

Sustainability of Municipal Solid Waste Scavenging and Recycling as Sources of Livelihood in Biu Local Government Area, Borno State

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Abstract

The present study evaluated the prospect of informal municipal solid waste scavenging and recycling as sources of livelihood among waste pickers in Biu local Government Area of Borno State. Data was collected directly from scavengers, artisanal recyclers as well as the middlemen through structured questionnaires and personal observations. Findings revealed that 124 (96.9%) were male, while only 4 (3.1%) were female who are mostly between 18–25 years. Analysis also revealed about 69.6% of respondents agreed that scavenging provides stable employment and income, while 43.7% agreed that scavenging and recycling supports their household needs. The study further showed that about 69.6% agreed that scavenging has improved their socio-economic well-being since the start of the operations. On the environmental and Health risks associated with Scavenging and Recycling, majority of the scavenger (77.4%) acknowledged that scavenging exposes them to health risks of cuts, respiratory infections, and exposure to hazardous substances. Only 32.8% agreed the work environment is safe, while the majority (64.1% disagreed) believed it is unsafe. This indicates poor safety conditions, lack of protective equipment, and exposure to smoke, dust and bad odor. On institutional recognition of informal about 95.3% disagreed/strongly disagreed that their activities are recognized by government, suggesting that scavenging is marginalized and excluded from formal waste management initiative. Multiple Linear Regression Analysis was applied to determine the relationship between livelihood benefits, environmental/health risks, institutional support (independent variables), and sustainability perception (dependent variable). The model explained approximately 51% of the variance ($R^2 = 0.508$) in sustainability, indicating that the chosen predictors account for a moderate to strong portion of the factors shaping respondents' perception of sustainability.

Keywords: MSW, Informal Waste Pickers, Sustainability, Income Level, Livelihood, Safety Conditions

Introduction

Municipal solid waste (MSW) management is a great challenge that is faced by urban countries across sub-Saharan Africa (Mbah and Nzeadibe, 2017). In many Nigerian towns and cities, the lack of a formal system of waste collection, limited sanitary infrastructure, and budgets that are constrained have resulted into an informal way of waste recovery where scavengers outsource for materials that are recyclable for either resale and reuse (Hyelnasinyi et al., 2024). In Biu Local Government Area (LGA), Borno State, the livelihood of vulnerable and marginal people is met by informal scavenging and recycling economy, also the act can influence public health, environmental quality, and the overall effectiveness of municipal waste management. The rate of urbanization, growth in human population, and the changing patterns in consumption have increased the number and differences of MSW in many Nigerian LGAs (Olukanmi and Mnenga et al., 2015). Municipal authorities usually struggle to create a waste collection practice that is comprehensive and safe; but posed with limited manpower, irregular funding, and insufficient infrastructure (Njewa et al., 2022). However, the sector is faced with precarious working conditions, constant exposure to hazardous materials, and social stigma. Borno State, which is a region affected by conflicts, these vulnerabilities are often increased, thereby creating complex relationship between the provision of livelihood for the individuals involved and social-environmental risks associated with the practice. Despite its economic importance, there has been little systematic research on examining the sustainability of MSW scavenging and recycling as a livelihood strategy in Biu LGA. As the approach of sustainability encompasses economic viability, social sustainability, environmental sustainability, and institutional sustainability, a sustainable scavenging-recycling ecosystem will be one where waste pickers and micro-recyclers can ensure working without issues relating to health and involve in waste-management systems that can reduce harm to the environment and contributes to the circular economy approach (Zisopoulos et al., 2023; Solaja et al., 2024). Practically, Biu LGA can represent a semi-urban region in northern Nigeria where there is limited and informal recovery services for municipal waste services. Theoretically, the study of scavenging in Biu will offer insight into how the principles of circular-economy can be achieved, and how policies can integrate informal waste workers into municipal planning. The findings can inform local interventions, municipal policy adjustments and broader development programming that seeks to align livelihoods with environmental goals. This study therefore investigates the sustainability of municipal solid waste scavenging and recycling as a source of livelihood in Biu LGA by addressing the socio-economic dimensions of participation; the operational and market characteristics of scavenging and small-scale recycling and the risks and institutional relationships that affect sustainability. When these questions are approached holistically, the study will identify opportunities for interventions that can improve incomes and working conditions while enhancing environmental and institutional outcomes. The significance of the research is that it is both policy-oriented and community-focused. This scope of study includes the survey of households and individuals that are directly engaged and key value chain actors in scavenging and recycling on a small-scale in Biu LGA. It will assess the types of material types recovered, seasonal variations, health and safety practices, and the institutional environment influencing operations.

Materials and Methods

Study Area Description

The study area for this study is Biu Local Government Area of Borno State. Biu Local Government Area is located in the southern part of Borno State and lies between latitudes $11^{\circ} 30'$ to $12^{\circ} 40'$ north of the equator and longitudes (Fig.1). The study area lies on the Biu Plateau at an average elevation of 626 meters above sea level and the drainage system covers the Biu dam, river Hawul and other minor streams and ponds. Biu is generally characterized by fine granite and volcanic silts of metamorphic rock which co-exist side by side with the granite intrusion, and they are believed to have been formed by regional metamorphic (Dibal and Yarima, 2021). Biu is mostly located in the Northern Guinea Savannah agroecological zone with a small proportion in the Northeast, the Kimba area, lying in the dryer Sudan Savannah zone (Amaza, et al., 2007). The study area is bordered by Damboa, Chibok and Askira Uba LGAs to the north and Bayo, Kwaya Kusar and Shani LGAs to the south. The inhabitants of Biu are mainly Babur and Bura people (also known as Pabir), Tera, Marghi, Mina and Fulani people (Mshelia, 2014). Agriculture mainly crop production activities and animal husbandry are the main source of livelihood in the study area. There are two cropping season, one that starts with early onset of rain, usually in May and the dry season cropping which starts soon after harvesting of the rain-fed crops between November- December. In addition to agriculture, the economy of Biu LGA thrives on a number of mineral resources such as Iron ore, Salt, Feldspar, and Topaz are found in Biu LGA. (Amaza et al, 2007).

Reconnaissance Survey

A reconnaissance survey was first conducted in the study area to obtain firsthand information on the major waste collection (informal collection) and recycling points, the distribution of scavengers, and their operational patterns. The exercise involved field visits to key dumpsites, roadside waste accumulation points, and informal recycling locations such as the Biu main market and nearby scrap dealer zones. The survey helped identify the main actors involved in scavenging and recycling, their working conditions, and appropriate locations for data collection.

Types and Sources of Data

Primary Data: primary data was collected directly from scavengers, artisanal recyclers as well as the middlemen involved in the study through the administration of structured questionnaires and personal observations was used to verify the facts of the respondents.

Secondary Data: secondary information was obtained from available literature to enrich the theoretical conceptualization of the study. The available literatures include related books, journals, published and unpublished texts, documents, magazines, conference articles, ministries of environment and related agencies. Other sources are from publications of the United Nations, World Bank, National Bureau of Statistics and related websites.

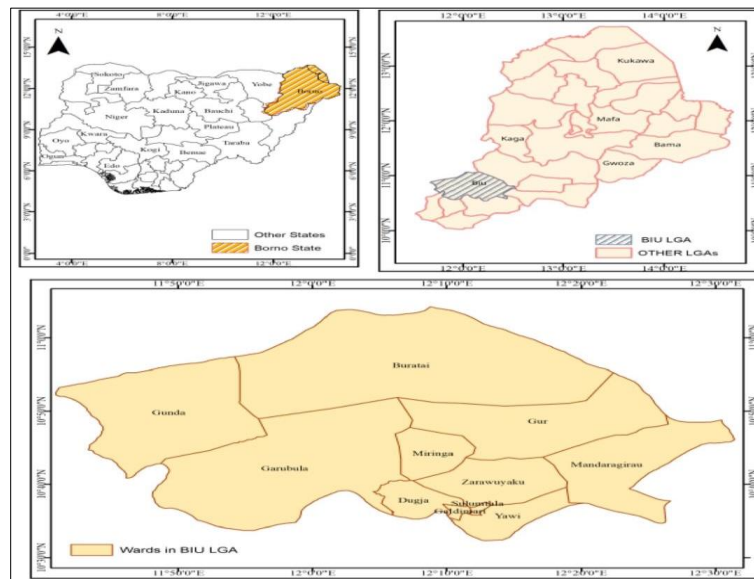


Figure 1: Wards in the Biu Local Government Area
Adopted and modified from the map of Borno State (2025)

Instrument for Data Collection

The primary instrument for data collection was a structured questionnaire designed based on the study's aim. The questionnaire comprised socio-demographic characteristics of respondents (gender, age, education, marital status, and ethnicity), Livelihood benefits derived from scavenging and recycling, Environmental and health risks associated with scavenging and recycling activities and lastly, Institutional support and sustainability perception. The questions were primarily close-ended and measured using a five-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1). In addition, a digital GPS map camera was used to capture some of the activities of scavengers and recyclers in the study area.

Sampling Frame (Sampling Population)

The study population comprised individuals engaged in waste scavenging and recycling activities within Biu Local Government Area. These included scavengers who collect recyclable items at dumpsites, road edges, and commercial areas, as well as artisanal recyclers and intermediaries who purchase the collected materials.

Sample size

The sample size for this study was determined using the Cochran (1977) formula for an infinite population, which is expressed as:

$$N_0 = (Z^2 \times p \times q) / e^2 \text{ Where:}$$

N_0 = desired sample size

Z = standard normal deviation at 95% confidence level (1.96)

P = estimated proportion of the population (0.5 used when unknown)

$Q = 1 - p$ E = margin of error (0.05)

A total of 135 respondents were selected for this study. This sample size was considered adequate based on the accessible scavengers and artisanal recycler population observed during the reconnaissance survey. The number also aligns with typical sampling standards for small localities where population records are informal.

Sampling Techniques (Sampling Methods)

Based on the reconnaissance survey and the conviction that there were fewer artisanal recyclers but a greater number of scavengers and plastic bottle collectors, a proportionate sample size was decided. Non-probability sampling techniques such as purposive and snowball sampling were used in identifying individuals to administer questionnaire to. These sampling techniques were appropriate given their strength in identifying unique and informative cases. Snowball sampling was the preferred method for identifying and sampling the cases in a network of difficult-to-find populations (Neuman, 1997; Bernard, 2002). This was used in getting artisanal recyclers. With the purposive sampling, personal judgment was used to select cases that will best meet the research questions and objectives (Saunders et. al., 2003). The researcher selected informants who are knowledgeable about the issues being investigated, willing to talk and representative of the range of points of view (Rubin and Rubin, 1995). In line with Schutts (2006) approach, areas with more respondents attracted more questionnaires. The reason for this decision is to avoid shortage in one area and surplus in another. The researcher was assisted by two field assistants. This was done by identifying convenient time when the middlemen, recyclers and scavengers could be met at their work place for the administration of the questionnaire.

Reliability of the Instrument

The reliability of the questionnaire was ensured by subjecting the coded data in SPSS to Cronbach- Alpha reliability test. The responses were analyzed using Cronbach's Alpha reliability coefficient in SPSS software. The following values were obtained for each section of the questionnaire; Livelihood benefits (0.71), Environment and Health risks (0.83), Institutional Support and Sustainability perception (0.82). This indicates a high level of internal consistency and reliability of the instrument, as suggested by Pallant (2020) and Nunnally (1978).

Data Analysis

Data collected were coded and analyzed using the Statistical Package for the Social Sciences (SPSS, Version 23). Both descriptive and inferential statistical methods were employed. Descriptive statistics was used to summarize demographic data and questionnaire responses through frequencies, percentages, means, and charts. Inferential statistics such as Multiple Linear Regression Analysis was applied to determine the relationship between livelihood benefits, environmental/health risks, institutional support (independent variables), and sustainability perception (dependent variable). The equation is given as follows;

$$SUS = \beta_0 + \beta_1LB + \beta_2HR + \beta_3IS + \beta_4EDU + \varepsilon$$

Where:

SUS = Sustainability score for respondent (dependent variable).

B0= Intercept (expected SUS when all predictors = 0).

LB = Livelihood Benefits score for respondent (predictor).

HR = Environmental & Health Risks score for respondent (predictor).

IS= Institutional Support score for respondent (predictor).

EDU = Education level for respondent (control variable).

ε = Error term (residual) for respondent.

Study Hypothesis

The null hypothesis H_0 : There is no significant relationship between predictor (Livelihood benefits, Health risks and Institutional support) and livelihood sustainability of waste scavenging and recycling in the study area

Results and Discussion

Demographic Characteristics of Respondents

Demographic composition of respondents is presented in Table 1. Out of the 128 respondents surveyed, 124 (96.9%) were male, while only 4 (3.1%) were female. This indicates that waste scavenging and recycling in the study area is a male-dominated activity, with very limited female participation. The male respondents involved in all waste activities which include scrap metal and plastic bottle collection, scavenging and artisanal recycling while the female respondents engaged in plastic bottle collection and cans collection. None of the women was involved in scrap metal collection and artisanal recycling. Scavenging and recycling are overwhelmingly male-dominated, and this aligns with several previous studies in Nigeria and other parts of the world (Dias, 2011; Asim et al., 2012; Rockson et al., 2013, Taiwo et al., 2022). Afon (2012) observed that scavenging activities in Nigerian cities such as Lagos and Ibadan were largely undertaken by men (88%), with women constituting only a small fraction. He attributed this to the physically demanding nature of scavenging and the stigma attached to waste-related jobs. Oteng-Ababio observed that males accounted for 86% of the scavengers found in Agbogbloshie, Accra.

In south Africa, Shoroma, et al., (2022) shows that 80% of the respondents in the study were male and 20% female, indicating that more males than females engaged in recycling. In another study by Arruda, et al. (2020), the majority of waste pickers were reported to be men and to experience greater inequalities and disproportionate economic and health impacts than their female counterparts. On the contrast, Ocean Conservancy (2023) argued that women and men engaged equally in informal recycling. Waste picking is labour intensive and will affect young males. Most times, waste pickers have to walk many miles daily to pick up waste under the hot sun or in heavy rain. More so they carry heavy loads on their backs or push carts to transport their collected waste. Also from table 1, it can be seen that 59 respondents (46.1%) were below 18 years, 36 respondents (28.1%) were between 18–25 years, 25 respondents (19.5%) were between 26–35 years, 6 respondents (4.7%) were between 36–45 years, and 2 respondents (1.6%) were 46 years and above. This shows that the majority of respondents are youths, particularly those under 25 years, who account for almost three-quarters (74.2%) of participants. These findings are consistent with earlier research in Nigeria and other developing countries. For example, Edokpayi et al. (2021) revealed a large number of waste pickers in low-income countries are within the age group 25 to 40 years, and thus to be mature people responsible for feeding their families. In another study, Yu (2020) reported that the majority of waste pickers in developing countries are young adults. According to a Statista Research report, the majority of those working as waste pickers fell within the age group of 18 to 55 years (Statista South Africa 2022).

Results of Lagos and Ilorin, Nigeria, and Botswana also revealed that all scavengers are under the age of 30 (Ogwueleka and Naveen, 2021). Scheinberg, et al., (2011) also reported that approximately 86.7% of the litter pickers at the Lagos landfill are between 19 and 30 years old. In Nigeria, Nzeadibe (2009) similarly observed that waste picking in Southeastern Nigeria was dominated by young people, often school dropouts or those from poor households. Afon (2012) also found that waste scavenging in Kano was largely a youth activity, with very low participation among older adults due to the strenuous physical requirements. In a recent study by Shoroma et al., (2025) the largest percentage of waste pickers (36%) were between the ages of 36 and 45 years. A deviation from this age was reported in the study carried out by Taiwo *et al.*, (2022). Their study showed that majority (62.0%) of the child waste pickers were males between 13 and 17 years (77.8%). This group of waste pickers are considered as child waste pickers who live and work, retrieving and sorting valuable items from municipal open dumps (Afon, 2011; Rigasa et al., 2015, Taiwo et al., 2022). Dada et al., (2022) have also noted that several of these children and youths settle in and around dumpsites to reduce the cost of transportation.

Table 1: Demographic Information of Respondents

Gender			Age range			Educational level		
	Freq	%		Freq	%		Freq	%
Male	124	96.9	Less than 18 years	59	46.1	No formal education	18	14.1
Female	4	3.1	18-25 years	36	28.1	Quranic	42	32.8
			26-35 years	25	19.5	Primary	36	28.1
<i>Total</i>	128	100	36-45 years	6	4.7	Secondary	31	24.2
			46 years and above	2	1.6	Tertiary	1	0.8
			<i>Total</i>	128	100	<i>Total</i>	128	100
Marital status			Ethnic Composition					
	Freq	%		Freq	%			
Single	84	65.6	Babur/Bura	107	83.6			
Married	44	34.4	Hausa/Fulani	12	12			
			Igbo	3	2.3			
<i>Total</i>	128	100	Yoruba	4	3.1			
			Others	2	1.6			
			<i>Total</i>	128	100			

Source: Field Survey, 2025

Table 1 also revealed that out of 128 respondents, 84 (65.6%) were single, while 44 (34.4%) were married. This shows that a majority of waste scavengers and recyclers in the study area are single individuals, with married persons forming just over one-third of the population. The predominance of single respondents suggests that scavenging and recycling are youth-centered occupations, as earlier analysis of age distribution also revealed. Being single may afford individuals greater flexibility to engage in such physically demanding work. Finding also revealed that out of the 128 respondents surveyed, 107 (83.6%) were Babur/Bura, which is the dominant ethnic group in the study area. Other groups represented include Hausa/Fulani (12 respondents, 9.4%), Yoruba (4 respondents, 3.1%), Igbo (3 respondents, 2.3%), and other ethnicities (2 respondents, 1.6%). This clearly indicates that scavenging and recycling in the area are largely practiced by the indigenous ethnic group. As represented in Figure 2, 18 respondents (14.1%) had no formal education, 42 respondents (32.8%) had Quranic education, 36 respondents (28.1%) attained primary education, 31 respondents (24.2%) attained secondary education, and only 1 respondent (0.8%) had tertiary

education. This distribution shows that the majority of waste scavengers and recyclers in the study area possess low levels of formal education, with a combined 75% not progressing beyond primary school.

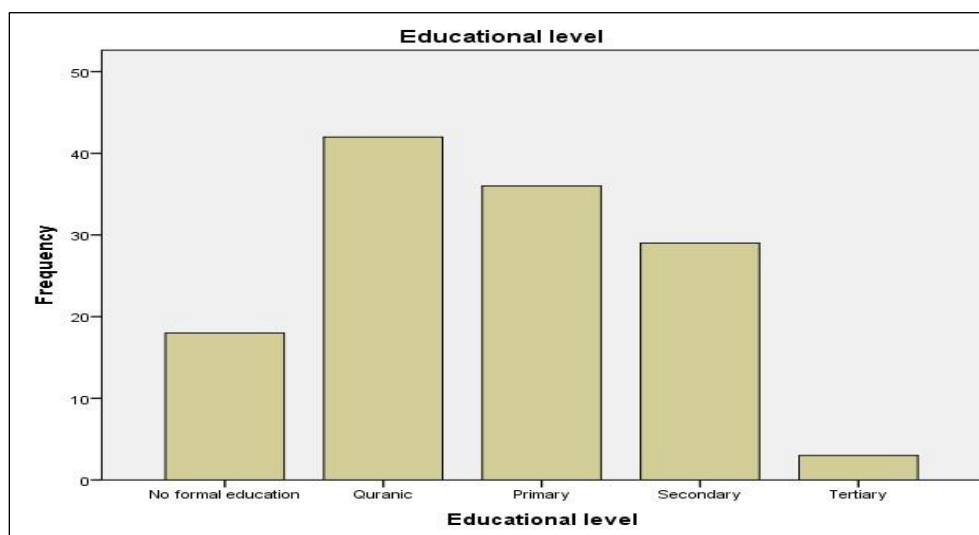


Figure 2: Educational level of respondents 128

Livelihood Benefits Derived from Scavenging and Recycling Activities

To examine the livelihood benefits derived from scavenging and recycling activities by the individuals involved in the study area, the following are the outcome of questionnaire administered:

Questionnaire ITEM A: Scavenging/Recycling Activities Provides Me with a Stable Employment and Income

As presented in Table 2 below, 28 respondents (21.9%) strongly agreed, 61 (47.7%) agreed, 12 (9.4%) were neutral, while 25 (19.5%) disagreed and 2 (1.6%) strongly disagreed. About 69.6% of respondents agreed that scavenging provides stable employment and income. This suggests that waste scavenging serves as a major livelihood source for the majority of respondents, despite its informal and precarious nature. 21.1% who disagreed or strongly disagreed reflect the reality that not all scavengers perceive the activity as truly stable or sufficient for long-term livelihood security. The fact that majority of sampled scavengers agreed that the activities of scavenging provide stable employment is a clear indication that informal waste picking operation in Nigeria is adaptive response to chronic poverty and limited employment in the formal sector in Nigeria as especially as most of the scavengers to no have access to basic education. This further exacerbate the porty level of young adults in the country. Recent reports show that Nigeria ranks low on the United Nations' Human Development Index, with 30.9% of the population living below the poverty line, most in the North of the country and rural areas (UNDP, 2023; World Bank 2016, World Bank, 2023). Incomplete access to essential education and health care services limits the productive potential of the younger generation, which is compounded by a lack of meaningful work prospects within a context of weak state capacity (World Bank, 2023).

Table 2: Stable Employment and income from Scavenging/recycling activities

Scale	Frequency	Percentage (%)
Strongly Disagree	2	1.6
Disagree	25	19.5
Neutral	12	9.4
Agree	61	47.7
Strongly Agree	28	21.9
Total	128	100.0

Source: Field Survey, 2025

Questionnaire ITEM B: These Activities Help Me to Support the Needs of My Household

From table 3 below, it can be deduced that 1 respondent (0.8%) strongly agreed, 55 (42.9%) agreed, 66 (51.6%) were neutral, 6 (4.7%) disagreed, and none strongly disagreed as it regards support of household's needs by scavenging/recycling activities. While 43.7% agreed that scavenging and recycling supports their household needs, the majority (51.6%) remained neutral. This neutrality may indicate that, although scavenging contributes some financial support, it is not always sufficient to meet household demands, or respondents are reluctant to fully attribute household sustenance solely to scavenging. The above findings are in agreement with previous studies (Viljoen et al., 2018, Brem et al., 2020, Fair Circularity Initiative, Systemiq, 2024). For example, Fair Circularity Initiative, Systemiq reported that as at 2024, an estimated 19-24 million individuals worldwide earn their livelihoods through collecting and recycling waste. The report further shows that approximately 0.5-1% of the global workforce are engaged in this critical but underappreciated occupation; and 80% of waste pickers operate within the informal economy. Informal waste pickers make a significant contribution to waste management systems by collecting almost 60% of recyclable materials. These materials when recovered are transported to designated centres where they are weighed and then sold to vendors at collection centre or through middlemen or directly to recyclers. The monthly income of the majority of waste pickers in Nigeria for example is above the country's ₦18,000 (\$58.7) per month minimum wage and about ₦560,000 (\$1827.4), the annual per capita income (PCI) (Omosimua et al., 2021).

Table 3: Household Needs Support from Scavenging and Recycling Activities

Support Household Needs	Frequency	Percentage (%)
Strongly Disagree	0	0
Disagree	6	4.7
Neutral	66	51.6
Agree	55	43.0
Strongly Agree	1	0.8
Total	128	100

Source: Field Survey, 2025

Questionnaire ITEM C: Waste Scavenging and Recycling Has Improved My Social and Economic Well-Being

As presented in table 4 below, 7 respondents (5.5%) strongly agreed, 82 (64.1%) agreed, 26 (20.3%) were neutral, 13 (10.1%) disagreed, and none strongly disagreed. An overwhelming 69.6% agreed that scavenging has improved their socio-economic well-being, while 20.3% remained neutral and only 10.1% disagreed. This suggests that respondents perceive tangible benefits in terms of income, social integration, and personal stability through scavenging activities. In south Africa, Rogan and Skinner (2018) reports that more than 2.5 million people are working informal sector, while waste picking provides between 60000 and 90000 informal self-employment opportunities in South Africa. Self-employment by waste pickers which requires little or no formal education contributes to improved income level and hence better Social and Economic Wellbeing. In Nigeria, Omosimua et al., (2021) reported that most of the waste pickers in Lagos earn between ₦2500 (\$8.2) and ₦4900 (\$16) on daily basis and ₦600, 000 (\$1958) annually. Other studies have also shown that income from informal waste pickers may be sufficient towards improving their social status (Afon, 2012; Binion and Gutberlet, 2012). A World Bank report shows that waste picking (waste recovery) provides a means of survival for about 1% of the population in African, Asian, and Latin American cities (Medina, 2010).

Table 4: Improvement of Social and Economic Wellbeing

Support household needs	Frequency	Percentage (%)
Strongly Disagree	0	0
Disagree	13	10.1
Neutral	26	20.3
Agree	82	64.1
Strongly Agree	7	5.5
Total	128	100

Source: Field survey, 2025

Similarly, Medina (2000) emphasized that scavenging supports millions worldwide, especially in contexts where formal job opportunities are limited. In Kano, Afon (2012) reported that scavengers derive income and household sustenance from waste picking, despite its low prestige and health hazards. Thus, the present study reinforces the notion that scavenging is not merely a coping mechanism but also a livelihood pathway with socioeconomic value, albeit constrained by instability and vulnerability.

Environmental and Health risks associated with Scavenging and Recycling

To examine the Environmental and Health risks associated with scavenging and recycling activities in the study area, the following are the outcome of questionnaire administered:

Questionnaire ITEM D: Scavenging and Recycling Expose Me to Health Risks (E.G., Injuries, Diseases)

Table 5 below reveals that 40 respondents (31.3%) strongly agreed, 59 (46.1%) agreed, 6 (4.7%) were neutral, 22 (17.2%) disagreed, and 1 (0.8%) strongly disagreed. A significant majority (77.4%) acknowledged that scavenging exposes them to health risks. This highlights the occupational hazards faced by scavengers, including cuts, respiratory infections, and exposure to hazardous substances. Health risks are widely recognized among participants, indicating the unsustainable and unsafe working conditions in

scavenging and recycling. More so, their health conditions are largely at risk because of the unsafe and hazardous means by which they carry out their activities (Omosimua et al., 2021). According to Awopetu et al., (2014), these scavengers are often found working where decaying organic waste, including highly toxic medical waste, are deposited. Economic inadequacies also push waste pickers to consume recovered food waste which can put them at risk of stomach infections, parasites infection, and food poisoning, which can cause nausea and diarrhoea (Da Silva et al., 2005). The bioaerosols and other toxic compounds inhaled in the combustion process also potent danger to them (Omosimua, et al., 2021). Additionally, open burning of waste can cause eye irritation, lung infections, decreased lung functions, and different respiratory ailments (Ray et al., 2004, Gomez-Correa et al., 2008). Scavengers are subjected to discrimination and harassment from the public (Mander, 2014; Nuripuh et al., 2022, Saldanha et al., 2022). Across all developing countries, scavengers are subjected to marginalization (Aparcana, 2017) essentially due to the nature of their jobs. In Abuja, Nigeria, Ogwueleka and Naveen, (2021) reported that scavengers suffer from low self-stream and stigmatization. In Tunisia, Palestine and Morocco, scavengers are abandoned and rejected (Scheinberg et al., 2012).

Table 5: Exposure to health risks

Exposure to health risks (e.g injuries, diseases)	Frequency	Percentage (%)
Strongly Disagree	1	0.8
Disagree	22	17.2
Neutral	6	4.7
Agree	59	46.1
Strongly Agree	40	31.3
Total	128	100

Source: Field Survey

Questionnaire ITEM E: The Work Environment in Scavenging and Recycling is Generally Safe

As represented in Figure, 3 respondents (2.3%) strongly agreed, 39 (30.5%) agreed, 4 (3.1%) were neutral, 54 (42.2%) disagreed, and 28 (21.9%) strongly disagreed. Only 32.8% agreed the work environment is safe, while the majority (64.1% disagreed) believed it is unsafe. This points to poor safety conditions, lack of protective equipment, and exposure to smoke, dust and bad odor. Respondents perceive scavenging as unsafe and hazardous, undermining its sustainability as a livelihood without safety interventions. This finding is inline with the study of Omosimua et al., (2021) who reported that waste pickers in developing countries are susceptible to injuries due to lack of the necessary personal protective equipment (PPE) and thus are faced with pitiable working conditions. In another study, Cointreau-Levine and Guidance, (2000) showed that majority of sampled scavengers in their study suffered from a wide range of illnesses, such as lead poisoning, skin diseases, respiratory infections, gastrointestinal diseases, and cuts from objects that are sharp. More studies have also reported that waste scavengers' occupational safety remains a major challenge due to the poor safety practices and inadequate utilization of Personal Protective Equipment (PPE) (Kodiya et. al., 2023 and Yusuf et al., 2023).

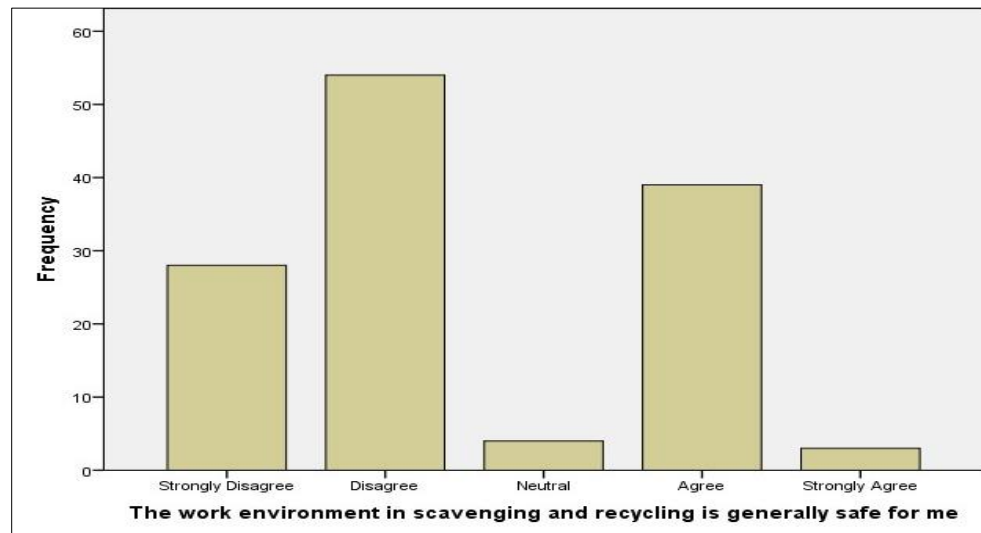


Figure 3: Safe Work Environment n= 128

Source: Field Survey, 2025

Questionnaire ITEM F: Environmental Hazards from Scavenging and Recycling Affect My Long-Term Wellbeing

As indicated in Table 6 below, 52 respondents (40.6%) strongly agreed, 44 (34.4%) agreed, 17 (13.3%) were neutral, 13 (10.1%) disagreed, and 2 (1.6%) strongly disagreed. About 75% agreed that environmental hazards negatively affect long-term wellbeing, showing awareness of chronic health issues such as infections, musculoskeletal problems, and reduced life expectancy. Respondents recognize scavenging as a double-edged livelihood; it provides income but compromises health in the long run.

Table 6: Effect of Scavenging and Recycling on Long Term Wellbeing

Effect of Scavenging and Recycling on long-term wellbeing	Frequency	Percentage (%)
Strongly Disagree	2	1.6
Disagree	13	10.1
Neutral	17	13.3
Agree	44	34.4
Strongly Agree	52	40.6
Total	128	100.0

Source: Field Survey, 2025

The above findings data demonstrates that respondents are fully aware of the environmental and health hazards of scavenging. While it provides immediate income, it also exposes them to unsafe conditions and long-term health risks, raising questions about the sustainability of scavenging without policy and health interventions. More so, findings in Table 6 align with earlier studies that documented health and environmental risks among waste scavengers. Afon (2012) reported that scavengers in Lagos faced frequent injuries and poor occupational safety. Similarly, Nzeadibe (2009) found that scavengers in Enugu often suffered from infections and unsafe working conditions. Globally, Wilson et al. (2006) observed that waste pickers are exposed to hazardous waste, chemical residues, and unsafe dumpsites, with limited or no

protective measures. Report by United Nations Environmental Programme (UNEP) established that scavengers may suffer from respiratory disorders due to protracted exposure to smoke from fires and dust from the waste dumpsite (UNEP, 2013). According to Aboagye-Larbi et al., (2014), some scavengers may be injured by sharp objects resulting in death or get exposed to human immune deficiency virus (HIV) and even hepatitis infection from health care waste. Magaji and Dakyes (2011) established that scavengers working in Gwagwalada, Abuja, suffered from respiratory disorders, typhoid, and cholera.

Institutional Support for Scavengers/Recyclers in the Study Area

To examine the institutional support for scavengers/recyclers in the study area, the following are the outcome of questionnaire administered:

Questionnaire ITEM G: Government Recognizes My Scavenging/Recycling Activities as Part of Waste Management

Responses obtained as presented in table 7 reveals that 0 respondents (0%) strongly agreed, 3 respondents (2.3%) agreed, 3 respondents (2.3%) were neutral, 62 respondents (48.4%) disagreed, and 60 respondents (46.9%) strongly disagreed to the statement that the Government recognizes their activities as part of waste management. An overwhelming 95.3% disagreed/strongly disagreed that their activities are recognized by government. This shows that scavenging is marginalized and excluded from formal waste management initiative. The lack of government recognition implies institutional neglect, which undermines scavenging as a sustainable livelihood and limits opportunities for integration into formal systems. In a similar study Ogboeli et al., (2025) reported that a primary obstacle for metal scavengers in Port Harcourt are the lack of formal acknowledgment and regulation. In contrast to established waste management systems that benefit from governmental policies and infrastructure, metal scavenging functions within an informal context, hindering scavengers' access to protective gear, equitable pricing, and legal safeguards (Schenck et al., 2019). A UNEP report also indicate that many scavengers operate in perilous environments, frequently without safety equipment, which exposes them to injuries, hazardous substances, and various diseases (UNEP, 2019).

Table 7: Government recognition of Scavengers/Recyclers

Government recognition	Frequency	Percentage (%)
Strongly Disagree	60	46.9
Disagree	62	48.4
Neutral	3	2.3
Agree	3	2.3
Strongly Agree	0	0
Total	128	100.0

Source: Fieldwork, 2025

Questionnaire ITEM H: I Have Access to Training or Orientation from Government/NGOs

As shown in table 8 below, none of the respondents strongly agreed nor agreed (0%) to receiving or having access to any training or orientation as it relates to their work. 104 respondents (81.3%) disagreed, and 24 (18.8%) strongly disagreed. A complete absence of positive responses indicates that respondents have no access to training, orientation, or capacity-building programs from either government or NGOs. This lack

of institutional capacity-building severely limits scavengers' and recyclers' ability to improve safety, efficiency, and long-term sustainability in their work.

Table 8: Access to training or Orientation from Government/NGOs

Access to training or orientation from Gov/NGOs	Frequency	Percentage (%)
Strongly Disagree	24	18.8
Disagree	104	81.3
Neutral	0	0
Agree	0	0
Strongly Agree	0	0
Total	128	100.0

Source: Fieldwork, 2025

Questionnaire ITEM I: My Work as a Scavenger/Recycler is Supported by Associations, Cooperatives, or Unions

As reflected in table 9, none of the respondents (0%) strongly agreed, 22 respondents (17.2%) agreed, no neutral response was also recorded (0%), 67 respondents (52.3%) disagreed, and 39 respondents (30.5%) strongly disagreed. Only 17.2% acknowledged support from associations or unions, particularly the Artisanal recyclers which is supported by an association as well as the scrap dealers which is also supported by an association while 82.8% disagreed. This suggests that scavengers largely work in isolation, with no registration with any formal organization or advocacy structures. Hence lack of social and institutional framework reduces their bargaining power, access to resources, and ability to negotiate for better working conditions especially as most of the waste pickers do not have direct access to recycling companies.

Table 9: My Work as a Scavenger/Recycler is Supported by Associations, Cooperatives, or Unions

Associations, Cooperatives or Unions	Frequency	Percentage (%)
Strongly Disagree	39	30.5
Disagree	67	52.3
Neutral	0	0
Agree	22	17.2
Strongly Agree	0	0
Total	128	100.0

Source: Field Survey, 2025

These findings align with previous research that highlighted institutional neglect of informal waste pickers. Nzeadibe (2009) reported that in Enugu, Nigeria, scavengers are excluded from official waste management frameworks and lack government recognition. Similarly, Afon (2012) found that informal waste pickers in Lagos operate without training or safety support from public institutions. The data reveals near-total absence of institutional support for scavengers in the study area. Government recognition, training opportunities, and cooperative support are either extremely weak or nonexistent. This lack of institutional engagement threatens the sustainability of scavenging and recycling.

Sustainability of Solid Wastes Scavenging and recycling as a Means of Livelihood

Questionnaire ITEM J: Waste Scavenging and Recycling Provide Long-Term Livelihood Opportunities for Me

As indicated in Table 10, 42 respondents (32.8%) strongly agreed, 66 respondents (51.6%) agreed, 29 respondents (22.7%) were neutral, while none disagreed. About 84.4% agreed scavenging provides long-term livelihood opportunities, showing strong optimism about its sustainability. The 22.7% who were neutral may reflect uncertainty about long-term stability due to health risks, institutional neglect, or low earnings. Most scavengers perceive waste picking as a sustainable livelihood option, though not without risks.

Table 10: Long Term Livelihood Opportunities

Long term opportunities	Frequency	Percentage (%)
Strongly Disagree	0	0
Disagree	0	0
Neutral	20	15.6
Agree	66	51.6
Strongly Agree	42	32.8
Total	128	100

Source: Field Survey, 2025

Questionnaire ITEM K: I Believe the Practice of Scavenging And Recycling Can Continue into the Future

As shown in table 11 below, 60 respondents (46.9%) strongly agreed, 58 respondents (45.3%) agreed, 10 respondents (7.8%) were neutral, and none disagreed. An overwhelming 92.2% agreed scavenging will continue into the future. This reflects respondents' recognition of the persistent demand for waste recovery, especially as waste generation increases with urbanization. Scavengers view their occupation as viable and enduring, tied to structural waste management challenges in the area.

Table 11: Perception on the continuation of recycling into the future

Continuation of recycling into the future	Frequency	Percentage (%)
Strongly Disagree	0	0
Disagree	0	0
Neutral	10	7.8
Agree	58	45.3
Strongly Agree	60	46.9
Total	128	100.0

Source: Fieldwork, (2025)

Questionnaire ITEM L: Scavenging And Recycling Contribute to Both My Economic Survival and Environmental Protection

Table 12 indicates that 64 respondents (50.0%) strongly agreed, 49 respondents (38.3%) agreed, 15 respondents (11.7%) were neutral, and none disagreed. About 88.3% agreed that scavenging contributes to both economic survival and environmental protection. Respondents recognize the dual role of scavenging in poverty alleviation and environmental sustainability through resource recovery.

Table 12: Contribution to Both Economic Survival and Environmental Protection

Contribution to Both Economic Survival and Environmental Protection	Frequency	Percentage (%)
Strongly Disagree	0	0
Disagree	0	0
Neutral	15	11.7
Agree	49	38.3
Strongly Agree	64	50.0
Total	128	100.0

Source: Fieldwork (2025)

These findings are consistent with research highlighting the dual livelihood and environmental benefits of scavenging. Nzeadibe (2009) found that informal recycling provides employment while reducing waste disposal pressures in Nigerian cities. Similarly, Wilson et al. (2006) emphasized that scavengers play a critical role in environmental protection by recovering materials from waste streams. The strong optimism of respondents in this study reflects similar findings in the literature: while scavenging is risky and informal, it is widely regarded as both economically indispensable and environmentally relevant.

Hypothesis Testing and Summary of Findings

The null hypothesis H0: There is no significant relationship between predictors (Livelihood benefits, Health risks and Institutional support) and livelihood sustainability of waste scavenging and recycling in the study area. The multiple linear regression analysis was conducted to examine the predictors of the sustainability of waste scavenging and recycling in the study area at 95% confidence intervals. The dependent variable was the sustainability score (composed of Items j, k, and l), while the predictors included livelihood benefits, environmental and health risks, institutional support while the educational level and age group of the respondents were used as control variables. The model explained approximately 51% of the variance ($R^2 = 0.508$) in sustainability, indicating that the chosen predictors account for a moderate to strong portion of the factors shaping respondents' perception of sustainability (Table 13).

Table 13: The Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			df1	df2	Sig. F Change
					R Square Change	F Change				
1	.713 ^a	.508	.492	.430	.508	.241		5	122	.000
a. Predictors: (Constant), Institutional support, What is your age? Environmental health risk, Livelihood Benefit, Educational level										

Source: Authors analysis, 2025

Table 14: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.465	5	.693	.241	.000b
Residual	165.152	122	1.354		
Total	168.617	127			

Source: Authors analysis, 2025

From the analysis; Livelihood benefits ($\beta = 0.41$, $t = 0.562$, $p < 0.001$) which is the strongest predictor; suggests that when scavenging provides reliable income and household support, respondents perceive it as sustainable. This finding implies that respondents who reported that scavenging provides stable income, supports household needs, and improves social and economic wellbeing were more likely to perceive scavenging and recycling as a sustainable livelihood.

Health risks ($\beta = -0.22$, $t = -0.314$, $p = 0.002$) negatively related to sustainability; the more respondents perceive risks, the less sustainable they consider scavenging. Respondents who perceived higher risks such as exposure to diseases, injuries, and unsafe working conditions were less likely to consider scavenging sustainable.

Institutional support ($\beta = 0.35$, $t = 0.426$, $p < 0.001$) significantly improves sustainability perceptions when properly put in place. Although most respondents reported limited or no institutional recognition or training opportunities particularly the scavengers, those who perceived some form of support (e.g. Artisanal recyclers and Scrap dealers associations) expressed higher sustainability confidence

Regarding the control variables, Education level ($\beta = 0.16$, $t = 0.211$, $p = 0.036$) positively significant; higher education leads to stronger belief in sustainability while the Age group of respondents ($\beta = 0.09$, $p = 0.153$) is not significant, meaning sustainability perception is not strongly age dependent.

Overall, the regression analysis demonstrates that sustainability in waste scavenging and recycling is multidimensional. It is driven strongly by the livelihood benefits it provides, supported by institutional backing, but constrained by health risks. Hence, we reject the null hypothesis H0 and accept the alternative hypothesis H1. (See Table 15)

Table 15: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	12.79	1.444		8.858	.000	4.968	7.827		
What is your age?	.009	.024	.008	.114	.015	.370	.138	.375	1.164
Educational level	.016	.065	.012	.211	.036	.303	.210	.459	1.740
Livelihood Benefit	.041	.067	.039	.562	.000	.343	.480	.311	1.637
Environmental health risk	-.022	.107	-.025	-.314	.002	-.479	-.359	.429	1.138
Institutional support	.035	.097	.031	.426	.000	.588	.350	.343	1.842

a. Dependent Variable: Sustainability

Conclusion and Recommendations

Informal waste collectors represent an important component of any waste management system, as their operation usually result in solid waste reduction, recycling and re-use. Besides their contribution to waste management life-cycle, waste picking provides employment opportunities and also raise livelihood standard of unemployed young people, who live on the margins of the economy and who are mostly uneducated. Findings from this study showed that waste scavenging and recycling provided employment and income for the majority of respondents (about 69.6%). Most of the respondents were reluctant to fully attribute household sustenance solely to scavenging/recycling activities. However, about 69.9% indicated that these activities supported household needs and improved their socio-economic well-being. A significant majority (77.4%) of respondents acknowledged that scavenging exposes them to injuries, diseases, and other hazards, indicating unsafe working conditions. Overall, this study demonstrates that scavenging and recycling activities contribute meaningfully to both improvement of livelihood and environmental sustainability in the study area. However, the sector remains informal and unregulated. The persistence of health risks and lack of institutional support threaten its long-term viability. The study concludes that for scavenging and recycling to be sustainable, there must be deliberate efforts to maximize socio-economic benefits, minimize occupational risks, and strengthen institutional support. This balance will allow the sector to move from informal survival activities to a recognized component of modern waste management and the circular economy. More so, government should establish a formal waste management framework that integrates scavengers through registration and recognition. By registering and recognizing scavengers within a formal waste management framework, local authorities can monitor activities and ensure accountability. Finally, there is need for more awareness campaigns programmes aimed at minimizing or completely eradicate stigmatization of scavengers, Nigeria where scavengers are often perceived as marginalized “dirty and most often than not regarded as criminals.

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