Challenges and Prospects of Metal Scavenging as a Strategy for Waste Reduction in Port Harcourt Metropolis, Rivers State, Nigeria

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ABSTRACT

Waste scavenging presents a growing challenge for numerous municipalities and local authorities in Nigeria. Unfortunately, this issue has often been overlooked by officials due to a lack of understanding regarding its role in resource recovery and recycling. This research examined the obstacles and opportunities associated with metal scavenging as a method for waste reduction in the Port Harcourt Metropolis of Rivers State, Nigeria. Employing a purposive sampling approach, the study involved interviews with 234 waste pickers using semi-structured questionnaires. The data gathered encompassed demographic information of the waste pickers (including age, gender, marital status, and educational background) as well as socio-economic effects (such as income and health issues) related to waste scavenging. The findings indicated that the primary motivators for waste scavenging are poverty (58%) and unemployment (35%). Additionally, waste scavenging plays a crucial role in enhancing the livelihoods of waste pickers, with 93.3% generating income from the sale of recovered materials. A significant majority (80%) of the waste pickers focus on scavenging metals, while a smaller proportion targets food items. The study concluded that, despite being overlooked, waste scavenging is vital for the livelihoods of waste pickers and contributes to waste management efforts in Port Harcourt. It is recommended that waste scavenging be regulated and incorporated into the formal waste management framework of Rivers State, potentially through the establishment of cooperatives for waste pickers that would be registered with the Rivers State Waste Management Agency and acknowledged within formal structures.

Keywords: Metal scavenging, Waste reduction, Solid waste management, Recycling, Urban waste.

INTRODUCTION

The solid waste management system currently in operation in Nigeria has been characterized as basic, ineffective, and unsustainable (Afon, 2020), failing to adequately address the issues associated with solid waste management. The waste collection methods employed in Nigeria are marked by significant inefficiencies, compounded by the improper disposal of solid waste (Ogwueleka, 2009). Predominantly, the open dumping method is utilized across various regions in Nigeria (Okoye, 2024). This approach is linked to pollution of land, water, and air, undermines aesthetic standards, and poses public health risks. In efforts to minimize the volume of waste collected, these sites are frequently set ablaze to incinerate the waste materials. Regrettably, this practice adversely affects the environment, leading to air pollution issues. A study titled “Household Waste Generation and Disposal in Public Housing Estates in Awka” indicated that residents reported air quality concerns, particularly in the evenings, due to smoke emanating from burning waste dumps (Okoye, 2024). Waste management continues to be a significant issue in urban areas globally, especially in rapidly expanding cities such as Port Harcourt, Nigeria. The inadequate disposal of solid waste, particularly metals, raises serious environmental and public health issues (Ogwueleka, 2009). Metal scavenging, which involves the informal

collection, sorting, and recycling of metal waste, has emerged as an effective approach for reducing waste and recovering resources. This activity enhances environmental sustainability by alleviating pressure on landfills, decreasing pollution, and fostering a circular economy (Wilson et al., 2012). Furthermore, it not only supports environmental goals but also creates economic opportunities for those involved in the informal waste sector (Medina, 2008).

Port Harcourt Metropolis serves as a significant commercial and industrial center in Nigeria, producing considerable quantities of metal waste due to construction activities, vehicle repairs, electronic waste, and various industrial operations (Nzeadibe, 2013). The informal recycling sector, especially metal scavengers, is essential for the recovery and recycling of these materials, which helps to diminish the amount of waste that would otherwise be deposited in landfills or dumpsites. However, despite the clear advantages of metal scavenging, this sector remains predominantly unregulated, placing scavengers at risk of numerous socio-economic, health, and environmental challenges (Gutberlet et al., 2017). A primary obstacle for metal scavengers in Port Harcourt is 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). Many scavengers operate in perilous environments, frequently without safety equipment, which exposes them to injuries, hazardous substances, and various diseases (UNEP, 2019). Notably, contact with heavy metals such as lead, mercury, and cadmium from electronic waste can lead to serious long-term health consequences (Lacoste & Chalmin, 2006).

A notable challenge faced by metal scavengers is their socio-economic marginalization. Negative societal attitudes often result in stigmatization, harassment by law enforcement, and discrimination, which restrict their access to improved working conditions and economic prospects (Dias, 2016). The lack of an organized framework allows intermediaries to take advantage of scavengers by acquiring scrap metals at low prices and selling them at inflated rates to recycling companies (Samson, 2020). This disparity in power diminishes the financial gains that scavengers could otherwise achieve from their labor. Moreover, environmental issues stem from the improper management of metal waste during scavenging operations. Although scavenging plays a role in waste reduction, insufficient knowledge regarding safe waste handling and disposal practices can result in environmental harm, such as soil and water pollution (Wilson et al., 2012). In Port Harcourt, the prevalent practice of open burning of insulated copper wires and electronic waste to recover valuable metals releases harmful pollutants into the air, posing risks to both human health and the environment (UNEP, 2019).

Despite these obstacles, metal scavenging offers considerable potential for sustainable waste management within the Port Harcourt Metropolis. The formalization of this sector through government policies, cooperative initiatives, and waste management programs could significantly improve its efficiency and sustainability (Nzeadibe, 2013). By incorporating scavengers into municipal waste management systems and providing them with access to protective gear, training, and financial assistance, their working conditions and income levels could be enhanced (Gutberlet et al., 2017). Additionally, fostering public-private partnerships in metal recycling efforts could facilitate resource recovery and job creation while mitigating the environmental consequences of metal waste. Additionally, awareness initiatives and advocacy can play a crucial role in transforming societal attitudes towards metal scavenging, promoting greater acceptance and integration of scavengers into the formal economy (Dias, 2016). Educational programs focused on safe waste management and recycling practices can equip scavengers with essential knowledge and skills, enabling them to operate more effectively and sustainably (Samson, 2020). By tackling the obstacles encountered by metal scavengers and leveraging the potential within this sector, Port Harcourt Metropolis can progress towards a more inclusive and environmentally sustainable waste management framework. This research aims to investigate the challenges and opportunities associated with metal scavenging as a method for waste reduction in Port Harcourt Metropolis, Rivers State, Nigeria. By analyzing the socio-economic, environmental, and regulatory aspects of metal scavenging, this study intends to offer evidence-based recommendations for enhancing waste management policies and incorporating scavengers into formal recycling systems. Ultimately, the findings will contribute to the ongoing discourse on sustainable urban waste management and resource conservation in Nigeria.

MATERIALS AND METHODS

Rivers State is located within the South-South geopolitical zone of Nigeria, encompassing an area of 11,077 square kilometers (4,277 square miles) and positioned at coordinates 4°45′N 6°50′E. The state is bordered to the south by the Atlantic Ocean, while to the north, it shares boundaries with Imo, Abia, and Anambra States. To the east, it is adjacent to Akwa Ibom State, and to the west, it is bordered by Bayelsa and Delta States. The Port Harcourt local government area is part of the Greater Port Harcourt region, situated at Latitude 4° 46' 38.71" N and Longitude 7° 00' 48.24" E, with UTM coordinates of 32N 279660.2215768 and 528378.96126353. This area is approximately 52 kilometers (32 miles) southeast of Ahoada and around 40 kilometers (25 miles) northwest of Bori. It is bordered to the south by Okrika, to the east by Eleme, to the north by Obio-Akpor, and to the west by Degema. The total area of Port Harcourt is 109 square kilometers (42 square miles), with a population density of 5,856.5 individuals per square kilometer (15,168 per square mile). According to projections from 2006, the population was estimated to be 756,600 in 2016 (citypopulation.de, 2017).

The precise number of waste pickers or scavengers in Port Harcourt remains uncertain due to the lack of regulation surrounding waste scavenging in the area, making it challenging to establish an appropriate sample size. Consequently, both exploratory and descriptive research methodologies were employed. The exploratory research design aims to investigate the phenomenon without necessarily yielding definitive conclusions, thereby enhancing the understanding of the issue at hand. Conversely, descriptive techniques offer detailed insights, facilitating a fresh perspective on familiar situations and articulating the current state of the phenomenon (Athanasou et al., 2013; Abdulraheem et al., 2018; Funmilayo et al., 2019; Gift & Obindah, 2020). These methodologies enable the integration of both qualitative and quantitative research methods (Athanasou et al., 2013; Abdulraheem et al., 2018; Funmilayo et al., 2019; Gift & Obindah, 2020). For this study, a purposive sampling technique was utilized, focusing exclusively on individuals identified as onsite scavengers for interviews. The pilot survey carried out by the researcher revealed that in Ikoku, there are five scrap dealers or middlemen in operation and each of these scrap dealers has a number of scavengers that supply materials that include plastics, metals and bottles to them. Specifically, three middlemen deal on metals, while the other two deal on plastics and bottles. Since this research is focused on waste metal scavenging, only the three metal scrap dealers were interviewed. The scavengers' dumpsites that supply the metals include; Ikoku, Eliozu, Elekahia, and Trans-Amadi. A total of 234 waste pickers were interviewed using a semi-structured questionnaire, which the researcher administered on-site between January and February 2019.

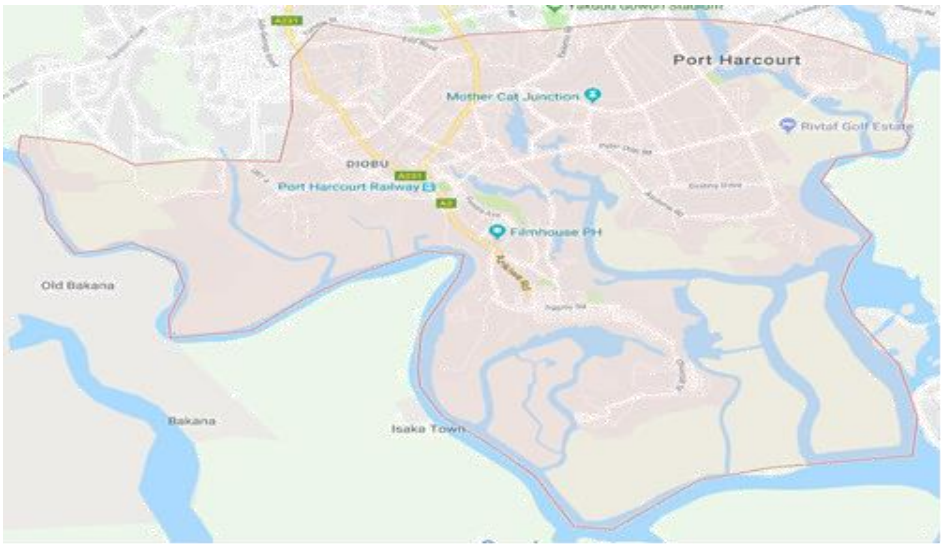

Fig 3.1 Port Harcourt City Local Government Area Showing Scrap Metal Dumps in Ikoku, Eliozu, Trans-Amadi and Elekahia

Data collection was carried out through questionnaires, which the researcher administered by interviewing waste pickers. Given the varied ethnic backgrounds present at the dumpsite, interviews were conducted in the language preferred by the waste pickers, which included English, Yoruba, or Hausa. The research primarily

relied on data gathered directly from waste pickers via questionnaire distribution and direct observations, while secondary data sources encompassed textbooks, journal articles, newspapers, and online resources. The questionnaire covered several parameters, including demographic information (age, gender, marital status, education), socio-economic and health-related data (income from waste sales, alternative employment opportunities, health issues encountered), and general information regarding the types of materials scavenged and market dynamics. Data collection occurred both during offloading periods, when waste-filled trucks arrived at the dumpsite to unload their cargo, and during intervals without offloading. This approach aimed to provide a comprehensive understanding of waste scavenging practices in the Port Harcourt Metropolis.

RESULT AND DISCUSSION

Sex of Respondent

Table 1 indicates that over 90% of the participants in the study are male, with females comprising approximately 9.8% of the respondents. The female participants are primarily located at the Ikoku scrap dump, which is the largest scrap market in Port Harcourt, and they are engaged exclusively in administrative and secretarial roles. Scavenging in Port Harcourt is characterized by a significant gender disparity, with males representing 90.1% of the workforce compared to 9.8% for females. These results align with findings from Schenck and Blaauw (2011), who reported a similar male predominance among waste pickers in Pretoria, South Africa. This suggests that a greater number of male children are involved in this physically demanding activity than their female counterparts. The observed gender imbalance may be attributed to cultural norms in the region that limit women's participation in certain informal sector jobs. Additionally, the male dominance in this field is not surprising, as the strenuous nature of the work renders it less suitable for women. This observation is consistent with various studies conducted globally, which have also identified scavenging as a predominantly male occupation (Nzeadibe, 2009; Dias, 2011; Asim et al., 2012; Rockson et al., 2013; Taiwo et al., 2022; Nuhu et al., 2022). Notably, all female respondents were single, mirroring findings from South Africa where a majority of scavengers were also single women (Nyathi, et al., 2018). This phenomenon may stem from the differing gender roles assigned to males and females across various societies. The demanding nature of waste scavenging, which is labor-intensive, competitive, and fraught with risks, requires considerable physical stamina, making it more manageable for men than for women, who may struggle to endure such conditions.

Table 1 shows the sex of respondents across the different sampling points.

	Male	%	Female	%
Ikoku	75	32.1	21	8.9
Eliozu	38	16.2		
Elekahia	42	17.9		
Trans-Amadi	56	23.9	2	0.9
Total	211	90.1	23	9.8

Age of Respondents

Age significantly influences the ability to manage the challenges associated with this demanding profession, which explains the prevalence of individuals under 18 in this field. The data presented in Figure 1 reveals that the age groups 0-15, 16-30, 31-44, and 45 and above account for 0.9%, 63.2%, 32.1%, and 3.8%, respectively. This indicates that the 16-30 age group constitutes a clear majority. The findings suggest that waste scavenging is an activity that necessitates the vigor typically found in younger individuals, as they are required to handle substantial daily loads. This implies that a certain level of physical strength is essential to thrive in this trade. Furthermore, the age distribution highlights that this enterprise represents one of the limited employment

opportunities available to teenagers in Nigeria, largely due to ongoing unemployment issues (Kodiya et al., 2023). Additionally, younger individuals possess the energy needed to withstand the pressures inherent in this demanding profession (Rankokwane & Gwebu, 2006).

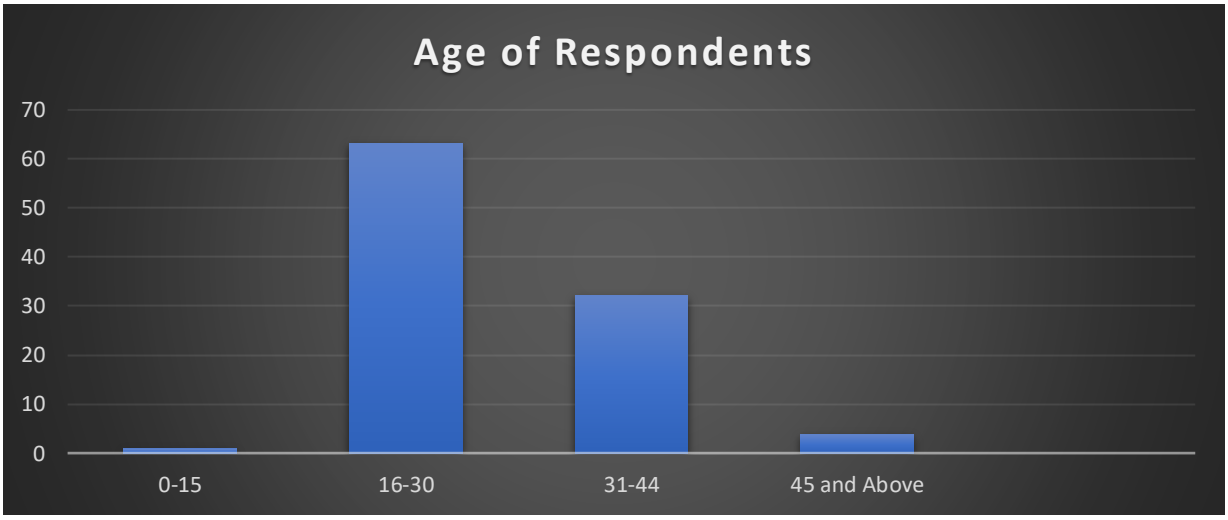

Fig. 1: Age of Respondents.

Marital Status

The findings presented in Table 2 indicate that a significant majority of 73.1% of participants are single, while only 26.9% are married, with no instances of widows or divorce reported. Culturally, married women, regardless of their employment status, receive support from their husbands, whereas single women often encounter limited resources and support systems. In contrast to the smaller number of single women observed in this case study, research by Nyathi et al. (2018) in South Africa suggests that a larger proportion of waste pickers are single women. This disparity may reflect the challenges faced by single women in society, highlighting their vulnerability due to a lack of safety nets and social capital, unlike married women who benefit from the financial and emotional support of their spouses, who are typically responsible for family provision.

Table 2 shows the Marital Status of respondents

	Single	%	Married	%	Widows	%	Divorced	%
Ikoku	80	34.2	16	6.8				
Eliozu	25	10.7	13	5.6				
Elekahia	30	12.8	12	5.1				
Trans-Amadi	36	15.4	22	9.4				
Total	171	73.1	63	26.9				

Family Size

Figure 2 illustrates the distribution of family sizes among respondents, with 22.6% belonging to families of three members, 29.5% to families of four, 22.2% to families of five, and 5.5% to families with more than five members. Families of four members constitute a simple majority and demonstrate the highest level of participation in metal waste recovery processes. This observation indicates a potential correlation between moderate family size and active involvement in scavenging activities (Ogwueleka, 2013; Yusuf et al., 2020; Nzeadibe & Mbah, 2015).

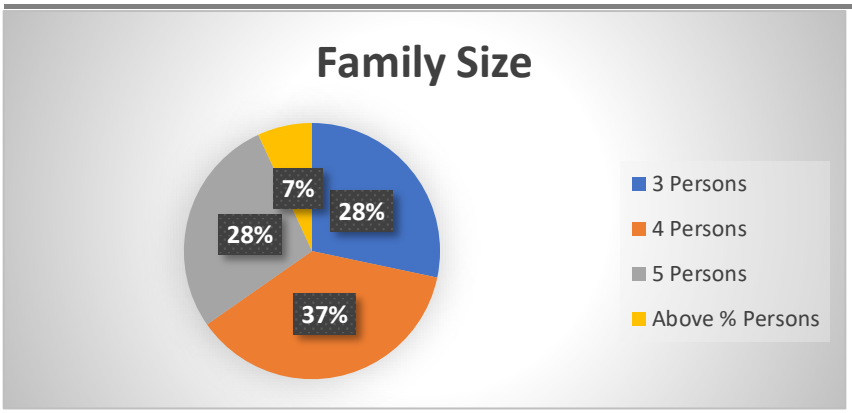

Fig. 2: Family Size

Other Members of the Family Involvement in Waste Recovery

The findings presented in Table 3 indicate that approximately 28.6% of respondents acknowledged their family members' participation in the scrap business and waste management, whereas around 64.1% expressed disagreement. This implies that, while metal scavenging may provide a means of livelihood for certain families, it is not widely accepted within households. This observation is consistent with the perspectives of Adebola (2006) and Nzeadibe (2009), who argue that metal scavenging in Nigeria predominantly operates as an individual or male-centric activity, often regarded as socially stigmatized and economically precarious. Furthermore, Afon (2012) highlights that family participation in scavenging is restricted due to the health risks involved and the informal, unregulated characteristics of the work. Nevertheless, scavenging remains vital for waste recovery, job creation, and resource recycling, particularly among low-income urban populations (Ogwueleka, 2013).

Table 3 shows other family members' involvement in the scrap business

	Yes	%	No	%
Ikoku	38	16.2	41	17.5
Eliozu	10	4.3	28	11.9
Elekahia			42	17.9
Trans-Amadi	19	8.1	39	16.7
Total	67	28.6	150	64.1

Level of Education

The data presented in Fig. 3 demonstrates a clear majority in descending order: 62.8% of respondents have completed secondary education, 24.7% have primary education, 10.6% have tertiary education, and 5.1% have no formal education. This suggests that some individuals can attend school while simultaneously participating in waste scavenging activities. A related study in Rivers State, Nigeria (Elenwo, 2015), found that 59.8% of scavengers lacked any formal education, with only 11.9% having completed primary education, 34.8% secondary education, and 10.3% tertiary education. In contrast, a study conducted in Bauchi reported that none of the waste scavengers interviewed had education beyond the secondary level (Ali and Yusuf, 2021). These findings differ from the current study, which indicates that 10.3% of respondents have achieved education beyond secondary school. It was noted that scavengers with higher educational qualifications often serve as depot owners who buy recyclables from dumpsites. The results indicate that many waste scavengers struggle to enter the formal job market due to insufficient education, as most employment opportunities require skilled labor. Nevertheless, the fact that approximately 40% of waste scavengers have completed secondary education

suggests that they could benefit from vocational training programs to obtain trade certificates, enabling them to become self-employed. A study by Magaji & Dakyes (2011) reflects a similar trend, aligning with the findings of this research.

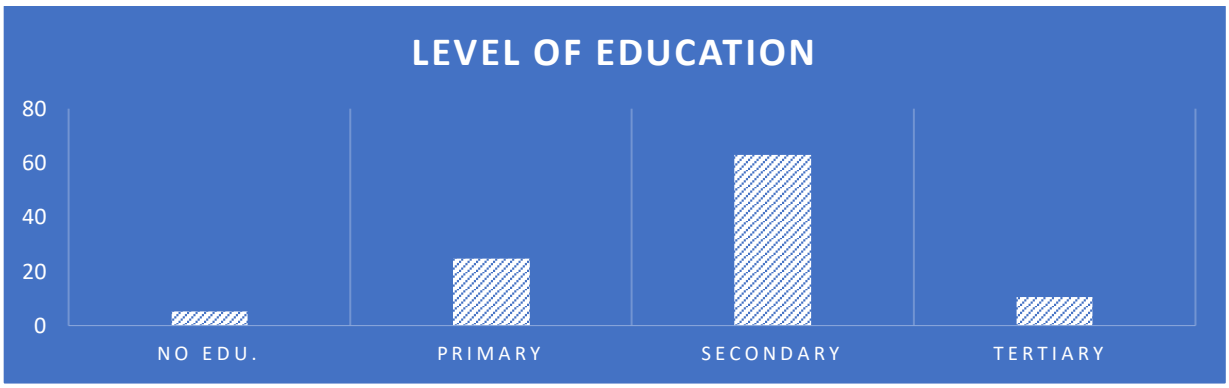

Fig. 3: Level of Education

Rivers State Indigenes in Scavenging

Table 4 illustrates a notable demographic trend in the scrap industry within the examined region: merely 8.1% of individuals engaged in metal scavenging are natives of Rivers State, whereas a significant 91.8% are non-natives or migrants. This indicates that the practice of metal scavenging is predominantly fueled by migrant populations, likely as a result of scarce job prospects and economic difficulties in their regions of origin. This observation is consistent with the research conducted by Nzeadibe and Anyadike (2012), who found that informal waste recovery efforts in Nigerian urban areas are primarily led by migrants from the northern regions of the country. Furthermore, Afon (2012) points out that local residents often find scavenging in urban environments unappealing due to the associated social stigma, low earnings, and health risks. Additionally, Adebola (2006) emphasized that non-indigenous individuals frequently perceive informal waste collection as a more viable means of livelihood in the absence of formal job opportunities. The prevalence of non-indigenes in this field may also signify a wider socio-economic disparity and limited integration between migrant workers and the local communities.

Table 4 shows Rivers State indigene involvement in the scrap business

	Yes	%	No	%
Ikoku	17	7.3	79	33.8
Eliozu			38	16.2
Elekahia			42	17.9
Trans-Amadi	2	0.9	56	23.9
Total	19	8.1	215	91.8

Ethnicity

Figure 4 presents the ethnic composition within the scrap metal industry, ranked by representation: the Hausa ethnic group from Northern Nigeria constitutes a substantial 81.1% of participants, followed by 14.5% from the South East (Igbo) and 5.1% from the South West (Yoruba). The pronounced prevalence of Northerners, particularly the Hausa, can be linked to the socio-political turmoil and economic dislocation instigated by the Boko Haram insurgency in certain areas of Northeast Nigeria. This violent conflict has severely disrupted daily life, resulting in widespread displacement, the cessation of agricultural activities, and a downturn in socio-economic engagement (International Crisis Group, 2016; Okoli & Nnaemeka, 2014). Consequently, numerous

young individuals from these impacted regions relocate to more stable areas, such as Rivers State, in pursuit of employment opportunities, with metal scavenging emerging as one of the limited viable options for survival. Nzeadibe (2009) and Adebola (2006) have also noted that metal scavenging in Nigerian urban centers is primarily undertaken by migrants, particularly from the northern regions, motivated by factors such as poverty, unemployment, and displacement.

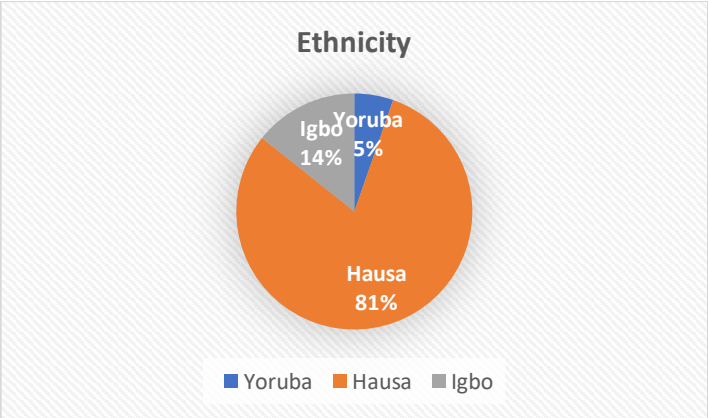

Fig. 4: Ethnicity

Duration of Residence in Port Harcourt

The research indicated that a significant number of metal scavengers have resided in Rivers State for an extended duration. Specifically, 28.2% indicated they have lived in the state for more than three years, 25.6% for approximately two years, and 20.5% for exactly three years, among other timeframes. This pattern implies a degree of settlement and adaptation among scavengers, indicating that many do not view scavenging as a temporary endeavor but rather as a sustained source of income. Nzeadibe and Anyadike (2012) highlight that numerous scavenger, especially those who are migrants, often establish semi-permanent homes in urban areas where waste management activities are common. In a similar vein, Afon (2012) discovered that informal waste workers, despite facing marginalization, typically create long-term residences in cities, relying on daily income from scavenging. Furthermore, Medina (2007) points out that in developing nations, waste picking evolves into a deeply rooted survival strategy, particularly for migrants experiencing economic exclusion, leading many to become permanent residents of their host cities. Collectively, these findings suggest that metal scavenging serves not merely as a temporary solution but as a long-term survival strategy for vulnerable communities.

Table 5 shows the duration of residence in Port Harcourt

	6 months	%	1 yr	%	2 yrs	%	3yrs	%	More than 3 years	%
Ikoku	3	1.3	14	5.9	25	10.7	21	8.9	33	14.1
Eliozu	6	2.6	5	2.1	12	5.1	6	2.6	9	3.8
Elekahia	8	3.4	10	4.3	3	1.3	10	4.3	11	4.7
Trans-Amadi			14	5.9	20	8.5	11	4.7	13	5.6
Total	17	7.3	43	18.4	60	25.6	48	20.5	66	28.2

Reason for Scavenging

Figure 5 illustrates that a significant majority (58%) of respondents indicated that their involvement with metal scavenging was primarily driven by poverty. Additionally, 35% cited unemployment and hunger as contributing factors, while 7% expressed a desire for increased income. The predominant motivation for 93%

of participants engaging in scavenging is the income and employment opportunities it offers, largely as a consequence of poverty. The themes of unemployment and economic necessity, as identified in this research, have also been prevalent in other studies examining the reasons behind participation in scavenging activities (Nzeadibe, 2009; Lambu, 2016; Adama, 2014; Dankani, 2010; Yusuf, 2021, et al; Ali and Yusuf, 2021). Scavengers reported feelings of hopelessness and disappointment stemming from the challenges of finding formal employment, which compels them to search through refuse for their livelihood. Evidence suggests that many scavengers do not choose this line of work voluntarily; rather, they are driven by escalating unemployment and poverty levels. Consequently, they view scavenging as a temporary solution, hoping that the income earned will enable them to transition to more respectable employment. This aligns with Hartmann's (2018) findings that many waste pickers are impoverished, as well as data from the Namibia Statistics Agency (2014), which revealed that the Kharas region had the highest unemployment rate among uneducated youth, with 23.9% having not completed primary education. Given that most waste pickers have only attained primary education, it is unsurprising that they represent a significant portion of the scavengers at the Port Harcourt dumping site. The issues of poverty and lack of alternative livelihoods are not exclusive to Rivers State; they are prevalent in many developing nations (Magaji & Dakyes, 2011; Fergutz, et al, 2011).

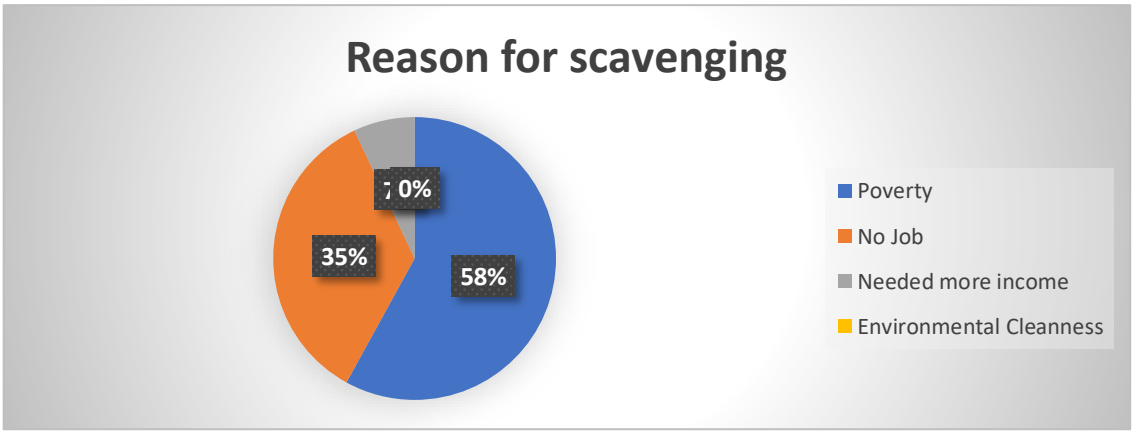

Fig. 5: Reason for Scavenging

Duration in Scavenging

As illustrated in Table 6, the length of residence among respondents in Port Harcourt shows considerable variation. Specifically, 11.9% have resided in the city for approximately six months, 17.5% for one year, 37.2% for two years, 23.0% for a period ranging from three to five years, and 10.2% for more than five years. The data reveals that the largest segment of metal scavengers has lived in Port Harcourt for two years (37.2%), with a notable number having resided there for three to five years (23.0%). This indicates that a considerable fraction of scavengers are not merely transient but rather semi-permanent or long-term inhabitants who depend on scavenging as a reliable means of livelihood. This observation is consistent with Nzeadibe (2009), who noted that waste scavenging in urban Nigeria is increasingly becoming a stable occupation for many migrants, particularly those facing educational and employment challenges. Similarly, Afon (2012) highlighted that numerous waste picker, especially in prominent cities like Lagos, exhibit long-term settlement patterns and often forge strong social and economic connections within their communities. Furthermore, Medina (2007) contends that waste pickers worldwide frequently evolve from temporary inhabitants to permanent residents, particularly when urban settings offer steady access to recyclable materials and affordable living conditions. These trends underscore the role of informal recycling as a strategy for coping with urban poverty and displacement.

Table 6 shows the duration in the scavenging business

	6 mont.	%	1 yr	%	2yrs	%	3 – 5 yrs	%	5yrs and above	%
Ikoku	17	7.3	20	8.5	26	11.1	21	8.9	12	5.1
Eliozu	3	1.3	9	3.8	16	6.8	21	8.9	9	3.8

Elekahia	6	2.6	3	1.3	24	10.3	6	2.6	3	1.3
Trans-Amadi	2	0.9	9	3.8	21	8.9	6	2.6		
Total	28	11.9	41	17.5	87	37.2	54	23.0	24	10.2

Site for Abundant Raw Material/Acquisition

Figure 6 depicts the various locations from which scavengers collect scrap and waste metal materials. These locations encompass dumpsites, landfills, residential areas, gutters, roadsides, streets, highways, auto-mechanic workshops, scrap vehicle markets, dustbins, and other public spaces. The data indicates that 55.1% of scrap materials are sourced from dumpsites, 19.2% from construction sites, 17.9% from commercial zones, and a mere 7.7% from residential neighborhoods. These results underscore dumpsites as the predominant source of recyclable metal materials. This observation aligns with the research conducted by Fahmi (2010), Rockson et al. (2013), Steuer et al. (2017), and Nuhu et al. (2022), all of whom confirm that dumpsites are the most crucial source of recoverable scrap metals, particularly iron, copper, and aluminum, for informal waste pickers and scavengers in developing nations.

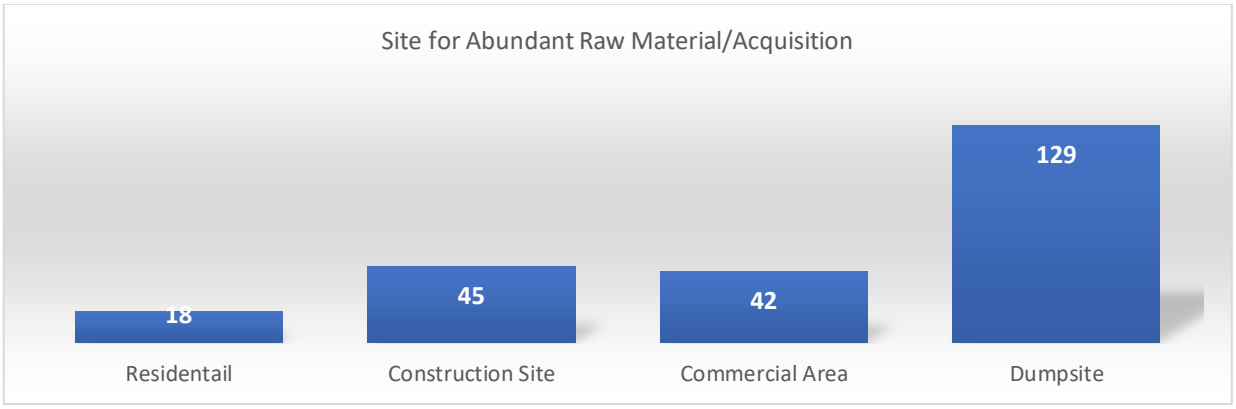

Fig. 6: Site for Abundant Raw Material/Acquisition

Material of Interest

The findings presented in Table 7 indicate that scavengers, despite traversing various locations such as streets, dustbins, landfills, dump sites, and auto mechanic workshops, exhibit specific interests in certain materials. The data shows that approximately 79.9% of respondents focus on metal scavenging, while 9.8% are interested in glass and plastic waste, and a mere 0.4% target other types of waste. This suggests that the predominant focus of waste scavengers is on metals. Additionally, there exists a market for these metals, as scavengers can readily sell them to recycling companies, eliminating the need for them to seek out customers. A study by Rankokwane & Gwebu (2006) in Gaborone, Botswana, corroborates these findings, revealing that many waste scavengers pursue similar materials. The research indicates that scavengers prioritize items with significant utility value, particularly those that are recyclable or reusable, which can be sold for income generation. The study also highlights that bottles are often repurposed for pharmaceuticals, beverages, and cosmetics, while plastic and rubber materials are processed for remolding. Scavengers utilize machinery to grind plastics into smaller particles, thereby minimizing their bulk. Additionally, the glass industry occasionally purchases broken bottles or glass through intermediaries. Each type of material has its own distinct market. Some scavengers also engage in sorting metal scraps, which are utilized in the manufacturing of shovels, locally made cooking pans, and musical instruments (Kodiya et al., 2023).

Table 7 shows scavenger's material of interest

	Paper	%	Metals	%	Glass/bottles	%	Plastics	%	Others	%
Ikoku			85	36.3	5	2.1	6	2.6		

Eliozu			49	20.9	3	1.2	6	2.6		
Elekahia			28	11.9	9	3.8	4	1.7	1	0.4
Trans-Amadi			25	10.7	6	2.6	7	2.9		
Total			187	79.9	23	9.8	23	9.8	1	0.4

Purchase of Metal Waste Material from Others

Figure 7 illustrates that scavengers navigate on foot to various locations, including streets, dustbins, landfills, dump sites, and auto mechanic workshops. The preceding table reveals that, despite employing tools such as shovels, diggers, and sickle-shaped iron implements to extract buried scrap metals from landfills and dumps, over 84.2% of scavengers reported purchasing scrap materials from others to enhance their collection efforts. In contrast, 15.8% stated that they only sell what they personally gather. They noted that their most significant acquisitions through purchases occur in and around auto mechanic workshops, refrigerator repair shops, and pre-sorted waste at dumpsites, even though scrap metals could be retrieved at no cost in the other mentioned areas. Middlemen, referred to as depot-own scavengers, procure materials from those scavenging at dumpsites and supply various agents who then take on the responsibility of transporting and delivering these materials to industries that utilize them as raw materials. Similar trading networks were documented in a related study by Wilson, et al (2006).

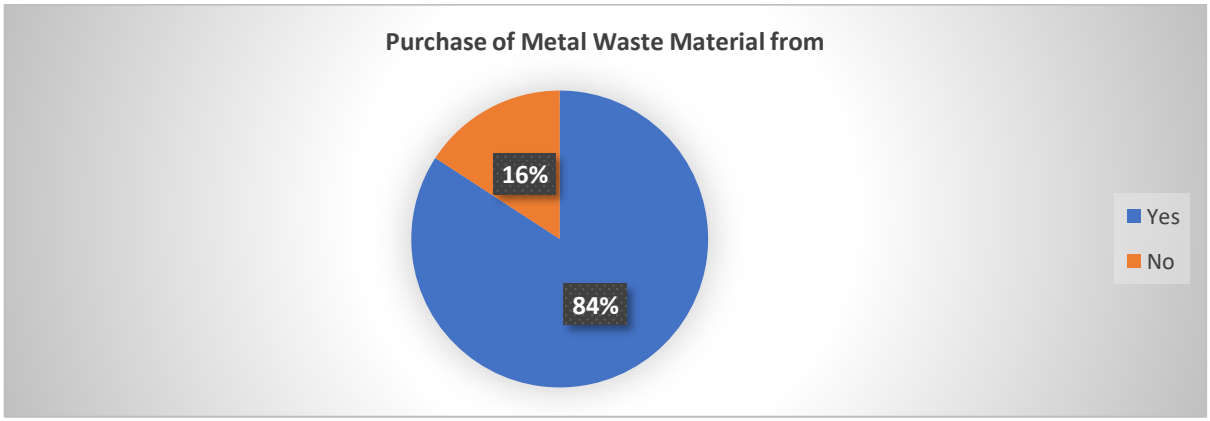

Fig. 7: Purchase of Metal Waste Material from Others

Monthly Income Generation (before engaging in the business)

The data presented in Table 8 indicates that the majority of respondents had incomes prior to engaging in scavenging that fall within specific ranges: approximately 35.9% earned between 2,000 and 2,999, 21.8% earned between 1,000 and 1,999, and 18.8% earned less than 1,000. In contrast, only 11.9% earned between 3,000 and 3,999, while 11.5% reported incomes of 4,000 or more. These findings highlight a significant level of poverty among participants before they turned to scavenging as a source of income. It can be inferred that, if properly organized, scavenging has the potential to alleviate poverty. Additionally, other research has shown that scavengers often earn more than the minimum wage provided by public sector jobs (Rockson et al., 2013; Larbi et al., 2014; Taiwo et al., 2022). This evidence suggests that scavenging may represent a viable and profitable economic activity.

Table 8 shows monthly income generation before engaging scavenging

	Less than 1k	%	1k - 1999	%	2k – 2999	%	3k – 3999	%	4k and above	%
Ikoku	10	4.3	12	5.1	65	27.8			9	3.8

Eliozu	8	3.4	14	5.9	2	0.9	8	3.4	6	2.6
Elekahia	6	2.6	14	5.9	10	4.3	4	1.7	8	3.4
Trans-Amadi	20	8.5	11	4.7	7	2.9	16	6.8	4	1.7
Total	44	18.8	51	21.8	84	35.9	28	11.9	27	11.5

Daily Income Generation within the First Six (6) months

Figure 8 illustrates that scavengers who transitioned to a new profession reported varying daily income levels during their initial six months. The research indicates that over 55.6% of these individuals earned more than ₦15,000, while approximately 37.6% received a moderate income of around ₦12,500. The average monthly income for waste scavengers in the studied area is ₦14,500, which translates to an average daily earning of ₦550 from their activities. These findings align with the work of Kodiya et al. (2023). Although this income may appear insufficient, it is nonetheless adequate to meet the basic needs of waste pickers and is, on average, higher than the minimum wage for certain low-ranking government employees, such as cleaners, security personnel, and petrol attendants. This study highlights the significant role of waste scavenging in supporting the livelihoods of scavengers in Port Harcourt, despite the apparent neglect by authorities, possibly due to a lack of documented evidence.

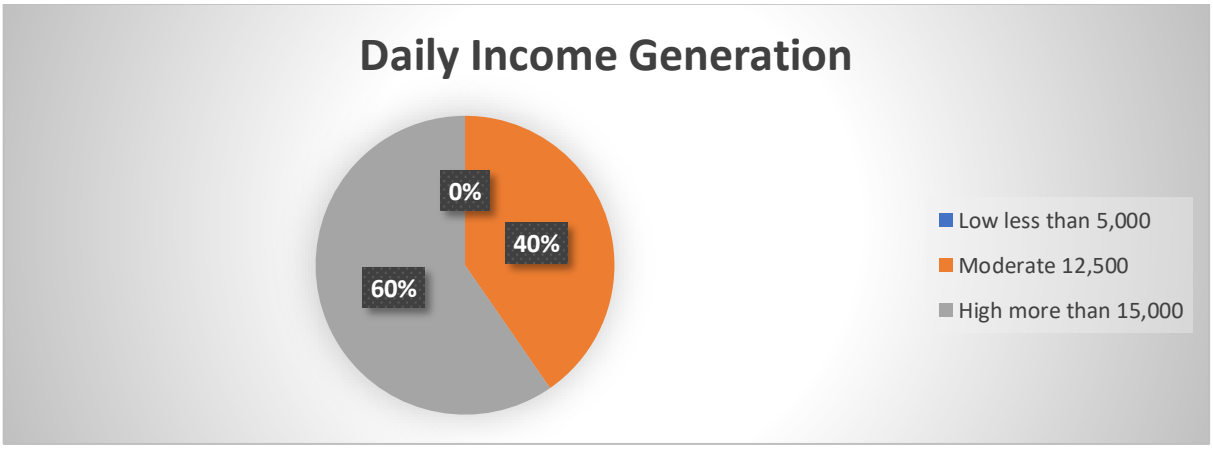

Fig. 8: Daily Income Generation within the First Six (6) months

Quantity of Materials Generated

Table 9 illustrates the challenges in accurately assessing the daily weight of metal collection, as scavengers often return with minimal or no yield. Nevertheless, there are fortunate days that exceed expectations, which can compensate for the less productive days. The data indicates that approximately 55.1% of scavengers collect less than 150 kg per day, 31.2% gather between 150-300 kg, and 13.7% manage to recover 300-450 kg. The value of the recyclables is contingent upon their quality and condition. Additional research has shown that scavengers primarily recover metals such as iron, copper, and aluminum (Fahmi, 2010; Rockson et al., 2013; Steuer et al., 2017; Nuhu et al., 2022).

Table 9 shows quantity of materials generated per day

	Less than 150kg	%	150 – 300kg	%	300 – 450kg	%	450kg and above	%
Ikoku	53	22.6	31	13.2	12	5.1		
Eliozu	26	11.1	12	5.1				

Elekahia	27	11.5	11	4.7	4	1.7		
Trans-Amadi	23	9.8	19	8.1	16	6.8		
Total	129	55.1	73	31.2	32	13.7		

Usage of Recovered Metal Materials

Figure 9 illustrates that a significant majority, 92.7%, of participants expressed disagreement regarding the utilization of recovered metal scrap materials, whereas only 7.3% acknowledged frequent use of these materials. This trend suggests a widespread hesitance or inability to integrate recycled metals into productive processes. The low adoption rate may stem from several factors, including insufficient awareness, restricted access to markets for recycled materials, and the complexities involved in processing and reusing recovered metals. This observation aligns with the findings of Medina (2007), who noted that despite the considerable quantities of metals salvaged by scavengers, their reuse is frequently hindered by the informal nature of the sector and a lack of technological resources. Likewise, Nzeadibe (2009) reported that although informal waste pickers manage to recover significant amounts of recyclable materials, their application is often limited by market demand and subpar recovery methods. Afon (2012) further emphasizes that scavengers, particularly in developing areas, encounter obstacles in the reuse of recovered metals due to the absence of structured recycling systems and established industry standards for material quality.

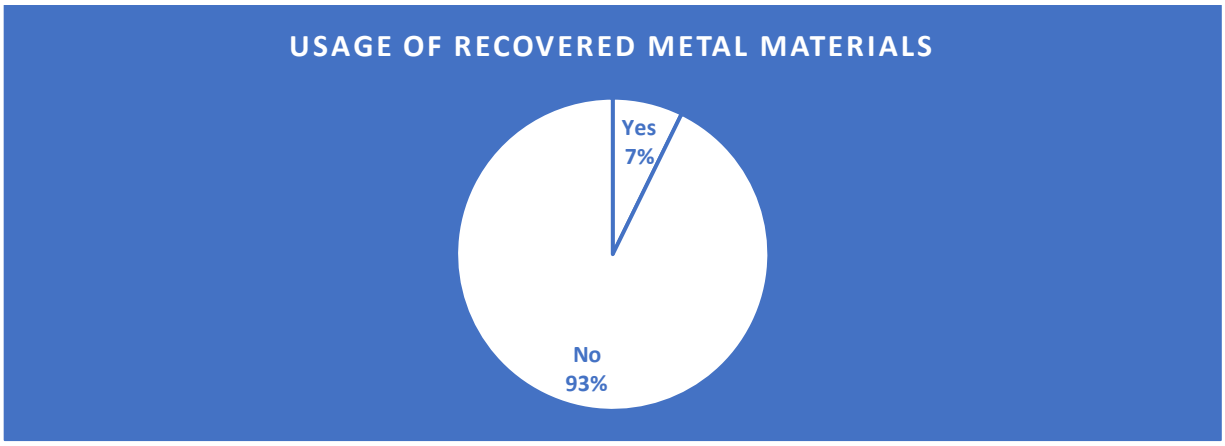

Fig. 9: Usage of Recovered Metal Materials

Frequency of Illness Occurrence

The data presented in Table 10 indicates that 37.2% of respondents reported feeling unwell once every three months, while 35.9% stated that they seldom experience illness. Additionally, 16.7% indicated that they fall ill once a month, and 10.3% reported becoming sick once a week. Engaging in waste scavenging poses significant health risks, potentially leading to occupational diseases due to hazardous working environments (Simatele et al., 2017). Notably, approximately 64.2% of waste scavengers indicated that they experienced illness after starting their scavenging activities (see Table 10). This finding aligns with research conducted by Cruvinel et al. (2020) in Brasilia, Brazil, which revealed that 85.8% of waste pickers working directly at dumpsites reported health issues.

Table 10 show the frequency of illness as associated with the scavenging business

	Once a week	%	Once a month	%	Once in three months	%	Rarely	%
Ikoku	2	0.9	25	10.6	37	15.8	32	13.7

Eliozu	8	3.4	9	3.8	19	8.1	2	0.9
Elekahia	1	0.4	3	1.3	10	4.3	28	11.9
Trans-Amadi	13	5.6	2	0.9	21	8.9	22	9.4
Total	24	10.3	39	16.7	87	37.2	84	35.9

Illness Associated with Scavenging

As illustrated in Figure 10, the responses regarding the primary illnesses associated with the scavenging profession are ranked as follows: 44.0% of participants identify malaria as the predominant disease, followed by 37.6% who cite typhoid, 14.9% who mention skin rashes, and 3.4% who refer to cholera. This suggests that the health issues faced by waste scavengers may be linked to the hazardous and unsanitary conditions inherent in their work. Additionally, economic difficulties compel scavengers to consume expired food, which can lead to stomach infections and parasitic infestations, while their reliance on untreated water and inadequate sanitation and healthcare further exacerbates their health risks (Cruvinel et al., 2020). Foodborne illnesses can result in symptoms such as diarrhea, parasitic infections, and nausea (Afon, 2012; Giusti, 2009), as well as respiratory issues and allergic reactions (Ravindra, et al., 2016). Moreover, household waste that contains organic matter tends to attract rodents and cockroaches, which are known carriers of vector-borne diseases that pose a threat to human health (Gutberlet & Uddin, 2017).

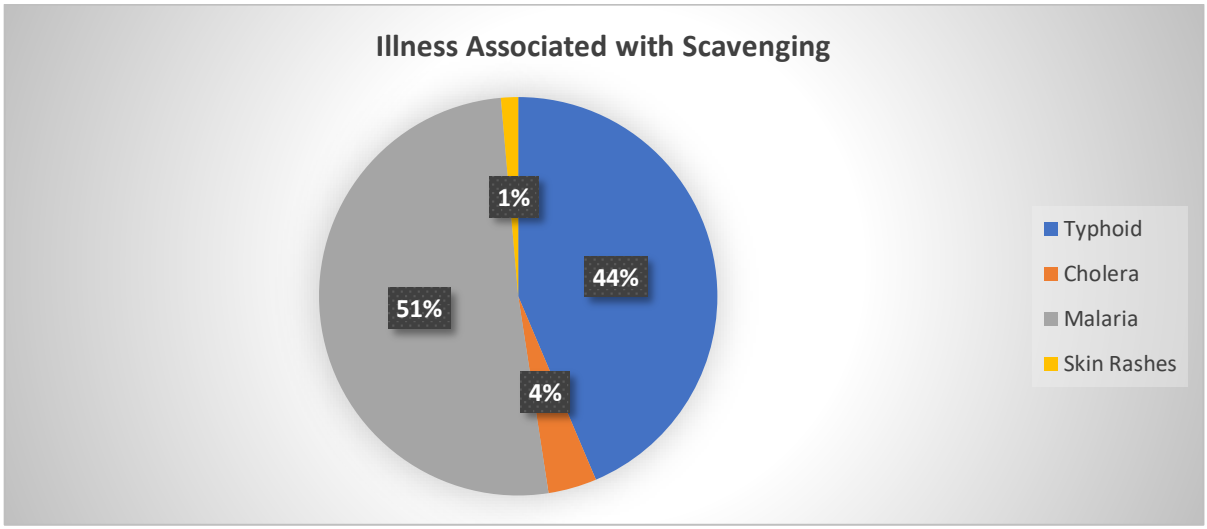

Fig. 10: Illness Associated with Scavenging

Resident's Perception of Scavenging: Scavenging reduces waste at dumpsite

The findings presented in Table 11 reveal the distribution of respondents' attitudes towards perceptual statements regarding metal scavenging. A significant majority, comprising 65.4%, concurred that scrap metal scavenging plays a vital role in minimizing waste at dumpsites, while only 34.6% expressed disagreement. Research has demonstrated that scavenging activities contribute to sustainable development by mitigating pollution and extending the lifespan of landfills (Navarrete-Hernandez & Navarrete-Hernandez, 2018; Fergutz et al., 2011; Colombijn & Morbidini, 2017; Paul et al., 2012), with the potential to decrease waste disposal by as much as 20% (Fergutz et al., 2011). In Jakarta, Indonesia, it is estimated that waste scavengers collect approximately 100 kilograms of waste daily, which accounts for about 2.8-7.5% of the total waste transported to the dump site (Sasaki & Araki, 2014). The income generated from scavenging is primarily allocated towards essential needs, such as family support and bill payments, underscoring the critical role of waste scavenging in sustaining livelihoods. Consequently, the advantages gained by waste scavengers and the broader economy when these individuals are incorporated into formal municipal solid waste management systems are notably substantial.

Table 11 show residence perception of the scavenging trade in Port Harcourt

	Strongly agree	%	Agree	%	Strongly disagree	%	Disagree	%
Ikoku	31	13.2	27	11.5	21	8.9	17	7.3
Eliozu	10	4.2	18	7.7	5	2.1	5	2.1
Elekahia	11	4.7	13	5.6	11	4.7	7	2.9
Trans-Amadi	22	9.4	21	8.9	7	2.9	8	3.4
Total	74	31.6	79	33.8	44	18.8	37	15.8

Health Precautionary Measures

Figure 11 indicates that scavengers do not adhere to health precautionary measures. While 42.7% reported compliance, this figure is significantly lower than the average of respondents who regard such measures as unimportant, resulting in varying degrees of negative health impacts. These results imply that waste pickers are particularly susceptible and face a heightened risk of disease exposure compared to the general population, largely due to the challenging working conditions they endure. Despite the social, health, and environmental challenges they encounter, waste scavengers remain committed to their activities (Sasaki, et al., 2014).

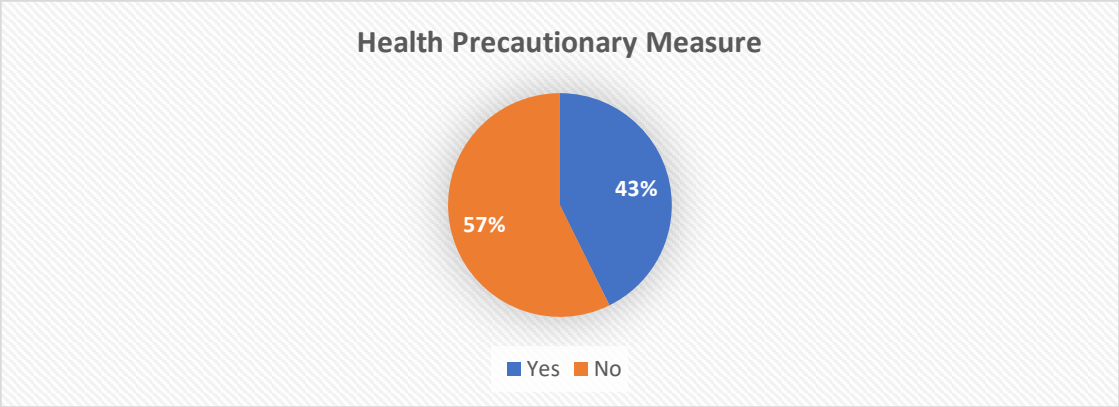

Fig. 11: Health Precautionary Measures

Safety Gadgets Used in Scavenging

Table 12 illustrates the safety equipment utilized in scavenging activities and the frequency of complaints reported in the surveyed regions. The findings indicate that merely 11.0% of individuals wear safety boots, 20.8% utilize protective gloves, 12.3% don nose masks, 38.0% are equipped with body coveralls, and approximately 10.6% employ all available safety gear. A significant number of waste scavengers in Port Harcourt lack essential protective equipment, such as gloves and masks, thereby increasing their vulnerability to various diseases. This issue is particularly pronounced in areas where waste scavenging is neglected by policymakers and lacks formal integration, or where there are insufficient institutional or policy frameworks to support such integration (Simatele et al., 2017; Sandhu, et al., 2017).

Table 12 shows safety gadget usage in the scavenging business

	Boots	%	Hand Glove	%	Nose Masks	%	Body overall	%	Others	%
Ikoku	8	3.4	19	8.1	5	2.1	41	17.5	7	3.0

Eliozu	2	0.8	10	4.2	4	1.7	18	7.7	4	1.7
Elekahia	9	3.8	8	3.4	9	3.8	11	4.7	5	2.1
Trans-Amadi	7	3.0	12	5.1	11	4.7	19	8.1	9	3.8
Total		11.0		20.8		12.3		38.0		10.6

Injury Suffered while Scavenging

Figure 12 illustrates the various types of injuries encountered by individuals engaged in scavenging activities. The severity of these injuries is exacerbated by scavengers' failure to adhere to safety regulations and health precautionary measures. The reported injuries consist of cuts (32.6%), scratches (9.8%), piercings (34.5%), and burns (11.1%). The absence of protective gear and a lack of knowledge regarding the safe handling of hazardous materials in waste expose scavengers to numerous health risks, including infectious diseases (Gutberlet & Uddin, 2017; Simatele et al., 2017). In addition to the risk of diseases, waste scavengers face other dangers, such as open wounds from sharp objects, which result from the absence of protective clothing, thereby increasing their susceptibility to additional health issues. Afon (2012) noted that many waste pickers are particularly at risk of insect bites and injuries from sharp objects due to the manual sorting of waste materials.

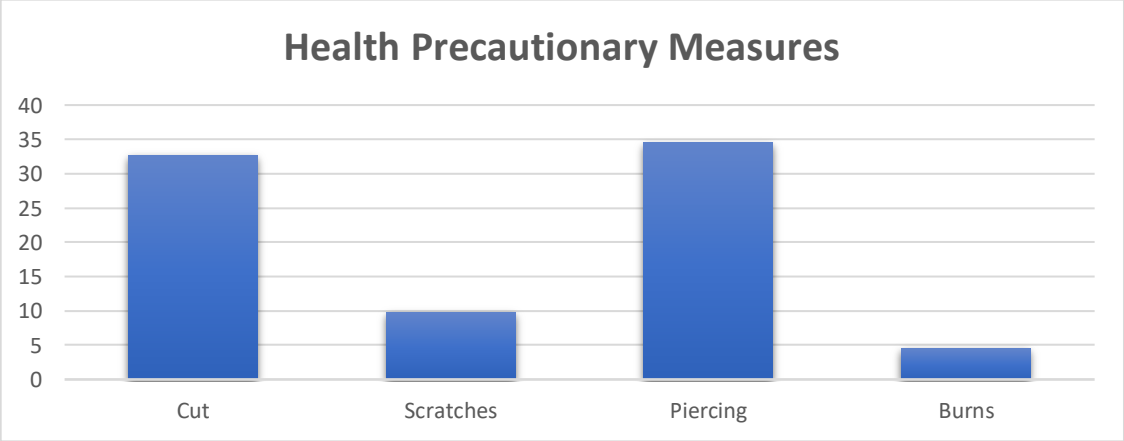

Fig. 12: Health Precautionary Measures

Challenges of Scavenging

According to Table 13, when ranked in ascending order, 21.4% of respondents identify the scarcity of materials as the primary challenge faced by scavengers in Port Harcourt, followed closely by 21.8% who cite health hazards, 27.4% who point to weather-related issues, and 29.5% who highlight insecurity and harassment. The weather-related challenges and health risks reported by participants in Port Harcourt are also prevalent in other developing nations (Afon, 2012; Santa, 2014). Addressing the vulnerabilities associated with scavenging should be a key focus for government intervention, aimed at effectively formalizing the operations of this economically significant group by incorporating their activities into the official waste management framework in Port Harcourt. Currently, this system overlooks the contributions of these individuals, despite their skills, resilience, and resourcefulness.

Table 13 shows challenges faced by scavengers in Port Harcourt

	Scarcity of materials	%	Insecurity/ harassments	%	Health hazards	%	Weather challenges	%
Ikoku	22	9.4	25	10.7	21	8.9	28	11.9

Eliozu	9	3.8	10	4.2	8	3.4	11	4.7
Elekahia	8	3.4	13	5.6	11	4.7	10	4.2
Trans-Amadi	11	4.7	21	8.9	11	4.7	15	6.4
Total	50	21.4	69	29.5	51	21.8	64	27.4

Improving Scavenging Activities

According to Figure 13, 29.1% of participants believe that public awareness is essential for enhancing the scavenging industry, while 26.9% support the establishment of scavenging cooperatives. Additionally, 22.2% advocate for health counseling, and 21.8% endorse the use of personal protective equipment. To mitigate health hazards and other associated risks, the integration of informal waste scavenging into the formal waste management system has been proposed as a solution in various countries (Thirarattanasunthon, et al., 2012).

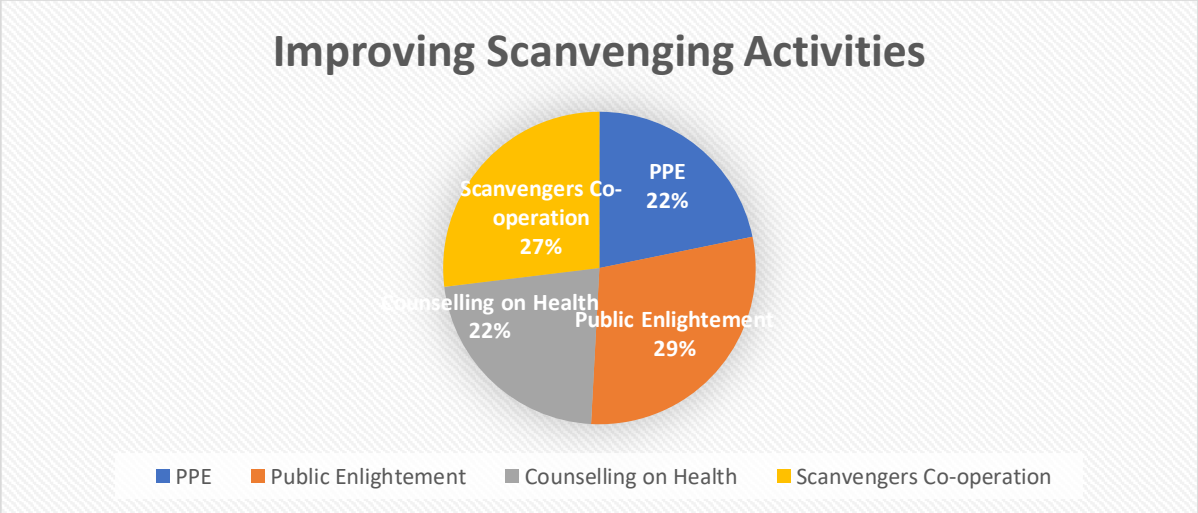

Fig. 13: Improving Scavenging Activities

Hypothesis testing

H_o: There is no statistically significant relationship between scavenging and reduction in the volume of waste generated in Port Harcourt Metropolis, Rivers State.

H_i: There is a significant reduction in the volume of waste generated

Observed table

	Strongly Agreed	Agreed	Strongly Disagreed	Disagreed	Total
Ikoku	31	27	21	17	96
Eliozu	10	18	5	5	38
Elekahia	11	13	11	7	42
Trans-Amadi	22	21	7	8	58
Total	74	79	44	37	234

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Expected table

Strongly Agreed	Agreed	Strongly Disagreed	Disagreed
30.1	32.4	18.1	15.2
12.0	12.8	7.1	6.0
13.3	14.2	7.9	6.6
18.3	19.6	10.9	9.2

The formula for chi-square is stated below;

$$X^2 = \frac{(f_o - f_e)^2}{f_e}$$

$X^2 = 10.88$

Degree of freedom = 9

T critical = 16.92

T calculated = 10.88

Since the critical T value exceeds the calculated T value, we do not reject the null hypothesis. Therefore, we conclude that there is no significant relationship between scavenging activities and the reduction in waste volume generated in Port Harcourt Metropolis, Rivers State.

CONCLUSIONS

The research indicates that poverty and unemployment are the primary factors driving waste scavenging in the Port Harcourt Metropolis. Additionally, it reveals that, despite being largely overlooked, waste scavenging plays a crucial role in supporting the livelihoods of scavengers and offers employment opportunities for the impoverished, highlighting a potential for formalization and enhanced income. The study also suggests that providing alternative livelihoods could diminish the reliance on waste scavenging. However, due to the health hazards linked to this activity, the research identifies the working conditions of waste scavengers as severely inadequate, exposing them to various risks and diseases. Furthermore, it concludes that there is a lack of legal frameworks governing waste scavenging in Port Harcourt Metropolis and, by extension, Rivers State, rendering the practice illegal despite its significant contribution to both the livelihoods of scavengers and overall waste management. Consequently, the study advocates for the Waste Management and Pollution Control Bill to acknowledge waste scavengers as vital contributors to waste management. This recognition would empower municipalities, including Port Harcourt Metropolis, to establish regulations that facilitate the integration of waste scavengers into the formal waste management system, allowing them to be registered and organized through associations that would provide them with legal rights and labor protections. Such formalization would enable waste scavengers to access education on environmental health and safety, equipping them to take necessary precautions while engaging in their work. Once integrated into the formal economy, waste scavengers could significantly enhance the local economies in which they operate. The findings of this study suggest that waste scavenging should not be viewed merely as a challenge but rather as an opportunity for municipalities to reduce costs and promote recycling, ultimately fostering job creation through formalization.

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