled (Abdel-Shafy & Mansour, 2018). Much of the waste ends up in uncontrolled dumps or is openly burned. Informal collectors fill critical gaps by offering door-to-door services in underserved areas, but they often operate without recognition, regulation, or support.

In West African cities such as Lagos, Abidjan, and Accra, waste generation is outpacing the capacity of formal systems. In Accra, about 30% of households lack regular collection, and informal collectors have become essential, providing flexible and affordable services, though they work under unsafe conditions and remain disconnected from municipal systems (Oduro-Appiah *et al*., 2019).

Ghana illustrates these challenges clearly. The country generates over 12,710 tonnes of waste daily, yet only about 10% is properly disposed of in engineered landfills (Amo-Asamoah *et al*., 2020). Weak financing, limited logistics, and poor enforcement undermine formal management. Many

households rely on informal collectors using tricycles or carts, but their work is poorly integrated into national strategies. Public perceptions of these services, regarding reliability, safety, affordability, and environmental impact, remain largely undocumented.

In the Greater Kumasi Metropolis, Public-Private Partnerships have expanded formal services but still fall short of demand. Peri-urban and informal settlements depend heavily on informal collectors, yet these services remain outside municipal oversight. Evidence on residents' satisfaction with such services is scarce. Existing studies focus mainly on formal systems, examining efficiency, cost recovery, and environmental impacts. Research on user satisfaction rarely considers informal providers or how households assess service quality. Factors such as frequency, responsiveness, affordability, and hygiene are poorly understood, especially in secondary cities like Kumasi.

1.2 Problem Statement

The rapid growth of the Greater Kumasi Metropolis has increased pressure on waste management systems. Formal collection services suffer from limited funding, weak logistics, and poor enforcement, leading many communities to experience inconsistent or inaccessible waste management services (Qian *et al*., 2024). These have led to the rise of informal household waste collectors, who now operate throughout metropolitan and peri-urban areas. In many neighbourhoods within Kumasi metropolis, particularly among low-income households and in newly developing areas, households depend on informal collectors for affordability, accessibility, and flexibility (Amo-Asamoah *et al*., 2020). Although informal collectors are vital to daily waste management, they operate outside formal regulation. Their work lacks standard procedures and proper monitoring, which creates environmental and public health risks, including improper dumping, open burning, and exposure to unsafe materials (Sharma & Jain, 2020). The lack of

reliable data on their activities also hinders municipal authorities from assessing the scale of informal collection and its impact on urban sanitation (Oduro-Appiah *et al*., 2019). Existing studies pay little attention to public perceptions of informal waste services. While many examine the economic roles or operational practices of informal collectors, few explore how households judge service quality, reliability, hygiene, affordability, or responsiveness (Oduro-Appiah *et al*., 2019). In Greater Kumasi, this gap is particularly important. Municipal authorities continue to focus on formal collection models, even though many residents cannot access or afford them. Without evidence on household satisfaction, current policies risk overlooking the needs of communities most affected by weak infrastructure (Abid *et al*., 2024). This study aims to fill these gaps by evaluating public satisfaction with informal household waste collection in the Greater Kumasi Metropolis. It investigates household perceptions of collection, transportation, and disposal practices and assesses the sustainability of informal services from the community's perspective. Using both quantitative and qualitative methods, the study offers insights into residents' experiences, expectations, and preferences. The findings aim to inform inclusive policies, enhance understanding of the informal sector's contributions, and guide improvements in waste management systems across the metropolis.

1.3 Objective

The study assessed public satisfaction with informal household solid waste collection, integrating sustainability and a tracking framework within the Greater Kumasi Metropolis.

1.3.1 Specific Objectives

1. To assess public satisfaction with the operations of informal household solid waste collectors in the Greater Kumasi Metropolis

2. To determine the environmental, economic and social sustainability of the informal household solid waste collection business in the Greater Kumasi Metropolis.
3. To determine the mode of tracking informal household solid waste collection and propose a framework for sustainable waste management using the tricycle concept in the Greater Kumasi Metropolis.

1.4 Research Questions

To achieve the objectives of the research, the following questions were asked:

1. How satisfied are residents with the operations of informal household solid waste collectors in terms of collection methods, transportation processes, and waste disposal practices?
2. To what extent is the informal household solid waste collection sector sustainable in the Greater Kumasi Metropolis, considering its economic viability, environmental impact, and social relevance?
3. What systems or mechanisms exist for tracking the activities of informal household solid waste collectors in the Greater Kumasi Metropolis, and how effective are they?

1.5 Justification of the Study

This study is motivated by the growing reliance on informal household waste collection in the Greater Kumasi Metropolis, despite limited empirical research from the user's perspective. In underserved urban communities, informal collectors are central to daily sanitation, yet their contributions remain largely absent from policy and planning discussions (Wilson *et al*., 2019). This gap reflects governance weaknesses and broader structural oversights in Ghana's pursuit of inclusive and sustainable urban systems. Informal collectors often work under difficult conditions, facing poor environments, inadequate protective equipment, irregular income, limited financing,

and health risks. They also encounter social stigma, weak institutional recognition, lack of training, and inconsistent collaboration with formal agencies. These challenges undermine service quality, reliability, and sustainability. While such issues are noted in broader literature, little context-specific evidence exists on how they shape household experiences and satisfaction in Ghana.

Current waste policies frequently rely on assumptions or fragmented accounts rather than locally grounded data. The absence of systematic evidence on household satisfaction limits the ability of municipal authorities and development partners to design fair, practical, and community-sensitive solutions. Without this, interventions risk marginalising the very actors who fill service gaps in low-income and hard-to-reach areas. This study addresses these gaps through a mixed-methods approach, combining quantitative measures of satisfaction with qualitative insights from lived experiences. It examines how informal services operate, the challenges households face, and the expectations that shape satisfaction. Unlike most studies that focus on formal systems, this research highlights the growing relevance of informal providers in urban Ghana.

Findings will provide a stronger empirical basis for policy, supporting a more balanced and inclusive approach to waste governance. Foregrounding community perspectives and recognizing the role of informal collectors, the study aims to inform policies that integrate these actors and advance sustainable urban development.

1.6 Scope of the study

The problems associated with waste generation, collection, and safe management are of global concern. As a result, it would be beneficial to expand the scope of this study by conducting a global investigation to help understand the global challenge and propose appropriate solutions. However, this current study was geographically limited to the Greater Kumasi Metropolis in the Ashanti Region, Ghana. Additionally, numerous health-related issues associated with household waste

collection have been identified, as revealed by the literature. However, the scope of this study was limited to the subject of public satisfaction associated with informal household waste collection.

1.7 Organization of the study

Generally, the study is divided into six chapters. The first chapter was the introductory section, which included the background, problem statement, justification of the study, research objectives and questions, and scope of study. The second chapter was the literature review section. Literature published on public satisfaction with informal household solid waste collection was reviewed to help identify research gaps and situate this current research.

Chapter 3 outlines the step-by-step procedures employed by the researcher in conducting the study. This included the study setting, research approach and design, key research variables, study participants, including the criteria for inclusion and exclusion, sample size and sampling techniques, data collection and instruments, ethical considerations, data management, statistical analysis, and study limitations. The fourth chapter presents the key findings of the study. The results were presented in accordance with the predetermined objectives of the research. In the fifth chapter, the researcher discussed the key findings presented in Chapter 4 in relation to the literature and justified the study's findings. In the last chapter (Chapter 6), the research concluded the study by following the objectives and presenting key findings, and proffered appropriate recommendations to address the identified issues.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.0 Introduction

Relevant documents and literature for the study are reviewed in this section. This review aimed to assess public satisfaction with informal waste collection, particularly in Ghana. The literature reviewed in this chapter encompasses assessing public satisfaction with the operations of informal household solid waste collectors, the sustainability of the informal household solid waste collection business, and the methods used to track informal household solid waste collection. Literature is reviewed from journal articles, unpublished literature and other electronic sources. The literature review was conducted in accordance with the study's objectives, and a comprehensive literature search was conducted across bibliographic databases and relevant journals. This topic is critical, as there is a paucity of evidence on public satisfaction with informal household solid waste collection in Ghana, particularly within the Kumasi Metropolis. This review presents an opportunity to synthesize existing evidence on the subject and situate the current study, justifying the need for this research in Ghana.

2.1. Overview of Informal Waste Collection in Ghana

In Ghana, informal waste collectors, often referred to as "waste pickers," play a pivotal role in managing household solid waste, especially in urban areas where formal waste management services are inadequate. These individuals operate without formal recognition or regulation, yet they provide essential services, including waste collection, sorting, and recycling. Urban solid waste and the growth of human settlements have drawn increasing attention in rapidly urbanizing cities, especially in developing countries where population and consumption patterns are intensifying (UN-Habitat, 2020). With its expanding cities and increasing consumption, the

country is facing significant challenges in waste management. One of the most pressing issues is the inadequate and inconsistent provision of waste collection services in low-income and peri-urban areas, where formal municipal waste services are either non-existent or irregular. A study by Oteng-Ababio employed qualitative research techniques to examine the role of the informal sector in solid waste management within the Greater Accra Metropolitan Area. The findings revealed that informal waste collection has become a survival strategy for thousands of the urban poor and that proper integration of this sector into existing solid waste management policies can lead to sustainable management practices and potentially alleviate poverty (Oteng-Ababio, 2012).

2.2 Public Satisfaction with Informal Household Solid Waste Collection Services

Public satisfaction is a crucial performance indicator in evaluating service delivery systems, including waste collection. It reflects the degree to which service users perceive value, reliability, fairness, and responsiveness from providers. While satisfaction is often studied in relation to formal municipal waste services, there is a growing recognition of its importance in understanding and improving informal household solid waste collection, especially in underserved urban areas (Guerrero *et al*., 2013).

2.2.1 Mode of Collection

The mode of collection used by informal waste collectors typically involves manual collection of refuse from households, either door-to-door or through pre-arranged pickup spots within neighbourhoods. These services are often organized informally, with collectors forming personal agreements with residents, who pay small, negotiated fees in exchange for regular or on-demand waste collection. Unlike the formal sector, which relies on scheduled collections and designated bins, the informal sector offers greater flexibility but also lacks standardized protocols (Oduro-Appiah *et al*., 2021). Informal collectors use simple tools such as handcarts, wheelbarrows, or

tricycles (commonly referred to as “Aboboyaa”) to collect and move waste. These tools, although efficient in narrow and unplanned urban layouts, limit the volume of waste that can be collected per trip and contribute to issues such as delayed pickups or spillage during transportation (Asase *et al*., 2009). In addition, many of these collectors lack protective gear, exposing them to health risks during collection and handling.

2.2.2 Transportation

Transportation of waste in the informal sector is largely unregulated. After collection, the waste is either taken directly to informal dumping sites or sorted by the collector to separate recyclable materials (e.g., plastics, metals, paper) from residual waste. These materials are then transported, often using the same basic means of transportation, to informal recycling depots or local scrap dealers. The absence of formal tracking systems means there is little oversight over how waste is transported or where it ends up (Oteng-Ababio, 2012). Similarly, a study by Boadi noted a significant weakness in Ghana’s urban waste management, thus the informal sector’s inability to safely and efficiently transport waste to final disposal sites (Boadi, 2005).Many informal operators dispose of residual waste in open drains, water bodies, or unlicensed dumpsites due to limited access to landfills and transfer stations, which raises environmental and public health concerns.

2.2.3 Disposal

Disposal practices among informal collectors vary significantly. Most do not have access to official disposal facilities, such as engineered landfills or transfer stations, due to cost barriers, a lack of permits, or distance. As a result, waste is frequently dumped in nearby bushes, water bodies, or informal dumpsites (Asase *et al*., 2009; Oteng-Ababio, 2012). This has contributed to the proliferation of unsanitary conditions and illegal dumping zones within many urban areas.

Additionally, a study conducted by Owusu-Sekyere found that collected waste is often burned in open areas to reduce volume or facilitate the recovery of metals, particularly in communities with

informal e-waste handlers. This practice releases toxic pollutants, posing environmental and health hazards to both collectors and nearby residents (Owusu-Sekyere *et al*., 2024). The lack of formal disposal infrastructure and the exclusion of informal workers from city-level planning continue to undermine the effectiveness and safety of informal disposal practices.

2.2.4 Factors Influencing Public Satisfaction

Several factors, including the environment after collection, influence public satisfaction with waste collection services. A study by Akateba and Yakubu utilized a cross-sectional household survey design to investigate householders' satisfaction with solid waste collection services provided by Zoomlion Ghana Ltd in the Wa Municipality. The study used structured questionnaires administered to 193 householders selected through simple random sampling. The study found that residents' satisfaction was significantly affected by the frequency and reliability of waste collection services (Akaateba & Yakubu, 2013). Similarly, Lissah and colleagues' qualitative study conducted to explore the perspectives and experiences of municipal waste company managers and supervisors in the Ho municipality of Ghana, using in-depth interviews to understand challenges in solid waste management practices, highlighted issues such as inadequate resources and logistical constraints affecting service delivery and public satisfaction (Lissah *et al*., 2021). Also, Guerrero and team revealed that Satisfaction with waste collection is generally influenced by factors such as frequency and timeliness of service, cost, customer interaction, perceived cleanliness, and trust in the service provider (Guerrero *et al*., 2013). According to Parasuraman *et al*. (1988), satisfaction is a function of the gap between customer expectations and their perception of actual service performance. While this model was initially designed for formal service environments, scholars such as Oteng-Ababio (2012) argue for its adaptation in informal contexts, where expectations are shaped by flexibility, social proximity, and reliability rather than regulation or infrastructure (Oteng-Ababio, 2012).

In informal settings, satisfaction may depend more on interpersonal relations than on fixed service standards. For instance, if the waste collector arrives on time, communicates well with households, and is willing to reschedule collection in emergencies, this may outweigh concerns about the lack of uniforms or documentation. As such, the evaluation of informal waste collectors must include both quantitative service indicators and qualitative relational dimensions (Charles, 2021a). Additionally, the frequency of collection, affordability and pricing models, attitude and professionalism of collectors, as well as hygiene and safety practices, were the main factors that primarily influence the activities of informal waste collectors.

Regular collection significantly boosts satisfaction levels. Households that receive waste collection at least once or twice a week are more likely to perceive the service as reliable (Guerrero *et al*., 2013). Informal services often operate on flexible or negotiable payment schemes. In Accra, Oteng-Ababio (2012) found that many low-income households preferred informal waste collectors because they allowed weekly payments rather than the monthly lump sums required by formal operators (Oteng-Ababio, 2012). Moreover, Residents appreciate collectors who are respectful, punctual, and communicative. In a study of informal collection services in Wa Municipality, Akaateba and Yakubu (2013) found that interpersonal behaviour significantly influenced household willingness to pay and overall satisfaction (Akaateba & Yakubu, 2013). Additionally, public health concerns can lower satisfaction if collectors fail to use protective gear or neglect to sanitise their collection tools. Charles (2021) emphasizes the importance of minimal health and safety protocols in maintaining both trust and service quality in the informal system (Charles, 2021a) .

2.2.5 Comparative Analysis with Formal Waste Services

The comparative evaluation of informal and formal waste collection services in Ghana reveals nuanced dynamics influencing public satisfaction. Informal waste collectors often provide more

frequent and affordable services compared to their formal counterparts. A study by the International Growth Centre (IGC) involving 1,800 households in Accra found that 80% of respondents relied on informal waste collection services due to lower prices and more frequent collections, even in areas where formal services were available (IGC, 2024). This preference underscores the responsiveness of informal services to the needs of low-income households. In contrast, formal waste services, while structured and regulated, often face challenges related to operational inefficiencies and limited coverage. Ampong and colleagues conducted a comparative analysis of the effectiveness and efficiency of formal and informal waste collectors in the urban waste management system in Ghana. The study employed a case study approach, focusing on households and waste collectors in the Suame Municipality of the Ashanti Region. Data were collected through questionnaires, interviews, waste quantification, and field measurements, and findings revealed that informal waste collectors, despite lower efficiency, had extensive coverage and played a crucial role in the urban waste management system (Ampong *et al*., 2024).

Moreover, public satisfaction with waste collection services is influenced by various factors, including the reliability of collection schedules, the behaviour of waste collectors, and the cleanliness of the environment post-collection. A mixed-method study conducted by Larbi-Tettey and Sulemana that assessed public satisfaction towards municipal solid waste collection services in Ho Municipality, Ghana, revealed that 56.5% and 32.5% of the respondents rated the quality of service as “Good” for the door-to-door and communal collection services, respectively. This suggests that clients of door-to-door solid waste collection services managed by private companies were more satisfied than patrons of the communal container collection system (Sulemana, 2018a). These findings highlight the need for a hybrid approach that leverages the strengths of both formal and informal waste collection systems to enhance service delivery and public satisfaction.

2.2.6 Cultural Norms and Perception of Professionalism

In many Ghanaian communities, perceptions of professionalism are influenced by visible symbols of order such as uniforms, identity cards, and branded collection vehicles. The absence of these in IH-SWC operations sometimes leads residents to view them as “unofficial” or “less credible,” even when they are reliable.

Nonetheless, informal actors can gain legitimacy through consistent performance, referrals, and word-of-mouth within tight-knit neighbourhoods. In this context, community trust becomes a substitute for regulation (Ampong *et al.,* 2024). This dynamic suggests that any assessment of public satisfaction must balance external indicators of professionalism with internal community values and norms

2.2.7 Challenges and Opportunities

Despite their contributions, informal waste collectors face numerous challenges that impact their operations and public perception. Key challenges include a lack of formal recognition, inadequate access to protective equipment, exposure to health hazards, and social stigmatization. A qualitative study conducted by Mumuni and colleagues that examined the roles and challenges of informal waste pickers in the Tamale Metropolis of Northern Ghana revealed that informal waste pickers are challenged by a lack of recognition and compensation for their contributions, as well as power relations that shape their invisibility in the waste management system (Mumuni & Borras, 2016)

Furthermore, a qualitative study conducted by Agyemang and team utilized phenomenological design to investigate psychosocial risk factors, work-related stress, and job satisfaction needs among municipal solid waste collectors in the Ho Municipality of Ghana revealed that poor communication from employers, huge workloads, and lack of protective equipment were significant contributors to occupational health hazards and reduced job satisfaction (Lissah *et al*.,

2020). Also, in Accra, the marginalization and lack of recognition for informal workers have been identified as shortcomings of the current solid waste management system. Embracing a circular economic model and harmonizing legal and institutional frameworks are essential for effective governance (IGC, 2024). Moreover, community-based monitoring and technological innovations can enhance the efficiency and accountability of informal waste collection services. Engaging local communities in tracking waste collection activities can improve service delivery and public satisfaction.

2.3.0 Sustainability of informal waste collection

Sustainability in waste management encompasses the long-term viability of service provision in economic, environmental, and social dimensions. For informal household solid waste collectors, sustainability involves the ability to maintain operations over time without compromising the health of the environment, the safety of workers, or the socio-economic resilience of the communities they serve ((UN-habitat, 2020).

Unlike formal waste systems, which are backed by public resources and institutional frameworks, informal waste collectors often operate under precarious conditions. They rely on user fees, sales of recycled materials, and informal agreements with households. Their long-term survival depends on consistent demand, operational adaptability, and an enabling socio-political environment.

2.3.1 Economic Sustainability

Informal waste collection serves as a significant source of income for many in Greater Kumasi. These collectors earn income through service-based fees from households and the sale of recyclables such as plastics and metals to intermediary buyers and recycling industries. A qualitative case study conducted by Abaitey and colleagues found that many informal waste service providers in Kumasi earn a relatively consistent daily income, sufficient to support basic

household needs (Abaitey *et al*., 2025). Additionally, their earnings are more stable than those of other informal economic activities, especially during economic downturns.

Moreover, the International Growth Centre (2024), through a policy brief informed by field observations and stakeholder consultations, emphasised that informal collectors in Ghana could divert and monetize significant volumes of recyclable materials annually, contributing to the circular economy and generating income reinvested locally. However, the sector faces challenges such as volatility in market prices for recyclables, lack of formal recognition, and limited access to financial services, which hinder economic sustainability (International Growth Centre, 2024)

2.3.2 Environmental Sustainability

Informal Waste collectors contribute significantly to environmental protection by removing waste from areas that would otherwise become illegal dumping grounds. Their work helps reduce pollution, prevent disease outbreaks, and mitigate flooding caused by clogged drainage systems (Wilson *et al*., 2006)

Informal waste collectors contribute to environmental sustainability by reducing the volume of waste directed to landfills, thereby mitigating environmental hazards. Their activities support the circular economy by supplying raw materials to recycling industries. A scoping review conducted in Saudi Arabia by Abubakar and team on environmental sustainability revealed that waste storage is largely poorly managed in facilities. Storage containers and transportation systems are often deficient and informal making the disposal methods predominantly via uncontrolled dumping, open-air incinerators, and landfills. The negative impacts of such practices include environmental problems such as air and water pollution, land degradation, emissions of methane and hazardous leachate, and climate change (Abubakar *et al*., 2022). However, the lack of formal recognition and support can lead to improper waste handling, posing environmental risks. Integrating informal

collectors into formal systems can enhance environmental outcomes by ensuring proper waste management practices and reducing pollution (Oteng-Ababio, 2012). In Ghana, informal waste collectors play a key role in material recovery and recycling. They collect plastics, metals, paper, and organic waste, often separating these materials manually and selling them to recycling centers or aggregators. In Accra and Kumasi, informal recyclers are responsible for over 30% of the total recyclables recovered annually, according to Charles (2021). Despite their effort, the environmental benefits of informal waste collectors are undeniable, especially in low-income communities underserved by formal services. Their inclusion in city planning could significantly enhance overall waste recovery rates.

2.3.3 Social Sustainability

Social sustainability refers to the extent to which informal waste collectors' systems promote dignity, equity, and health for both workers and the communities they serve (UN-Habitat, 2020). Informal waste collectors often come from marginalized backgrounds, and their work is stigmatized despite its essential public health function.

Socially, informal waste collection provides livelihoods for marginalized populations, contributing to poverty alleviation and social inclusion. The sector offers employment opportunities for individuals with limited access to formal employment, fostering community development. However, informal collectors often face social stigmatization, lack of social protection, and exposure to health hazards due to inadequate protective equipment. A cross-sectional survey conducted in the Cape Coast Metropolis by Maneen and team revealed that a substantial proportion of workers faced high levels of health risks due to low levels of physical safety climate in the industry, which is fueling poor safety practices among the workers (Maneen *et al*., 2025). Moreover, a study conducted in Tanzania that utilized a qualitative approach to assess the social sustainability of informal waste collection revealed that limited access to resources, negative

perception of their activities, competition, unsupportive policies, unreliable supply of raw materials, dishonesty of waste pickers and poor working conditions are the main social problems faced by informal waste collectors (Charles, 2021).

The key problems faced by Informal waste collectors socially are Occupational Health Stigmatization. Informal collectors often lack protective gear (gloves, boots, masks) and face exposure to sharp objects, biological waste, and chemical hazards (Maneen *et al*., 2025). In Kumasi, field studies indicate that over 60% of informal collectors report minor injuries monthly. Also, they are frequently seen as "dirty" or "uncivilized." This limits their social mobility and discourages youth participation in the sector (Oteng-Ababio, 2012; Charles, 2021).

2.4 Mode of tracking informal household solid waste collection

Tracking mechanisms are essential in any waste management system. They help monitor collection frequency, route coverage, collector performance, payment compliance, and waste quantities (UN-Habitat, 2020). In formal systems, tracking is commonly performed using GPS-enabled trucks, digital payment systems, service logs, and municipal oversight structures.

Informal waste collectors play a crucial role in solid waste management, particularly in developing regions where formal systems may be inadequate. Effective monitoring of these activities is essential for enhancing efficiency, environmental sustainability, and policy development. In Brazil, a participatory mapping combined with a geographical information system was used together with GPS tracking and web-based mapping to coordinate waste collection routes and client interactions (Offenhuber & Lee, 2013). This approach empowered waste collectors to manage and interpret spatial data, facilitating collaborative system redesign. Similarly, in Kampala, Uganda, a qualitative study was employed to understand the role of institutions in enabling or constraining actors in solid waste collection. The study highlighted the importance of community engagement

and the need for inclusive policies that recognize informal waste collectors' contributions (Muheirwe *et al*., 2024).

Furthermore, in Kenya, Lee and colleagues designed and deployed an application to map informal waste management in Mombasa, Kenya. The study revealed that the use of phones and web-based applications can document waste handling dynamics effectively, providing insights into the spatial organisation of informal waste collection. Such tools enable real-time data collection and analysis, enhancing the understanding of informal waste systems (Lee *et al*., 2015). Similarly, a mixed-method study was conducted in South African cities to investigate waste management performance. The study showed that digital technologies, such as ICT-enabled Platforms, play a crucial role in optimizing waste diversion practices. These technologies facilitate real-time monitoring, data collection, and transparent transactions, enhancing the efficiency of waste reclaimers and contributing to improved environmental outcomes.

In addition, the implemented ICT-enabled solutions and digital platforms track waste collection, monitor household waste generation, and assess waste diversion rates (Siwawa, 2025). Moreover, a study was conducted by Paul and team in Bangladesh on an innovative waste management system to monitor formal and informal waste collection in real-time. Paul and team utilized smart bins equipped with sensors to communicate with waste collectors, providing data on fill levels and optimizing collection routes (Paul *et al*., 2024). Additionally, a survey conducted in Nigeria found that integrating informal waste collectors into the formal system would enhance tracking capabilities and promote sustainable waste management practices. This includes recognizing their role in recycling and providing support through training and resources (Meijer & Berg, 2010).

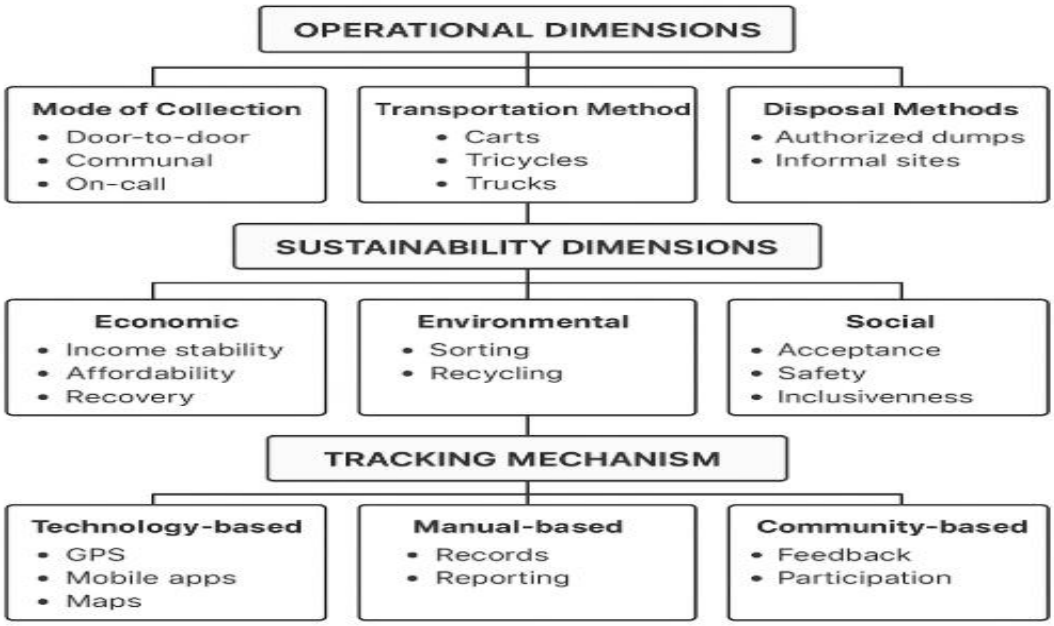
However, in the context of informal household solid waste collectors, such systems are largely absent or highly improvised. Informal operators generally do not use digital or institutional

tracking. Instead, their "monitoring" often relies on interpersonal relationships, verbal agreements, and community reputation. As a result, there are concerns about efficiency, data accuracy, and service transparency (Charles, 2021)

2.5 Identified Knowledge Gaps

Recent studies highlight the increasing importance of informal household solid waste collection in African cities, yet significant gaps still exist. First, public satisfaction with informal collectors is often regarded as less important, with limited data on service quality, reliability, safety, and community views in Ghanaian urban areas (Mensah, 2021). This leaves questions unanswered about how users evaluate performance and what influences satisfaction in Greater Kumasi. Second, although the informal sector plays a role in urban waste management, few studies systematically explore its environmental, economic, and social sustainability. Existing research often examines economic survival or environmental risks in isolation, neglecting the integrated view of all three sustainability dimensions (Amoah *et al*., 2020). These limits understanding of its long-term effects. Third, little is known about how informal collection is monitored, coordinated, or incorporated into municipal systems. Mechanisms for tracking tricycle-based operations are rarely discussed, and no framework currently exists to improve oversight and sustainability in Kumasi (Adomako, 2022).

2.5 Conceptual Framework



The framework integrates the core components of waste management and how they interact. Operationally, it covers collection, transport, and disposal activities that shape efficiency, reliability, and user experience. A sustainability layer evaluates economic stability, environmental practices, and social acceptance to ensure long-term viability. Oversight is strengthened through tracking, technology, manual processes, and community input to monitor performance and enforce accountability. Government support and public participation connect all elements, with policy, enforcement, and citizen engagement determining system performance.

The framework aligns with established theories. SERVQUAL links service quality dimensions (reliability, responsiveness, assurance) to collection modes, transport efficiency, and safe disposal (Parasuraman *et al*., 1988). Stakeholder theory emphasises balancing the interests of households, providers, regulators, and community groups (Freeman, 1984). Institutional theory shows how rules, norms, and government structures shape practices around disposal sites, reporting, and compliance (Scott, 2014). Together, these perspectives reinforce the framework's focus on quality, participation, and institutional support.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This is the third chapter of the study, which emphasises the methods. In this chapter, the step-by-step approaches or procedures followed in completing the study were duly reported. Specifically, the chapter encompassed research type and design, study settings, study population (including inclusion and exclusion criteria), sample size and sampling techniques, data collection instruments and techniques, instrument piloting, data management and analysis, and ethical considerations.

3.2 Research type and design

The study employed a mixed-methods research approach, where both quantitative and qualitative findings on public satisfaction with informal household waste collection in the Greater Kumasi Metropolis were triangulated. In this research approach, whilst the quantitative research focused on collecting and analyzing quantitative data from household residents on satisfaction with informal household waste collection, the qualitative approach explored or gathered narrative data from the informal waste collectors and key informants (e. g environmental health officers) on the sustainability and mode of tracking of this informal waste collection system in the Greater Kumasi Metropolis.

For the quantitative study, a community-based analytical cross-sectional study design was adopted to draw respondents for the study. A community-based approach was employed to recruit household residents for the study. The cross-sectional design was adopted because the exposures and outcomes (i.e., satisfaction) were assessed simultaneously, and at a single point in time, using a snapshot of the population.

On the other hand, an inductive approach using a form of enquiry was adopted for the qualitative study. This approach was selected to gather a detailed and in-depth understanding of the issues

regarding. The qualitative inductive approach was selected due to the subjective nature of some of the research questions. This approach is believed to help provide a better understanding of the actual problem being investigated and collect qualitative information for the study through key informant interviews.

3.3 Study settings

The study was conducted in the Greater Kumasi Metropolis, one of the largest Metropolis in Ghana. The Greater Kumasi Metropolis encompasses seven administrative Metropolitan and Municipalities, such as the Kumasi Metropolitan Assembly, Asokore Mampong, Tafo, Asokwa, Kwadaso, Suame, and Oforikrom Municipalities (Liwur *et al*., 2024). The Metropolis shares borders with Kwabre East and Afigya Kwabre to the North, and with Bosomtwe District to the south. The Metropolis also shares boundaries with the Ejisu and Juaben Municipalities to the East, as well as Atwima Nwabiagya and Atwima Kwanwoma.

The transfer of goods and services to other regions and the nation at large is greatly facilitated by Kumasi's advantageous location, which features a key interior transport terminal. With 214.3 square km land area, the Metropolitan area is positioned in the deciduous forest, where migrants from other regions of the nation come in quest of better pastures due to the premeditated location of the Metropolis with the concentration of economic and industrial processes (Liwur *et al*., 2024). The population of Greater Kumasi Metropolis is estimated as 722,280, with an annual growth rate of 3.8%. This growth rate of the Metropolis exceeds that of the region (2.7%) and the country (2.5%), making it the fastest-growing city in the country in terms of population size. The continual amplification of the urban growth rate of the Kumasi Metropolis over decades has resulted in the transformation of environmental, social, economic, and demographic phenomena (Ghana Statistical Service 2021).

Due to the increase in urbanization and growth rate in the Greater Kumasi Metropolis, there is an increase in waste generation that exceeds the capacity of the formal waste collectors. Evidence by Darko *et al*. (2022) revealed that significant water bodies have been polluted by human activities, primarily through chemical compositions, including microbial loads, heavy metals, pesticide residues, and polycyclic aromatic hydrocarbons. Considering these occurrences and the available environmental resources and statistics on encroachment of this area, the Greater Kumasi Metropolis was selected as the ideal study setting (Liwur *et al*., 2024).

3.4 Study population

The participants selected for the study were household residents, informal household waste collectors, and environmental health officers in the Greater Kumasi Metropolis. The choice of these participants lies in seeking information on public satisfaction with informal household waste collection from diverse backgrounds to provide in-depth insights into the subject.

3.4.1 Inclusion criteria

1. The study included household residents (≥18 years) who primarily generate household waste for it to be collected by informal waste collectors: This cohort was selected to find out their satisfaction with informal household waste collection.
2. Informal waste collectors involved in the collection of household waste were included. This cohort was included to find out the sustainability of the informal household waste collection.
3. The study included environmental health officers at the various Metropolitan and Municipal Assemblies in the Greater Kumasi Metropolis. These participants were included to solicit the mode of tracking and integration of informal household waste collection.

3.4.2 Exclusion Criteria

1. The study excluded informal waste collectors who had not collected waste for less than six months, and environmental health officers had less than six months of professional experience.

3.5 Sample size and sampling techniques

3.5.1 Sample size

Quantitatively, using the Taro Yamane method (1976) formula (n = N/(1 + Ne^2)) where N is the total population, estimated at 4979, and e is the margin of error, the sample size was computed as follows. (Sulemana, 2018b).

Following the Yamane formula for sample size calculation:

$$n = \frac{N}{1+Ne\wedge 2}$$

$$= \frac{4979}{1+4979(0.04)^2} \quad \frac{4979}{1+4979(0.0016)} \quad \frac{4979}{1+7.9664} \quad \frac{4979}{8.9664} \quad =555.29 \approx 555.3$$

Adjusting for a 10% non-response rate,

$$\text{Adjusted sample size} = \frac{Original\ Sanple\ Size}{1-Non\ response\ rate} = \frac{610}{1-0.10} = \frac{555.3}{0.90} = 617$$

Therefore, a total sample of 617 participants will be used for this research.

For the qualitative research, five (5) key informant interviews were conducted among respondents until saturation was achieved (no new themes emerged). Once saturation was achieved, the researcher used the number (5) was used as the sample size. The number five (5) was selected because saturation was achieved, and this number produced the same results as additional interviews could have provided. Additionally, among the informal waste collectors, ten (10) in-depth interviews were conducted to achieve saturation. Once saturation was achieved, the 10 was used as the sample. The participants in the quantitative study were not involved in the qualitative study, thereby enriching the diverse understanding and perspectives on the subject being studied.

3.5.2 Sampling technique

For the quantitative research, the researcher employed probability sampling, specifically the multistage sampling techniques, to collect information from respondents. Firstly, the Greater Kumasi Metropolis was put into 20 clusters (4 clusters per municipality). In each municipality, two clusters were selected for the study. Within each cluster, households were systematically selected for the study. In each cluster, the fifth household, counting from the right, was first selected by standing in the centre of the community. Following that, a systematic approach was followed by counting every 15^{th} household. This approach was adopted because it had been successfully used in the USAID-sponsored urban sanitation project. Lastly, respondents were drawn from respective households for participation. If the selected individual declines to participate, the next person is invited to the study. This exact procedure was repeated for the total number of visit days until the researcher had obtained the required sample size for the study (Khanom *et al*., 2015).

Qualitatively, a non-probability sampling technique was employed. Specifically, a purposive sampling technique was adopted to select key participants for the study. This sampling technique was adopted because respondents possess key theoretical knowledge and practical experience, as well as characteristics relevant to the study.

3.6 Instrument pretesting

Questionnaire piloting was conducted to ensure the reliability and validity of the research instrument. Before data collection, the data collection instruments were pretested in the Asokwa sub-metro. After pretesting, mistakes identified, coupled with ambiguous and sensitive statements, were rephrased. Additionally, some questions that were considered sensitive for patients or made them feel uncomfortable answering were rephrased or rewritten to enhance the reliability and validity of the data collection instrument.

3.7 Data collection instrument and techniques

3.7.1 Data collection instrument

To achieve the study's objectives, a data collection instrument was designed to gather information from the study participants.

Quantitatively, a structured questionnaire was designed to gather information from household residents regarding their satisfaction with informal household waste collection. This instrument captured socio-demographics, frequency of waste collection, activities involved in waste collection, attitudes of collectors, pricing, transportation and dumping, among others (de Oliveira-Filho *et al*., 2014).

Qualitatively, in-depth interview and Key informant interview guides were developed. Specifically, the in-depth interview guides were employed to solicit information from informal household waste collectors. The guide addressed the challenges related to waste collection, payment methods, perceptions, and sustainability of informal waste collection, including the potential for formal registration and integration into the official waste collection system. The key informant guide was employed to gather information from key informants, such as environmental health officers, regarding their awareness of informal waste collection, the possibility of regulation and registration, and the tracking and integration of their services into mainstream or formal household waste collection.

3.7.2 Data collection techniques

For the quantitative aspect of the study, the data collection exercise spanned four months (120 days). A total of 40 visits (visited each municipality 8 times) were made during the quantitative data collection, with each visit recruiting between 30 and 35 participants. Before the actual data collection, the structured questionnaire was uploaded onto the Kobocollect software for data collection. The Kobocollect software was used in place of traditional paper-based data collection

to ensure efficiency and security in data handling. The questionnaires were then administered using the computer-assisted Kobocollect software. The responses provided by the respondents were entered on Android-based devices using the Kobocollect software, stored locally and synchronized regularly to the appropriate server. During data collection, respondents were approached individually and invited to participate in the study. Consented clients were then invited to participate in the study. The researcher guided the invited participants in answering the research questions and ensured their rights were protected, while also helping them choose appropriate venues to ensure privacy.

Qualitatively, the interviews were conducted, allowing for more open-ended questions to be asked, granting the interviewee the opportunity to express themselves rather than answering straightforward questions. The interview days were agreed upon between the interviewer and interviewee. The venue for the interview was pre-arranged with the participants to ensure commitment. To ensure privacy and confidentiality, most interviews were conducted at respondents' offices (for key informants) behind closed doors, preventing entry by other staff. Each key informant interview lasted approximately 30–40 minutes. All interviews were conducted in the English language and audio-recorded with the key informant's consent to the recording. For the in-depth interview, each lasted for at most 30 minutes and was conducted in the Ghanaian language, mostly Twi. Where the informant needed to attend to official duties, the interview, including the audio recording, was paused and resumed upon return from official duties. Additionally, notes were taken alongside the audio recording to complement the audio and also take note of non-verbal cues and actions important to the study.

3.8 Data management and analysis

Data downloaded from the virtual server were cleaned and checked for consistency using custom commands before analysis. Statistical analyses were conducted using R Studio version 4.1.3. Descriptive statistics (mean, standard deviation, and frequencies) summarised the characteristics of the sampled population. At a 5% significance level, chi-square tests of independence were used to examine associations between the dependent variables (Economic sustainability of household waste collection) and independent variables such as age, gender, marital status, religion, household size, employment and monthly salary. Subsequently, two-level binary logistic regression models were built at a 95% confidence level: Model I (unadjusted) assessed the crude association between independent and dependent variables, while Model II (adjusted) controlled for other covariates. Variables significant in univariate analysis were included in Model II. Results were reported as odds ratios with 95% confidence intervals.

Qualitative data from interviews were transcribed verbatim and analyzed thematically using a variable matrix, flowcharts, and illustrative quotes. NVivo software supported the qualitative analysis.

3.9 Ethical consideration

Seeking ethical clearance is essential in every study, particularly when it involves human subjects, to ensure compliance with all ethical procedures and to protect the rights of participants. For this study, in accordance with the Declaration of Helsinki, ethical clearance was obtained from the Committee for Human Research, Publication, and Ethics (CHRPE) of the Kwame Nkrumah University of Science and Technology (KNUST). These ethics provided backing for the study. Additionally, permission was sought from the Metropolitan Directorate and the Heads of Departments of the selected health institutions. Informed consent was obtained from all participants before their interviews.

CHAPTER FOUR

4.0 PRESENTATION OF RESULTS

4.1 Introduction

This section is the fourth chapter of the study. In this chapter, the results of the study based on the findings are presented. The study's results were presented in relation to the key objectives and variables of interest.

4.1.1 Socio-demographic characteristics of Respondents

Table 4.1 shows that of the 617 respondents who participated in the study, 28.8% were between the ages of 30 and 39, and 21.6% were between the ages of 18 and 29. The majority of respondents (61.1%) were female, whereas 38.9% were male. Concerning educational level, 33.7% obtained secondary education or vocational training, 7.1% obtained tertiary education, and 23% obtained junior secondary education or middle school education. Furthermore, 46.5% of the participants were married, and 34.2% were never married. The majority (69.9%) of participants were Christians, and 17.7% identified as Muslims. Regarding ethnicity, the majority (65.2%) identified as Akans, while 13.1% belonged to the Dagomba, Nanumba, and Frafra ethnic groups.

In **Table 4.2,** most (76.2%) participants were not household owners, whereas 23.8% were landlords/ladies. Participants have varied household sizes, ranging from 4 to 6 (44.6%) and seven or more (36.8%). Most participants (74.2%) were employed, with 22.4% being artisans and 17.0% being entrepreneurs. Close to one-third (28.0%) earned between 1001 and 2000 Ghana cedis per month, and 26.4% earned between 501 and 1000 Ghana cedis per month.

Table 4. 1: Socio-Demographic Characteristics of Respondents

Variables	Frequency	Percentage (%)
Age group		
18-29	133	21.6
30 – 39	178	28.8
40 – 49	125	20.3
50-59	84	13.6
60+	97	15.7
Gender		
Female	377	61.1
Male	240	38.9
Education		
No formal education	55	8.9
Primary education	45	7.3
JSS/JHS/Middle School	142	23.0
SHS/SSS//Tech/Voc	208	33.7
Tertiary	167	27.1
Marriage		
Never married	211	34.2
Married	287	46.5
Separated/divorced	70	11.3
Widowed	49	7.9
Religion		
Christian	431	69.9
Moslem/Islam	109	17.7
No religion/atheist	59	9.6
Traditionalist	18	2.9
Ethnicity		
Akan	402	65.2
Dagomba, Nanumba, Frafra	81	13.1
Ewe/Krobo	58	9.4
Ga-adangbe	20	3.2
Grusi/gruma/Gonja	41	6.6
Other	15	2.4

Table 4.2: Household Characteristics of Participants

Study Variable	Frequency	Percentage (%)
Household Owner		
No	470	76.2
Yes	147	23.8
Household Size		
1-3	115	18.6
4-6	275	44.6
7+	227	36.8
Household Head		
No	364	59.0
Yes	253	41.0
Residence		
Peri-urban	156	25.3
Urban	461	74.7
Employment		
Employed	458	74.2
Retiree/pensioner	32	5.2
Student	81	13.1
Unemployed	46	7.5
Occupation, if employed		
Agriculture/farming	15	2.4
Artisan	138	22.4
Civil/public servant	69	11.2
Private sector	33	5.3
Self-employed/entrepreneurship	105	17.0
Trading/business	98	15.9
Estate Location		
No	272	44.1
Yes	345	55.9
Income		
<500	153	24.8
500 – 1000	163	26.4
1001 – 2000	173	28.0
2001 – 3000	92	14.9
>3000	36	5.8

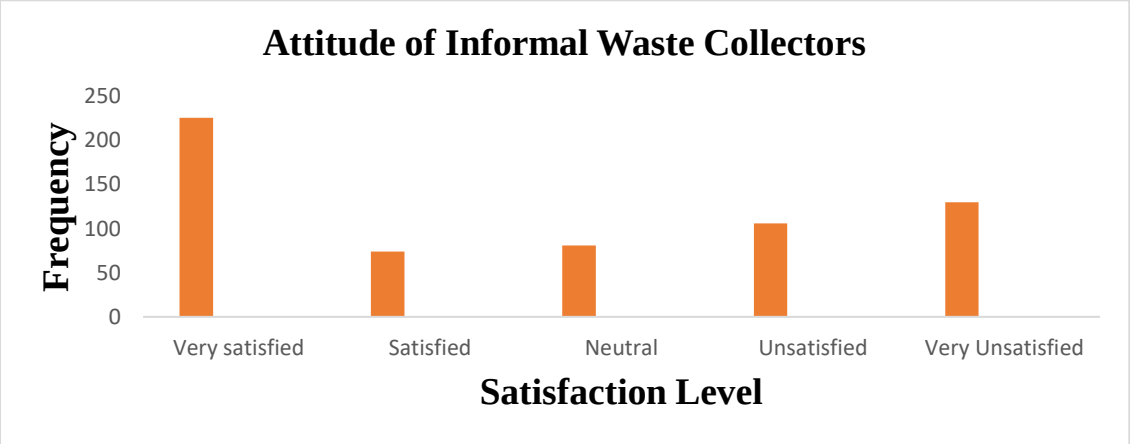


Figure 4:1: Attitude of informal waste collectors

The graph illustrates residents' ratings of informal waste collectors' attitudes. Most report being very satisfied, with smaller groups indicating satisfied or neutral views. However, a significant proportion expresses dissatisfaction, including a large, highly dissatisfied segment. Overall, the distribution reflects predominantly positive experiences, tempered by clear concerns among many households.

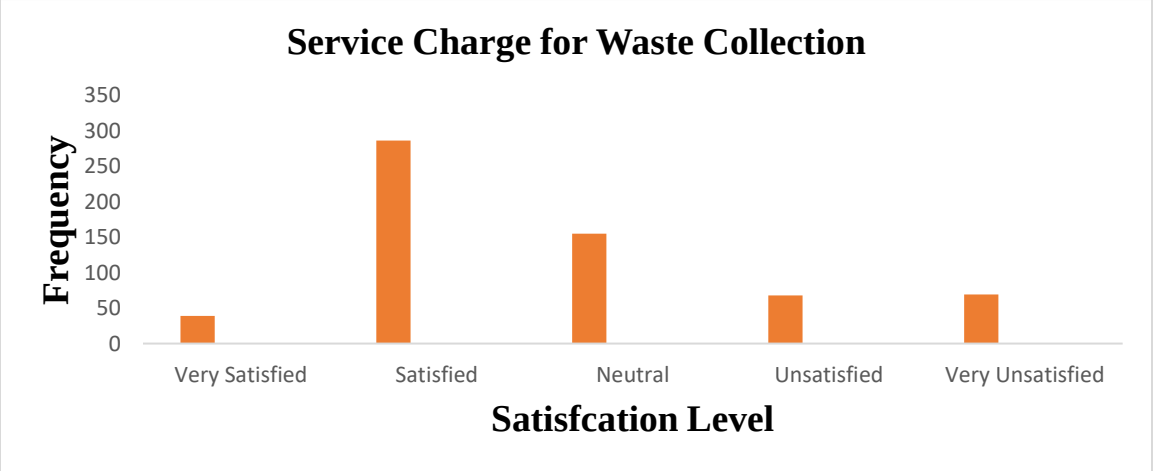


Figure 4:2: Service Charge for informal waste collection

The chart shows widespread support for waste collection charges, with most respondents satisfied. Neutral opinions are the second-largest group, while smaller but significant proportions report

dissatisfaction or strong dissatisfaction, and very few express high satisfactions. Overall, the pattern reflects general acceptance of fees, tempered by concerns over affordability and value.

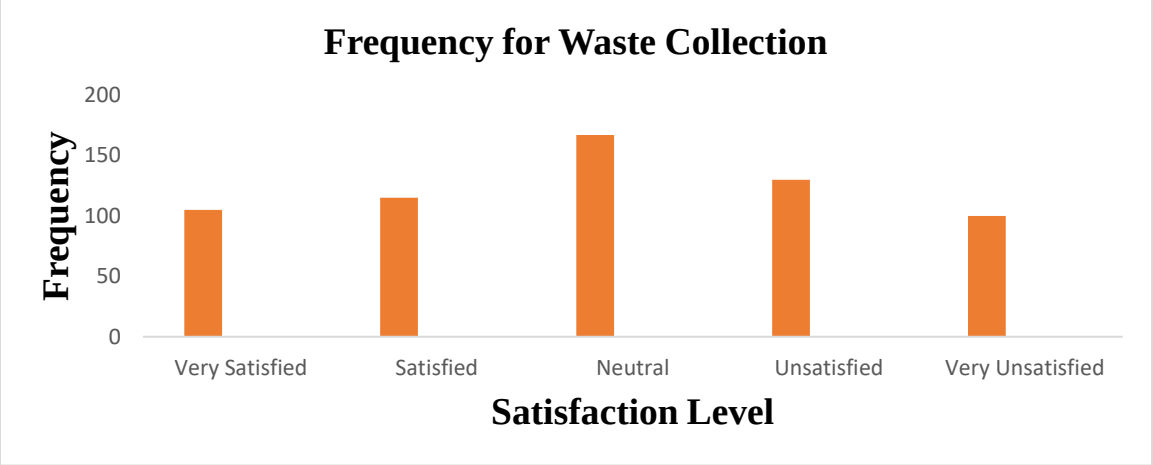


Figure 4:3: Frequency of informal waste collection

The chart displays mixed opinions on how frequently waste is collected. Neutral responses are the highest, followed by notable dissatisfaction. Satisfaction and strong satisfaction are moderate, while strong dissatisfaction is slightly lower. Overall, the pattern indicates inconsistent collection frequency, with many residents neither satisfied nor fully confident in the regularity of services.

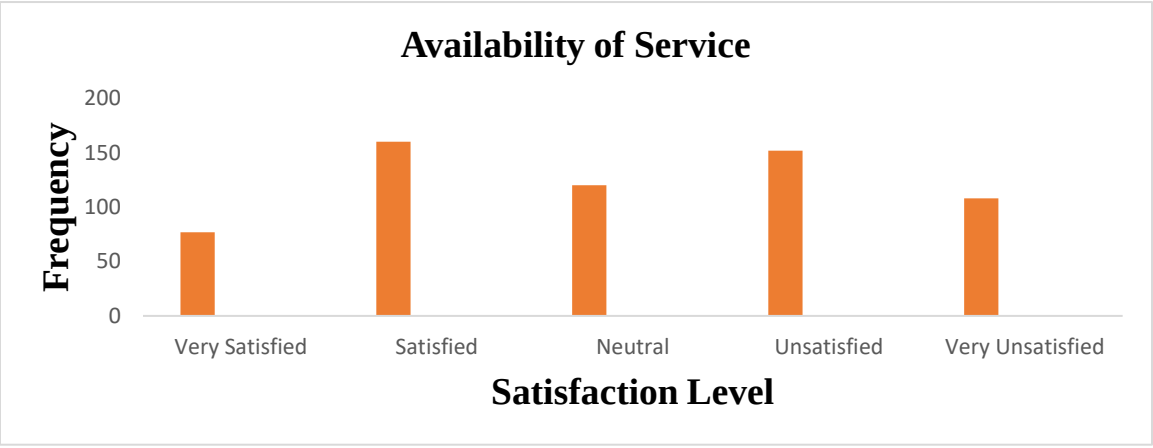


Figure 4:4: Availability of Service for informal waste collection

The graph displays satisfaction with service availability. Most respondents are satisfied, followed by neutral and unsatisfied groups. Very satisfied and very unsatisfied responses are less common. The distribution suggests moderate approval overall, with notable concerns among some households regarding consistency or access to services.

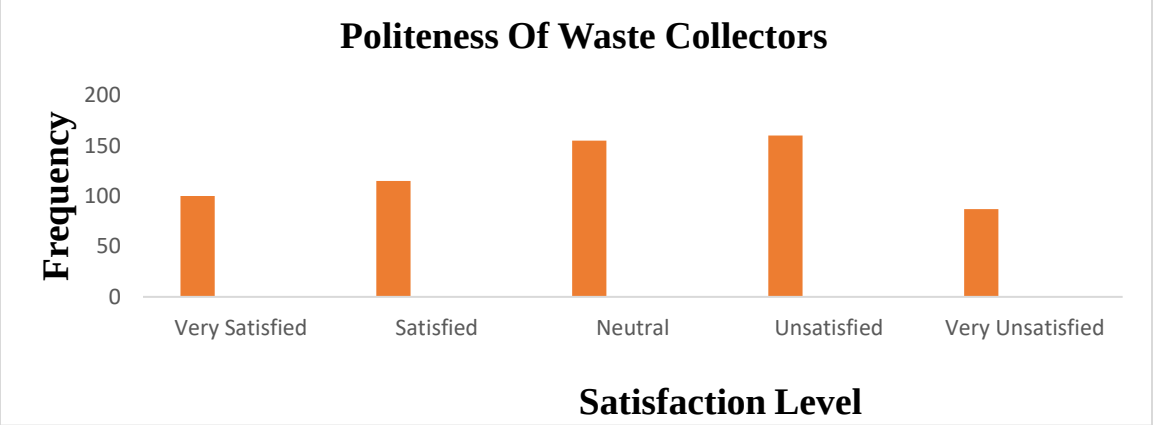


Figure 4:5: Politeness of informal waste collectors

The graph presents residents' ratings of waste collectors' politeness. Neutral and unsatisfied responses dominate, followed by very unsatisfied and satisfied groups. The distribution suggests mixed perceptions, with politeness often questioned, highlighting the need for improved interpersonal conduct in service delivery.

Figure 4:6: Reliability of informal waste collection

The graph illustrates satisfaction with waste collection reliability. “Satisfied” and “Unsatisfied” responses dominate, followed by “Neutral.” “Very Satisfied” and “Very Unsatisfied” are the least frequent. The distribution suggests mixed perceptions, with moderate approval offset by notable concerns, indicating inconsistent service experiences among households.

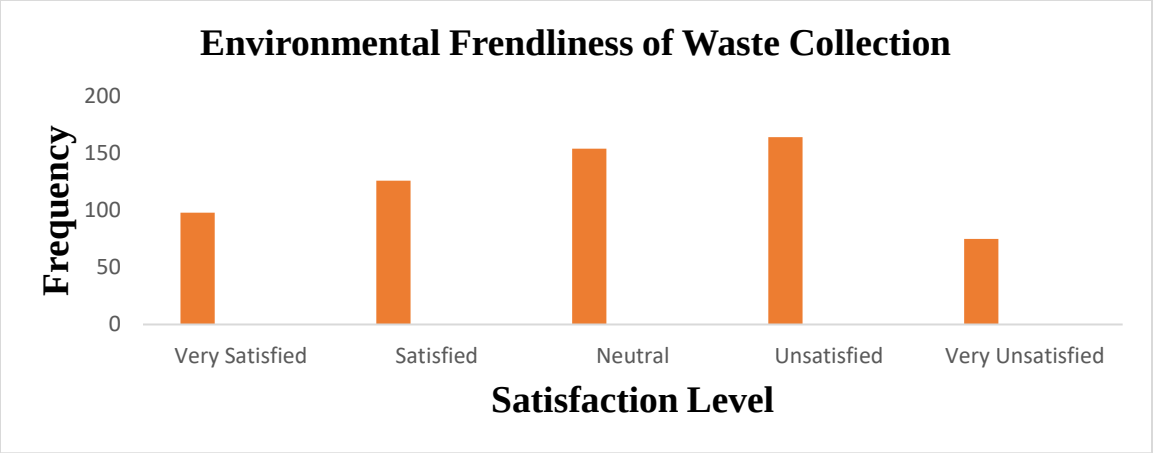


Figure 4:7: Environmental friendliness of informal waste collection

The graph shows residents’ ratings of the environmental friendliness of waste collection. Neutral responses dominate, followed by satisfied and unsatisfied views. The distribution suggests moderate approval, with mixed perceptions and concerns about the ecological impact of current waste management practices.

Table 4.4 shows that 25.8% were satisfied with the reliability of informal waste collection, 26.6% were unsatisfied with the environmental friendliness of informal waste collection, whereas 25.0% were neither satisfied nor unsatisfied with the environmental friendliness of waste collection. Assurance of disposing of waste safely, 13.1% and 27.1% were very satisfied and satisfied with the assurance that waste collected would be safely disposed. Concerning safety, 25.1% of the participants were neither satisfied nor unsatisfied, and 22.7% were satisfied with the safety of informal waste collection. The use of PPEs, 35.7% of the participants were satisfied with waste collectors' usage of PEEs, and 29.2% were neither satisfied nor unsatisfied. The majority (55.3%) of the participants indicated that the price of informal waste collectors is moderate, and 13.9%) indicated that the price is too high.

Table 4.4: Respondents' satisfaction level of informal waste collection

Satisfaction level	Frequency(n=617)	Percentage (%)
Assurance of disposing of waste safely		
Very satisfied	81	13.1
Satisfied	167	27.1
Neither satisfied nor unsatisfied	151	24.5
Unsatisfied	152	24.6
Very unsatisfied	66	10.7
Safety of waste collection		
Very satisfied	121	19.6
Satisfied	140	22.7
Neither satisfied nor unsatisfied	155	25.1
Unsatisfied	140	22.7
Very unsatisfied	61	9.9
Safety perception of waste collectors		
Very satisfied	75	12.2
Satisfied	178	28.8
Neither satisfied nor unsatisfied	180	29.2
Unsatisfied	139	22.5
Very unsatisfied	45	7.3
Waste collector wearing PPE		
Very satisfied	102	16.5
Satisfied	220	35.7
Neither satisfied nor unsatisfied	180	29.2
Unsatisfied	83	13.5

Very unsatisfied	32	5.2
Waste transportation to dump sites		
Very satisfied	82	13.3
Satisfied	153	24.8
Neither satisfied nor unsatisfied	172	27.9
Unsatisfied	127	20.6
Very unsatisfied	83	13.5
Price of waste collection		
Too low	45	7.3
Low	61	9.9
Moderate	341	55.3
High	84	13.6
Too High	86	13.9

4.1.3 Sustainability of informal waste collection

Table 4.5: Economic/Environmental and Social Sustainability of the informal household solid waste collection business

Economical/environmental/Social	Frequency (617)	Percentage (%)
How would you want informal waste collectors to be paid		
Per waste collection	311	50.4
Daily	93	15.1
Weekly	65	10.5
Monthly	148	24
What medium do you prefer to make the payment		
Cash	378	61.3
Electronic Payment	157	25.4
To an agency/company	44	7.1
No idea	38	6.2
Do you want the services to be digitalized		
Yes	227	36.8
No	118	19.1
No idea	272	44.1
Sustainability of informal waste activities		
Yes	496	80.4
No	121	19.6
Economical sustainability of informal waste		
Yes	479	77.6
No	138	22.4
Environmental sustainability of informal waste		
Yes	406	65.8

No	211	34.2
Satisfaction with the mode of disposal of waste collected		
Yes	406	65.8
No	211	34.2
Do you see waste collectors dumping indiscriminately		
Yes	76	12.3
No	541	87.7
Will you recommend the transfer station		
Yes	283	45.9
No	334	54.1
Do you think informal waste collection is environmentally friendly		
Yes	381	61.8
No	236	38.2

Table 4.5 presents the sustainability of informal solid waste collection among the 617 respondents. The majority (50.4%) of the participants claimed that waste collectors should be paid per waste collection, with cash being the dominant payment method (61.3%). Also, 44.1% of the participants were uncertain about the digitalization of informal waste, while 36.8% supported the digitalization. Most respondents (80.4%) perceived informal household solid waste collection activities as sustainable, 77.6% indicated that informal household waste collection is economically sustainable, and 65.8% accepted that informal household waste collection is environmentally sustainable.

Table 4.6 shows that 77.0% consider informal waste collection socially acceptable. Most (80.1%) participants reported that people in their communities actively use the services, and 9.9% believed that society is generally satisfied with the services provided.

Table 3: Economic/Environmental and Social Sustainability of the informal household solid waste collection business

Economical/environmental/Social	Frequency (617)	Percentage (%)
Do you think informal waste collection is socially sustainable		
Yes	475	77

No	142	23
Do people in your community patronize their services		
Yes	494	80.1
No	123	19.9
Do you think society is happy with their services		
Yes	493	79.9
No	124	20.1
Do you prefer their services to the formal waste collectors		
Yes	482	78.1
No	135	21.9
Do you think your community prefer their services to the formal waste collectors		
Yes	482	78.1
No	135	21.9

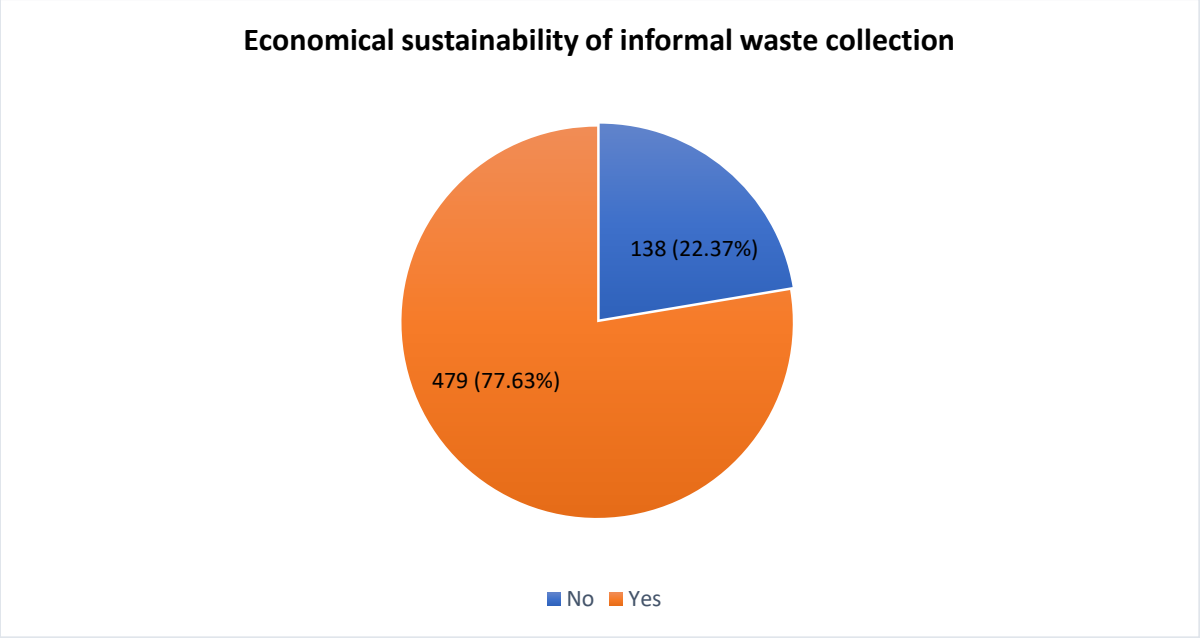


Figure 4:2: Economic sustainability of informal waste collection

Figure 4:2 presents a graphical representation of the economic sustainability of informal waste collection among the 617 participants, of which 77.63% considered informal waste collection to be economically sustainable. In contrast, 22.37% indicated that it is not economically sustainable.

Figure 4:3 shows that the majority of the participants (65.8%) considered informal waste collection to be environmentally sustainable, and more than 34.2% indicated that informal waste collection is environmentally unsustainable.

Figure 4:4 indicates that the social sustainability of informal waste collection is 61.8%, indicating that informal waste collection is socially sustainable, and 38.2% indicates that it is socially unsustainable.

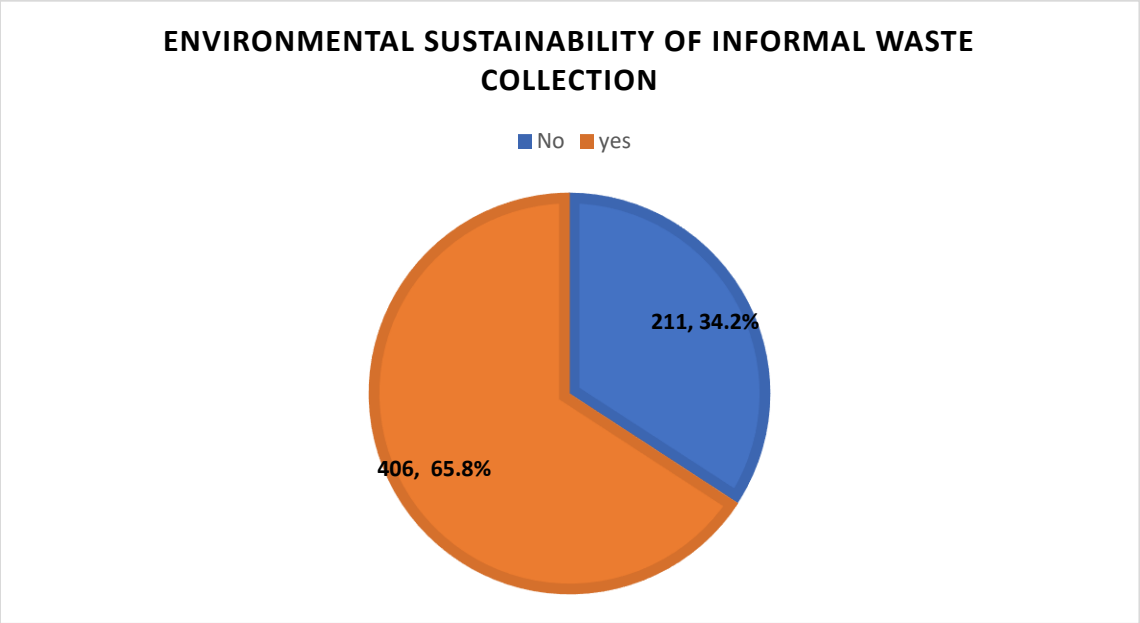


Figure 4: 3: Environmental sustainability of informal waste collection

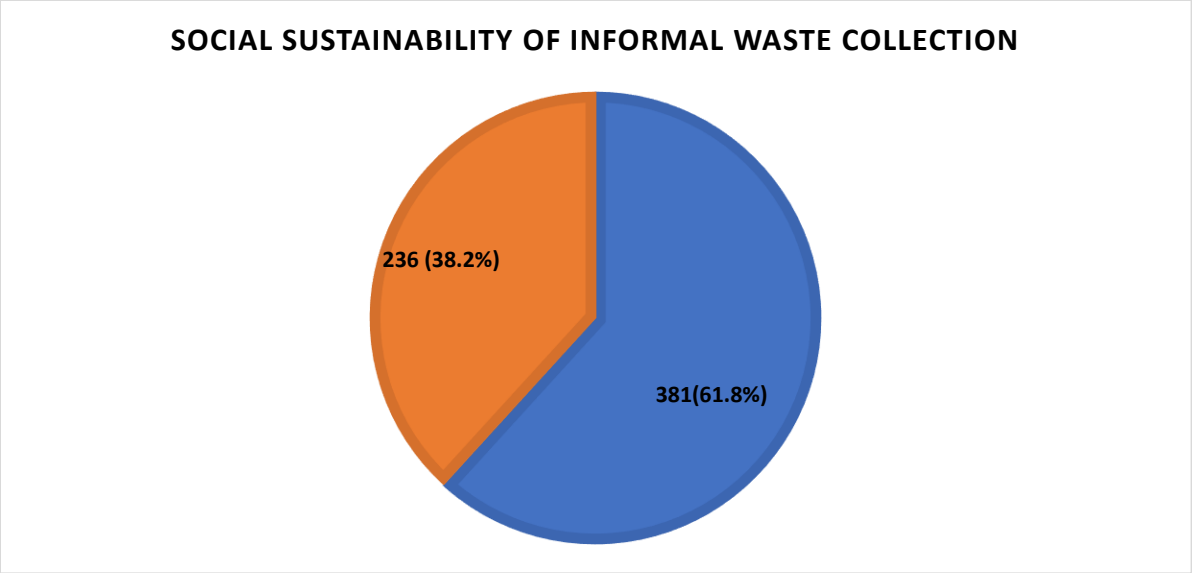


Figure 4: 4 Social sustainability of informal waste collection

4.3 Association between Socio-Demographic Characteristics of Participants with the overall satisfaction of informal waste collection

Table 4:7 Bivariate Analysis of socio-demographic characteristics and overall satisfaction of informal waste collection

Variable	Satisfied	Not satisfied	X^2 (p-value)
Age group(years)			7.9021(0.095)
18-29	106 (21.5)	27 (22.0)	
30-39	136 (27.5)	42 (34.1)	
40-49	110 (22.3)	15 (12.2)	
50-59	63 (12.8)	21 (17.1)	
60+	79 (16.0)	18 (14.6)	
Gender			0.5709 (0.449)
Female	306 (61.9)	71 (57.7)	
Male	188 (38.1)	52 (42.3)	
Education			**24.094 (<0.001)**
No formal education	41 (8.3)	14 (11.4)	
Primary education	26 (5.3)	19 (15.4)	

JSS/JHS/Middle School	108 (21.9)	34 (27.6)	
SHS/SSS//Tech/Voc	182 (36.8)	26 (21.1)	
Tertiary	137 (27.7)	30 (24.4)	
Marriage			2.944 (0.400)
Never married	165 (33.4)	46 (37.4)	
Married	238 (48.2)	49 (39.8)	
Separated/divorced	54 (10.9)	16 (13.0)	
Widowed	37 (7.5)	12 (9.8)	
Religion			6.879(0.075)
Christian	343 (69.4)	88 (71.5)	
Moslem/Islam	94 (19.0)	15 (12.2)	
No religion/atheist	46 (9.3)	13 (10.6)	
Traditionalist	11 (2.2)	7 (5.7)	
Ethnicity			10.041 (0.074)
Akan	321(65.0)	81 (65.9)	
Dagomba, Nanumba, Frafra	69 (14.0)	12 (9.8)	
Ewe/Krobo	49 (9.9)	9 (7.3)	
Ga-adangbe	14 (2.8)	6 (4.9)	
Grusi/gruma/Gonja	33 (6.7)	8 (6.5)	
Other	8 (1.6)	7 (5.7)	

Table 4:8 Bivariate Analysis of socio-demographic characteristics and overall satisfaction of informal waste collection

Variable	Satisfied	Not satisfied	X^2 (p-value)
Household Owner			**6.531 (0.010)**
Yes	129 (26.1)	18 (14.6)	
No	365 (73.9)	105 (85.4)	
Household size			**62.592 (<0.001)**
1-3	101 (20.4)	14(11.4)	
4-6	249(50.4)	26(21.1)	
7+	144 (29.1)	83 (67.5)	
Household Head			**26.101 (<0.001)**
Yes	228 (46.2)	25 (20.3)	
No	266 (53.8)	98 (79.7)	
Residence			**86.897 (<0.001)**
Peri-urban	85 (17.2)	71 (57.7)	
Urban	409 (82.8)	52 (42.3)	
Employment			**18.966 (<0.001)**
Employed	380 (76.9)	78(63.4)	

Retiree/pensioner	24 (4.9)	8 (6.5)	
Student	64 (13.0)	17 (13.8)	
Unemployed	26 (5.3)	20 (16.3)	
Estate Location			**26.319 (<0.001)**
No	192 (38.9)	80 (65.0)	
Yes	302 (61.1)	43 (35.0)	
Income			**25.25 (<0.001)**
<500	105 (21.3)	48 (39.0)	
500 – 1000	125 (25.3)	38 (30.9)	
1001 - 2000	150 (30.4)	23 (18.7)	
2001 - 3000	83 (16.8)	9 (7.3)	
>3000	31 (6.3)	5 (4.1)	

Table 4:7 and **4:8** present the results of the chi-square test of independence between the socio-demographic characteristics and overall satisfaction with informal waste collection. At 5% alpha level, education ($X^2 = 24.094$, P=<0.001), household owner ($X^{2\,=}$ 6.531, P=0.010), household size ($X^{2\,=}$ 62.592, P = <0.001), household head (X^2 = 26.101, P= <0.001), residence (X^2 = 86.897, P = <0.001), employment (X^2 = 18.966, P= <0.001), estate location (X^2 =26.319, P= <0.001), income (X^2 =25.25, P= <0.001) were statistically associated with overall satisfaction of informal waste collection. However, age **(**$X^2 = 7.9021$, P = 0.095), gender ($X^2 = 0.5709$, P = 0.449), marriage ($X^2 = 2.944$, P = 0.400), religion ($X^2 = 6.879$, P = 0.075), and ethnicity ($X^2 = 10.041$, P = 0.074) were not statistically associated with overall satisfaction with informal waste collection.

Table 4:9 presents the results of the chi-square test of independence between the sustainability key variables and overall satisfaction of informal waste collection. At 5% alpha level, frequency of waste collection (X^2=45.215, (P= <0.001), politeness of waste collector (X^2=38.683, P= <0.001), waste collectors wearing personal protective equipment (X^2=34.572, P= <0.001), waste transportation to site (X^2= 26.298, P = <0.001), digitalization of waste collection service

(X^2=43.712, P = <0.001), prefer informal waste activities sustained (X^2=121.2, P= <0.001) and prefer informal services over formal waste collection (X^2=14.434, P= <0.001) were statistically associated with overall satisfaction of informal waste collection whiles overflows of waste bin before collection of waste (X^2 =4.1026, P = 0.042) and indiscriminately dumping of waste (X^2=0.171, P= <0.679) were statistically not associated with overall satisfaction of informal waste collection.

Table 4.9 Bivariate Analysis of the sustainability of informal waste collectors and overall satisfaction

Variable	Satisfied (%)	Unsatisfied (%)	X^2 (p-value)
Overflows of the waste bin before collection			4.1026 (0.042)
Yes	66 (13.4)	26 (21.1)	
No	428 (86.6)	79 (78.9)	
Frequency of waste collection			**45.215(<0.001)**
Once daily	244 (52.4)	64 (50.1)	
Twice daily	43 (9.7)	32 (28.6)	
Once a week	172 (33.9)	30 (13.2)	
Once monthly/rarely	20 (4.0)	10 (8.1)	
Want service to be digitalized			**3.712(<0.001)**
Yes	198 (40.1)	29 (23.6)	
No	69 (14.0)	49 (39.8)	
No idea	227 (46.0)	45 (36.6)	
Prefer informal waste collection activities to be sustained.			**121.2(<0.001)**
Yes	441 (89.3)	55 (44.7)	

No	53 (10.7)	68 (55.3)	
Do waste collectors dump waste indiscriminately			0.171(<0.679)
Yes	59 (11.9)	17 (13.8)	
No	435 (88.1)	106 (86.2)	
Prefer informal services to the formal waste collectors			14.434(<0.001)
Yes	402 (81.4)	80 (65.0)	
No	92 (18.6)	43 (35.0)	

Table 4:10 presents the results of the logistic regression of overall satisfaction with informal waste collection. Respondents with secondary education or vocational training were more likely to be satisfied with informal waste collection compared to those with no formal education [OR= 2.39, 95%CI= 1.12 – 4.95], and landlords/ladies had increased odds of being satisfied with informal waste collection compared to tenants [OR= 2.05, 95%CI = 1.22 – 3.62]. Respondents with 7+ household size [OR=0.24, 95%CI 0.13 – 0.44] and unemployed respondents [OR=0.27, 95%CI 0.14 – 0.51] had lower odds of being satisfied with informal waste collection compared to their respective counterparts**.** Household heads had an increased odds of being satisfied with informal waste collection compared to their counterparts [OR=3.34, 95%CI=2.11 – 5.47].

In Table 4:10, after adjusting for other covariates, respondents who obtained secondary education or vocational training had decreased odds to be satisfied with informal waste collection compared to no formal education [AOR= 0.47, 95%CI=0.23 – 0.98], respondents who were very satisfied with the politeness of informal waste collectors had an increased odds [AOR = 1.35, 95% CI: 1.11 – 3.03] of being satisfied with informal waste collection, and participants who believed in the sustainability of informal waste collection had the highest odds of being satisfied with informal waste collection [AOR=5.81,95%CI:3.20–10.70]. Conversely, unemployed respondents had the lowest odds of being satisfied with informal waste collection and respondents who were very unsatisfied with waste collectors wearing personal protective equipment had lower odds of being

satisfied with informal waste collection [AOR=0.27, 95%CI:0.10 – 0.71] and [AOR = 0.16, 95% CI:0.05 – 0.49], respectively.

Table 4:10 Logistic regression of overall satisfaction with informal waste collectors

Variable	OR	95% CI (P-value)	AOR	95% CI (P-value)
Education				
No formal education	Ref	Ref	Ref	Ref
Primary education	0.47	[0.20 – 1.10] (0.083)	0.99	[0.47 – 2.02] (0.982)
JSS/JHS/Middle School	1.09	[0.52 – 2.21] (0.818)	0.68	[0.34 – 1.34] (0.262)
SHS/SSS//Tech/Voc	**2.39**	**[1.12 – 4.95] (0.025)**	**0.47**	**[0.23 – 0.98] (0.044)**
Tertiary	1.56	[0.74 – 3.20] (0.238)	1.08	[0.57 – 2.04] (0.817)
Household owner				
No	Ref	Ref	Ref	Ref
Yes	**2.05**	**[1.22 – 3.62] (0.006)**	1.39	[0.61 – 3.28] (0.447)
Household size				
1-3	Ref	Ref	Ref	Ref
4-6	1.33	[0.65 – 2.63] (0.423)	0.57	[0.24 – 1.30] (0.193)
7+	**0.24**	**[0.13 – 0.44] (< 0.001)**	0.48	[0.17 – 1.29] (0.142)
Household Head				
No	Ref	Ref	Ref	Ref
Yes	**3.34**	**[2.11 – 5.47] (<0.001)**	1.73	[0.85 – 3.65] (0.138)
Residence				
Peri-urban	Ref	Ref	Ref	Ref
Urban	**6.57**	**[4.39 – 10.46] (<0.001)**	1.79	[0.67 – 4.89] (0.248)
Employment				
Employed	Ref	Ref	Ref	Ref
Retiree/pensioner	0.61	[0.27 – 1.51] (0.268)	0.65	[0.20 – 2.30] (0.484)
Student	0.77	[0.43 – 1.42] (0.391)	0.78	[0.31 – 2.02] (0.603)
Unemployed	**0.27**	**[0.14 – 0.51] (< 0.001)**	**0.27**	**[0.10-0.71] (0.007)**
Estate Location				
No	Ref	Ref	Ref	Ref
Yes	**2.92**	**[1.94 – 4.44] (<0.001)**	**0.90**	[0.41 – 1.92] (0.779)
Income				
<500	Ref	Ref	Ref	Ref
500 – 1000	1.50	[0.91 – 2.48] (0.110)	1.00	[0.45 – 2.25] (0.994)
1001 – 2000	**2.96**	**[1.71 – 5.25] (<0.001)**	0.96	[0.39-2.34] (0.920)
2001 – 3000	**4.14**	**[2.00 – 9.54] (<0.001)**	1.46	[0.49-4.55] (0.508)
>3000	**2.76**	**[1.08 – 8.62] (0.032)**	0.73	[0.19- 3.02] (0.644)

Frequency of waste collection				
Once daily	Ref	Ref	Ref	Ref
Twice daily	**0.29**	**[0.16 – 0.51] (<0.001)**	2.84	[0.27 – 24.10] (0.351)
Once a week	**2.48**	**[1.37 – 4.79] (0.002)**	3.68	[0.36 – 28.68] (0.230)
Once monthly/rarely	0.49	[0.22 – 1.16] (0.101)	2.16	[0.21 – 18.29] (0.491)

Table 4.11 Logistic regression of overall satisfaction with informal waste collectors

Want service to be digitalized				
No	**Ref**	**Ref**	**Ref**	**Ref**
Yes	**4.81**	**[2.83 – 8.31] (<0.001)**	1.71	[0.78 – 3.75] (0.176)
No idea	**3.57**	**[2.19 – 5.83] (<0.000)**	1.88	[0.90 – 3.88] (0.089)
Sustainability of informal waste collection				
No	**Ref**	**Ref**	**Ref**	**Ref**
Yes	**10.21**	**[6.50 – 16.22] (<0.001)**	**5.81**	**[3.20 – 10.70] (<0.001)**
Do you prefer informal services to the formal waste collectors				
No	**Ref**	**Ref**	**Ref**	**Ref**
Yes	**2.35**	**[1.51 – 3.62] (<0.001)**	1.17	[0.64 – 2.10] (0.602)

4.2.1 Participant background information

This qualitative inquiry involved 10 in-depth interviews (IDIs) with informal household waste collectors and five key informant interviews (KIIs) with senior municipal and regional environmental health officials within the Greater Kumasi Metropolis, Ghana. All IDI participants were male, with their ages ranging from 25 to 50 years and a mean of 35.2 years. Regarding education, half (50%) of the participants had completed secondary education, followed by those with no formal education (30%). The informal waste collectors worked across various districts, including Suame, Aboabo, Asokwa, Asokore-Mampong, and Oti. KII participants included a Regional Environmental Health Director and a Municipal official, with nearly two-thirds of the participants (60%) having 10 or more years of work experience. For the KII participants, the age

ranges from 38 to 53 years, with the majority (80%) being males, holding various positions such as Environmental Health Assistant, Director, and Unit heads, and having working experience ranging from 4 to 24 years.

Table 4:12: In-Depth Interview Participants

Participant ID	Age	Gender	Education	District	Years in Collection
IDI-1	25	Male	SHS	Unspecified	10
IDI-2	34	Male	None	Aboabo	9
IDI-3	47	Male	Primary	Asokwa	10
IDI-4	43	Male	None	Asawase	8
IDI-5	27	Male	JHS	Suame	5
IDI-6	41	Male	SHS	Asokwa	18
IDI-7	34	Male	None	Aboabo	9
IDI-8	26	Male	SHS	Oti	10
IDI-9	50	Male	SHS	Asokwa	10
IDI-10	25	Male	SHS	Asokore-Mampong	12

Table 4: 13 Key Informant Interview (KII) Participants

Participant ID	Age	Gender	Position	District	Work experience
KII-1	45	Male	Head of Solid Waste Unit	Kumasi Metro	11
KII-2	39	Female	Environmental Health Assistant	Old Tafo	4
KII-3	53	Male	Regional Environmental Health Director	Kumasi Metro	24
KII-4	48	Male	Head of Unit	Old Tafo	19
KII-5	38	Male	Senior Public Health officer (Land force)	Kumasi Metropolitan	12

Perspectives of Informal Waste Collectors (IDIs)

Operational Insecurity and Unregulated Competition

The study revealed operational insecurity and unregulated competition among informal household waste collectors. Specifically, the lack of operational protection was concerning the territory and competition. Respondents reported that there are no regulations governing their activities, and there are frequent encroachments and even penetration into their works by unregistered or foreign collectors, often leading to confrontations and fighting. The participants further aver that these unregulated entries have exacerbated tension and led to a reduction of profits, mainly as newcomers accept lower fees, disrupting established relationships and expectations. The following are the excerpts from the IDIs of the informal waste collectors:

"People just buy tricycles and start work. They are unaware of the rules. Most of them are foreigners and they invade our zones. Sometimes, we fight, in fact, a physical fight, just to claim our working space." (IDI-1)

"There are no rules. Anyone can wake up and start this work. It creates too many people for one area, and we end up with too little waste to collect and little profit." (IDI-4).

Economic sustainability of informal waste collection

Economic sustainability was the most contested domain. Participants shared varying responses related to the economic sustainability of informal household waste collection. Some participants believe that the job is economically sustainable, whilst others share different perspectives. Specifically, while some collectors found the job a crucial supplement to their income, many struggled with rising operational costs, particularly those related to fuel and tricycle maintenance, as well as inconsistent household payments. Participants had the following to share:

"The work could collapse today if we're only looking at money. Fuel prices are killing us, and customers don't always pay. Sometimes, you work a whole day and make a loss." (IDI-3).

Another participant averted that:

"We manage because we do other things too. I fix electricals after my morning rounds. This job alone can't take care of you." (IDI-2)

However, very few of the participants hold different assertions that there is potential in the work if better structured and supported:

"If they reduce the dumping fee and help with fuel, this job can take care of families. We're not lazy; we just don't get support." (IDI-9)

Environmental Sustainability

The study revealed a divergent view on the environmental sustainability of informal household waste collection. However, most respondents affirmed that informal household waste collection is environmentally sustainable, citing the necessity of their work and highlighting the absence of formal services in specific neighbourhoods. The following are quotes from the IDIs conducted:

"We go to places no one goes. Not even Zoomlion. Communities depend on us. If we don't come, they throw it in the drains." (IDI-6)

While others acknowledged that household waste collection is sustainable, some noted that waste availability was inconsistent, with increased competition reducing daily volumes and thereby heightening the risk that the work would not be environmentally sustainable. Below is the quote:

"Sometimes, I don't get half a load. I must wait or do another job until I can get more. There are too many collectors now." (IDI-5).

Social Sustainability

In terms of the social sustainability of informal household solid waste collection, the study revealed divergent views as waste collectors' social perceptions were ambivalent. Some of the household waste collectors acknowledged their essential role, but they also felt undervalued or disrespected, especially when households delayed payments or refused service. Participant made this assertion:

"They treat us like the garbage we collect. Only when they need us, then they talk nicely. Otherwise, they act like we're not humans." (IDI-7)

While others felt disrespected and undervalued, others held a different opinion. Other waste collectors described their strong relationships with long-term clients, even citing emotional support and mutual recognition. The following are excerpts:

"Some call me 'my collector or cleaner' with pride. They wait for me; they smile and even give me food sometimes. That's how we build trust." (IDI-2)

Institutional Neglect and Absence of Training

The study revealed lamentations of the informal household waste collectors of institutional neglect and absence of training or refresher training. Specifically, the study found that the consistent concern across participants was the lack of structured training, equipment, or health support from municipal authorities. Few had ever received gloves or masks, and none reported regular check-ups or health insurance. Participants shared the following:

"No one thinks about our health or safety. We use our hands, we get cuts, infections… still, no one asks if we are okay." (IDI-5)

"At the beginning, someone came to take our names. That's all. They promised training, but nothing happened." (IDI-1)

While there were great lamentations on the institutional neglect and training absence, very few groups reported internal training initiated by local leaders or associations. Below are excerpts from the IDIs conducted:

"Our leader bought gloves and trained us on how to cover the waste with nets. But he's just one man; he can't do everything." (IDI-6)

Attitudes Towards Regulation and Formalization

The study revealed that participants were willing and ready to be formalized and regulated. Participants expressed openness to formal registration and regulation; however, this formalization and regulation must be beneficial to the informal waste collectors. For example, the provision of tangibles like PPE, fuel subsidies, and fair remuneration. In addition, the household waste collection common demand was for territorial zoning and professionalization, including licenses, uniforms, and structured dumping protocols. Despite the strong agreement and attitudes towards formalization and regulation, some of the informal waste collectors were skeptical about working for companies that might underpay or restrict autonomy. Participants had the following to share:

"If the company pays well and gives us fuel, PPE, and insurance, then I will join. But not if they just come to take our money." (IDI-8)

"We don't want Zoomlion-style exploitation. They delay salaries for months. We need trust and good working conditions." (IDI-10)

"Everyone should be registered and given an ID. You can't just wake up and start working. That's why there's chaos." (IDI-9)

B. Perspectives of Key Informants (KIIs)

Recognition of Role of informal collectors and service gaps

The study revealed that all the key informants are highly aware of the work of the informal household waste collectors. All key informants acknowledged that the informal collectors filled a major vacuum in municipal waste services, especially in peri-urban and low-income communities. The key informants shared the following:

"No assembly can collect all the refuse we generate. Informal collectors are bridging that gap; without them, we would drown in filth." (KII-3)

"In my own house, we have an informal collector who comes every Thursday. It works because the formal trucks can't reach us." (KII-2)

Regulation Capacity and Institutional Constraints

Regarding the capacity to regulate the activities of the informal waste collectors, the key informants revealed that the Metropolitan and municipal assemblies possessed the capacity to regulate IWCs but were often constrained by bureaucratic or political barriers. The informants shared that once they are given the green light, they can regulate the informal waste collectors and ensure the sustainability of their activities. The following were excerpts from the KIIs:

"We had plans to organize them. But management said we need approval from the Ministry. Zoomlion is the only approved contractor now." (KII-4)

"We have the structure. We just don't have the go-ahead. It's frustrating because the informal sector could be an asset." (KII-1)

Satisfaction with Services and Quality Concerns

Regarding satisfaction with the activities of informal waste collectors, the study revealed varying levels of satisfaction among the informants. Although informants expressed measured satisfaction by praising the coverage and flexibility of informal waste collection activities, they were

concerned about hygiene, professionalism, and public safety following their work. Informants had the following to share:

"Some of them use the same tricycle to carry food and garbage. That's dangerous. And some don't wear gloves or boots." (KII-3)

"Children, even 12-year-olds, are riding these waste bikes. That's an accident waiting to happen." (KII-1)

Despite all this, on the overall satisfaction level using a scale of 1 to 10, the key informant gave a relatively high satisfaction score for the activities of the informal waste collectors. Participant expressed the following:

"I'd rate their contribution as 8 out of 10. They are helping, no doubt. But they need training and supervision." (KII-3).

Pathways to Sustainability—Registration and Revenue Streams

The study revealed that the key informants held strong beliefs that the activities of informal waste collectors could be sustained. However, they emphasized that sustainability (i.e economic, environmental, and social) can be achieved through structured formalization and integration into existing or formaliZed waste collection systems. Without this, participants revealed that the activities of waste collectors will not be sustainable. The informants shared the following quotes:

"We could include their service charges in our fee-fixing structure. That way, they get paid officially and can maintain their tricycles." (KII-1)

Some municipalities have already introduced designated dumping containers for IWCs, which generated modest revenue:

"We assigned them a container, and they pay a small fee to dump there. We collect 2500 cedis monthly from just one location." (KII-2).

Integration, Monitoring, and Reporting Frameworks

Regarding the integration, monitoring, and reporting frameworks for informal household waste collectors, the key informant expressed strong possibilities. Specifically, the key informants proposed that using multiple tracking and accountability mechanisms, including sticker systems, association-based monitoring, and digital reporting, would help establish an effective integration, monitoring, and reporting structure for these informal collectors. This would ensure their work is done in accordance with environmental practices, prioritising safety, professionalism, and sustainability. The key informants shared the following:

"We can use coloured stickers—red for garbage, green for food. That way, we know who is supposed to do what." (KII-3)

"Let's decentralize the reporting. Unit committee members can track who dumps where and how often. That would create real accountability." (KII-5)

The key informants expressed that although currently there is no formal integration in place, all informants agreed it was a necessary next step. Below is an excerpt of the KII:

"We need to bring them under an umbrella. That way, we can regulate, protect, and collaborate with them for better waste management." (KII-2).

4.3 Mode of tracking Informal Household Solid Waste Collection in Greater Kumasi Metropolis

The study revealed a profound insight that, despite acknowledging the informal waste collectors and their critical role in waste management in the Greater Kumasi Metropolis, which operates mostly outside formal regulatory or monitoring systems, there is currently no standardized tracking system to monitor their waste collection and activities. Results from both the IDIs and KIIs reveal that the tracking of informal waste collection is currently informal, fragmented and inconsistent across different jurisdictions.

4.3.1 Absence of Structured Tracking Systems

The study revealed that there is currently a lack of a formal system for monitoring informal waste collection, despite its acknowledged role in waste collection and management in the Metropolis. Although some municipalities indicated that, in practice, some limited tracking is done at waste disposal points. However, this method of tracking is not uniformly adopted across all districts and often lacks integration with broader municipal waste data or tracking systems. This finding highlights an overarching institutional gap regarding oversight (including tracking) and accountability mechanisms. Below are excerpts from the Key Informant Interviews:

"No, there is no such plan to track the activities of informal waste collectors (KII-1).

Similarly, a key informant confirmed that: *"For now, there's no plan. There's no plan to track activities of informal waste collectors"*. (KII-3).

One officer described: *"We have someone at the central collection site so that the person can take records on the tricycles that come to dump the refuse, but this is not formal"* (KII-2).

Despite the availability of a structured tracking or monitoring system in the Greater Kumasi Metropolis, some informants believe that their colleagues act as their monitors and ensure the right things are done. Participants expressed that some monitoring efforts occur informally through peer networks. This form of horizontal accountability operates in the absence of formal regulation and depends heavily on the cohesion and leadership within informal waste collectors.

Key informant had this to say:

"Their own colleagues should be able to monitor their other colleagues that if they are not doing the right thing, they can tell us" (KII-3).

4.3.2 Recommendations for Registration and Technological Integration

Although there are currently no tracking systems for informal waste collection in the Greater Kumasi Metropolis, Key informants believed that it is more than essential to formally register and

digitally track the activities of informal waste collectors to improve monitoring and accountability. Key informants strongly asserted that although registration and tracking are of utmost importance to both local officials and regulators, they will also be contingent upon a growing consensus among waste collectors for the use of digitised solutions to facilitate efficient tracking.

The KIIs revealed the following:

"We gave them unique codes to prevent cross contamination... we should expand and make it easier for everyone to see them and make tracking effective" (KII-4).

Another added: *"Wouldn't it be appropriate to have trackers on the tricycles so that we have a central system? That would be best"* (KII-2).

4.3.3 Perspectives of Informal Waste Collectors

Despite the unavailability of a standardized or formalized mode of tracking for informal waste collection in the Metropolis, the informal waste collectors articulated the need for regulation and structured oversight, including instituting a formalized tracking system. The participants had these to share:

"Some people just litter the waste materials around... we have to be registered with identification numbers so that [offenders] will be sanctioned" (IDI-2).

"There should be proper monitoring to identify those who are doing the job well and those who need to be sacked" (IDI-1).

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter systematically reviews the study's outcomes according to the specific objectives. It presents the study's findings, compares them with relevant literature, identifies contributing factors, and discusses their implications.

5.1.2 Public satisfaction with informal household solid waste collection

The current study revealed that participants' demographics significantly influenced their satisfaction with informal waste collection services. Respondents with secondary or vocational education were more likely to express satisfaction compared to those without formal education. This finding aligns with studies that highlight education as a key determinant of environmental satisfaction and waste management behaviour (Asante *et al*., 2021; Boateng *et al*., 2023). Educated individuals often have greater awareness of environmental sanitation and a better appreciation of the benefits of organised waste collection, which may shape more positive attitudes toward informal systems (Oduro-Appiah *et al*., 2020).

Similarly, landlords or landladies were more likely to be satisfied compared to tenants. This supports findings from Aidoo and Mensah (2022), who observed that property owners tend to engage more actively in community waste initiatives, given their long-term stake in property maintenance and neighbourhood cleanliness. Tenants, on the other hand, may perceive waste services as the responsibility of landlords, reducing their satisfaction or participation levels.

Conversely, respondents from larger households (more than 7 members) and unemployed individuals had significantly lower odds of satisfaction. This is consistent with studies showing that higher household waste generation without adequate disposal options can lead to dissatisfaction (Osei-Tutu *et al.,* 2020). Economic constraints among unemployed individuals may

also heighten dissatisfaction due to perceived costs or inefficiencies in informal services (Abalo *et al*., 2022).

Finally, household heads were more satisfied with informal waste collection. This is consistent with studies that report household decision-makers are often more engaged with waste service providers and community sanitation activities (Alhassan *et al*., 2023). These findings emphasize the role of socio-economic factors in shaping public perceptions of informal waste systems and highlight the need for community education and policy support to enhance service satisfaction and sustainability.

5.1.3: Sustainability of informal household solid waste collection

The findings of the study revealed a strong association between waste collection frequency and satisfaction levels among participants of informal waste collection systems. These results support earlier studies indicating that timely waste collection significantly influences residents' perceptions of service quality (Bello *et al.,* 2020; Miezah *et al*., 2015). Irregular collection often leads to waste pile-up, odour, and public health risks, which undermine trust in informal waste systems (Boateng *et al*., 2019). Therefore, consistent service delivery remains a key determinant of satisfaction.

The politeness of waste collectors also showed a strong association with satisfaction, aligning with previous research that identified interpersonal relations and service courtesy as important predictors of perceived service quality in community-based waste systems (Adeolu *et al*., 2018). Positive interactions enhance community cooperation and willingness to pay for waste services (Munyai & Odiyo, 2021). Conversely, impolite behaviour or poor communication may discourage participation and weaken community-based environmental initiatives.

Similarly, the finding that the use of personal protective equipment (PPE) by waste collectors is significantly associated with satisfaction aligns with the broader occupational health literature. Studies show that when waste handlers wear visible protective gear, it signals professionalism, safety consciousness, and reliability (Aluko *et al*., 2016; Wilson *et al*., 2012). In many developing countries, the absence of PPE reflects poor regulation and limited formal support for informal waste workers, which can negatively affect public perception (Blaise *et al*., 2022).

The significant relationship between waste transportation and satisfaction indicates that how efficiently waste is moved from collection points to disposal or recycling sites matters to residents. Similar findings were reported by Zurbrügg *et al*. (2018), who emphasised that delays in transporting collected waste often result in secondary dumping and odour nuisances, reducing public confidence in waste management systems.

The association between digitalisation of waste collection services and satisfaction reflects a growing shift toward technology-enabled waste management. Studies across African cities have highlighted how mobile-based coordination, GPS tracking, and digital payment systems improve accountability and convenience in informal waste operations (Oduro-Appiah *et al*., 2022). The positive association here suggests that respondents value modernisation and transparency within the informal system.

The strongest association observed was between the preference for sustaining informal waste activities and overall satisfaction. This reinforces findings from several studies that informal waste systems, despite being unregulated, are deeply embedded in urban livelihoods and fill gaps left by formal municipal services (Wilson *et al*., 2012; Oguntoyinbo, 2019). Respondents' preference for informal services over formal ones may stem from affordability, flexibility, and proximity, which have been cited as advantages of informal waste collection (Miezah *et al*., 2015).

In contrast, overflow of waste bins and indiscriminate dumping were not significantly associated with satisfaction. While these issues are visible indicators of poor waste management, they may be viewed as systemic challenges beyond the control of informal collectors, especially in areas lacking infrastructure or adequate disposal sites (Kaza *et al*., 2018). This suggests that users may differentiate between the shortcomings of the system and the performance of individual service providers.

These findings highlight that satisfaction with informal waste collection is influenced more by the quality of interaction, consistency of service, safety practices, and modernization efforts than by broader systemic waste challenges. Similar to observations in other developing contexts, the results emphasize the need for integrating informal waste actors into formal urban waste management systems through structured partnerships, training, and digital support. Strengthening these areas could enhance public satisfaction, improve environmental outcomes, and promote sustainable waste management practices across communities.

5.1.4: Mode of tracking informal household solid waste collection

The study revealed that there is currently no formal system for monitoring informal waste collection, despite its important contribution to waste management in the Metropolis. While some municipalities indicated limited tracking at disposal sites, this practice is inconsistent across districts and lacks integration with broader municipal waste data systems. This finding highlights a significant institutional gap in oversight, coordination, and accountability mechanisms.

This finding aligns with several studies that have documented weak institutional frameworks and fragmented governance in managing informal waste systems in developing countries (Wilson *et al*., 2012; Gutberlet & Uddin, 2017). These studies suggest that while informal waste collectors play a central role in urban sanitation, local governments often fail to incorporate them into formal

waste management strategies. The absence of structured monitoring systems results in data gaps that hinder policy planning, resource allocation, and performance evaluation.

Similarly, research by Osei and Agyeman (2021) in Accra found that informal waste activities were largely invisible in municipal databases, even though they accounted for a substantial portion of waste recovery. The inconsistency in tracking, as reported in this current study, reflects broader issues of informality, where operations depend on ad hoc practices rather than standardized procedures. This lack of integration weakens accountability and limits the ability to regulate or support informal actors effectively.

The current study also identified that, in the absence of formal oversight, some informal monitoring occurs through peer networks. This form of horizontal accountability, where colleagues monitor each other's practices, has been reported in related literature as a self-regulatory mechanism within informal sectors (Schneider & Williams, 2013). Such arrangements depend heavily on trust, group cohesion, and leadership rather than institutional control. While this can promote community-based discipline, it is not a substitute for a structured monitoring framework that ensures compliance with safety and environmental standards.

The lack of a coordinated monitoring system, as revealed by this study, could be attributed to several factors. First, limited municipal resources and staffing constraints often make it challenging to formalize monitoring of the large and dispersed informal waste sector (Oduro-Appiah *et al*., 2019). Second, policy ambiguity about the recognition of informal waste collectors creates uncertainty, discouraging municipalities from investing in structured oversight systems. Finally, the absence of clear communication and collaboration channels between informal collectors and local authorities reduces opportunities for data integration and joint decision-making.

The implications of these findings are significant. Without formal monitoring, municipalities lack reliable data on waste volumes handled by informal collectors, which limits their ability to plan for infrastructure and environmental management. The lack of accountability also increases the risk of unsafe disposal practices, environmental pollution, and occupational hazards among waste workers. Moreover, the informality perpetuates social and economic exclusion, as informal collectors remain outside of municipal support systems such as training, health insurance, and access to protective equipment.

This study suggests that integrating informal waste collectors into formal monitoring and reporting systems could improve overall waste governance. Establishing a participatory framework that includes informal workers in data collection, oversight committees, and performance reviews can strengthen accountability and enhance coordination between actors. Similar integration models in Latin America, such as in Colombia and Brazil, have demonstrated that formal recognition and inclusion of informal recyclers lead to better waste recovery rates, improved worker welfare, and more reliable municipal data (Dias, 2016; Gutberlet, 2018).

Therefore, the findings underscore the need for policy reform and institutional support to bridge the current oversight gap. Municipalities should establish standardized tracking mechanisms at disposal points, build digital waste data systems that include informal contributions, and promote collaborative monitoring between local authorities and informal waste associations. These steps will help ensure transparency, enhance efficiency, and contribute to sustainable waste management outcomes in the Greater Kumasi Metropolis.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

6.1 Introduction

This chapter summarizes the study's significant findings, limitations, conclusions from the results obtained, and recommendations for further studies.

6.2 Summary of the key findings

The study sampled 617 respondents: 28.8% were aged 30–39 years, and 21.6% were 18–29 years. Females comprised 61.1% of the sample. Educational attainment varied, with 33.7% completing secondary or vocational education, 23.0% junior secondary/middle school, and 7.1% tertiary education. Nearly half (46.5%) were married, 34.2% never married; 69.9% identified as Christian and 17.7% as Muslim. The predominant ethnic group was Akan (65.2%), followed by Dagomba/Nanumba/Frafra (13.1%).

Chi-square tests of independence reveal the association between participants' socio-demographic factors and their overall satisfaction with informal waste collection: education ($X^2 = 24.094$, $p < 0.001$), household ownership ($X^2 = 6.531$, $p = 0.010$), household size ($X^2 = 62.592$, $p < 0.001$), household headship ($X^2 = 26.101$, $p < 0.001$), residence ($X^2 = 86.897$, $p < 0.001$), employment status ($X^2 = 18.966$, $p < 0.001$), estate location ($X^2 = 26.319$, $p < 0.001$), and income ($X^2 = 25.25$, $p < 0.001$). Age, gender, marital status, religion, and ethnicity were not significantly associated with satisfaction.

6.2 Conclusion

The study found that 80.1% of residents were satisfied with informal waste collection services. Much of this satisfaction stemmed from how collectors interacted with households and from the perception that these services support environmental and social sustainability. At the same time, residents with higher levels of education, those who were unemployed, and those who were dissatisfied with the use of personal protective equipment reported lower satisfaction levels. The findings show that the informal solid waste collection sector is viewed as economically beneficial, environmentally responsible, and socially supportive. Still, the sector operates under several constraints, including high operational costs, inconsistent payments, limited disposal facilities, and ongoing social marginalization. The study also highlights that current tracking and record-keeping practices within the sector are informal, fragmented, and unstandardized. This lack of visibility limits effective coordination, monitoring, and long-term planning.

6.3 Recommendation

Government (National Level)

1. The government should introduce targeted subsidies for informal waste collectors (IWCs) since satisfaction varied by income and employment status, and high operational costs are known to reduce sustainability. The strong association between income and satisfaction ($p < 0.001$) suggests that cost-related barriers affect service quality.
2. Develop national guidelines for equitable waste service delivery. This is because the study found a significant association with residence, estate location, and household size, indicating uneven access and satisfaction levels across different communities.

Metropolitan, Municipal and District Assemblies (MMDAs)

1. The MMDs should improve local-level coordination and zoning of waste collection services since satisfaction differed significantly by residence, household ownership, and estate location, showing that service gaps exist across localities.
2. The MMDs should also expand public education on proper waste handling. This is because the study found that education was strongly associated with satisfaction ($p < 0.001$). Communities with lower literacy levels are likely to have lower satisfaction due to limited awareness of waste practices.
3. There should also be support for community-based monitoring of IWCs since household headship and household size affected satisfaction, suggesting households value transparent and reliable service.

Community Members

1. Strengthen community collaboration with IWCs by encouraging residents to maintain clear communication with IWCs on collection times and access points. This is because the current study found that satisfaction varied by household characteristics, indicating that households influence how the service is delivered.
2. Enhance household-level waste management practices through education on proper waste storage and segregation, as household size significantly influenced satisfaction, highlighting the need for improved household practices to complement collection services.

Areas for Further Research

1. Clarify why estate location strongly shapes satisfaction; qualitative studies can unpack estate-specific factors.
2. Examine how household size influences waste volumes and service demand.
3. Assess how employment and income affect willingness to pay to guide subsidy and pricing decisions for IWCs.
4. Explore satisfaction differences by education level to identify knowledge gaps for targeted education.
5. Review IWC operational costs to determine how subsidies, including fuel support, strengthen sustainability and user satisfaction.

REFERENCES

Abaitey, A., Mensah, R., & Boakye, S. (2025). *Informal waste service provision and livelihood sustainability in Kumasi, Ghana: A qualitative case study*. Journal of Environmental Management and Sustainability, 19(2), 115–129.

Abubakar, I. R., Al-Shihri, F. S., & Ahmed, S. M. (2022). Solid waste management and environmental sustainability: A scoping review from Saudi Arabia. *Sustainability*, 14(4), 2234. https://doi.org/10.3390/su14042234

Akaateba, M. A., & Yakubu, I. (2013). Householders' satisfaction towards solid waste collection services of Zoomlion Ghana Ltd in the Wa Municipality. *Journal of Environment and Earth Science*, 3(2), 147–156.

Ampong, E., Adjei, P., & Owusu, S. (2024). Comparative analysis of formal and informal solid waste collection systems in urban Ghana: Evidence from Suame Municipality. *Waste Management & Research*, 42(1), 55–70.

Asase, M., Yanful, E. K., Mensah, M., Stanford, J., & Amponsah, S. (2009). Comparison of municipal solid waste management systems in Canada and Ghana: A case study of the cities of London, Ontario and Kumasi, Ghana. *Waste Management*, 29(10), 2779–2786.

Baud, I., Grafakos, S., Hordijk, M., & Post, J. (2006). Quality of life and alliances in solid waste management: Contributions to urban sustainable development. *Cities*, 18(1), 3–12.

Boadi, K. O. (2005). Environmental and health impacts of household solid waste handling and disposal practices in the Accra Metropolitan Area, Ghana. *Journal of Environmental Health*, 68(4), 32–36.

Boampong, E., Oduro-Appiah, K., & Ankomah, J. (2020). Community perspectives on informal waste management services in Ghana. *Environmental Management and Sustainable Development*, 9(4), 82–98.

Charles, D. (2021a). Informal waste collection systems and community trust in Kumasi, Ghana. *African Journal of Sustainable Development*, 11(2), 55–73.

Charles, D. (2021). Social sustainability challenges among informal waste collectors in East Africa. *Waste Management Review*, 13(1), 45–62.

Chati, F. (2012). Policy integration and informal waste collection in Ghanaian cities: Challenges and opportunities. *Journal of Urban Management*, 1(2), 89–102.

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, 33(1), 220–232.

International Growth Centre (IGC). (2024). *Informal waste management and circular economy opportunities in Ghana: Policy brief*. London School of Economics and Political Science.

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: A global snapshot of solid waste management to 2050.* Washington, DC: World Bank.

Lee, J., Offenhuber, D., & Pereira, C. (2015). Mapping the informal waste sector: Case of Mombasa, Kenya. *Environment and Planning B: Urban Analytics and City Science*, 42(5), 932–950.

Lissah, S. Y., Agyemang, E., & Owusu, A. (2020). Psychosocial risk factors and job satisfaction among municipal solid waste collectors in Ghana. *Journal of Occupational Health and Safety Research*, 17(3), 133–148.

Lissah, S. Y., Agyemang, E., & Miezah, K. (2021). Managerial perspectives on municipal solid waste management challenges in Ghana. *Environmental Management and Sustainable Development*, 10(1), 55–72.

Maneen, E., Asante, F., & Opoku, A. (2025). Safety climate and occupational health risks among solid waste collectors in Cape Coast, Ghana. *Journal of Environmental Health Research*, 35(2), 99–113.

Martin Medina, M. (2008). *The world's scavengers: Salvaging for sustainable consumption and production.* Lanham, MD: AltaMira Press.

Meijer, J., & Berg, P. (2010). Integration of informal waste collectors in formal solid waste management systems in Nigeria. *Waste Management & Research,* 28(9), 815–822.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., & Mensah, M. Y. (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste Management*, 46, 15–27.

Muheirwe, E., Nkurunziza, A., & Bagonza, R. (2024). Institutional roles in solid waste collection: Lessons from Kampala, Uganda. *African Journal of Environmental Policy and Governance*, 8(1), 45–63.

Mumuni, E., & Borras, S. (2016). The roles and challenges of informal waste pickers in Tamale Metropolis, Ghana. *Environment and Urbanization ASIA*, 7(2), 157–170.

Oduro-Appiah, K., Agyemang, E., & Boakye, R. (2021). Informal solid waste management practices in Ghanaian urban areas: Evidence and implications. *Journal of Urban Environmental Engineering*, 15(1), 58–70.

Offenhuber, D., & Lee, J. (2013). Putting the informal waste sector on the map: Participatory mapping of waste management infrastructure in Brazil. *Waste Management*, 33(4), 1281–1292.

Oteng-Ababio, M. (2012). The role of the informal sector in solid waste management in the GAMA, Ghana: Challenges and opportunities. *Habitat International*, 36(2), 246–252.

Owusu-Sekyere, E., Agyemang, S., & Boateng, D. (2024). Environmental and health implications of informal waste disposal in Ghanaian communities. *Journal of Environmental Health and Pollution Studies*, 9(1), 45–59.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12–40.

Paul, M., Rahman, T., & Chowdhury, N. (2024). Smart waste management systems for real-time monitoring in developing cities: Evidence from Bangladesh. *Waste Management & Research*, 42(3), 275–288.

Siwawa, B. (2025). ICT-enabled waste management and monitoring systems in South African cities. *Journal of Cleaner Production*, 422, 139871.

Sulemana, M. (2018a). Public satisfaction towards municipal solid waste collection services in Ho Municipality, Ghana. *Journal of Urban and Environmental Studies*, 5(2), 41–53.

UN-Habitat. (2020). *Waste Wise Cities Tool: Assessing municipal solid waste management performance.* Nairobi: United Nations Human Settlements Programme.

United Nations Environment Programme (UNEP). (2024). *Global waste management outlook 2024: Policy trends and future pathways.* Nairobi: UNEP.

Williams, K., Adomako, R., & Boadu, E. (2023). Decentralization and challenges in municipal solid waste management in Ghana. *Journal of Environmental Policy and Planning*, 25(6), 812–829.

Wilson, D. C. (2012). *Integrated sustainable waste management in developing countries.* Wasteaware Benchmark Indicators, ISWA.

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.

Darko, E., Boakye, R., & Nyarko, J. (2022). *Assessment of pollution levels of water bodies in the Kumasi Metropolis, Ghana*. Environmental Monitoring and Assessment, 194(8), 547–556. https://doi.org/10.1007/s10661-022-10011-3

de Oliveira-Filho, J. R., de Lima, M. A. G., & de Souza, M. T. (2014). *Solid waste management and recycling behavior: A case study in urban communities*. Waste Management & Research, 32(12), 1221–1229. https://doi.org/10.1177/0734242X14557382

Ghana Statistical Service. (2021). *2021 Population and Housing Census: Summary report of final results*. Accra: Ghana Statistical Service.

Khanom, N., Dutta, S., & Rahman, M. (2015). *Community-based approaches to urban sanitation: Lessons from developing countries*. Journal of Environmental Management, 154, 193–200. https://doi.org/10.1016/j.jenvman.2015.02.030

Liwur, R., Opoku, P., & Asante, F. (2024). *Urban expansion and environmental transformation in the Greater Kumasi Metropolitan Area, Ghana*. Journal of Urban and Regional Studies, 18(2), 45–60.

Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). *Sample size, power and effect size revisited: Simplified and practical approaches in pre-clinical, clinical and laboratory studies*. Biochemistry and Medicine, 31(1), 010502. https://doi.org/10.11613/BM.2021.010502

Silva, M. J., Santos, L. F., & Costa, A. C. (2014). *Non-response in community-based surveys: Implications for sampling design and data reliability*. International Journal of Social Research Methodology, 17(6), 659–672. https://doi.org/10.1080/13645579.2013.820123

Sulemana, A. (2018b). *Determining sample size in social science research: The case of Ghanaian population-based studies*. Journal of Social Science Research, 12(4), 112–120.

Boateng, S., Boakye-Ansah, D., Baah, A., Aboagye, B., & Adu-Gyamfi Kyeremeh, P. (2023). Solid waste management practices and challenges in rural and urban senior high schools in Ashanti Region, Ghana. *Journal of Environmental & Public Health*, 2023, 1–8.

APPENDIX

Household Questionnaire

Public Satisfaction of Informal Household Solid Waste Collection in the Greater Kumasi Metropolis

Section A: Socio-demographic characteristics of respondents

No.	Socio-demographic characteristics	Responses
1	Age of respondent [in years]	.....
2.	Gender of respondent	[ ] Male [ ] Female [ ] Prefer not to say
3.	Are you the household head	[ ] No [ ] Yes
4.	Educational level of respondent	[ ] No formal education [ ] Primary education [ ] JHS/JSS/Middle school [ ] SHS/SSS/A/Level/Voc/Tech [ ] Tertiary
5.	Marital status of respondent	[ ] Never married [ ] Married [ ] Separated/Divorced [ ] Widowed
6.	Religion of respondent	[ ] No religion/atheist [ ] Christian [ ] Moslem/Islam [ ] African traditionalist
7.	Ethnicity of respondent	[ ] Akan e.g Fante, Ashanti, Akuapem [ ] Ewe/Krobo [ ] Ga-adangbe [ ] Kokomba/Nanumba/Gonja [ ] Other, specify .....
8.	Household size	.....
9.	Household type	[ ] Compound house [ ] Single family semi-detached [ ] Multi-family semi-detached
10.	Place of residence	[ ] Urban [ ] Peri-urban [ ] Rural
11.	Employment status	[ ] Employed [ ] Unemployed [ ] Retiree/pensioner
12.	Occupation, if employed	[ ] Agricultural/farming [ ] Civil/public servant [ ] Private sector [ ] Artisans e. g driver, masonry

		[ ] Business/trading [ ] Entrepreneurship [ ] Other
13	Located in estate or gated community	[ ] No [ ] Yes
14	Monthly income [in GHC]	[ ] <500 [ ] 501 – 1000 [ ] 1001 – 2000 [ ] 2001 – 3000 [ ] >3000

SECTION B: Satisfaction with informal household solid waste collection

15. Overall, are you satisfied about the informal household solid waste collection service? [ ] No [ ] Yes

16. If yes, why are you satisfied .....

17. Does the waste bin overflows before waste is collected? [ ] No [ ] Yes

18. How often does the tricycles come for collection? [ ] Everyday [ ] Once a week [ ] Twice a week [ ] Thrice a week [ ] Once monthly

19. How much do you pay per waste collection .....

Kindly indicate your satisfaction with the following questions using the following scales. 5=Very satisfied, 4 = Satisfied, 3= Neither satisfied or unsatisfied, 2= Unsatisfied, 1= Very unsatisfied

No.	Question/variable	Very satisfied	Satisfied	Neither satisfied nor unsatisfied	Unsatisfied	Very unsatisfied
20	Attitude of informal waste collectors					
21	Service charge for waste collection					
22	Frequency for waste collection					
23	Availability of service					
24	Politeness of waste collectors					
25	Reliability of the waste collection					
26	Environmental friendliness of waste collection					

27.	Assurance of disposing waste safely					
28.	Safety of waste collection					
29.	Safety perception of waste collector					
30.	Waste collector wearing of PPEs					
31	How they transport waste to damp sites					
32.	How waste is disposed by informal collectors					

Section C: Economic Sustainability of informal household solid waste collection business

33. How would want informal waste collectors to be paid [ ] Monthly [ ] weekly [ ] daily
34. What medium do you prefer to make the payment [ ] cash [ ] Momo [ ] To an agency/company

35. Would you want/prefer informal waste collection activities be sustained [ ] No [ ] Yes

36. Do you think informal waste collection will be sustainable [ ] No [ ] Yes
37. If yes, why do you think it will be sustainable?

38. Do you think informal waste collection is economically sustainable [ ] No [ ] Yes

39. If yes, why do you think it is sustainable?

Environmental sustainability

40. Do you think informal waste collection is environmentally sustainable [ ] No [ ] Yes

41. If yes, why do you think it is sustainable?

42. Are you satisfied with the mode of disposal of waste collected No Yes

43. Do you see waste collectors dumping indiscriminately No Yes

44. Will you recommend transfer station No Yes

Social Sustainability

45. Do you think informal waste collection is socially sustainable [ ] No [ ] Yes

46. If yes, why do you think it is sustainable?

47. Do people in your community patronize their services No Yes

48. Do you think society is happy with their services No Yes

49 Dsero you prefer their services to the formal waste collectors No Yes

50. Do you think your community prefer their services to the formal waste collectors Yes No

In-depth Interview of Informal Household solid Waste Collectors

No	Question/Variable
1	Age
2	Gender
3	Educational level
4	Marital status
5	Ethnicity
5	District
6	Position/role
6	Years worked as informal waste collector
7	Years worked in this metropolis/municipal/district/organisation

1. What are some of the challenges you encounter as a solid waste collector
2. Do you think your activities are generally sustainable
3. Do you think informal household solid waste collection is economically sustainable [ ] No [ ] Yes

If yes, why do you think it is sustainable?

4. Do you think informal waste collection is environmentally sustainable [ ] No [ ] Yes

If yes, why do you think it is sustainable?

5. Where do you dump your waste?
6. What is the average distance to the disposal site?
7. Will you recommend a transfer station to the current disposal site?
8. Do you think informal waste collection is socially sustainable [ ] No [ ] Yes

If yes, why do you think it is sustainable?

9. Does the Assembly organize training for informal waste collectors

10. Are you registered under an organization/company?
11. Would you like to join a cooperative/company/limited liability?
12. What is the main reason you would participate/join or not in an cooperative/organization
13. How do you want your activities to be regulated?
14. Do you prefer electronic form of payment for waste collection

Key Informant Interview Guide

No	Question/Variable
1	Age
2	Gender
3	Organization affiliated to
4	District
5	Position/role
6	Years practiced as environmental officer
7	Years worked in this metropolis/municipal/district/organisation

1. Are you aware of the activities of informal household solid waste collectors
2. Does the institution/metropolis/municipal/district have the capacity to regulate the activities of the informal solid waste collectors.
3. Are you satisfied with the activities of informal household solid household solid waste collectors
4. Do you think the informal waste collector should continue their operations in this metropolis/municipal/district
5. If yes, what can be done to sustain the activities of the informal solid waste collectors
   Probe for sustainability economically
   Probe for sustainability environmentally
   Probe for sustainability socially
6. If no, why do you think informal household solid waste collectors' activities should not continue
7. Do you prefer that we register and regulate the informal waste collectors as a limited liability organization under a known organization.
8. What reporting format would you recommend for informal household solid waste collectors
9. Is there any plan or regulation for tracking the activities of informal solid waste collector

10. If yes, how are you tracking the activities of informal solid waste collectors
11. If no, how would you want to track the activities of informal waste collectors
12. What do you think needs to be done to improve the activities of informal waste collection
13. Are there plans to integrate the informal waste collectors