The Impact of Gender-Inclusive Practices and Gender-Based Employment Opportunities on Efficient and Effective Solid Waste Management: Effects on Household Economic Outcomes

Abstract

Solid waste management is a critical component of sustainable development, yet gender inequality persists in the sector, hindering its effectiveness. Despite the significant role of women in waste management, their contributions remain undervalued and under-recognized. This study aims to address the knowledge gap on the impact of gender-inclusive practices in solid waste management, which is essential for developing effective strategies to promote gender equality and improve waste management outcomes. A survey of 122 waste workers revealed that majority of respondents was adults, with a slightly higher proportion of females (51.6%) than males (48.4%). The study found that gender-inclusive practices significantly improved both efficiency (85% vs 75%, F-statistic = 6.2, p-value = 0.01) and effectiveness (80% vs 70%) in solid waste management strategies. Recyclers had the highest percentage of gender-inclusive policies (50%), followed by Sorters (40%) and Policy Makers (45%). However, there were no significant differences between male and female perceptions of gender-inclusive policies across all roles (all p-values > 0.20). The study also found a positive impact of gender-based employment on economic outcomes for households, with 20.5% of Waste Collectors reporting positive outcomes. The findings underscore the importance of gender-inclusive practices in solid waste management and highlight the need for policies and training programs that promote gender equality in the sector.

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

1.0 INTRODUCTION

The effective management of solid waste is a critical component of sustainable development, as it directly impacts environmental quality, public health, and household economic outcomes (Rodić& Wilson, 2017). However, the solid waste management sector faces significant challenges, including inefficient collection, inadequate disposal, and limited employment opportunities, which are exacerbated by gender inequality. The increasing rate of solid waste generation, driven by population growth, industrialization, urbanization, and globalization, further compounds these challenges (Achankeng, 2003). According to the World Bank, annual waste generation is expected to increase by 73% from 2020 to 2050, reaching 3.88 billion tonnes. Solid waste management is essential for achieving sustainable human development, as emphasized by the United Nations' Sustainable Development Goal 6 (Sethi*et al.*, 2020). Ineffective solid waste management affects not only the environment but also citizen-government relationships and community productivity and cleanliness (Ludidi, 2013). Women, in particular, bear the brunt of environmental deterioration and are critical stakeholders in solid waste management, from collection to disposal. Despite this, gender inequality persists in the sector, with women facing limited access to employment opportunities and decision-making processes. This study aims to address the pressing need for gender-inclusive practices in solid waste management, exploring the impact of gender-inclusive practices and gender-based

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employment opportunities on efficient and effective solid waste management and its effects on household economic outcomes. By investigating this research problem, this study seeks to contribute to the development of gender-inclusive policies and practices that promote sustainable solid waste management and improved household economic outcomes.

Materials and Methods

2.1 Study Area

The thesis was conducted using three (3) metropolitan cities as study areas, they include Osogbo (Osun state), Ilorin (Kwara State) and Ibadan (Oyo State) in Nigeria. These metropolitan cities were selected due to (1) the significant amount of waste generated as a result of daily influx or migration of people as a result of urbanization (2) the residents include different class of people like: aged and youth, educated and uneducated and different tribes which will have different perspective and roles in waste generation and waste management and(3) they are the location or center of government policy decision and management therefore execution on solid waste managementshould be effective there. Each State Waste Management Agency and Dumping Sites were visited. The Dumping sites include Lapite Dumpsite in Oyo State, Panke Dumping Site in Kwara State and Egbedi Dumping sites in Osun State. Few waste collecting points visited include Roundabout, Oja Oba and Iyana Cele in Ibadan, Amilegbe, Oja-Oba, and Tanke in Ilorin; Abeere, Igbona and Aregbe in Osogbo.

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i.The reason for selecting this study area
ii.The specific waste management and dumping sites you visited.
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2.2 Methodological Approach

This study employed a descriptive cross-sectional survey design to investigate the impact of gender-inclusive practices on solid waste management.

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ii. How does this design fit into your research?
iii.How does it help with the analysis of your data and presentation of your findings?

2.2.1 Data Sources and Collection Methods

The study used two major sources of data collection:

2.2.1.1 Field Survey and Stakeholder Consultations

A field survey was conducted to gather primary data through situation analysis on solid waste management. Consultation meetings were held with: State Ministry of Environment, State Waste Management Agencies (OWMA, KWEPA, and OYOWMA), Private Service Providers (PSP) and State Dump Sites. These stakeholder consultations helped identify salient issues faced by waste workers in solid waste management. A context-specific questionnaire was developed for waste workers based on the information gathered.

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i. Which people did you consult in these Ministries? Which category of workers?? Top management, middle management???? Why did you choose to meet these people and how important are their contributions or participation to achieving the research objectives? These needs to be some justification for choosing the respondents of the study
ii.What is the meaning of these acronyms? Example OWMA, KWEPA

2.3 Sampling Strategy

A stratified random sampling technique was used to select respondents.

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2.3.1 Questionnaire Development and Administration

A well-structured questionnaire was developed based on the information gathered from stakeholder consultations. The questionnaire was administered to the selected respondents.

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2.4 Sample Size Calculation

A sample size of one hundred and twenty-two (122) respondents was determined using the formula provided by Taro Yamane (1967).

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

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

Table 1 revealed the gender distribution of the study sample to include male 48.4% and female 51.6% respondents. Majority of the respondents belonged to agegroupof 31-40years which has the largest corresponding frequency (33.6%), also the largest percentage of them are married (73.8%) and most of the respondents (36.9%) included in the study sample had a family size of more than 4 members. An indication that the waste workers areadults and they are majorlywomen.

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

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Table 2reveals 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 renumeration 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 3presents 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.

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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

Table 4 shows the adoption of gender-inclusive policies across various roles. Recyclers have the highest percentage of gender-inclusive policies at 50%, followed by Sorters at 40% and Policy Makers at 45%. Waste Collectors and those in 'Other' roles have lower adoption rates at 35% and 30%, respectively.

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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 demonstrates that gender-inclusive practices significantly improve both efficiency and effectiveness in solid waste management strategies. The efficiency average is higher for implemented practices (85%) compared to those not implemented (75%). Similarly, effectiveness is greater with implemented practices (80%) versus non-implemented ones (70%). The differences are statistically significant (F-statistic = 6.2, p-value = 0.01), highlighting that gender-inclusive practices substantially enhance both metrics.

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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%)

DISCUSSION

The study aimed to examine the impact of gender-inclusive practices on solid waste management, and the results provide valuable insights into the relationship between gender equality and effective waste management.

Table 1 presents the socio-demographic characteristics of the respondents, revealing a slightly higher proportion of female waste workers than males. This finding is consistent with previous studies that have highlighted the significant role of women in waste management. The majority of respondents belonged to the age group of 31-40 years, which is a critical age range for waste management, as they are likely to be in leadership positions or have significant experience in the sector (Khanal*et al.,* 2021)

Table 2 shows the socio-economic characteristics of the respondents, with 52.5% having tertiary qualifications and 53.3% being waste collectors. This finding is consistent with previous studies (Phu*et al.,* 2020) that have emphasized the importance of education and training in improving waste management practices. The average income of the respondents was less than ₦30,000, which is a relatively low income, highlighting the need for better remuneration and benefits for waste workers.

Table 3 presents the impact of gender-inclusive practices on solid waste management, with approximately 59% of respondents reporting positive impacts. These findings highlight the importance of gender-inclusive practices in improving waste management outcomes (Surchat, 2024).The results also showed that gender-inclusive practices significantly improve both the efficiency and effectiveness of solid waste management strategies.

This study showed that recyclers have the highest percentage (50%) of gender-inclusive policies has significant implications. It suggests that recyclers are leading the way in promoting gender equality and that other roles in the solid waste management sector could learn from their

example. Targeting interventions and support towards recyclers could help maintain and expand gender-inclusive policies, leading to a more equitable and effective sector.

Table 5 demonstrates the impact of gender-inclusive practices on efficiency and effectiveness in solid waste management strategies, with significant improvements in both metrics (Mozar&Sijbesma, 2010)that have highlighted the importance of gender-inclusive practices in improving waste management outcomes.

Table 6 presents the ANOVA results for gender-inclusive policies by role, revealing no significant differences between male and female perceptions of gender-inclusive policies across all roles. This suggests that gender equality is crucial for effective waste management, as both men and women share similar views on the importance of gender-inclusive policies.

Table 7 reveals that gender-based employment has a positive impact on economic outcomes for households, with 20.5% of waste collectors reporting beneficial effects. This suggests that gender-based employment plays a significant role in promoting economic empowerment, as it leads to improved financial well-being for households.

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Conclusion

In conclusion, the study provides valuable insights into the impact of gender-inclusive practices on solid waste management. The results highlight the importance of gender equality in promoting effective waste management, and the need for policies and training programs that promote gender equality in the sector. The study contributes to the existing literature on gender and waste management, and provides practical recommendations for policymakers and practitioners.

References

Achankeng, E. (2003). Globalization, urbanization and municipal solid waste management in Africa.In *Proceedings of the African Studies Association of Australasia and the Pacific 26th annual conference* (pp. 1-22).

Khanal, A., Sondhi, A., &Giri, S. (2021). Use of personal protective equipment among waste workers of Sisdol landfill site of Nepal. *International Journal of Occupational Safety and Health*, *11*(3), 158-164.

Ludidi, N. A. (2013). *Public participation as a mechanism for promoting sustainable waste management service delivery in Sedibeng District Municipality* (Doctoral dissertation, North-West University).

Mozar, R., &Sijbesma, C. (2010).Gender-and poor-inclusive community-managed sanitation and hygiene in urban Indonesia. *Water Practice and Technology*, *5*(4), wpt2010103.

Phu, S. T. P., Pham, T., Fujiwara, T., Hoang, G., Van Pham, D., Thi, H., ...& Le, C. D. (2020). Enhancing waste management practice-The appropriate strategy for improving solid waste management system in Vietnam towards sustainability. *Chemical Engineering Transactions*, *78*, 319-324.

Rodić, L., & Wilson, D. C. (2017). Resolving governance issues to achieve priority sustainable development goals related to solid waste management in developing countries. *Sustainability*, *9*(3), 404.

Sethi, G., Bedregal, L. P. A., Cassou, E., Constantino, L., Hou, X., Jain, S., ...& Kneller, C. (2020). Addressing Food Loss and Waste: A Global Problem with Local Solutions.

Surchat, M. (2024). *Gender-inclusive biowaste recycling: The example of Rwanda* (Doctoral dissertation, ETH Zurich).