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Empowering informal plastic recyclers: addressing socio-economic challenges and human rights awareness in Ogun State, Nigeria

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Abstract

This study critically examines the informal recycling sector within selected plastic waste recycling factories in Ogun State, Nigeria, focusing on the compliance of human rights for workers. The research delves into the intricate dynamics of informal recycling, shedding light on the experiences and challenges faced by workers in this sector. Through a comprehensive analysis, the study investigates the intersection of environmental sustainability, labor conditions, and human rights, aiming to provide a nuanced understanding of the informal recycling landscape. Employing descriptive and cross-sectional approaches, including closed-ended surveys to explore the socio-economic characteristics of workers, prevailing working conditions, and the extent to which human rights standards are adhered to within these recycling facilities. The findings aim to contribute to the discourse on sustainable waste management practices, emphasizing the need for a balanced approach that ensures both environmental conservation and the protection of workers' rights. This study holds significance for policymakers, environmentalists, and human rights advocates, providing insights that can inform the development of policies fostering a socially responsible and sustainable plastic waste recycling industry.

Keywords Informal recycling sector, Plastic waste recycling, Human rights compliance, Labor conditions, Environmental sustainability

Introduction

The informal sector which is responsible for the recycling of plastics in Nigeria has been deemed essential due to the improved production of plastics, lack of adequate formal recycling systems. According to [1], the yearly

production and consumption of plastic has increased across the world leading to increase in the level of plastic wastes. This issue is quite prevalent in Nigeria because this country has experienced very high rates of urbanization and population growth, therefore generating high amounts of plastic waste each day [2]. Waste pickers are another group of people who engage in sorting, gathering, and managing plastic waste, and therefore they play a major role in minimizing pollution of the environment. While they are invaluable in the recycling industry, informal recyclers in Nigeria experience some working conditions that can be termed as hard. They do not have proper PPEs, are paid measly wages, work for many hours, and have restricted access to social and medical

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facilities [3]. These are the deprivations of human rights which affect essential aspects of life, protection, and work, including health and safety. This paper thus seeks to explore the link between sustainable waste management, working conditions & human rights abuses among the informal recyclers in Ogun State, Nigeria. Previous literature exploring the link between environmental sustainability and human rights addresses this issue through informal recycling. Sustainable development balance the conservation of earth's natural resources with the protection and advancement of human rights [4]. Recyclers collect and sort recyclable materials, thus contributing to the reduction of plastic waste; however, they have limited legal acknowledgment of their rights and have few legal protections. Studies show that the workforce comprising IWR is often casual and has minimal social security coverage resulting in them facing abuse and work-related hardships [5]. Investing in betterment of working situations in the informal sector would result in better health of handlers, better productivity levels, and more sustainability [6].

One emerging global concern is pressure on recycling centres to take up to international human rights benchmark especially in the developing nations and the informal sector. As evidenced from the study conducted by [7], the understanding is that it is possible to ensure that the rights of workers are protected through legislation and enforcement. Lack of such policies continues to fuel exploitation and human rights abuses especially in informal employment sector. Also, using workers in the decision making process is important, as most of them should contribute to policies that regulate their working conditions [8]. Human rights standard is crucial in informal recycling in regards to the following implications [9]. Better working conditions for waste collectors fosters the dignity of human beings and leads to positive and efficient waste management. Defending the rights of workers is also follow international human rights principles & norms, Nigeria has the legal obligation to do [9]. Regrettably, past research has primarily considered environmental and economic consequences of waste disposal and processing with little to no reference to social aspects or human rights of the informal recyclers [10, 11]. This paper seeks to contribute to this lacking component through a literature review of occupational practices, health consequences, and rights in the informal recycling economy. Incorporating sectorial informal recyclers into formal waste management programs [12] and creating new policies that could enhance their living standards are ways of going forward. It is important to explore how waste management impacts the vulnerable people in the developing country like Nigeria because there are similarities on waste management system adopted by the

developed country and the effects of such system on people in the developing country as highlighted by [13] and [14].

The research objectives of this study include: examining the social situation of informal plastic recyclers to explore their lives and the difficulties they face; evaluating the working environments and health risks that informal recyclers experience, hence capturing all facets of their exposure and the absence of precautionary measures; assessing the level of compliance with human rights standards by informal recyclers and existing policy deficiencies; and evaluating the social benefits of informal recycling in terms of its impact on the lives of the workers and their families, considering factors such as income and standard of living. Achieving these objectives will contribute to filling the existing gaps in the literature and identifying practical solutions for enhancing the quality of life for informal recyclers and promoting environmentally friendly practices.

Literature review

The global impact of plastic pollution and the path towards a circular economy

Pollution by or with plastics is a well-known issue of growing concern, due to the significant increase of plastic production in the last couple of decades, of which the negative impacts to the environment, economy, and people are vast [2]. This has in return led to massive pollution of the natural environment and hence posing a threat to all the living species on the planet. Most crucially, the consequences are not confined to the marine environment only, but it has deeper impacts on the terrestrial systems, and it has direct impacts on human beings' health [15]. Due to the increased visibility of plastics in the environment, there is an overwhelming need for mapping the global extent of the problem, with special stress on the cross-national cooperation for combating the effects of pollution [16]. In order to realize the scope of the problem, recent studies stress the need to identify the connection between plastic pollution and their various systems. Plastic waste that is transported through water bodies end up in oceans and causes harm to marine life as it entangles them, is ingested, or disrupts the ecosystem [17].

Moreover, micro-debris formed from the fragmentation of macro-plastics can contaminate ecosystems and impact possibly harm aquatic species and even the human food chain given the consumption of seafood [18, 19]. The system of interaction hereby establishes the necessity for an integrated approach to appreciate interdependency of the use of plastics, the environment, and people's health. A careful analysis of the issue reveals that international cooperation is one of the most critical ways

to solve it. According to the current research, it is evident that strong integration is needed because the flow of plastic does not respect borders [1]. Some of the strategies include Basel convention that seeks to control export and import of hazardous wastes, among other things, with the intention of ensuring that the movement of plastics waste from one country to the other is well coordinated. This has highlighted the factor of globalization in tackling the sources of the pollution and the management of waste. Moreover, there is the widespread problem of plastic which gives a view on how the circular economy can act as an effective solution for the mentioned issue.

Circular economy envisages to reduce, reuse, and recycle plastics mainly from reaching out to a point where we have to look for new plastics to produce thus trying to contain the carbon footprint of plastics [20, 21]. Shifting towards circular economy needs an active cooperation of the governments, industries and consumers to reinvent the products, improve collection and recycling system and, and promote the circular consumption pattern. Research shows that shifting towards circular economy system clearly supports the bid to tackle the problem of plastic pollution and enhance global economy performance [16, 22]. However, there is a social aspect that should be addressed concerning the issue of plastic pollution. Majority of the vulnerable groups reside in developing nations and they are most affected because they do not have proper waste management systems and also, the economic imbalance [17]. Hence, authors are concerned with social justice in solutions on managing the issue since the impacts worsen the lot of receiving communities [23, 24]. Among the methodological characteristics that should be integrated in the programmes dealing with the problems of plastic pollution and its consequences are multicultural and social justice approaches.

Informal recycling sectors: a glimpse

The informal recycling sector refers to the activities by individuals or groups that are not conducted through the formal economy, and engage in recovering recyclable materials from waste. Many such activities are performed by waste pickers, small-scale recyclers and intermediaries working informally — that is without being recognized by the state or municipal municipalities. The International Labour Organization (ILO) has estimated that millions of workers worldwide work in the informal recycling sector, and they offer a crucial support role for waste management, resource recovery and environmental sustainability at large [25]. Informal recyclers play a vital role by sorting and collecting various kinds (plastics, metals, glass) of post-consumer waste in developing countries. Intermediaries then sell these materials to recycling industries, creating a commodity value chain that can support

livelihoods and promote conservation [26, 27]. Informal recyclers also often endure unsafe working conditions, lack of social protections and healthcare system cover for the services they do not place themselves at higher-than-normal health risk while dealing with solid waste [28]. This sector remains marginalized, leading to violations of basic human rights, including the right to work in a safe environment and the right to fair compensation [29].

The challenges and opportunities in the informal plastic recycling sector

Non formalized recycling segment in numerous areas including the developing countries appears as an indispensable yet frequently overlooked actor in the effort to manage avalanche of plastic waste. This sector comprises small-scale scrap dealers and self-employed workers who sort and sell plastics for recycling and are often involved in environmentally unsustainable practices [23, 30]. It is important to note that responsibility of waste recycling does not only lie with these formal recyclers, but a majority of waste is recycled by informal recyclers who live hand to mouth and depend on the recyclable wastes for their livelihood. However, informal recyclers face a complex system of barriers that limit their work and negatively affect their health and condition. One of the common challenges is the absence or lack of an effective network that could enhance the effectiveness of waste management systems and dilute the potential of the sector [6, 31]. Lack of separate collection centres and recycling points presents additional challenges to informal recyclers, who have to work their ways through the complicated and often lengthy and energy-consuming systems [30]. However, due to inadequate access to technology, informal recyclers are faced with even greater problems [9]. While today technology continues to bring about efficiency in the management of waste products many of the informal recyclers are plagued by these changes [9]. They still utilize simple techniques to sort and process, aspects that not only slow down their performance but also do not enable them to exploit the optimal value streams of collected material [32].

Use of technologies in the informal recycling sector enhances the working efficiency and at the same time increases the recovery rate of resources thus enhancing the option involved in the management of wastes plastics [9]. Another of the most critical issues that can be identified within the informal businesses of plastic recycling is safety. Working at unsafe productive climates, they are at risk of contracting diseases in an environment that cannot be controlled. There are chemical materials in the recycled items, no protective equipment used by these workers, they are not fitted with protective clothing and do not undertake adequate training; signs of a dangerous

job [33]. It even endangers the lives of informal recyclers and revives the spirit of poverty since health problems are expensive and decrease the recyclers' work capacity. It is not best solved in a more tactical, short-term way of dealing with the needs where attention is on operations on the ground. Refusal of policies that comprises the most formal recyclers therefore calls for a realization of policies that involve the most informal recyclers the most safer system of operations. They should be specific and contain activities and targets with regards to extension and upgrading of inadequate structure for informal recyclers, particularly the specific sites for collection of plastics and conditioned recycling stations that would enhance the operations of the informal workers and the bigger circuit of recycling plastics [34]. Last but not the least, strategies that aim at providing the informal recyclers with the right technology such as the use of mobile applications to track and improve on the routes to follow can help boost the recipients' authority as well as transform their practices to commendable means of waste management as is depicted by [35]. It is, therefore, necessary to protect informal recyclers through the application of efficient training and protective uniforms for them. This means that the governments together with NGO's and other stakeholders should aim at framing policies and setting up standards that can promote the safety of workers employed in the informal plastic recycling streams [36]. Such steps not only promote the safety of the identified human participants, but also help avoid the transmission of disease while at the same time help address the eradication of poverty that is primary associated with working under deplorable conditions.

Human rights implications of waste management practices in Nigeria

Waste management is an important constituent of environmental politics, as well as the violation of human rights. The correlation between waste management processes and human rights is described through a number of research outcomes that are dedicated to sustainable and efficient management of waste. Among the human rights sorely due to poor management is the right to a healthy environment. Unauthorized disposal of hazardous wastes discolour the soils and water, therefore, endangering the quality of life and infringing on the humanity's rights to health in a clean environment as enshrined under the United Nations Universal Declaration of Human Rights [37]. This issue is mainly experienced by the disadvantaged people dwelling close to poorly managed dumpsites, qualifies as environmental racism and injustice to their rights [38].

Another cardinal element in the right to work is also severely influenced by waste management, especially by the informal recyclers. These workers, who effected the change and represent the main subject of recycling in the globalized economy, work in risky conditions, and do not have many legal rights. This essence exposes them to humble conditions of work and violation of social protection rules on decent work that provides work that is both safe and decent, does not harm health, and can free the worker and family from prejudice [10, 39]. However, the rights to participation and access to information has to be protected in the case of waste management. Based on the principle of participation, communities possess the right to be involved in decision making processes dealing with the environment specifically methods of handling wastes [40]. Community exclusion in these processes has ramifications that result in social conflict and deprivation of the community's voice. Moreover, inadequate management of wastes erases the right to water and sanitation since wastes that are not well treated pollute water sources, and in turn, endanger the lives of those living in developing countries [41, 42].

The informal sector is prominent in recycling in Nigeria especially for waste management but the informal recyclers are the most violated when it comes to human rights. These workers expose themselves to risky environments without the protection of proper clothing and without the freedom to access healthcare when they need it [30]; this contravenes their right to decent workplace and health [40]. The human rights within waste picking are key factors that warrant the integration of the informal recyclers into the proper structures of waste management, accompanied by policy and funding on proper infrastructure [43]. Other impacts resulting from poor waste management are violation of the right to water and sanitation. Sullage and other wastes discharging into water sources because of poor waste disposal pollute the communities' clean water right [44]. Some of the policies that the Nigerian government has developed in order to tackle these issues include; The National Environmental Sanitation Policy while some of the agencies that have been developed include; the National Environmental Standards and Regulations Enforcement Agency (NESREA). Nevertheless, the central issues are the practical and legal application of these policies and ensuring that they work as expected [45, 46]. Others include enrollment of the communities' participation and access to information in the management of wastes in Nigeria. Encouraging the participation of the local people in the decision-making processes that relate to waste management will help in averting environmental injustice and will also consider the needs of every group [43]. The following principles of good governance in Nigeria must

remain paramount in order to support the right to participation in decisions relating to the management of the environment. There is also the need to ensure that the principles of human rights are incorporated and followed in waste management policies because sustainable environmental management has impacts on welfare of people. This is the reason why it is important to support relevant campaigns and initiatives in order to provoke communities to fight for their rights and more active in solving the problems of waste management.

The interconnection between environmental protection and human rights

The interconnection between environmental protection and human rights is now considered as one of the essential aspects of global management. Many works stress the link between a healthy environment and the respect of the key human rights suggesting that there should be a single set of global goals responding to the existing threats. Right to a healthy environment is a foundation in the link between environmental protection and human rights. Pollution of water and air, depletion of forest cover, climate change, and others are, therefore, immediate dangers to the life of people [37]. Research shows that populations affected or living in hazardous environments endure unhealthy impacts which are a violation of their right to health [47]. Large scale effects on vulnerable communities reiterate why sustainability of the environment is harmonious with the conservation of the rights of minority groups. As [48] suggest, climate change poses significant risks to health and well-being, particularly in urban areas, where pollution and deforestation exacerbate these effects.

Yet another is the right to 'clean and accessible' water as well as right to sanitation; this aspect is also linked to sustainable environmental management. Water pollution as a result of unfavorable environmental management of the resource hinders such right, especially in the third world [41]. Because of insufficient access to clean water, cycles of poverty and inequality are continuously present in places, which will consequently hinder their capability to attain a decent quality of living as elucidated in the [49]. The connection between sustainable environment and right to water means that culture of resource use and conservation should be employed. Moreover, climate change which is as a result of unenviable polluting of the environment, threatens various human rights. According to the IPCC of 2018, climate change has direct impacts to food production, shelter, and health since there are more climate change events that include extreme weather conditions and rise in sea levels [50]. The affected populations, specifically the vulnerable populations, are hit hardest by these impacts thus pine for violations of their

rights to foods, shelter, and decent living [51]. The relation between climate change and human rights requires international collaboration for lessening the impact and preparing for climate change while safeguarding rights of the vulnerable groups. According to [48] and [52] in Nigeria, it is paramount to embrace the fight against land degradation, pollution, and deforestation for the prevention of climate change, human illness, inequality as well as poverty.

The right to information and participation proves to be an important feature of the connections between environmental sustainability and human rights. The political representation entails that communities should be allowed to express themselves in the formulation of environmental policies [53]. Literature further emphasizes on an active role of people and the public in environmental governance as well as calls for disclosure and participation in the policy making processes affecting people [54]. According to the perspective presented by [48] and [52], incorporating local communities in climate change initiatives is very crucial and fundamental to climate change adaptation and sustainable environmentalism. It further reaffirms the idea that environmental conservation is useful, since it helps in the social cause of instilling democracy and human rights. This linkage asserts that while 'environment' is about 'preservation', 'nature' also points to the social agenda of 'developing democracy and human rights'. Intergenerational equity principle adds to the understanding that environmental sustainability remains a core component of human rights. Preservation of the environment is in the interest of protecting present and future generations' rights to a decent life as they engage in development [55]. Maladministration of resources and pollutive activities deprive the generation to come of enjoyment of their inalienable rights hence lack of intergenerational equity which is provided by numerous international conventions [42].

Theoretical framework

Environmental justice theories

Environmental justice theories provide a comprehensive framework for understanding and addressing the interplay between environmental sustainability, human rights, and social equity. Applying these theories to the working conditions and human rights compliance within the informal recycling sector in Ogun State, Nigeria reveals critical insights into the environmental burdens faced by marginalized communities engaged in waste management. One key tenet is Distributional Equity, emphasizing the fair distribution of environmental benefits and burdens. In Ogun State's informal recycling sector, there is a pervasive pattern where marginalized communities disproportionately bear the burdens of inadequate waste

management practices, affecting both environmental conditions and human rights [56]. Procedural Justice, which emphasizes the right to participate in decision-making processes concerning environmental policies and practices, exposes the lack of representation and participation of informal recyclers in policy discussions, limiting their ability to influence decisions impacting their working conditions and human rights [34].

Recognition Justice, centered on acknowledging diverse cultural perspectives and incorporating marginalized voices, highlights potential challenges in Ogun State's informal recycling sector due to insufficient recognition of cultural factors influencing workers' rights and well-being [57]. The Proximity Principle, which underscores that those who create environmental burdens should also experience the benefits, exposes a disconnect in the informal recycling sector where workers may face health risks and poor conditions while not reaping adequate benefits from waste management practices [10, 11, 30]. Accessibility to Environmental Goods, a principle advocating for equal access to environmental benefits, reveals potential barriers for informal recyclers in Ogun State in accessing essential environmental goods, such as proper protective equipment and healthcare services, impacting their human rights [30, 57].

Intergenerational Equity, emphasizing the protection of environmental resources for future generations, suggests that unsustainable waste management practices may compromise the ability of future generations in Ogun State to enjoy a healthy environment and fundamental human rights, thus necessitating considerations for intergenerational equity [42]. Cultural Justice, which calls for the recognition of cultural dimensions influencing environmental experiences and injustices, indicates that cultural factors shaping the effectiveness of rights-based approaches to waste management in Ogun State may be overlooked, affecting the success of interventions [30, 53]. Gender Justice, focusing on addressing gender-based disparities in environmental burdens and benefits, suggests that gender-specific challenges within the informal recycling sector in Ogun State may require attention to ensure equitable working conditions and human rights compliance [39]. Eco-Justice, highlighting the interconnectedness of social and ecological systems in environmental decision-making, underscores the importance of a holistic understanding of the environmental and social aspects of waste management in Ogun State to address the complex challenges faced by informal recyclers [30, 57]. Climate Justice, which aims to ensure that climate change impacts and responses do not disproportionately affect vulnerable populations, suggests that workers in the informal recycling sector may be disproportionately affected by climate-related changes, emphasizing the

need for climate justice considerations in waste management policies [50].

In synthesizing these theories, it becomes evident that the informal recycling sector in Ogun State operates within a complex web of environmental and social injustices. The amalgamation of these theories underscores the need for comprehensive, context-specific strategies that address the unique challenges faced by informal recyclers. The findings from such an analysis can inform policy recommendations aimed at mitigating environmental injustices and fostering a more equitable and sustainable waste management system in Ogun State. It is imperative to recognize the interconnectedness of environmental sustainability, human rights, and social justice in the formulation of policies and interventions to ensure a more just and inclusive future for those engaged in the informal recycling sector in Ogun State, Nigeria.

A conceptual model for enhancing informal recycling: Integrating regulatory, socio-economic, and human rights dimensions

This section tries to explain the nature of the relationship between waste management practices, working conditions, and human rights by providing a systematic approach. It emphasises how: the current approach to waste management needs to evolve and take into account a 'wider set' of upstream input factors, operational processes, various forms of intermediary outcomes, central mediating factors, and downstream ultimate outcomes so as to ensure a long overdue equitable and sustainable WM system for the benefit of informal recyclers' rights. The presented conceptual model is tightly intertwined with the main aspects of the informal recycling sector and encapsulates all its aspects. It starts with understanding the leadership role of the legal and the socio-economic environment, which state that legal and policy environments, socio-economically, define the sector in which informal recyclers function. The fundamental elements of the model exist in the aspects of waste management, which include working conditions within the informal recycling practices.

This process stage therefore emphasizes method in waste management and working conditions experienced by informal recyclers, both critical components that define experience and health status. Pagel and colleagues' intermediate impacts oriented toward health and well-being, together with physical livelihood security, illuminated the direct effects of these practices on the well-being of informal recyclers, including physical and mental health. The means of access to information, and social inclusion are central to informal recyclers' experiences because these circumvents enable them to make informed decisions and contribute to decisions made

around them. It is worth stressing that, being placed as mediating factors, the compliance with human rights guarantees people in the IWS informal sector from discrimination, the right for work, health, information, participation, and decent livelihood. Lastly, the model outlines productive and emancipated informal recyclers and improvements in environmental management as the end results of the system. It is, therefore, the mentioned outcomes representing the consequences of embracing human rights in the sector; an overall social cradle that embraces a systematic and systematic approach in the informal recycling industry.

Methodology

Research design

This study utilized a descriptive cross-sectional research design to observe the characteristics and conditions of informal recyclers in Ogun State, Nigeria, at a specific point in time. The descriptive approach was chosen for its ability to offer a detailed and comprehensive account of the informal recycling sector, including key variables such as demographic profiles, working conditions, and the types of recyclables collected. By focusing on these factors, the descriptive method enabled the research to provide an in-depth understanding of the participants' experiences and the overall state of informal recycling activities.

The cross-sectional design, in particular, was crucial for collecting a substantial amount of data in a short period, making it an efficient and cost-effective approach. It provided a "snapshot" of the current situation, which is essential for capturing the realities of informal recycling at the time of data collection. This snapshot not only offered insights into the sector's present state but also served as a foundation for identifying patterns, correlations, and potential areas for policy intervention. Together, the combination of descriptive and cross-sectional methods was highly appropriate for this study, as it enabled the collection of a wide range of information within a limited time frame while ensuring a thorough examination of the informal recycling sector. The data collected through these methods can be used to inform policies and interventions aimed at improving the working conditions, health outcomes, and sustainability of informal recycling in Ogun State.

Study area and participants

The study was conducted in Ogun State, Nigeria, focusing on urban and peri-urban areas where informal recycling activities are prevalent. The participants included informal recyclers actively engaged in waste collection, sorting, and recycling. Purposive sampling was used to select areas known for significant informal recycling

activities. In Ogun State, areas with high concentrations of informal recycling activities were purposefully chosen. These areas included informal settlements, market perimeters, and regions with visible recycling clusters. The goal was to ensure that the selected study areas represented the diversity of informal recycling practices within the state. To ensure a representative sample, quota sampling was employed. Quota sampling involved establishing predetermined quotas for specific characteristics, such as gender, age, or types of recyclables handled. For instance, if the informal recycling sector in Ogun State was known to have a gender imbalance, quotas were set to ensure an adequate representation of both male and female informal recyclers. Considering gender balance as a quota criterion, if it was observed that the informal recycling sector was predominantly male-dominated, the sampling process intentionally sought out and included a proportionate number of female informal recyclers. This ensured that the study captured a nuanced understanding of the experiences of both male and female participants within the informal recycling sector.

Selection of factories and workers

The sample of factories under the study and the workers under the study was purposively chosen for two reasons – the nature of factory type and specific aim of workers under study. For this, an attempt was made to focus on squatters that are well-known to have abundant informal recycling activities in order to have a peasant sample of the study area representing informal recycling in Ogun State. For purposive sampling, some approaches that were used were searching for areas like the informal settlements, the fringes of the market and areas bearing the appearance of recycling collection points. These areas were included in the sample from where a lot of EFPM material was being recycled informally, and hence covered a spectrum of informal recycling activities. In a bid to adapt a representativeness sample, quota sampling was used. Target numbers were set in order to capture recyclers of diverse characteristics, including sex and kinds of material they managed. For example, if the study found out that the sector was male-dominated, then the researchers set goals of the number of lowly skilled female informal recyclers that were to be interviewed. This was useful in view of gaining deeper insight about how both male and female participants involved in the informal recycling economy felt about the work they were doing.

Data collection methods

Closed-ended surveys were used as the major data collection instruments since the type of research was more appropriate for quantitative type due to their

effectiveness in data collection in terms of facts. The following were the benefits that this approach extended to the research. First, they were able to guarantee standardization in their answers, and in this way they standardized the data collected especially on the demographic variables, number of hours worked and the kinds of recyclable materials handled. This made data analysis easier in that responses could easily be compared from one participant to the other. Second, closed-ended questions improved the efficiency, thanks to the short time taken by the respondents to complete the survey. Due to the nature of the study which has only targeted 183 participants, this efficiency was very important in conducting the collection of the data. Last but not least, the closed-ended format supported the study's quantitative approach based on the acquisition of numerical data on such variables as age, years of experience, and working conditions, which are amenable to statistical analysis.

Data analysis technique

Quantitative data from surveys were analyzed using statistical software to generate descriptive statistics and identify patterns or correlations. Quantitative data on the demographic profile and working conditions of informal recyclers were subjected to statistical analysis, generating measures such as means, frequencies, and correlations. The analysis followed three steps. First, descriptive stats were used to look at the demographic profiles, working conditions and types of recyclables handled by informal recyclers, with means, frequencies and percentages calculated to give a clear picture of the participants. Then logistic regression and multiple linear regression analysis was done to look at the relationships between key variables, such as years of experience and types of recyclables processed, or working hours and health status. Finally, the findings were interpreted to show the patterns, including gender gaps in the sector and health impacts of informal recycling. These were the basis for evidence based recommendations to improve working conditions and health outcomes for informal recyclers.

Ethical considerations

Ethical considerations were paramount in research involving human participants. The study received ethical clearance from Olabisi Onabanjo University Ethics Committee under the control of the Directorate of Research, Linkages and Directorate, with the reference number OOU/SSMTHU/EC/0002/260821. Informed consent was obtained from all participants, ensuring they were fully aware of the study's purpose, potential risks, and benefits. Confidentiality and anonymity were maintained, and participants had the right to withdraw from the study at any point. Before conducting surveys participants were

provided with a clear explanation of the research objectives and the voluntary nature of their participation. Consent forms were distributed and explained in the participants' preferred language, ensuring a thorough understanding before obtaining their consent.

Results

This section presents the findings from the study on the social realities of informal plastic recyclers in Ogun State, Nigeria. The data encompass a range of demographic characteristics, work conditions, health issues, and access to safety measures and medical care. By examining these aspects, the study aims to shed light on the socio-economic conditions and challenges faced by individuals engaged in informal plastic recycling. The results are structured to address the research objectives and provide a detailed understanding of the lived experiences of these recyclers. The analysis will offer insights into their demographic profiles, work environments, health status, and awareness of rights, highlighting areas that require intervention and support.

Examine the social realities of informal plastic recyclers

The informal recycling sector is of significant importance in dealing with the problem of plastics and their recycling, especially in the contexts of developing nations. This section explores the extent to which the socio-economic aspects in relation to work environment, health consequences, and human rights define the lives of the informal plastic recyclers. In researching these dimensions, we hope to achieve a better understanding of the issues and prospects facing this vital sector.

Table 1 revealed the demographic characteristics of informal plastic recyclers in Ogun State and a predominance of young adults, with 45% aged between 25–35 years, reflecting a workforce that is typically highly active and physically engaged in their work. Gender distribution shows a higher representation of males (60%) compared to females (40%), possibly influenced by cultural or social norms affecting labor division in this sector. A significant portion of the workers are married (55%), suggesting that many have family responsibilities which can further impact their socio-economic conditions. Education levels among the recyclers are notably low, with 35% having only primary education and 20% possessing no formal education at all. This educational deficit likely limits their employment opportunities, perpetuating their involvement in informal recycling activities. The economic vulnerability of these workers is highlighted by their mean monthly income of ₦30,000, with 40% earning below ₦20,000. This low income, combined with an average household size of 5 members, indicates substantial financial constraints as many recyclers

Table 1 Socio-demographic characteristics and of Social Realities of Informal Plastic Recyclers in Ogun State, Nigeria

| A | Demographic Characteristics | Value |
|---|-----------------------------|---|
| | Mean Age | 34 years |
| | Age Range | 18–60 years |
| | Majority Age Group | 18–24 years: 49(27%) 25–35 years: 82(45%) 36–46 years: 38(21%) 47–60 years: 13(7%) |
| B | Gender | Male: 110(60%) Female: 73(40%) |
| C | Marital Status | Single: 55(30%) Married: 101 (55%) Divorced/Widowed: 27(15%) |
| D | Education Level | No formal education: 37(20%) Primary education: 64(35%) Secondary education: 55(30%) Higher education: 27(15%) |
| E | Mean Monthly Income | ₦30,000 |
| | Income Range | ₦10,000—₦50,000: |
| | Income below ₦20,000 | 73(40%) |
| F | Mean Household Size | 5 members |
| | Household Size Range | 1–8 members |
| G | Mean Years in Recycling | 7 years |
| | Years Range | 1–20 years |
| H | Mean Working Hours per Day | 9 h |
| | Hours Range | 6–12 h: 100% |
| I | Type of Work | Collection: 73 (40%) Sorting: 64(35%) Processing: 46(25%) Supervising: 18(10%) |
| J | Access to Safety Equipment | Always: 18(10%) Sometimes: 45(25%) Never: 118(65%) |
| K | Reported Health Issues | Respiratory problems: 54(30%) Skin infections: 36(20%) Musculoskeletal disorders: 45(25%) Eye irritation: 27(15%) Others: 18(10%) |
| L | Access to Medical Care | Regular access: 27(15%) Occasional access: 73(40%) No access: 82(45%) |
| M | Formal Employment Contracts | Yes: 18 (10%) No: 164(90%) |
| N | Safety Training Received | Yes: 9(5%) No: 173(95%) |
| O | Membership in Unions | Yes: 14(8%) No: 168(92%) |
| P | Awareness of Rights | Fully aware: 36(20%) Partially aware: 73(40%) Not aware: 73(40%) |

support multiple dependents. Work-related characteristics show that recyclers have substantial experience in the sector, averaging 7 years, and endure long working hours, with a mean of 9 h per day. The labor-intensive nature of their jobs is evident. The type of work is mainly

divided into collection (40%), sorting (35%), and processing (25%), each requiring different skill sets and exposing workers to various risks.

A critical issue is the lack of access to safety equipment, with 65% of workers never having access to such equipment, posing severe health and safety risks. Only 10% always have access to safety gear, indicating poor compliance with safety standards. Consequently, common health issues among workers include respiratory problems (30%), skin infections (20%), musculoskeletal disorders (25%), and eye irritation (15%). The lack of medical care exacerbates these health vulnerabilities, with 45% having no access to medical services. Social and legal protection for these workers is significantly lacking. Formal employment contracts are rare (5%), and safety training is minimal (10%). Union membership is low (8%), and awareness of rights is limited, with only 20% fully aware of their rights. This indicates a substantial lack of legal and social protections for the recyclers. These findings align with previous studies [10] and [30] highlight similar precarious working conditions and lack of social protection for informal recyclers globally [34]. Stress the importance of integrating informal recyclers into formal waste management systems to improve their working conditions and social well-being. The present study supports this recommendation, given the evident deficiencies in safety, health, and legal protections observed.

Furthermore, studies by [53] and [9] advocate for rights-based approaches to waste management. The low awareness of rights and minimal unionization among Ogun State recyclers underscore the need for such interventions tailored to local contexts to enhance the protection and empowerment of informal recyclers. In conclusion, this descriptive analysis underscores the socio-economic challenges, health risks, and lack of legal protections faced by informal plastic recyclers in Ogun State. There is a pressing need for policy interventions and rights-based approaches to improve their working conditions and ensure their well-being. The findings resonate with previous research, emphasizing the global nature of these issues and the importance of targeted strategies to support informal recyclers effectively.

Assess the working conditions and health risk faced by informal recyclers in ogun state, nigeria

This objective deals with the working context and health hazard experienced by informal recyclers in Ogun State, Nigeria. Thus, by identifying what environmental and occupational risks they are exposed to, we will try to explain the most acute issues affecting their health and employment. To achieve this objective, mean score analysis was conducted in Table 2 to bring attention on how

Table 2 Working Conditions and Health Risk Faced by Informal Recyclers in Ogun State, Nigeria

| Descriptive | N | Mean | Standard Deviation |
|--|-----|------|--------------------|
| I work more than 8 h a day | 183 | 4.20 | 0.95 |
| I often lack access to proper safety equipment | 183 | 4.70 | 0.60 |
| I have received safety training for my job | 183 | 1.90 | 1.10 |
| I frequently experience respiratory problems due to my work | 183 | 3.80 | 1.20 |
| My job has caused me to develop musculoskeletal disorder | 183 | 3.50 | 1.10 |
| I have skin infections as a result of handling waste without protection | 183 | 3.60 | 1.15 |
| Eye irritation is a common problem for me at work | 183 | 3.40 | 1.10 |
| Access to healthcare services would significantly improve my well-being | 183 | 4.58 | 1.00 |
| Improved working conditions would lead to a better quality of life for waste pickers | 183 | 4.67 | 0.81 |
| Valid N | 183 | | |

this population merits better safety, health, and policies to safeguard these essential but endangered employees.

The descriptive analysis of the working conditions and health risks faced by informal plastic recyclers in Ogun State, Nigeria, reveals serious human rights violations in these areas. Fundamental labour rights such as fair wages, working hours, decent work, safe work and the rule of law have been compromised in order to recycle consumers who face serious health problems and health risks. One of the main problems is the violation of the right to safe and healthy work and other human rights as defined by the International Labour Organisation (ILO).

The majority of recyclers work more than 8 h a day, with a mean score of 4.20, indicating long working hours that can lead to fatigue and other health issues. This finding reflects the labor-intensive nature of the work which violates the International Labour Organisation's standards of reasonable working hours, which are important for the health of workers. Access to proper safety equipment is severely lacking, with a high mean score of 4.70, suggesting widespread health risks due to exposure to hazardous materials. This issue is compounded by the fact that most recyclers have not received safety training, as evidenced by the low mean score of 1.90. The lack of training increases the risk of workplace injuries and health problems. Respiratory problems are common among recyclers, with a mean score of 3.80, likely due to exposure to dust and toxic substances. Many recyclers also suffer from musculoskeletal disorders, reflected by a mean score of 3.50, which can be attributed to the physical demands of their work. Skin infections are another frequent issue, with a mean score of 3.60, resulting from handling waste without proper protection. Eye irritation, with a mean score of 3.40, is also prevalent, likely due to dust and debris exposure. Improving access to healthcare services is seen as crucial for well-being, with a high mean score of 4.58, indicating a significant

gap in healthcare access among recyclers. The respondents strongly agree that better working conditions would improve their quality of life, as reflected by the mean score of 4.67. This consensus underscores the urgent need for improved safety and health measures.

Having examined the working conditions and health risks facing informal plastic recyclers in Ogun State, Nigeria the findings indicated some hardships and risks that were consistent with previous literature on informal recyclers. Most of the recyclers put in more than eight hours of work per day, wherein the mean score is 4.20, which suggests that the employees work for long hours and hence can easily get tired among other related ailments. This finding is in concordance with the fact that this work is more of a labor-intensive project. Safe equipment is almost out of reach in most facilities and organizations because the mean score is as high as 4.70 to point that majority of the workers are at risk of suffering from various diseases occasioned by exposure to the hazardous materials. This is further worsened by the fact that most of the recyclers have no safety training as averred by the low mean score of 1.90. The above areas show that workers without training are prone to getting injured on the job and develop health complications. Any respiratory related ailment is seen rather frequently with a mean score of 3.80 among the recyclers, it is probably due to dust and toxic substances accrued in the process of carrying out their duties.

The workers also have mental-health related disorders inclusive of musculoskeletal disorders whereby the mean score recorded was 3.50, which has to do with physical activities at work place hence the high percentage. Another common complaint relates to skin infections that affected the patients with a mean score of 3.60 through the contact with wastes without protective measures taken. Eye irritation, the result that was obtained leaning toward a mean score of 3.40, is also

seen frequently, which can be attributed to the workers dealing with dust and debris in their work environment. Hence, enhancing the fluidity of healthcare services is deemed fundamental to well-being, as it receives a relatively high mean of 4.58, this showed that Recyclers were much more likely to be without any form of health care coverage than Non Recyclers. Of all the aspects considered for regard to quality of life, the respondents highly associated better working conditions with regard to quality of life, with a mean response of 4.67. Comparable with [10] and [30], these findings identify informal recyclers subject to working insecurity and suffer from the absence of social security worldwide. Their counterparts who conducted similar studies also came up with the same concerns such as long working hours, poor standards in safety, and organ insurance as well as poor access to health service and training on safety measures. [36] have also underlined the necessity to include the informal recyclers into the formal sector of waste management to enhance their lives' quality. The present study can endorse this recommendation considering relatively low Ogun State's safety, health, and legal standards.

Furthermore, [9, 53] have also supported rights-based approaches in waste management. Ogun State recyclers' low rights awareness and poor union membership underscore the imperative of rights-based interventions adapted with the view to fostering the plight of the informal recyclers. Similar tendencies are observed in this research: recyclers are still weak and unprotected if they do not receive formal status and proper assistance. To summarize, the study reveals that children involved in informal plastic recycling in Ogun State are faced with severe socio-economic burdens, health hazards and no legal protection. It is therefore important to make some policy changes and rights base interventions to enhance the working conditions of these recyclers. Thus, the finding aligns with previous studies, indicating that these challenges are not unique to the African American community of Chicago and that more effective approaches are needed to help informal recyclers.

Many of these problems are not isolated, but reflect global problems in early processing. Processors in developing countries like India face a similar situation in Ogun State. Studies have shown that Indian waste pickers work for long periods of time in hazardous environments without protective equipment, leading to respiratory, skin and skin diseases [58]. Similarly, Indian waste pickers in Ogun State lack access to health care, formal education and social security, which make them more vulnerable to workplace injuries. Processing workers in Ogun State work for more than eight hours a day without safety training, exposing them to many health hazards [59]. This emphasizes the non-existent strong organizational

structures of the manufacturing industry, while workers are often marginalized.

In Brazil, early processors known as "catadores" faced similar problems, including low wages, lack of safety equipment, and denial of labor rights [60]. However, Brazil has been successful in integrating these workers into waste management systems in cities such as São Paulo, providing them with legal support, government benefits and safety equipment [61]. In contrast, processors in Ogun State remain excluded from such legal frameworks, indicating serious deficiencies in management oversight and worker protection. In developed countries such as Germany and South Korea, recycling is strictly regulated, with strict labor and safety standards. People working in these industries benefit from a comprehensive legal framework that ensures adequate safety and health insurance [27]. For example, in Germany, recycling machines are often used to reduce the health risks associated with manual labor. Strong unions protect fair wages, benefits and reasonable working hours in contrast to the lack of labor laws in Ogun State [27].

Investigate the level of awareness and implementation of human rights standards

This objective set out to provide insights into the current state of human rights adherence and highlight areas where improvements are needed to ensure that the rights to work, health, information, and participation are fully realized within this crucial sector. Hence, Table 3 showed a logistic regression output to achieve this research objective.

The discussion of the findings based on the results of the logistic regression analysis provides further understanding of the high awareness of human rights standards among informal recyclers. Firstly, the intercept, which defines the log-odds of high awareness for a 'typical' person with reference category attributes, equals -2. aged 50 and has been determined to be statically significant. This point to perhaps low knowledge of human rights standard, a feature observed by [11] and [30] in their studies. Coincidentally, these studies also found that informal recyclers globally lack adequate awareness due to low education standards and lack of information. Every year of age significantly raises the odds of obtaining high awareness; the odds ratio is 1.05 (95% CI=0.96; 1.15), $p=0.04$. [30] made some findings which are different from the results of this study; we found that there was relatively low awareness difference among the different ages of people. According to our findings on the level of knowledge of the participation in the recycling process among elder people in relation to the norms of protecting human rights, it has been revealed that elder people are more aware of the norms in protecting such rights

Table 3 Logistic Regression Output

| Predictor | Coefficient (β / β) | Standard Error | Odds Ratio (Exp(β / β)) | p -value |
|-----------------------|-----------------------------------|----------------|---------------------------------------|------------|
| Intercept | -2.50 | 1.20 | - | 0.03 |
| Age | 0.05 | 0.02 | 1.05 | 0.04 |
| Gender (Male) | 0.80 | 0.30 | 2.23 | 0.01 |
| Education (Primary) | 0.60 | 0.40 | 1.82 | 0.15 |
| Education (Secondary) | 1.20 | 0.45 | 3.32 | 0.01 |
| Education (Higher) | 1.50 | 0.60 | 4.48 | 0.02 |
| Experience | 0.10 | 0.03 | 1.11 | 0.005 |
| Income | 0.0005 | 0.0002 | 1.0005 | 0.04 |

as compared to the younger generation. This could be attributed to the fact that the two have taken time in the field as well as the amount of time that they observe in the field affects the knowledge they have acquired regarding the market. Another importance is gender whereby; the results also showed that the male category has a higher chance of having high awareness than the female gender with an odds ratio of 2. This can be discussed in regards to the findings obtained while investigating the distribution of awareness between genders, as identified by [30]. Based on the said observation, the community realized that women in the informal sectors are not to adequately exposed to education and training.

The degree of education is deemed to be highly influential in creating awareness. People with secondary education have their awareness odds more than three times than those without secondary education, likewise, those with higher education have their awareness odds more than four times than the odd of those with no formal education. These results correlate with the findings from [53], that include education as one of the key factors in raising awareness on rights. On the other hand, our measurement is somewhat different from the study of [30] where they found primary education effective to increase awareness. In this case, primary education did not obtain the needed level of statistical significance ($p=0.15$). Other factors that also help include having

experience in the recycling sector as well as professional experience in environmental conservation. Indeed, it is notable that every added year of work experience boosts the likelihood for inclusion on a list by 11% as per the results of the carried statistical evaluation of the study ($OR=1.11$, $p=0.005$). Of course, this finding corresponds with the Study by [10], which states that with the years of the experience of the practitioner in the field there is increase in understanding of the importance of human right standards. This understanding is attributed to the fact that the age brings experience in the practical applications and therefore, exposure.

Impact of informal recycling on the well-being of workers and their families

This research objective aims to explore the impact of informal recycling activities on the overall well-being of workers and their families. In doing thus, we employed multiple linear regression analysis in Table 4 to understand how the informal recycling sector influences the quality of life of those involved.

The intercept, or baseline overall well-being score when all predictor variables are zero, is 0.4531 and has been found to be statistically significant with a p -value of 0.017. Monthly income has a significant impact on well-being, with even a small increase in income resulting in a noticeable improvement in overall well-being.

Table 4 Impact of Informal Recycling on the Well-Being of Workers and Their Families

| Dep. Variable: | Overall Well-Being | R-squared: 0.62 | Adj. R-squared: 0.61 | | F-statistic: 75.89 | |
|----------------------|--------------------|-----------------|-------------------------|-------|------------------------------|--------|
| No. Observations: | Df Residuals: 178 | Df Model: 4 | Log-Likelihood: -310.25 | | Prob (F-statistic): < 0.0001 | |
| | Coef | std err | T | P> t | 0.025 | 0.975 |
| Const | 0.4531 | 0.189 | 2.396 | 0.017 | 0.081 | 0.825 |
| Monthly Income | 0.0001 | 2.56e-05 | 4.508 | 0.000 | 0.000 | 0.000 |
| Working Hours | -0.0502 | 0.023 | -2.167 | 0.031 | -0.096 | -0.004 |
| Access to Healthcare | 0.4208 | 0.198 | 2.125 | 0.035 | 0.030 | 0.811 |
| Job Satisfaction | 0.3215 | 0.065 | 4.946 | 0.000 | 0.193 | 0.450 |

This finding is statistically significant, highlighting the importance of financial stability for one's happiness. On the other hand, extended working hours have a detrimental effect on well-being, as each extra hour decreases the well-being score by 0.0502 units ($p=0.031$). Having access to healthcare has a substantial positive impact on overall well-being, with a statistically significant increase of 0.4208 units ($p=0.035$). Job satisfaction is a significant predictor, positively impacting well-being by 0.3215 units ($p<0.0001$). The correlation between income and well-being is supported by research conducted by [10] and [30]. These studies highlight the importance of financial stability in improving the overall quality of life for informal recyclers. This discovery emphasises the significance of economic interventions in enhancing the overall welfare of this group. In addition, studies conducted by [11] and [62] provide evidence that higher income generated from recycling activities can greatly enhance the quality of life for informal recyclers. This indicates that offering financial incentives and fair compensation is crucial for this particular group of individuals.

The well-being consequences of working long hours are supported by research conducted by [30] and [53]. These studies emphasise the negative impact of extended work hours on both physical and mental well-being, emphasising the importance of implementing policies that encourage more balanced and healthier work schedules. In addition, a study conducted by [35] highlights the detrimental effects of extended working hours in informal sectors. These effects include fatigue, decreased productivity, and an increased risk of work-related illnesses. This research underscores the importance of implementing regulations on working hours to promote the well-being of workers. The positive impact of healthcare access on well-being aligns with [38] findings, highlighting the importance of healthcare in enhancing the quality of life for informal workers. This discovery implies that improving the availability of healthcare could greatly advantage informal recyclers. [38] also reached similar conclusions, highlighting the positive impact of enhanced healthcare access for informal sector workers. They found that this leads to improved health outcomes and reduces economic vulnerability by alleviating health-related expenses. The significance of healthcare access is also emphasised in studies by [9] and [53], which underscore the vital role of healthcare support in ensuring the long-term viability of informal recycling activities.

Multiple studies, such as the ones conducted by [12] and [8], have provided strong evidence for the positive correlation between job satisfaction and well-being. The profound influence of job satisfaction on mental and physical health suggests that enhancing working conditions and job satisfaction can result in remarkable

enhancements in overall well-being. A study conducted by [16] indicates that job satisfaction has a positive impact on worker morale, as well as increasing productivity and reducing turnover rates. In addition, [11] highlight the significance of job satisfaction in relation to perceived social status and community recognition. These factors play a crucial role in the overall well-being of informal workers. This study highlights the various factors that impact the well-being of informal plastic recyclers in Ogun State, Nigeria. The study highlights that factors such as monthly income, access to healthcare, and job satisfaction play a crucial role in determining one's well-being. On the other hand, it suggests that long working hours can have a negative impact on overall well-being. These findings align with previous research, emphasising the importance of comprehensive interventions that tackle economic, health, and working conditions in order to enhance the lives of informal recyclers. By incorporating these valuable insights into policy and practice, stakeholders can devise more impactful strategies to improve the welfare of informal workers and their families. This approach is in line with global research and also tackles the specific needs and challenges faced by informal recyclers in Nigeria.

Conclusion and recommendations

This study has discussed the findings about informal plastic recyclers engaged in Ogun State, Nigeria and brought out the evidence about their efficiency in waste management and better environment. However, these recyclers encounter many socio-economic barriers; poor education, poor health, and low income which make them remain illiterate and sick and unable to break out of the poverty cycle. The study highlights the necessity of the implementation of a more extensive and integrated approach when addressing these problems with the primary focus on the improvement of human rights' perception among the workers. The study concludes indicating that informal plastic recyclers are mostly socially excluded with minimal ability to access fundamental human necessities let alone their rights to standard health services, education, and remuneration. This discriminative treatment not only dignifies their poor standard of living but also makes it impossible for them to progress economically. Furthermore, the recyclers do not know about their rights, and this makes them vulnerable to various vices, including being exposed to dangerous working conditions.

The study also emphasizes the need to increase awareness of their rights as human beings among the irregular informal recyclers. In other words, awareness can help those involved in recycling to fight for better working conditions, health-care and social-security benefits,

and acknowledgement of their role in waste reduction and environmental protection. It is paramount to launch educational campaigns and community-based programs, which would raise awareness and provide the necessary support to recyclers in order to understand their rights and protect them. Moreover, the findings of the study suggest that forming partnerships with various stakeholders, including government agencies, civil institutions, and the private sector, is critical for establishing long-term solutions. Such collaborations may help in delivering training programs for improved working practices, financial assistance, and healthcare access to improve informal recycler's socio-economic benefits. They can also encourage further professionalization of the recycling branch and offer legal frameworks for its employees' safety.

Policy recommendations

Findings from the study of the informal recycling sector in Ogun, as well as comparisons with similar contexts in other areas, highlight the need for targeted policy interventions to improve working conditions, enforce labor laws and promote sustainable environmental outcomes. Based on the identified shortcomings, several practical recommendations are proposed:

1. Formalization of the informal recycling sector: The main recommendation is the formalization of informal recyclers in the waste management system in Ogun State. Legal recognition of these workers would give them access to important labor rights, including social security, health services and protective measures. Incorporating waste pickers into formal waste management systems, as seen in Colombia and Brazil, can significantly improve their quality of life, improve working conditions and ensure better access to training and protective equipment. The government could adopt policies to register informal cleaners and integrate them into the formal economy through a cooperative system, providing better legal protection and bargaining power.
2. Implementation of labor and safety regulations: The study revealed significant gaps in the implementation of labor and safety standards, with many janitors working long hours without safety equipment or health insurance. The government should prioritize the implementation of existing labor regulations by conducting regular inspections of recycling facilities, while ensuring compliance with health and safety standards. This includes requiring the use of personal protective equipment (PPE) and providing cleaning staff with safety training. Strengthening checks on employees and imposing fines on non-compliant employers can prevent unsafe practices. In addition, the implementation of low-cost or subsidized PPE distribution programs to cleaners can reduce the health risks associated with their work.
3. Provision of accessible health and social services: Informal scavengers in Ogun State face serious health risks and many do not have access to affordable health services. To address this problem, the government should introduce subsidized health programs based on the specific health needs of waste pickers. Establishing mobile health clinics that regularly visit informal recycling sites can provide hygiene workers with basic health services and screening for common workplace illnesses such as respiratory problems, skin infections and musculoskeletal problems. In addition, the creation of social security systems, including accident insurance and pension systems for informal workers, will provide financial protection in case of injury or illness.
4. Improving safe working conditions through public-private partnerships: Partnerships between government, non-governmental organizations (NGOs) and the private sector can improve the working environment for informal waste pickers. Private companies involved in waste management could be encouraged to partner with informal waste collectors and provide them with better tools, equipment and safety training. In return, these companies can receive tax credits or subsidies for contributing to improved employee well-being and environmental sustainability. NGOs can also play an important role in raising awareness, advocating for workers' rights and providing capacity building programs for cleaners to improve their skills and safety practices.
5. Develop a solid waste management policy and infrastructure: To ensure long-term sustainability, Ogun State needs to develop a solid waste management policy that takes into account environmental benefits and worker welfare. This includes improving waste collection and recycling infrastructure to reduce manual disposal and exposure to hazardous substances. Investing in recycling facilities and mechanical systems can reduce the health risks associated with manual waste disposal, as is the case in countries such as Germany and South Korea. Government subsidies to recyclers also help them purchase new equipment, to improve productivity and safety.
6. Public awareness and support for rights-related approaches: Research findings indicate that recyclers are not aware of rights and the importance of ensuring better work. It is important to promote public awareness programs to educate repeat athletes about their rights and encourage integration. Rights-related

interventions supported by NGOs and civil society organizations should focus on promoting better working conditions, such as fair wages, fair working hours and the right to organize. Empowering recyclers to defend their rights will promote more cooperative efforts and improve their social status.

7. Inclusion of informal recyclers in environmental policies: Finally, because informal recyclers play an important role in the life of the environment, they should be included in environmental policies. Ogun State should create a recycling program to encourage and integrate the contribution of the informal sector. For example, it would be important to provide financial incentives for recyclers to participate in formal recycling programs, train them in environmentally friendly practices, and involve them in decision-making processes related to waste management.

Authors' contributions

Oludele Mayowa Solaja: As the lead author, Oludele Mayowa Solaja conceptualized and designed the study, developed the research framework, and oversaw the data collection and analysis process. Solaja was also responsible for writing the manuscript, ensuring its coherence, and integrating feedback from co-authors. Omosat Kelly Osifo: Omosat Kelly Osifo contributed significantly to the literature review and theoretical framework of the study. Osifo assisted in the development of the survey instrument and was actively involved in the data collection process. Osifo also provided critical revisions and edits to the manuscript, enhancing its scholarly rigor. Olamide Faruq Amoo: Olamide Faruq Amoo played a key role in the data analysis and interpretation of the study's findings. Amoo was instrumental in designing the data analysis strategy and performed the statistical analysis. Amoo also contributed to the discussion section, providing insights into the socio-economic implications of the findings and their relevance to environmental sustainability and human rights. All authors read and approved the final manuscript, and they agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the research.

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Availability of data and materials

- All relevant data are included within the published article and its supplementary.
- The datasets and materials used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval was sought from Olabisi Onabanjo University Ethics Committee under the control of the Directorate of Research, Linkages and Directorate, with the reference number OOU/SSMTHU/EC/0002/260821. All research participants provided their informed consent thus being fully informed of the aim of the study, potential hazards and advantages involved in the study.

Consent for publication

Not Applicable.

Competing interests

The authors declare no competing interests.

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