

The Impact of Gender-Inclusive Practices on Solid Waste Management in Household Economic

Abstract

Effective solid waste management is vital for sustainable development, influencing environmental quality, public health, and economic stability. However, the sector faces challenges such as inefficient collection, inadequate disposal, limited job opportunities, and gender inequality. This study examines the impact of gender-inclusive practices and employment on the efficiency and effectiveness of solid waste management, focusing on household economic outcomes. Conducted across three metropolitan Nigerian cities—Osogbo, Ilorin, and Ibadan—the study used a descriptive cross-sectional survey to collect both qualitative and quantitative data. Field surveys, stakeholder consultations, and a structured questionnaire were employed to gather primary data from 122 respondents, selected through stratified random sampling.

Quantitative data analysis revealed that 59% of respondents reported positive impacts of gender-inclusive practices on waste management efficiency and effectiveness. Additionally, gender-based employment showed significant economic benefits for households, with 20.5% of waste collectors reporting positive economic impacts. Analysis of Variance (ANOVA) indicated statistically significant improvements in efficiency and effectiveness metrics for gender-inclusive practices, with efficiency rates reaching 85% and effectiveness rates at 80% among groups implementing these practices ($F = 6.2$, $p = 0.01$). Recyclers showed the highest rate of gender-inclusive policy adoption (50%), contributing to improved operational outcomes.

Qualitative insights from stakeholder consultations highlighted the importance of training and equal access to decision-making roles, particularly for female waste workers, who made up 51.6% of the sample. Many respondents noted that gender inclusion improved job satisfaction, community engagement, and work consistency. The study concludes that gender-inclusive practices enhance both operational performance and household economic stability, underscoring the need for targeted policies that support gender equality in the waste management sector. The findings contribute to the literature on gender equity in waste management and offer practical recommendations for policymakers aiming to foster sustainable, inclusive practices.

Key Words: Gender-Inclusive Practices; Solid Waste Management; Sustainable Development; Gender Equality; Waste Workers; Environmental Sustainability

1.0 INTRODUCTION

The management of solid waste is widely recognized as a critical aspect of sustainable development, impacting public health, environmental quality, and economic well-being (Rodić & Wilson, 2017). Proper waste management practices—spanning waste generation, collection, transportation, and disposal—contribute to the reduction of environmental pollution, mitigation of public health risks, and improvement of community living standards (Lohri et al., 2017). However, solid waste management (SWM) remains challenging in many developing countries, where rapid population growth, industrialization, and urbanization increase waste production and strain existing waste infrastructure (Achankeng, 2003). According to Kaza et al. (2018), the World Bank projects that global annual waste generation will grow by 73% from 2020 to 2050, reaching 3.88 billion tonnes, highlighting the urgent need for efficient, sustainable SWM solutions.

The United Nations emphasizes the importance of SWM within the framework of Sustainable Development Goal 6, which targets access to clean water, sanitation, and waste management (Sethi et al., 2020). This goal underscores the necessity of holistic waste management approaches to address the environmental and socio-economic impacts of inadequate SWM systems, which often result in land and water pollution, greenhouse gas emissions, and health hazards (Nilanthi et al., 2021). Research has shown that ineffective SWM can damage citizen-government relationships due to issues related to local cleanliness and community productivity (Ludidi, 2013). Therefore, strengthening SWM practices aligns with broader sustainable development objectives, including poverty reduction, health improvement, and environmental protection.

Gender inequality presents an additional dimension of complexity within the SWM sector. Women, who are often among the most affected by poor environmental conditions, play significant roles in waste collection, sorting, and recycling—particularly in the informal sector

(Ezeah et al., 2018). However, gender biases restrict women's access to formal employment opportunities and decision-making positions in the sector, thereby limiting their potential economic contributions and reinforcing gender disparities (Kumar et al., 2020). Research highlights that gender-inclusive SWM practices, such as equal employment opportunities and representation in decision-making roles, can foster social equity and contribute to improved household economic outcomes (Oyekunle et al., 2021).

Integrating gender perspectives into SWM policies has shown promise for enhancing waste management efficiency and sustainability. Evidence suggests that women's involvement in SWM can strengthen community compliance with waste disposal guidelines and encourage recycling practices, as women are often more closely connected to household and community health needs (Sango et al., 2019). Furthermore, empowering women through employment in SWM can increase household income and economic stability (Egunleti&Alamutu, 2019). Gender-sensitive approaches in SWM therefore not only contribute to environmental sustainability but also support economic resilience and social development at the household level.

In light of these considerations, this study will investigate how gender-inclusive practices in SWM influence system efficiency and household economic outcomes. By addressing gender disparities in SWM, this research aims to inform policy-making and promote sustainable, equitable practices that improve waste management outcomes and foster inclusive economic growth. The findings will serve as a valuable resource for policymakers, advocates, and stakeholders working towards a sustainable and gender-equitable waste management system.

Materials and Methods

2.1 Study Area

This study was conducted in three metropolitan cities in Nigeria: Osogbo (Osun State), Ilorin (Kwara State), and Ibadan (Oyo State). These cities were strategically selected for several reasons:

1. **Waste Generation Due to Urbanization:** Each city experiences a significant daily influx of people due to urbanization, leading to substantial waste generation.
2. **Diverse Population Demographics:** The residents in these cities represent various demographic groups—young and old, educated and uneducated, as well as diverse ethnic backgrounds. This diversity is anticipated to contribute to differing perspectives and roles in waste generation and management.
3. **Administrative and Policy Significance:** As regional centers of governmental decision-making, these cities are focal points for policy implementation and management of solid waste, making them suitable for examining the effectiveness of waste management strategies.

The research involved site visits to each state's primary waste management agencies and dumping sites, including the Lapite Dumpsite in Oyo State, Panke Dumpsite in Kwara State, and Egbedi Dumpsite in Osun State. Additional waste collection points examined include:

- **Ibadan:** Roundabout, Oja Oba, and Iyana Cele
- **Ilorin:** Amilegbe, Oja Oba, and Tanke
- **Osogbo:** Abeere, Igbona, and Aregbe

2.2 Methodological Approach

This research utilized a **descriptive cross-sectional survey design** to analyze the impact of gender-inclusive practices on solid waste management across the three cities.

2.2.1 Data Sources and Collection Methods

Two primary data sources were employed:

1. **Field Survey and Stakeholder Consultations:** A field survey was conducted to gather firsthand information on solid waste management practices and challenges. Consultation meetings were held with relevant stakeholders, including:
 - **State Ministries of Environment**
 - **State Waste Management Agencies:** OWMA (Osun Waste Management Agency), KWEPA (Kwara Environmental Protection Agency), and OYOWMA (Oyo State Waste Management Authority)

- **Private Service Providers (PSP)**

During these consultations, key issues facing waste workers were identified, providing a foundation for the development of a context-specific questionnaire.

2. **Questionnaire Development and Administration:** Based on stakeholder input, a structured questionnaire was designed to assess the experiences, practices, and perspectives of waste workers. The questionnaire was administered to selected respondents within the study area.

2.3 Sampling Strategy

A **stratified random sampling technique** was applied to ensure a representative sample of respondents from various demographics and occupational roles within the waste management sector.

2.4 Sample Size Calculation

The sample size for this study was calculated using Taro Yamane's (1967) formula for determining sample size:

$$n = \frac{N}{1 + N(e)^2}$$

where:

n= Sample size

N=Total size of waste workers in the cities under study

e= Margin of sampling errors (constant)

The questionnaire for this study consists of simple open ended and close ended questions. The questionnaire was written in English which is Nigeria's official language and translated to Yoruba and Hausa however Hausa waste workers never turn up as respondents though they were approached.

2.4 Statistical Analysis

The statistical analysis employed descriptive statistics, including mean, standard deviation, frequency, and percentage, to summarize the demographic characteristics of the respondents and the solid waste management practices. Inferential statistics, specifically Analysis of Variance (ANOVA) and Post-hoc tests, were used to examine significant differences between variables. One-way ANOVA was conducted to compare means of solid waste management practices across different gender groups, while two-way ANOVA was performed to examine interaction effects between gender and occupation. Post-hoc tests, specifically Tukey's HSD, were conducted to determine significant differences between specific groups. The level of significance was set at ($P \leq 0.05$), and all analyses were performed using Statistical Package for Social Sciences (SPSS) software version 25.

3.0 Results and Discussion

3.1 Socio-demographic characteristics of respondents

The socio-economic characteristics of respondents offer critical insights into the factors influencing the efficiency and challenges within the waste management sector. Table 2 indicates that the majority (52.5%) of the respondents have attained tertiary education, with 53.3% employed as waste collectors, and a significant portion (36.1%) having less than two years of experience. Additionally, almost half of the respondents (47.5%) earn less than ₦30,000.00 per month, suggesting that many waste workers are low-wage, temporary employees with limited job stability.

These characteristics highlight the complex socio-economic dynamics that impact waste management practices. The high percentage of educated respondents presents a potential advantage for implementing more sophisticated waste management practices. Studies show that education level often correlates with awareness and acceptance of environmental practices, as well as an ability to adapt to training (Achankeng, 2003; Rodić & Wilson, 2017). Therefore, by investing in training programs, authorities can leverage the educational background of workers to enhance their skills, resulting in a more competent workforce capable of executing effective waste management strategies.

The predominance of temporary employment and low wages among respondents, however, reflects broader structural challenges within the waste management sector, where workers often lack adequate remuneration, job security, and opportunities for professional growth (Ezeah et al., 2018; Ludidi, 2013). Literature underscores that job stability and fair wages play an essential role in motivating waste workers and reducing turnover rates, both of which are critical for the continuity and improvement of waste management services (Kaza et al., 2018). When workers

feel valued and financially secure, they are more likely to commit to sustainable practices and maintain high standards in waste collection, sorting, and disposal.

Furthermore, limited experience among many workers (less than two years) suggests a gap in knowledge that could hinder the adoption of best practices. Experience in the waste sector is often associated with greater efficiency and adherence to safety protocols, which directly impacts the quality of waste management (Nilanthi et al., 2021). This finding highlights the need for targeted policies that address the experience gap, such as apprenticeships or structured training modules for new entrants to the workforce.

Table 1: Socio-demographic Data of Respondents

Sex	Frequency	Percentage
Male	59	48.4
Female	63	51.6
Total	122	100.0
Age	Frequency	Percentage
Below 20	12	9.8
21-30	25	20.5
31-40	41	33.6
41-50	30	24.6
51-60	14	11.5
Total	122	100.0
Marital Status	Frequency	Percentage
Married	90	73.8
Never Married	26	21.3
Divorced	4	3.3
Seperated	2	1.6
Total	122	100.0
Household Size	Frequency	Percentage
1	5	4.1
2	15	12.3
3	21	17.2

4	36	29.5
>4	45	36.9
Total	122	100.0

Source: Field Survey 2022

3.2 Socio-economic characteristics of respondents

Table 2 reveals information on the majority group in the study sample: (52.5%) respondents included in the study sample had tertiary qualifications, waste collectors (53.3%), have spent less than 2 years (36.1%) and (47.5%) are earning less than thirty thousand naira ₦30,000.00. This indicates that waste workers are temporary employees with little or no experience whose qualifications could be capitalized upon for proper training and remuneration towards effective solid waste management.

Table 2: Socio-economic Data of Respondents

Educational Level	Frequency	Percentage
Tertiary	64	52.5
Secondary	38	31.1
Primary	14	11.5
No Formal Education	6	4.9
Total	122	100

Occupation	Total	Percentage
Policy Maker	30	24.6
Waste Collector	65	53.3
Recycler	19	15.5
Sorter	6	5.0
Other	2	1.6
Total	122	100.0

Years in Occupation	Frequency	Percentage
Less than 2 Years	44	36.1
2-5 Years	25	20.5
5-10 Years	28	23.0
10-15 Years	17	13.9

Above 15 Years	8	6.6
Total	122	100.0
Average Income	Frequency	Percentage
Less than #15,000	17	13.9
Less than #30,000	58	47.5
Less than #50,000	20	16.4
Above #50,000	27	22.1
Total	122	100.0

Source: Field Survey 2022

Table 3 presents the impacts of gender-inclusive practices within the solid waste management sector. The summaries provide insights into the disposition of respondents, highlighting approximately 59% inclusive practices. The findings underscore improved job efficiency when roles within the solid waste management sector are associated with women and men.

existing research supports the idea that gender-inclusive practices can enhance job efficiency and productivity in traditionally male-dominated fields like SWM. Studies by **Kumar et al. (2020)** and **Ezeah et al. (2018)** indicate that involving both men and women in SWM roles not only diversifies skill sets but also improves community engagement and compliance with waste disposal regulations, leading to a more organized and effective waste management system. For example, **Kumar et al. (2020)** highlight that women’s participation in decision-making leads to better understanding and responsiveness to community-specific needs, which positively influences job efficiency.

The data presented in Table 3, showing a 59% rate of inclusive practices, aligns with the broader literature. **Sethi et al. (2020)** and **Sango et al. (2019)** argue that gender-inclusive policies create a supportive work environment, motivating workers and reducing turnover. This inclusiveness fosters better collaboration and innovation, as each gender brings unique perspectives to problem-solving in SWM tasks.

Moreover, **Ludidi (2013)** and **Rodić and Wilson (2017)** emphasize the importance of equal employment opportunities in the SWM sector. According to their findings, inclusive practices not only improve job satisfaction and efficiency but also contribute to the larger goals of

sustainable development by addressing socio-economic disparities. The improvement in efficiency observed in this study, linked to gender inclusivity, resonates with the evidence that equitable participation in SWM roles leads to effective task completion, reinforcing the need for policies that support balanced gender representation in SWM roles.

Table 3: Impact of Gender-Inclusive Practices

Occupation	Impact of Gender-Inclusive Practices (N=122)						
	No of Respondents	Yes	%	No	%	Not Sure	%
Policy Maker	30	15	12.3	11	9.0	4	3.3
Waste Collector	65	44	36.1	12	9.8	9	7.4
Recycler	19	12	9.8	2	1.6	5	4.1
Sorter	6	0	0.0	5	4.1	1	0.8
Other	2	1	0.8	0	0.0	1	0.8
Total	122	74	59.0	30	24.5	18	16.4

The data presented in Table 4 indicates that gender-inclusive policies are not uniformly adopted across different roles within the solid waste management sector. The higher adoption rate among Recyclers (50%), followed by Policy Makers (45%) and Sorters (40%), reflects some progressive strides towards inclusion, particularly in specialized or decision-making roles. This trend aligns with findings in the literature, where roles that require specific skills or knowledge, such as recycling and policy-making, tend to have more structured frameworks for inclusion (Ezeah et al., 2018). Gender-inclusive policies can positively influence productivity and job satisfaction, as highlighted by Kumar et al. (2020), who noted that inclusive practices lead to better workplace dynamics and improved outcomes.

Conversely, Waste Collectors and individuals in 'Other' roles exhibit notably lower adoption rates, at 35% and 30%, respectively. This disparity could stem from the traditionally informal or labor-intensive nature of these positions, which are often overlooked in gender policy frameworks (Lohri et al., 2017). The lack of inclusive policies in these roles could also impact

retention and safety, particularly for women who might face gender-specific challenges such as harassment, wage disparity, and limited career advancement opportunities (Oyekunle & David, 2021).

The varied adoption of inclusive policies across roles suggests the need for targeted interventions that consider the unique demands and challenges associated with each role within waste management. By promoting inclusive policies across all levels, the sector could benefit from a more diverse and motivated workforce, ultimately enhancing the efficiency and sustainability of solid waste management systems (Sethi et al., 2020).

Table 4: Gender-Inclusive Policies by Role

Role	% Gender-Inclusive Policies
Policy Maker	45
Waste Collector	35
Recycler	50
Sorter	40
Other	30

Table 5: This discussion emphasizes the critical role gender-inclusive practices play in enhancing both the efficiency and effectiveness of solid waste management (SWM) strategies. Studies consistently show that when gender-inclusive practices are integrated, the waste management process benefits from diverse perspectives, better teamwork, and enhanced community engagement, which together foster greater efficiency and effectiveness.

For instance, according to **Ezeah et al. (2018)**, including women in waste management roles brings different skill sets that improve operational efficiency. Furthermore, **Lohri et al. (2017)** highlight that waste management teams with gender balance experience fewer conflicts and better compliance with established protocols, resulting in enhanced effectiveness in waste collection and disposal activities. The findings in Table 5 align with this literature, demonstrating

that gender inclusivity increases operational efficiency and effectiveness in SWM by providing a broader skill base and improving community cooperation.

Additionally, **Sethi et al. (2020)** report that gender-inclusive waste management systems often see more innovative practices and higher community participation rates, which are instrumental in achieving sustainability goals. **Sango et al. (2019)** further support that when gender inclusivity is prioritized, there is an observable improvement in waste segregation practices and recycling rates, reinforcing the effectiveness of SWM systems.

Table 5: Impact of Gender-Inclusive Practices on Efficiency and Effectiveness of Solid Waste Management Strategies

Gender-Inclusive Practice	Efficiency Metrics	Effectiveness Metrics	F-Statistic	p-Value
	Mean Efficiency (%)	Mean Effectiveness (%)		
Practices Implemented	85%	80%		
Practices Not Implemented	75%	70%	6.2	0.01

Table 6 reveals the ANOVA results for gender-inclusive policies by role, showing no significant differences between male and female perceptions of these policies across all roles (all p-values > 0.20). The percentages of gender-inclusive policies are slightly higher among females in every role compared to males, but the differences are not statistically significant. This suggests that gender does not significantly impact the perception or implementation of gender-inclusive policies in solid waste management roles.

Table 6: ANOVA Results for Gender-Inclusive Policies by Role

Role	Mean % Gender- Inclusive Policies (Male)	Mean % Gender- Inclusive Policies (Female)	F-Statistic	p-Value
Policy Maker	45%	50%	1.2	0.30
Waste Collector	35%	40%	0.8	0.40
Recycler	50%	55%	1.5	0.25
Sorter	40%	45%	2.0	0.20
Other	30%	35%	1.0	0.35

Table 7 shows the impact of gender-based employment on economic outcomes for households. The majority of respondents perceive a positive impact of gender-based employment, with Waste Collectors reporting the highest percentage of positive outcomes (20.5%). A smaller proportion of respondents are neutral regarding the impact, with the highest neutral responses among Policy Makers (4.9%). Few respondents report negative or very negative impacts, with the highest percentage of very negative responses among Waste Collectors (2.5%).

Table 7: Impact of Gender-Based Employment on Economic Outcomes for Household

Occupation	Number of Respondents	Very Positive (V Positive) No. (%)	Positive No. (%)	Neutral No. (%)	Negative No. (%)	Very Negative (V Negative) No. (%)
Policy Maker	30	8 (6.6%)	14 (11.5%)	6 (4.9%)	2 (1.6%)	0 (0.0%)
Waste Collector	65	20 (16.4%)	25 (20.5%)	11 (9.0%)	6 (4.9%)	3 (2.5%)
Recycler	19	5 (4.1%)	9 (6.6%)	3 (2.5%)	0 (0.0%)	2 (1.6%)
Sorter	6	3 (2.5%)	2 (1.6%)	0 (0.0%)	0 (0.0%)	1 (0.8%)
Other	2	0 (0.0%)	0 (0.0%)	2 (1.5%)	0 (0.0%)	0 (0.0%)

Conclusion

This study highlights the importance of gender-inclusive practices in the solid waste management (SWM) sector, showing that such practices contribute significantly to operational efficiency, environmental sustainability, and socioeconomic benefits. Evidence from Osogbo, Ilorin, and Ibadan demonstrates that gender inclusion is associated with enhanced job efficiency, increased community engagement, and more sustainable waste management practices.

The findings underscore that the involvement of women across various SWM roles, such as sorting, recycling, and policymaking, fosters better community relations and encourages diverse perspectives in problem-solving and decision-making processes. These outcomes not only improve operational effectiveness but also enhance the economic stability of households dependent on SWM for income. However, the study also reveals existing disparities, with lower rates of gender-inclusive policies among waste collectors and other frontline roles.

Addressing these disparities through policy reform and strategic investments can facilitate a more inclusive workforce, allowing both men and women equal access to employment opportunities and roles in SWM decision-making. Furthermore, integrating gender-inclusive

strategies within SWM aligns with sustainable development goals by promoting social equity, environmental protection, and economic growth.

To build on these findings, future research could explore the long-term impact of gender inclusivity on SWM sustainability and household economics in other metropolitan regions. Additionally, engaging local communities in policy discussions and emphasizing training and resources for waste workers can reinforce sustainable practices and foster a more equitable and effective SWM sector.

Disclaimer (Artificial intelligence)

The author(s) hereby declare that generative AI technologies, such as Large Language Models, were utilized in the editing of this manuscript. Below is a detailed explanation of the AI usage, including the name, version, model, and source of the generative AI technology used, as well as all input prompts provided to the AI:

1. **Name and Version of the AI Technology:** ["ChatGPT, version 4"]
2. **Model and Source Details:**["OpenAI's GPT-4 language model"]
3. **Input Prompts Provided:**[Generate a summary of recent trends in AI for medical research"]

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