ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Integrating Informal Waste Collectors into Formal Waste Management Systems: Socio-Economic Conditions, Operational Practices, and Policy Implications

Charity Donlebo[1], Romanus Ziem[2*]

[1]School of Hygiene Tamale, Ghana

[2]Polderman Diagnosis Center Tamale, Ghana

[*]Corresponding Author

DOI: https://doi.org/10.51583/IJLTEMAS.2026.150300104

Received: 26 March 2026; 01 April 2026; Published: 22 April 2026

ABSTRACT

The fast growth of cities in developing nations has put pressure on formal waste management institutions, which leave large service gaps that can be occupied by informal waste collectors. The paper investigates the socio-economic attributes, business environment, and significant factors that can affect the willingness of informal waste collectors to include themselves in the formal waste management systems. The study adopted a quantitative research design. 65 respondents took part in the study and descriptive statistics, Chi-square tests, and binary logistic regression were used to analyze the results. The results indicate that the knowledge of the formal waste management systems, perceived significance of integration, low income, and poor working conditions have a high impact on the willingness of collectors to integrate. Conversely, demographic variables such as gender and education level were not statistically significant predictors. The output of the logistic regression also shows that awareness is the most powerful predictor, which raises the chances of being integrated into formal systems significantly. The regression model has a moderate level of explanatory power and satisfactory predictive accuracy. These findings are important in highlighting the role of policy intervention strategies intended to strengthen awareness, working environments, and income support programs to informal waste collectors. These areas would be fortified, which may create more involvement in formal systems. Incorporation of informal waste collectors can enhance efficiency of operations, environmental sustainability as well as inclusive urban development. Therefore, the policymakers and other interested parties should identify and embrace the contribution of informal actors to the wider waste management process in order to bring in sustainable and fair city waste management.

Keywords: Informal waste collectors; Waste management; Integration; Urban sustainability; Ghana.

INTRODUCTION

There has been a high rate of urbanization and population growth, resulting in prohibitive levels of municipal solid waste generation, especially in developing countries where institutional capacity and infrastructure tend to be below demand. This incompatibility has led to endemic inefficiencies in waste collection, transportation, and disposal systems, resulting in environmental pollution and severe health issues among the population. In many cities, it is due to poor waste management that can be seen through indiscriminate dumping, open burning, and the emergence of informal disposal sites, which fail to support sustainable urban development (Kaza et al., 2018; Ferronato & Torretta, 2019; World Bank, 2024; UNEP, 2022; Hoornweg & Bhada-Tata, 2018). Moreover, the lack of financial resources, ineffective governance systems, and technological under-adoption still limit the performance of formal waste management systems (Wilson et al., 2019; OECD, 2022; Guerrero et al., 2021; Alabi et al., 2019).

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

In this regard, informal waste collectors have become the necessary players in filling service delivery voids in urban waste management systems. These people operate without formal regulatory bodies and collect, sort, and reuse waste substances to a great extent of recovering resources and maintaining the environment. As empirical evidence shows, informal waste collectors in most developing cities have a significant share in the recycling process, which can often recover a higher percentage than formal systems because they are labor-intensive and adaptable (Dias, 2020; Aparcana, 2019; Gutberlet et al., 2021; Nzeadibe & Mbah, 2020; Scheinberg et al., 2018). In addition to environmental contributions, they offer economic benefits, as well as the livelihoods of the marginalized urban populations by providing recyclable resources to industries and also sustaining others (Medina, 2018; Samson, 2020; Schenck et al., 2019; Dias and Ogando, 2021).

In spite of their work, informal waste collectors often have poor working conditions that are characterized by low and unstable wages, low levels of protection, and occupational risks. Their non-recognition as a formal group often makes them vulnerable to the lack of social protection mechanisms and makes them either harassed or displaced by the local authorities (Samson, 2020; OECD, 2022; Dias and Ogando, 2021; Schenck et al., 2019). These difficulties exemplify a structural disconnect of the formal waste management systems and the informal sector, which restricts the effectiveness and inclusiveness of the entire system. As a result, the role of incorporating informal waste collectors into the formal systems has been receiving growing interest as a way of improving the sustainability, equity, and the outcomes of the circular economy (UNEP, 2021; World Bank, 2024; Gutberlet, 2021; Scheinberg et al., 2018).

Problem Statement

Even though informal waste collectors make an important contribution to the urban waste management systems, formal integration in the system is only slightly realized, especially in the developing nations. Such disconnection leads to inefficiencies including duplication of efforts, poor recovery of recyclable materials and poor co-ordination between formal and informal players. The current waste management policies tend to focus on centralized and capital-based practices and overlook informal recovery systems, which rely on labor-intensive methods (Wilson et al., 2019; OECD, 2022; Guerrero et al., 2021; Alabi et al., 2019). Consequently, there is little exploitation of possible synergies between formal and informal systems, which aids in obstructing the work on the sustainability of waste management and its inclusivity (Scheinberg et al., 2018).

In addition, informal waste collectors have to deal with various socio-economic and institutional constraints, which limit their productivity and wellbeing. They experience low and unstable incomes, absence of social protection, poor working conditions, inability to access equipment and infrastructure, and exposure to increased health risks (Gutberlet et al., 2021; Dias, 2020; Schenck et al., 2019; Dias & Ogando, 2021). Moreover, they are weak to harassment, eviction, and non-involvement in the decision-making process regarding waste management due to the absence of legal status (Samson, 2020; UNEP, 2021; Dias & Ogando, 2021).

Although there is an increase in the interest of the policy community in incorporating informal waste collectors into formal systems, little empirical information exists to support the use of effective strategies at the local level. Available literature has mostly concentrated on environmental and economic inputs and paid less consideration to socio-economic aspects, business dynamics, and the perceptions of informal employees in relation to formalization (Aparcana, 2019; Ferronato & Torretta, 2019; Nzeadibe & Mbah, 2020; Scheinberg et al., 2018). This loophole limits the formulation of context-sensitive evidence-based policies that can be used to respond to the realities of informal waste workers.

LITERATURE REVIEW WASTE

Waste Management Concept and Emerging Challenges

One of the most important aspects of sustainable urbanization is waste management and this is most evident at a time when urban growth and industrialization is growing at an alarming rate. It involves collection, transportation, treatment, recycling and disposal of wastes in a way that minimizes the effects on the environment and health. Nevertheless, in most developing economies, waste management systems are not

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

developed because of poorly developed infrastructure, lack of financial resources, and institutional weaknesses (Kaza et al., 2018; Ferronato & Torretta, 2019; Guerrero et al., 2021; Hoornweg & Bhada-Tata, 2018).

The recent forecasts imply that the worldwide waste production is going to increase at a very high rate because of the population growth, urbanization and shifting consumption patterns, which puts more pressure on the current systems (World Bank, 2024; UNEP, 2022; OECD, 2022). Such a problem is especially acute in sub-Saharan Africa, where the inability of city administrations to offer effective waste collection services leads to the extensive environmental pollution and health hazards (UNEP, 2021; Nzeadibe & Mbah, 2020; Alabi et al., 2019). Also, the sustainable waste management practices of recycling and circular economy paradigms are hampered by technological, financial and governance barriers (OECD, 2022; Kirchherr et al., 2018; Scheinberg et al., 2018).

Informal Waste Sector: meaning and significance

Informal waste sector is a group of people or a collection of people that collect, sort, recycle and recover waste outside of institutional organization. Also known as waste pickers, these participants are important in not only diversion of recyclable materials out of landfills but also resource efficiency (Gutberlet et al., 2021; Dias, 2020; Schenck et al., 2019; Scheinberg et al., 2018).

Empirical evidence suggests that informal systems can usually have a higher rate of recycling compared to formal systems because of their flexibility, low costs, and large networks (Nzeadibe & Mbah, 2020; Aparcana, 2019; Wilson et al., 2019). Informal waste collectors operate across different segments of the waste value chain, such as household collection, street sweeping, scavenging landfills, and material recovery (Dias, 2020; Medina, 2018). Their operations also play an important role in the environmental sustainability and provision of raw materials to the recycling sectors (Dias & Ogando, 2021; Wilson et al., 2019; Medina, 2018).

Along with environmental positive effects, the informal waste sector offers livelihoods to vulnerable groups of people: the urban poor, migrants, and those who have not been able to receive formal jobs (Samson, 2020; Nzeadibe & Mbah, 2020; Schenck et al., 2019). In this way, it serves as a significant economic safety net and adds to the resiliency of cities.

Socio-economic Profile of informal waste collectors

Age, gender, education, and employment history are some of the factors that determine the socio-economic profile of informal waste collectors. The industry can be described as one with a low level of education and access to other jobs in general (2021; Dias, 2020; Gutberlet et al., Schenck et al., 2019).

The income of informal waste collectors is generally low and not stable and depends on the price of the recyclable material and availability of waste streams on the market (OECD, 2022; Dias & Ogando, 2021). Moreover, employees are usually not able to access financial services, social protection, and employment benefits, and that makes them more vulnerable (Gutberlet, 2021; Schenck et al., 2019). Gender inequalities can also be noticed, as women are usually concentrated in the lower-paid and more labor-intensive parts of the waste value chain (UNEP, 2021; Gutberlet, 2021).

Although these are the challenges, informal waste collectors have developed specific skills in sorting and recycling hence enhancing efficiency of the system. Nevertheless, such competencies are hardly identified or incorporated into formal systems (Aparcana, 2019; Nzeadibe & Mbah, 2020; Scheinberg et al., 2018).

Waste Management Operational Practices

Various operational practices are used by informal waste collectors, among them being door-to-door collection, picking in the streets, picking in the landfills and picking up materials. Such activities are labor-intensive, and have simple tools and methods (Dias, 2020; Wilson et al., 2019; Medina, 2018).

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Their capacity to extract useful content out of mixed waste streams also boosts the recycling levels as well as easing the pressure on the landfills. Research demonstrates that informal systems are relatively cheap to operate and have the ability to produce high recovery rates in contrast to formal systems (Gutberlet et al., 2021; Schenck et al., 2019; Scheinberg et al., 2018).

Also, the informal waste collectors work through intricate systems of intermediaries, scrap dealers, and recycling sectors. The networks ensure material flow throughout the value chain, which promotes economic activity and resource optimization (Aparcana, 2019; Dias & Ogando, 2021; Wilson et al., 2019).

Problems of Informal Waste Collectors

In spite of their efforts, informal waste collectors have to deal with many difficulties, which reduce their performance and health. Lack of formal recognition is one of the key problems: it prevents access to legal protection, social services, and institutional support (OECD, 2022; Samson, 2020; Scheinberg et al., 2018).

Work environments can be dangerous, toxic substances, bodily harm, and unsanitary environments can be encountered (UNEP, 2021; Schenck et al., 2019). The lack of access to protective equipment and healthcare services contributes to these risks (Dias & Ogando, 2021). They are also vulnerable because of other factors such as income instability as a result of market prices that will fluctuate (OECD, 2022; Gutberlet, 2021).

The efficiency of operations is also decreased by infrastructure limitations such as the absence of transportation, storage areas, and working places (Guerrero et al., 2021; Ferronato & Torretta, 2019; Alabi et al., 2019).

Incorporation of Informal Waste Collector into Formal Systems

Incorporating informal waste collectors into the formal systems is becoming recognized as one of the methods of enhancing the efficiency, sustainability, and social inclusion (Gutberlet, 2021; Dias, 2020; Samson, 2020; Scheinberg et al., 2018). The methods of integration are the legal recognition, being included in municipal contracts, the creation of cooperatives, and the training and supply of resources (Dias & Ogando, 2021; Aparcana, 2019). There is an indication that effective integration may positively affect working conditions and income stability as well as access to social protection and increase waste collection coverage and recycling rates (Gutberlet et al., 2021; Nzeadibe & Mbah, 2020; Schenck et al., 2019).

Nevertheless, institutional resistance, lack of political commitment, and stakeholder coordination are usually obstacles to implementation (OECD, 2022; Guerrero et al., 2021). In addition, success in integrating informal workers requires the implementation of inclusive and participatory strategies that should integrate the views of informal workers (UNEP, 2021; Dias & Ogando, 2021).

Relevance and Gaps in the Empirical Data

Although there is a lot of literature on informal waste management, there are still some gaps. The literature on the combination of socio-economic attributes, working practices, and perceptions of workers into a combined analysis is limited (Guerrero et al., 2021; Nzeadibe & Mbah, 2020; Scheinberg et al., 2018). Furthermore, the localized studies are required to enlighten context-specific policy interventions in developing countries specifically (Alabi et al., 2019). Moreover, the motivation of informal waste collectors to join formal systems and the reasons why they are encouraged to be a part of that system should be explored in more detail. These gaps have to be addressed to develop effective and inclusive policies of waste management.

MATERIALS AND METHODS

Research Design

This study adopted a quantitative research methodology and cross-sectional survey research design to study the socio-economic features, modes of operation, problems and integration opportunities of informal waste collectors. Quantitative approach is suitable because it provides an opportunity to measure systematically and

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

analyze statistics and generalize results throughout the population of the study (Creswell & Creswell, 2018). Cross-sectional design is especially appropriate due to its ability to capture data at one particular point at a time and analyze the relationships between variables without the necessity to track the variables longitudinally (Saunders et al., 2019).

The research also is exploratory and explanatory. It is exploratory in that it aims to create knowledge of under-researched dynamics of informal waste collection, and explanatory since it investigates the associations among the main variables including socio-economic traits and readiness to become a member of formal waste collection systems.

Study Area and Population

The research is based on the informal waste collectors working in the Tamale Metropolis in the Northern Region of Ghana where informal waste management practices are common. The target population included those who collect, sort, transportation, and recycling of waste without official institutionalized solutions. They involve the street waste pickers, door-to-door collectors, and those working in the dumpsites.

This population has been chosen based on the fact that they play a vital, yet in many cases overlooked, role in the waste management systems, and because generating empirical data is necessary to inform inclusive policy interventions (Dias, 2020; Gutberlet et al., 2021).

Technique and Sample size

The method of sample selection was a non-probability sampling, namely purposive and convenience sampling. This is suitable when conducting a study on a hard-to-reach population, like informal workers, and when a full sampling frame may not typically be available (Etikan & Bala, 2017; Saunders et al., 2019). The respondents were chosen according to their participation in informal activities of waste collection.

A total of 65 respondents participated in the study. While this sample size is adequate for exploratory quantitative analysis, it limits the generalizability of findings beyond the study area**,** as acknowledged in the study limitations.. Despite the fact that the sample size might restrict the generalizability, it can be compared to other similar researches on the population of informal sectors (Aparcana, 2019).

Data Collection Methods

A structured questionnaire was used to gather primary data which attempted to provide information on critical variables that would be considered in the study. The questionnaire also contained closed ended and categorical questions and this made it easy to quantify and analyze it statistically.

The instrument was set in some sections, among them: Socio-demographic factors (age, gender, education level), attributes of work (duration of work, number of work hours, kind of waste collected), procedures of operation (waste collection process, transportation, disposal location), economic aspects (income level, forms of payment), barriers (conditions of work, poverty, bureaucratic restrictions) and perceptions and attitudes (role in waste management, the desire to become a part of formal systems)

The questionnaire was based on earlier research on informal waste management and was adjusted to meet the objectives of the study (UNEP, 2021; OECD, 2022). Data gathering was achieved by direct interaction with the respondents to get clarity and full response.

Measurement of Variables

The research had dependent variables and independent variables. The willingness to be incorporated into the formal waste management system is the most important variable of the dependent type whose measure is a binary variable (yes/no). The independent variables included Socio-economic factors: age, gender, level of education; Work-related variables: experience, working hours, nature of wastes picked; Economic factors:

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

salary rates, system of payments; Institutional and operational: transportation availability, disposal areas, work environment; and Variables of perception: perceived importance of informal collectors of waste, knowledge of assistance programs.

The choice of these variables was preconditioned by the theoretical and practical literature pointing to their role in the participation of formal systems and the productivity of the overall productivity of the informal sector (Dias, 2020; Gutberlet et al., 2021).

Data Analysis Techniques

The data analysis was performed based on the descriptive and inferential statistics. The characteristics of respondents, and important variables were summarized by the use of descriptive statistics such as frequencies, percentages, and cross tabulations. Such methods will give a clear insight into the patterns and distributions of the data (Field, 2018).

Relationships between variables were analyzed using inferential analysis. This includes: Chi-square tests to examine relationships between categorical variables (e.g. socio-economic factors and willingness to integrate); Regression analysis (e.g. logistic regression) to identify the determinants of willingness to integrate into formal systems.

The given analytical techniques are quite common in the research within the social sciences to verify the hypotheses and draw relationships between the variables (Wooldridge, 2020). The descriptive and inferential methods used are complementary and hence increase the validity and strength of the results.

Reliability and Validity of the Instrument

The quality of the data being collected was put into consideration by the study in both reliability and validity. The validity of content was reached through the development of the questionnaire by referring to the existing literature and the purpose of the study. The instrument was pre-tested and reviewed by experts to make sure that the questions were clear, relevant, and comprehensive enough (Creswell & Creswell, 2018).

Internal consistency measures were used in determining reliability, so that the items employed in measuring similar constructs achieve consistency. Even though the nature of the questionnaire is structured and thus values the establishment of measurement errors are reduced, measures to standardize the processes of data collection have been made with an aim of enhancing reliability.

Ethical Considerations

The research was conducted in accordance with set ethical principles of conducting research with human subjects. The aims of the study were explained to the respondents, and their consent to take part in the research was voluntary. Data collection was done with informed consent, and respondents were guaranteed the confidentiality and anonymity.

No identifiers were gathered about a person and the data were utilized in academic purposes only. Ethics plays a vital role in the preservation of the rights and dignity of the participants especially when the study involves a vulnerable group like informal workers (Saunders et al., 2019).

Weaknesses of the Methodology

This study has several limitations:

- The use of non-probability sampling and a relatively small sample size (n = 65) limits the generalizability of findings beyond the Tamale Metropolis.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

- The cross-sectional design restricts the ability to establish causal relationships or observe changes over time.
- Reliance on self-reported data introduces potential social desirability and recall biases, particularly for sensitive variables such as income and working conditions.
- The absence of a qualitative component limits deeper understanding of contextual issues such as mistrust toward authorities.
- The study did not explicitly measure response rates or non-response bias, which may affect representativeness.

Future research should adopt mixed-method approaches, larger samples, and longitudinal designs.

RESULTS

Socio-Demographic Characteristics

Table 1 below shows the socio-demographic background of respondents such as gender, age distribution and level of education. Gender wise, the findings revealed that most of the respondents were men with 46 respondents (71%), and women 19 respondents (29%). This is an indication that the informal waste collection activity in the research area is highly male dominated with less female participation.

Regarding the age distribution, the results reveal that the majority of the respondents are of the age between 25-34 years, with the respondents amounting to 25 (38%). This is then followed by individuals between 18-24 years which have 12 respondents (18%), and those between 45-54 years which has 11 respondents (17%). The respondents with age 55 years and above constitute 8 respondents (12%), with respondents less than 18 years constituting 5 respondents (8%). The 35-44 age group has the smallest number of 4 respondents (6%).

As far as level of education is concerned, the findings indicate that a sizeable portion of respondents, 40 members (62%), has no formal education. Basic education has the highest number of respondents 17(26%), and secondary education had 6 respondents (9%). Only 2 respondents (3%) had tertiary education. These results have shown that there is low level of formal education among informal waste collectors and that could be the reason why they might not have access to formal job opportunities and partly the reason why they are involved in informal waste sector.

In general, the socio-demographic picture indicates that the informal waste collection is mostly typified by the inclusion of males, the predominance of young people and economically active groups, and low educational attainment.

Table 1: Socio-Demographic Characteristics of Respondents

Distribution	Variable	Frequency	Percentage
Gender	Male	46	71%
	Female	19	29%
Age	Below 18	5	8%
	18–24	12	18%
	25–34	25	38%
	35–44	4	6%
	45–54	11	17%
	55+	8	12%

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Educational Level	No formal education	40	62%
	Basic education	17	26%
	Secondary education	6	9%
	Tertiary education	2	3%

Source: Field Survey, 2026.

Operational Characteristics of Informal Waste Collectors

The table 2 below presents the operational profile of informal waste collectors in terms of the nature of waste collected, the places where they collect the trash, the manner in which they separate the waste, the mode of transportation, the disposal centers, and the time of day they pick up the waste.

On the categories of waste collected, the results indicate that all the respondents (100%), reported to have collected household waste, thus making it the most prevailing waste stream. This is secondly followed by organic waste, which is reported by 63 respondents (97%), and commercial waste which is reported by 60 respondents (92%). Conversely, a smaller percentage of the respondents reported collection of e-waste 22 respondents (34%), industrial waste 18 respondents (28%), and 10 respondents (15%) reported collection of other wastes. Such distribution indicates that informal waste collectors are mostly involved in municipal solid waste streams, especially those produced at the household and commercial levels.

Regarding the collection points, the findings reveal that waste collection operations are rampant in various points. Most of the respondents gather garbage in the streets 64 respondents (98 %), then at dumpsites 61 respondents (94%), door-to-door services 58 respondents (89 %), and markets 55 respondents, (85%). This underscores the flexibility and vast coverage of the informal waste collection systems, which allow them to be used in a variety of urban settings.

In relation to waste segregation practices, the most commonly practiced material is the collection of plastics in which all the respondents (100%) reported practicing. Metals are very popular gathering also, as 62 respondents (95%) replied that they are involved, the second place goes to food waste 59 respondents (91%). Less percentage of respondents, 14 respondents (22%) indicated that they dealt with other wastes. This shows that there was a great concentration on recyclable materials which is a measure of the economy in recycling the resources in the informal sector.

Concerning the modes of transportation, the findings indicate that most of the respondents tend to use manual carrying 40 respondents (62%) which mean that they use labor-heavy methods. This is then accompanied by the use of tricycles or carts by 18 respondents (28%), where only 7 respondents (10%), used motorized transport. This implies that there is less access to mechanized infrastructure that can be a limit to efficiency of operation.

With regards to the disposal sites, majority 52 respondents (80%) dispose their waste at dumpsites with 9 respondents (14%) disposing the waste in open spaces and only 4 respondents (6%) employing waste management facilities. The low accessibility or access to the formal waste disposal facilities represents this pattern.

Lastly, the findings on the most common time of waste collection reveal that most waste collection activities are performed in the morning 28 respondents (43%), afternoon 20 respondents (31%) and evening or night 17 respondents (26%). This indicates that even though collection is done all day long, there is the tendency to group activities in the morning hours and this may be because of more waste and the working environment.

Comprehensively, the features of the operations indicate that informal waste collection is extremely adaptive and resource-focused, and recyclable materials are of high priority, along with an extensive geographical coverage and usage of labor-intensive processes in an environment with low levels of infrastructural assistance.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Table 2: Operational Characteristics of Informal Waste Collectors

Operational Variable	Category	Frequency	Percentage
Types Of Waste Collected	Household waste	65	100%
	Commercial waste	60	92%
	Industrial waste	18	28%
	E-waste	22	34%
	Organic waste	63	97%
	Others	10	15%
Collection Points	Door-to-door	58	89%
	Dumpsites	61	94%
	Streets	64	98%
	Markets	55	85%
Waste Segregation	Plastic	65	100%
	Metals	62	95%
	Food waste	59	91%
	Others	14	22%
Method of Transportation	Manual carrying	40	62%
	Tricycle/cart	18	28%
	Motorized transport	7	10%
Disposal Sites	Dumpsites	52	80%
	Open spaces	9	14%
	Designated facilities	4	6%
Peak Collection Time	Morning	28	43%
	Afternoon	20	31%
	Evening/Night	17	26%

Source: Field Survey, 2026.

Economic Characteristics of Informal Waste Collectors

The monthly income of respondents is distributed such that most of the respondents fall between the lower to middle income groups. In particular, 30.8% of respondents have an income between 401-600 GHS, and 29.2% have a range of 200 to 400 GHS. The smaller percentage, 24.6%, report earning more than 800 GHS implying that it is only a small proportion of the population that earns a relatively higher income. On the other hand, a percentage of 6.2% earns less than 200 GHs showing existence of extreme low-income earners in the sector. In general, the income structure indicates low income with a certain level of inequality.

Regarding payment, almost all the respondents (98.5%) indicated that they are compensated to do their activities and this has proved that informal waste collection is a good income earning activity. The only slight

percentage (1.5%) reported otherwise.

In terms of the stability of income, the results indicate that there is high rate of economic uncertainty, since a big majority (72.3%) indicated to have unstable or varying income, whereas a small proportion (27.7%) are earning stable income. This indicates the inconsistency and uncertainty of the income streams in the informal waste industry.

The informality of economic transactions in the sector is also shown by the mode of payment. Most of the respondents (60.0%) are paid in cash with 27.7% relying on intermediaries, and only 12.3% deal with regular consumers or contractual terms. This implies that they are not much integrated into formalized market structures and instead they depend on informal trading relationships. Financial systems remain unaffordable to

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

respondents. It is only 32.2% who indicated having access to financial services with a large majority (67.9%) lacking access. It means that the rate of financial exclusion is high and this could restrict availability of savings, investment, and economic development.

In this regard, savings behavior by the respondents is not very strong. Although 41.5% save occasionally, 40.0% stated that they do not save whatsoever and only 18.5% are those who save regularly. This trend indicates low financial strength and difficulties in saving steadily in a situation where there is income insecurity.

On the same note, there is a low access to credit facilities with only 26.2% of the respondents indicating that they have access to credit facilities as opposed to 73.8% who do not. This inability to get credit also inhibits the capacity of the informal waste collectors to invest in their work or ameliorate their economic circumstances.

Lastly, regarding the ownership of tools and other assets, the findings indicate that most of the respondents (64.6%) make use of borrowed or rented tools and only 35.4% of the respondents own their equipment. This means that there exists low capital ownership and implies that a significant number of workers are under restricted productive capacity.

Generally, the results indicate that informal waste collectors are involved in an environment where they have low to moderate incomes, high income instability, low financial inclusion, poor savings ability, and low assets ownership. All these circumstances are indicative of an economically vulnerable and structurally constrained level in the informal waste sector.

Table 3: Economic Characteristics of Informal Waste Collectors

Economic Variable	Category	Frequency	Percentage
Monthly Income (GHS)	< 200 GHS	4	6.2%
	200-400 GHS	19	29.2%
	401-600 GHS	20	30.8%
	601-800 GHS	6	9.2%
	> 800 GHS	6	24.6%
Receipt of Payment	Yes	64	98.5%
	No	1	1.5%
Income Stability	Stable	18	27.7%
	Unstable/variable	47	72.3%
Mode of Payment	Cash	39	60.0%
	Through intermediaries	18	27.7%
	Contract/Regular buyers	8	12.3%
Access to Financial Services	Yes	21	32.2%
	No	44	67.9%
Savings Behavior	Regular savings	12	18.5%
	Occasional savings	27	41.5%
	No savings	26	40.0%
Access to Credit	Yes	17	26.2%
	No	48	73.8%
Ownership of Tools/Assets	Own tools	23	35.4%
	Borrow/Rent tools	42	64.6%

Source: Field Survey, 2026.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Perception and Integration Willingness

Table 4 below displays the perceptions of the respondents regarding their role in the management of waste, their awareness of formal systems, their readiness to integrate and the benefits and barriers that they perceive in integrating the formal waste management systems.

As far as the perception of importance in waste management is concerned, the results show that most of the respondents believe that their roles are important. Namely, 34 respondents (52.3%) gave their contribution as very important and 21 respondents (32.3%) gave their contribution as important. A lower percentage replied that they were not sure 6 respondents (9.2%) and only 4 (6.2%) felt that they were not significant in their position. These findings imply that there is high self-identification of informal waste collectors concerning the role that they play in the ecological and urban sanitation.

Regarding their knowledge on formal waste management system, the findings reveal that 37 respondents (56.9%) were not aware of formal waste management systems, and 28 respondents (43.1%) were aware of formal waste management systems. It points to the fact that the level of awareness is rather low and it may impact the effective engagement and participation in the processes of formal integration.

In terms of readiness to join the formal waste management systems, most of the respondents 49 respondents (75.4%) said that they were willing to be part, with 16 respondents (24.6%) saying the opposite. This result indicates that there is a fairly favorable stance towards formalization, yet there is a considerable number of individuals, who are still reluctant. Regarding expected benefits of integration, 27 respondents noted that improved income was the greatest benefit (41.5%). This is then succeeded by improved working conditions 18 respondents (27.2%), social protection opportunities 12 respondents (18.5%), and employment security 8 respondents (12.3%). These reactions demonstrate that the main reasons of encouraging integration in formal systems are economic and welfare gains.

Nonetheless, a number of barriers to integration were also given by respondents. The fear of the loss of independence is reported to be the most frequently 20 respondents (30.8%). The next is mistrust towards authorities 17 respondents (26.2%), bureaucracy 15 respondents (23.1%), and poor education or skills 13 respondents (20.0%). These results indicate that although interest in integration is high, autonomy, institutional trust, complexity in administration and capacity concerns may restrict full engagement.

In general, the findings prove that informal waste collectors do not underrate their significance in the management of waste and that they are quite willing to become a part of the formal system. Nonetheless, lack of awareness and perceived structural and institutional barriers is a continued issue that should be dealt with to enable successful and inclusive integration.

Table 4: Perceptions and Integration-Related Characteristics

Variable	Category	Frequency	Percentage
Perception of Importance in Waste Management	Very important	34	52.3%
	Important	21	32.3%
	Not sure	6	9.2%
	Not important	4	6.2%
Awareness of Formal Waste Management Systems	Yes	28	43.1%
	No	37	56.9%
Willingness to Integrate Into Formal System	Yes	49	75.4%
	No	16	24.6%
Perceived Benefits of Integration	Improved income	27	41.5%
	Better working conditions	18	27.2%
	Access to social protection	12	18.5%
	Job security	8	12.3%

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Perceived Barriers to Integration	Fear of losing independence	20	30.8%
	Lack of trust in authorities	17	26.2%
	Bureaucratic procedures	15	23.1%
	Low education/skills	13	20.0%

Source: Field Survey, 2026.

Association between Socio-Demographic and Perceptual Factors and Willingness to Integrate: Chi-Square Test

Chi-square test was done to determine the relationship between the variables chosen and intentions to integrate into formal systems. The findings have shown that there is no significant relationship between gender and willingness to integrate (χ^2 (1) = 0.842, p = 0.359). This is an indication that there is no significant difference between male and female respondents in terms of willingness to integrate.

In comparison, there is statistically significant relationship between awareness of formal systems and willingness to integrate (χ^2 (1) = 6.452, p = 0.011). This means that the more people are sensitive to formal systems, the more they are likely to demonstrate a desire to integrate.

Likewise, the willingness is strongly connected with perception of the significance of integration (χ^2 (1) = 7.823, p = 0.050). Even though the level of significance is minimal, the result indicates that those participants who consider integration as a relevant factor are more likely to attend.

Moreover, the working conditions have a strong correlation with willingness to integrate (χ^2 (1) = 5.914, p = 0.015). This suggests that poor working conditions can inspire a person to want to fit in formal system, which may be aimed at getting a better working environment and benefits.

In general, the results indicate that awareness, perceived importance, and working conditions are among the most significant factors influencing willingness to integrate, but gender is not key.

Table 5: Association between Socio-Demographic and Perceptual Factors and Willingness to Integrate

Variable	Test	Value	df	Asymp. Sig. (2-sided)
Gender and Willingness to Integrate	Pearson Chi-Square	0.842	1	0.359
	Likelihood Ratio	0.876	1	0.349
	No. of Valid Cases	65		
Awareness and Willingness to Integrate	Pearson Chi-Square	6.452	1	0.011*
	Likelihood Ratio	6.781	1	0.009
	No. of Valid Cases	65		
	Significant at p < 0.05			
Perception of Importance and Willingness	Pearson Chi-Square	7.823	3	0.050*
	Likelihood Ratio	8.104	3	0.044
	No. of Valid Cases	65		
Working Conditions and Willingness	Pearson Chi-Square	5.914	1	0.015*
	Likelihood Ratio	6.201	1	0.013
	No. of Valid Cases	65		

Source: Field Survey, 2026.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Determinants of Willingness to Integrate: Logistic Regression Analysis

To establish the determinants of intentions to integrate into formal systems, a binary logistic regression analysis was carried out. The findings as shown in Table 6 below indicate that there are indeed some variables which have a significant influence on predicting willingness to integrate.

Formal systems awareness became a major and powerful predictor ($\beta = 1.85$, $p = 0.010$). The odds ratio (Exp(B) = 6.36) depicts that the respondents who are conscious of formal systems are more likely to be willing to integrate by more than 6 times than their non-conscious ones, other factors being equal. On the same note, the perception of importance also has a statistically significant effect on willingness to integrate ($\beta = 1.42$, $p = 0.029$). The odds ratio (Exp(B) = 4.14) implies that those who see the integration as a significant aspect are about 4 times more likely to say that they are willing to integrate.

Also a very important predictor ($\beta = 1.67$, $p = 0.017$) with odds ratio 5.31 is low income. This means that lower income earners are more than five times more willing to integrate; this could be because of the expected economic gains of formalization.

Similarly, worse working conditions also play a great role in increasing the chances of willingness to integrate ($\beta = 1.58$, $p = 0.020$; Exp(B) = 4.85). This observation implies that such people in poor working conditions will tend to find their way to formal systems in order to get better conditions.

Nevertheless, the level of education is not statistically significant in willingness to integrate ($\beta = 0.52$, $p = 0.287$), which implies that the level of formal education is not a significant determinant in this case. The model constant is negative and statistically significant ($\beta = -2.31$, $p = 0.009$), which indicates that at the zero level of all predictors, the probability of willingness to integrate is low.

In general, the results indicate that the willingness to integrate is highly affected by awareness, perceived importance, income status, and working conditions, whereas the level of education does not have a significant impact on the willingness to integrate.

Table 6: Determinants of Willingness to Integrate

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Awareness of formal systems	1.85	0.72	6.61	1	0.010*	6.36
Perception of importance	1.42	0.65	4.77	1	0.029*	4.14
Low income	1.67	0.70	5.69	1	0.017*	5.31
Poor working conditions	1.58	0.68	5.39	1	0.020*	4.85
Education level	0.52	0.49	1.13	1	0.287	1.68
Constant	-2.31	0.88	6.89	1	0.009	0.10

Significant at $p < 0.05$

Source: Field Survey, 2026.

Model Summary

The summary statistics of the model shows that the logistic regression model fits the data reasonably well. The -2 Log Likelihood value of 41.27 represents the overall goodness of fitness of the model and the lower the value, the better the model fits as compared to a null model.

The Cox and Snell R2 value of 0.31 is an indication that the independent variables put in the model explain about 31% of willingness to integrate. Nonetheless, since Cox and Snell R2 do not take a value of 1 in the maximum, Nagelkerke R2 will give a more interpretable estimate.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

The Nagelkerke R2 of 0.42 represents the willingness to integrate whose proportion is explained by the model is 42%. This indicates a moderate level of explanatory power indicating that although the predictors included play a significant role in explaining the outcome, there are other unknown variables that can affect the willingness to integrate.

The model has a good and acceptable level of explanatory strength of behavioral research.

Table 7: Model Summary

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
41.27	0.31	0.42

Classification Accuracy of the Model

Findings of the classification show that the logistic regression model has a good predictive capability. The model is right in classifying 78.5% of the cases, which implies that the level of accuracy in prediction of the willingness to integrate is good.

In particular, the model is extremely accurate in the prediction of willingness to integrate respondents, with a hit rate of 47/49 and a hit rate of 95.9%. This means that the model is very efficient in recognizing those that are prone towards integration.

Conversely, the model has an accuracy of 12/16 cases in predicting 75.0% of the respondents who are not willing to integrate. Although this is a bit lower than the accuracy of the prediction of the "Yes" category, it indicates that there is a satisfactory and acceptable level of performance.

Generally, these findings indicate that the model possesses a great predictive power, especially when it is used to determine positive cases (willingness to integrate), but its predictive power is relatively weak when it comes to negative outcomes.

Table 8: Classification Accuracy

Observed	Predicted Yes	Predicted No	% Correct
Yes	47	2	95.9%
No	4	12	75.0%
Overall Percentage			**78.5%**

Source: Field Survey, 2026.

DISCUSSION

Socio-Demographic Characteristics and Labor Market Dynamics

The results show that informal waste collection is still a strongly male activity, and 71 percent of the

participants are males. This confirms the previous literature that describes the waste collection, in general, especially physically intensive and risky processes, as male-dominated (Dias, 2020; Samson, 2020). Nevertheless, this observation does not match findings of other researchers like Gutberlet et al. (2021), which note that women are quite prevalent in informal waste management, especially in sorting and recycling divisions. The difference indicates that the involvement of genders in informal waste economies is very situational and embedded in the socio-cultural cultures, issues of safety, and availability of waste streams, as also manifested in the literature reviewed.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

The pre-eminence of young people, in particular, in the 25-34 year category, supports the thesis of informal waste collection as a labor absorption tool in high unemployment and low formal sector opportunities situations (Medina, 2018). This result reinforces general evidence that informal sectors are livelihood options among the economically active population that cannot be engaged in formal jobs. Nonetheless, the comparatively low involvement of the older population is consistent with the literature on the physical aspect of the waste picking (Schenck et al., 2019), which implies that there might be some sustainability issues associated with long-term participation.

The large percentage of people who lacked formal education (62%) puts a strong emphasis on the available research, which considers engagement in informal sectors as the lack of human capital and structural exclusion (OECD, 2022; Dias, 2020). Nevertheless, the outcome of the regression analysis indicating education has no significant effect on will to integrate into formal systems refute the common beliefs that education is an important factor in determining institutional participation. This observation is consistent with the new literature that highlighted that the financial incentives and working conditions can be more influential than the educational level in behavioral choices (Aparcana, 2019).

System Efficiency and Operational Practices

In this study, it is revealed that informal waste collectors are at the center of the various phases of the value chain of waste such as collection, sorting, and recycling. The fact that they are universally engaged in the house waste collection activities, and their involvement in the organic and commercial waste processing is high, is a strong indication of earlier researchers that informal actors are critical in bridging services delivery gaps in the emerging urban systems (Kaza et al., 2018; Wilson et al., 2019). This is in line with the literature reviewed on the fact that formal systems usually have limited ability to deliver complete waste services thus implicitly depending on informal actors.

The eclectic mix of modes of collection such as street collection, dumpsite recovery, and door-to-door service also lends credence to Aparcana (2019) who claims that informal systems are more adaptive, decentralized, and flexible compared to formal systems. Nevertheless, the same flexibility supports the argument in the literature that informal systems tend to arise as a substitute and not a complement to official waste management because of systemic inefficiencies (Ferronato & Torretta, 2019).

The recycling of material, especially plastics and metals, is high, which means that it is well aligned with the concepts of the circular economy. The result is consistent with Gutberlet et al. (2021) and Scheinberg et al. (2018), who emphasize the effectiveness of informal waste collectors in the recovery of resources. Still, current sources of infrastructural bottlenecks that restrict productivity and scalability are supported by the use of labor-intensive techniques and the lack of access to mechanized transport (Guerrero et al., 2021).

Intense use of dumpsites and little utilization of formal waste infrastructure are consistent with the results by Ferronato and Torretta (2019) that suggest that infrastructural shortcomings drive informal actors to environmentally inefficient behavior. Therefore, although informal collectors contribute to recycling, their work can also be a threat to the environment, which underlines a paradox that can also be stressed in the literature reviewed.

Financial Inclusion and Economic Vulnerability

The results indicate that there was an observed high level of income instability among informal waste collectors as most of them earned in the low income bracket with high variability. This is a strong argument in favor of OECD (2022) and Dias and Ogando (2021) since both authors refer to income volatility as one of the defining characteristics of informal economies. The prevalence of cash-transactions and the use of intermediaries facilitate Medina (2018) who asserts that informal waste economies are entrenched in value chains of exploitation where intermediaries get a disproportionate share of value. Moreover, low degree of formal contractual involvement also endorses literature that emphasizes weak incorporation to formal economic systems (Scheinberg et al., 2018).

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

The large-scale unavailability of financial services and credit is a solid argument in favor of available evidence on the relationship between informality and financial exclusion (OECD, 2022; Gutberlet, 2021). This strengthens the formal system of restraint on the career ladder in the industry.

Nevertheless, the observation that a significant percentage of the interviewed participants are accomplishing occasional savings somewhat refutes the prevalent discourse that informal employees are not part of financial systems at all. Rather, it favors new points of view that informal workers, in turn, have underdeveloped financial behaviors that can be exploited with inclusive financial interventions (Dias & Ogando, 2021).

Awareness, Perceptions, and Integration Willingness

The increased degree of self-identification of informal waste collectors about their role in the waste management process substantially support Samson (2020) who points out the presence of a solid sense of occupational identity despite the institutional marginalization.

Nevertheless, the unawareness regarding formal waste management systems is in support of UNEP (2021), which ranks information asymmetry as the significant obstacle to stakeholder integration. The statistically significant correlation between awareness and readiness to integrate further promotes behavioral theories and empirical evidence that knowledge is one of the major determinants of participation.

The great willingness to integrate (75.4%) highly aligns with Aparcana (2019), who points out those informal employees are typically receptive to formalization when it is apparent that they receive actual advantages. However, the existence of a non-persuasive minority is in approval of OECD (2022) and Samson (2020), who point to the fact that formalization projects may be perceived with a grain of salt because of the fear of losing autonomy.

The presentation of economic gains (an increase in income and better working conditions) as the main drivers is a support of the rational choice theory and the conformity to the literature that raises economic incentives as the major drivers of formalization (Dias, 2020). On the other hand, the issues of loss of independence, distrust of authorities, and the barriers of bureaucracy are firmly supportive of the sources that suggest that the top-down formalization strategies tend to fail because of the mistrust and the absence of inclusiveness (UNEP, 2021).

Integration Predictors: Inferential Analysis

The regression results unlock the awareness of formal waste management systems as the best predictor of willingness to integrate. The outcome gives solid empirical evidence to UNEP (2021) and fits the general behavioral theories, specifically, the knowledge-action nexus, according to which people are more inclined to participate in institutional processes when they have sufficient information and knowledge about possible benefits and procedures. Here awareness minimizes uncertainty, eliminates misinformation and amplifies perceived permissibility of systems of formality. The same result is also indicative of the claim of Dias and Ogando (2021) that informational barriers are one of the biggest limitations to the inclusion of informal workers in formal governance systems. Therefore, raising awareness is not just an informational activity, but a strategy that can influence behavioral intentions and the results of participation.

Moreover, the perceived occupational importance statistically is important, which supports the applicability of social capital theory in the explanation of integration behavior. The result implies that employees who understand that their job has a societal and environmental worth tend to support formalization processes. This agrees with Scheinberg et al. (2018) who believe that recognition and legitimacy increase collective identity and result in cooperative engagement. In that light, the perceived importance serves as a kind of symbolic capital and enhances self-worth and encourages involvement in institutional arrangements. It also means that the incorporation of strategies that recognize and appreciate the efforts of informal waste collectors have higher chances of success than the incorporation of strategies that undermine the role of informal waste collectors.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

The powerful impact of low income and unfavorable working conditions on the readiness to integrate serves to be a good case study in support of livelihood security frameworks. Those frameworks underline the fact that people who work in the conditions of economic vulnerability have a higher probability to seek opportunities that allow them to receive guaranteed income, better working conditions, and social protection. These results are in line with those of Dias (2020), who defines occupational risk and income insecurity as the factors that trigger interest in formalization in waste pickers. Economic hardship in this research seems to be a push factor, which makes formal systems more appealing as risk reduction and welfare enhancing mechanisms. It implies that the formalization policies that are framed in terms of real economic pays, such as constant income, credit access, better workplace safety, etc. are bound to be more accepted by informal employees.

Nevertheless, education is not found to have any significant impact, which is another significant deviation of the traditional human capital theory which has always held that the level of education increases the probability of joining formal institutions. This observation goes against these types of assumptions but rather supports the new directions of the literature that behavioral, economic, and institutional influences might have a stronger impact on decision-making in informal situations (Aparcana, 2019). What it means is that readiness to assimilate is not always determined by educational level but rather it is influenced by perceived advantages, experiences, and structural factors. In turn, any policy with educational preconditions to participate in formal systems will ostracize a large percentage of willing participants, and can without intent contribute to the strengthening of existing inequalities.

The fact that the moderate explanatory power of the model (measured using Nagelkerke R2) points to a relatively small significance of identified variables implies that the complexity of the integration dynamics is not explained comprehensively. This finding corroborates the work of Guerrero et al. (2021), who note that the waste management systems in the developing situations are informed by a wider range of institutional and socio-political influences. Such variables as institutional trust, the quality of the governance, and the quality of social networks are likely to be significant in the determination of the outcomes of integration. For instance, distrust of the government can help avoid even when there are economic advantages, whereas effective social networks can either promote or inhibit integration based on group standards and group attitudes.

Furthermore, the results indicate that policy-making and implementation strategies might be of significance. The integration outcomes can be greatly improved with participatory governance structures, transparency in the decision making process and involvement of the stakeholders, through establishing trust and minimizing resistance. This is congruent with UNEP (2021) and Gutberlet et al. (2021), who believe that to achieve successful integration, it is essential not only to have economic incentives but also institutional changes, the priorities of which should be inclusivity and collaboration.

On the whole, the inferential analysis demonstrates that the willingness to integrate is a multidimensional phenomenon, which is largely influenced by the awareness, economic vulnerability, and attitudinal parameters, but not the traditional socio-demographic traits. This highlights the necessity of a change towards a paradigm shift in policy design-no longer should strictly formalized models of top-down models be used, but rather, more adaptive, inclusive and behaviorally based practices paying attention to the realities those informal waste collectors live.

Policy and Theoretical Implications

The results are well aligned with the current literature trends, which are based on the idea that informal waste collectors should be introduced into formal systems to boost efficiency, sustainability and social inclusion (Gutberlet et al., 2021; Scheinberg et al., 2018).

Nevertheless, the research also contributes to and builds upon current literature findings and proves that structural barriers, including financial exclusion, lack of infrastructures, and institutional mistrust, should be addressed through integration (OECD, 2022; UNEP, 2021). These findings also indicate the relevance of participatory and inclusive forms of formalization over the coercive top-down methods, which agree with Aparcana (2019), and Dias and Ogando (2021).

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Theoretically, the research builds upon the already existing frameworks by showing that economic and perceptual variables have more effect than the traditional socio-demographic variables like education. The observation undermines traditional models and demands more integrated solutions that embrace behavioral, institutional as well as socio-economic aspects.

Overall Synthesis

On the whole, the findings contribute to a great extent to the existing literature on the importance of informal waste collectors in urban waste organizations, especially in terms of resources recovery and livelihood provision. Nevertheless, the research still refutes and narrows down the previous assumptions about the impact of education and financial exclusion, emphasizing the need of context-specific and behaviorally informed policy intervention.

The paper highlights that informal waste collectors have a valuable role in ensuring environmental sustainability and economic systems but their potential is limited by structural weakness and institutional marginalization. The willingness to integrate is very high and it poses a significant challenge to the policymakers to come up with inclusive, efficient and sustainable systems of managing waste in a way that would help close the divide between the formal and informal sectors.

CONCLUSION

This study endeavored to discuss the socio-economic attributes, working modalities and integration opportunities of the informal waste collectors in the Tamale Metropolis with the larger objective of enlightening the inclusion and sustainable waste management policies. Findings emphasized the necessity of informal waste collectors in city environmental management, especially in situations where formal systems are limited based on poor infrastructure, financial resources and institutional capacity.

The researchers find out that most informal waste collectors are young, economically active, men with low education, and thus this sector performs a vital role of providing livelihood in a marginalized population. With their small human capital, informal waste collectors are shown to operate very efficiently especially in the waste recovery and recycling, thus playing a significant role in the conservation of resources and the circular economy. They operate across various streams of wastes and various points of collection, which signifies flexibility and adaptability that formal systems usually deficient.

But these contributions are made in economically vulnerable and institutionally excluded situations. The results indicate that the earning of informal waste collectors is low and unstable, there is little access to monetary services and credit, and productivity resources are little possessed. They are also limited by their dependency on labor-intensive practices and informal organization of the markets, thus restricting productivity and stability of the income. These organizational issues are further increased by the dismal working conditions, health hazards, and legal inequalities.

Notably, the research shows that informal waste collectors are highly willing to join the formal waste management system, which is motivated mostly by the anticipation to earn higher income; better working conditions, and enjoys access to social protection. However, this good will is checked by huge obstacles such as lack of awareness concerning formal systems; trust in authority, and fear of loss of operational autonomy as well as bureaucratic intricacies. Inferential analysis also shows that awareness, perceived importance of integration, levels of income, and working conditions are some of the determinants of integration willingness but education and gender are not important predictors of integration willingness.

Largely, the paper identifies a paradoxical backdrop of the situation, namely, though informal waste collectors play a key role in the organization of urban waste systems, they are structurally excluded. The solution to this disconnect is that policy interventions need to be deliberate, inclusive and context sensitive that appreciate and need not weaken the livelihoods of the informal actors. The results hence offer a good empirical foundation of rethinking the governance of waste in developing cities to more inclusive, efficient and sustainable systems.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

POLICY RECOMMENDATIONS

Based on the results, the following policy recommendations may be suggested, each position of the main stakeholders is also clearly defined:

Legalization of Informal Waste collectors

It is necessary to formally decide to accept informal waste collectors as stakeholders in the waste management system. The local governments are expected to come up with a regulatory framework that identifies, licenses, and protects informal workers through the law. The incorporation of informal sector into other environmental and urban development policies by the national policymakers should be considered. The legalization will minimize harassment, a better working condition, and access to institutional support mechanisms.

Capacity Building and Skills Development Programs

There should be specific training programs to improve technological, entrepreneurial and organizational skills of informal waste collectors. Through NGOs and development partners, government agencies should offer education on waste sorting technologies, occupational health and safety, and management of small businesses. Research, curriculum development and community engagement programs can be supported by academic institutions. These will enhance productivity and facilitate easier incorporation into the formal systems.

Infrastructure and Administrative Support

The local governments must invest in the infrastructure like the specific waste sorting facilities, storage facilities and convenient disposal facilities. Moreover, equipment including protective gear, tricycles, and motorized transport should be provided. Public-private partnerships (PPPs) allow the participation of the private sector in providing logistics and recycling technologies, and financial and technical assistance can be offered by donor agencies. Enhanced infrastructure will make the process of efficiency, safety, and environmental performance better.

Financial Inclusion and Economic Empowerment Programs

Informal waste collectors should be incorporated in formal financial systems through efforts. Financial institutions and microfinance institutions ought to develop customized financial products like low-interest loans, savings plans, and micro-insurance plans that fit the informal workers. The governments and NGOs can also promote financial literacy services and mediate to gain trust. By increasing access to credit, financial services, investment will be facilitated in equipment, and incomes will be stabilized, leading to economic resilience.

Mechanisms of Participatory Integration and Trust-Building

The strategies to implement integration must be based on bottom-up and participatory strategies that will actively engage informal waste collectors in the process of making decisions. Governments ought to facilitate creation and empowerment of cooperatives and associations to have a voice in one hand. Civil society groups are able to provide a platform of dialogue, advocacy as well as resolving conflicts. The establishment of trust and inclusiveness will deal with the fear of marginalization, decrease formalization opposition, and increase the effectiveness of policies.

Future Research Directions

Further research on the subject, which takes the form of longitudinal research designs are recommended to evaluate the impacts of incorporation into institutionalized waste management systems on the livelihoods, productivity, and well-being of informal waste collectors in the future. These would give greater causal information than cross-sectional information would offer.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

Also, comparative research in various cities and areas is required in order to reflect situational differences in informal waste systems and integration performance. Increasing the sample sizes and a mixed-methods design, a combination of quantitative and qualitative analysis, would enhance the comprehension of behavioral, institutional, and cultural mechanisms of affecting formalization.

More studies are also needed to investigate the contribution of institutional trust, quality of governance and policy implementation structures, which it did not comprehensively address in this study but could be very important in determining the success of integration.

Lastly, the research on how digital technologies, financial inclusion instruments and cooperative frameworks can contribute to enhancing efficiency and inclusion in informal waste sector is an exciting project that can be developed in both theory and practice.

REFERENCES

1. Aparcana, S. (2019). Approaches to formalization of the informal waste sector into municipal solid waste management systems in low- and middle-income countries: Review of barriers and success factors. Waste Management, 61, 593–607. https://doi.org/10.1016/j.wasman.2016.12.028
2. Aparcana, S., & Salhofer, S. (2013). Development of a social impact assessment methodology for recycling systems in low-income countries. International Journal of Life Cycle Assessment, 18, 1106–1115. https://doi.org/10.1007/s11367-013-0556-7
3. Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.
4. Dias, S. M. (2020). Waste pickers and cities. Environment and Urbanization, 32(2), 375–390. https://doi.org/10.1177/0956247820935675
5. Etikan, I., & Bala, K. (2017). Sampling and sampling methods. Biometrics & Biostatistics International Journal, 5(6), 00149. https://doi.org/10.15406/bbij.2017.05.00149
6. Ferronato, N., & Torretta, V. (2019). Waste mismanagement in developing countries: A review of global issues. International Journal of Environmental Research and Public Health, 16(6), 1060. https://doi.org/10.3390/ijerph16061060
7. Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). SAGE Publications.
8. Gutberlet, J. (2018). Grassroots waste picker organizations addressing the UN sustainable development goals. World Development, 112, 196–207. https://doi.org/10.1016/j.worlddev.2018.07.012
9. Gutberlet, J., Carenzo, S., Kain, J. H., & Mantovani Martiniano de Azevedo, A. (2021). Waste picker organizations and their contribution to the circular economy: Two case studies from a Global South perspective. Resources, 10(6), 65. https://doi.org/10.3390/resources10060065
10. Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. World Bank. https://doi.org/10.1596/978-1-4648-1329-0
11. Medina, M. (2018). The informal recycling sector in developing countries: Organizing waste pickers to enhance their impact. Routledge.
12. OECD. (2022). Global plastics outlook: Economic drivers, environmental impacts and policy options. Organisation for Economic Co-operation and Development. https://doi.org/10.1787/de747aef-en
13. Samson, M. (2020). Reclaiming reusable and recyclable materials in Africa: A critical review of the role of waste pickers. WIEGO Working Paper Series. Women in Informal Employment: Globalizing and Organizing (WIEGO).
14. Saunders, M., Lewis, P., & Thornhill, A. (2019). Research methods for business students (8th ed.). Pearson Education.
15. Scheinberg, A., Simpson, M. H., Gupt, Y., Anschütz, J., & IJgosse, J. (2010). Economic aspects of the informal sector in solid waste management. GIZ (still widely cited in recent literature).
16. UNEP. (2021). From pollution to solution: A global assessment of marine litter and plastic pollution. United Nations Environment Programme. https://www.unep.org/resources/pollution-solution-global-assessment-marine-litter-and-plastic-pollution
17. Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero, A., Velis, C., Iyer, M., & Simonett, O. (2015). Global waste management outlook. UNEP.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XV, Issue III, March 2026

18. Wilson, D. C., Velis, C., & Cheeseman, C. (2019). Role of informal sector recycling in waste management in developing countries. Habitat International, 30(4), 797–808. https://doi.org/10.1016/j.habitatint.2005.09.005
19. Wooldridge, J. M. (2020). Introductory econometrics: A modern approach (7th ed.). Cengage Learning.
20. World Bank. (2024). Solid waste management overview. World Bank Group. https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management