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An Assessment of Community Awareness, Participation, and Challenges in Liquid Waste Management in Akure Metropolis, Ondo State, Nigeria.

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Abstract
This study investigated community awareness, engagement, and the challenges hindering effective participation in liquid waste management in Akure Metropolis, Ondo State, Nigeria. Using a descriptive survey design, data were collected from 100 respondents across residential, commercial, and industrial zones. Results revealed a generally high level of individual awareness and willingness to adopt good waste management practices. However, community-wide participation was found to be only moderate, due largely to inadequate infrastructure, limited public awareness initiatives, poor enforcement of sanitation laws, and weak government-community collaboration. Statistical analyses, including ANOVA and Tukey post hoc tests, confirmed significant differences in perceptions between residents, local officials, and waste management personnel, with residents perceiving the challenges more acutely. These findings underscore the need for a multi-stakeholder, inclusive approach to improve engagement, strengthen institutional support, and enhance infrastructure. The study recommends targeted awareness campaigns, community-driven waste monitoring, policy enforcement, and capacity-building programs to foster sustainable liquid waste management practices in Akure Metropolis.

Keywords: Liquid waste management, Community participation, Public awareness, Sanitation, Environmental health, Akure Metropolis, Urban sustainability.

1. Introduction

Effective liquid waste management is essential for urban sustainability, public health, and environmental protection. In rapidly urbanizing regions like Akure Metropolis, Ondo State, Nigeria, the challenges of managing liquid waste have become increasingly complex. The burgeoning population, coupled with industrial and commercial growth, has led to heightened pressure on existing waste management infrastructure (Adeleke, 2017; Akinola, 2018). This background section examines the significance of liquid waste management, the role of community participation, and the specific context of Akure Metropolis, supported by extensive literature.

Liquid waste, which includes sewage, industrial effluents, and household wastewater, poses significant risks if not properly managed. Contaminated water sources can lead to widespread public health issues such as cholera, dysentery, and other waterborne diseases (Fewtrell & Kay, 2008; World Bank, 2003). Additionally, improper disposal of liquid waste can result in environmental degradation, affecting soil quality and biodiversity (Adewumi et al., 2010; Kumar & Puri, 2012). Effective liquid waste management is critical for safeguarding both human health and the environment. It involves not only the collection and treatment of waste but also the establishment of infrastructure and policies that support sustainable practices (Hanjra et al., 2012; Goni, 2006). In many developing countries, including Nigeria, liquid waste management systems are often inadequate, leading to significant public health and environmental challenges (UNEP, 2015; WHO, 2018).

Community participation is recognized as a vital component of successful waste management strategies (Muller & Hoffman, 2001; Schubeler et al., 1996). It ensures that waste management practices are culturally appropriate, economically feasible, and meet the needs of the local population. Engaging communities in the planning and implementation processes can enhance the effectiveness and sustainability of waste management programme Cointreau, 2006; Wilson & Scheinberg, 2010). Studies have shown that community involvement can lead to improved waste segregation, recycling rates, and overall management efficiency (Henry et al., 2006; Marshall & Farahbakhsh, 2013). However, achieving meaningful community participation often requires addressing various socio-economic and institutional barriers (Nwanta et al., 2010; Okot-Okumu & Nyenje, 2011). In Nigeria, the concept of community-driven waste management is not entirely new, but its implementation has been inconsistent and faces numerous challenges (Onwughara et al., 2010; Agunwamba, 2003).

Nigeria, like many other developing countries, faces significant challenges in managing liquid waste. The country's rapid urbanization has outpaced the development of necessary infrastructure, leading to inadequate and often unsafe waste disposal practices (Ogunjuyigbe et al., 2014; Bello et al., 2016). Many urban areas lack comprehensive sewer

systems, and wastewater treatment facilities are often insufficient to handle the volume of waste generated (Oyelola & Babatunde, 2008; Adefemi & Awokunmi, 2009). Research indicates that a significant portion of liquid waste in Nigeria is managed by the informal sector, which, while playing a crucial role, often operates without regulation, leading to environmental pollution and health risks (Ojo, 2014; Agunwamba, 1998). There is a pressing need for formalizing and integrating these informal systems into the official waste management framework (Ladele et al., 2016; Ojewale, 2015).

Several barriers hinder effective community participation in liquid waste management in Akure. Socio-economic factors, such as poverty and lack of education, limit the ability of residents to engage in waste management activities (Ishaku et al., 2010; Uwadiegwu & Iyi, 2015). Additionally, cultural attitudes towards waste, where it is often seen as solely the government's responsibility, further complicate efforts to foster community involvement (Ekong, 2015; Arimah & Adinnu, 1995). Infrastructure deficiencies, such as the lack of adequate waste collection and treatment facilities, also pose significant challenges. Many households rely on poorly maintained septic tanks, and industrial effluents are frequently discharged into water bodies without adequate treatment (Akinbile & Yusoff, 2011; Oluwande, 1983). The limited financial and technical resources of local authorities further exacerbate these issues (Bello et al., 2016).

This study aims to assess the current state of community participation in liquid waste management in Akure, identify the challenges, and propose strategies to enhance community engagement. By addressing these issues, Akure can develop more effective and sustainable waste management systems, ultimately improving the quality of life for its residents and protecting the environment.

2. Statement of Problem

Effective liquid waste management is crucial for maintaining environmental health, public safety, and sustainable urban living. In many developing urban areas like Akure Metropolis, improper disposal and management of liquid waste have become persistent challenges, leading to environmental degradation, blocked drainage systems, the spread of waterborne diseases, and a general decline in the quality of life.

Despite various interventions by government agencies and environmental health bodies, there appears to be a gap in the level of awareness and participation of the community in proper liquid waste management practices. Many residents may lack adequate information about appropriate disposal methods or may not see waste management as a collective responsibility.

Furthermore, community involvement is often hindered by various challenges, including limited infrastructure, poor enforcement of regulations, socio-cultural factors, and lack of motivation or incentives for public participation. These barriers reduce the effectiveness of waste management programs and pose a serious threat to sustainable environmental practices in Akure Metropolis.

Therefore, this study seeks to investigate the level of community awareness and participation in liquid waste management practices, assess the residents' knowledge and engagement, and identify the key challenges preventing effective community involvement in the management of liquid waste within Akure Metropolis.

3. **Purpose of the Study**

The primary purpose of this study is to examine community awareness, participation, and challenges related to liquid waste management in Akure Metropolis. The study aims to explore how well residents understand liquid waste issues, the extent of their involvement in management practices, and the obstacles hindering effective participation.
Specifically, the study seeks to:

1. Evaluate the level of community awareness and participation in liquid waste management practices in Akure Metropolis.
2. Assess the extent to which residents of Akure Metropolis are informed about liquid waste management issues and engaged in relevant practices.
3. Identify the challenges and barriers to effective community participation in liquid waste management in Akure Metropolis.

4. Research question:

1 What are the level of community awareness and participation in liquid waste management practices in Akure Metropolis?
2 To what extent are residents of Akure Metropolis informed about liquid waste management issues and engaged in relevant practices?
3 What are the major challenges and barriers hindering effective community participation in liquid waste management in Akure Metropolis?

5. Research Hypotheses:

HO_1 There is no significant level of community awareness and participation in liquid waste management practices in Akure Metropolis.
HO_2 Residents of Akure Metropolis are not significantly informed about liquid waste management issues and are not actively engaged in relevant practices.
HO_3 There are no significant challenges and barriers hindering effective community participation in liquid waste management in Akure Metropolis.

6. Methodology

This study used a descriptive survey design to assess the extent of community awareness, participation, and challenges in liquid waste management in Akure Metropolis, Ondo State, Nigeria. A sample of 100 respondents was selected through a stratified random sampling technique to ensure representation from residential, commercial, and industrial zones. Data were collected using a structured questionnaire, which included items on awareness, participation, and barriers to effective waste management. The instrument was validated by experts and yielded a reliability coefficient of 0.74 after a pilot test.

Data were analyzed using SPSS software. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to interpret findings, guided by a decision rule for rating responses as high, moderate, or low.

7. Presentation of Results

Research Question 1: "What are the levels of community awareness and participation in liquid waste management practices in Akure Metropolis?"

Table 1: Responses from Respondents on the Level of Community Awareness and Participation in Liquid Waste Management Practices in Akure Metropolis

SN	Items	SA (%)	A (%)	D (%)	SD (%)	Mean	SD	Decision
1	I am aware of the importance of proper liquid waste management.	50	35	10	5	3.30	0.75	High awareness
2	Community members are informed about the dangers of improper liquid waste.	40	30	20	10	3.00	0.89	Fair awareness
3	I have attended a sensitization program on waste management.	25	30	25	20	2.60	0.98	Moderate awareness
4	I dispose of liquid waste properly in my household or business.	35	40	15	10	3.00	0.85	Good personal practice
5	My neighbors generally practice proper liquid waste disposal.	20	30	30	20	2.50	0.97	Mixed practices in community
6	Community members actively participate in local sanitation programs.	30	35	20	15	2.80	0.91	Moderate participation
7	I am willing to adopt new waste management practices or technologies.	45	35	10	10	3.15	0.84	Strong willingness
8	There are community discussions on liquid waste management issues.	20	25	30	25	2.40	1.00	Low engagement forums
9	Local authorities involve the community in waste management efforts.	15	20	35	30	2.20	1.02	Poor official-community linkage
10	Liquid waste management is a regular topic in community development meetings.	20	30	25	25	2.45	0.98	Irregular engagement

Grand mean = 2.64

The data presented in Table 1 reveal the levels of community awareness and participation in liquid waste management practices across Akure Metropolis. A review of the individual items shows that awareness of the importance of proper liquid waste management is high (Mean = 3.30), and a strong willingness exists among residents to adopt new waste management technologies (Mean = 3.15). Similarly, good personal disposal practices were noted (Mean = 3.00), reflecting individual efforts toward responsible waste behavior.

However, several critical indicators highlight a gap between personal awareness and community-level action. Community engagement in sensitization programs (Mean = 2.60), sanitation activities (Mean = 2.80), and local discussions (Mean = 2.40) show only moderate to low levels of participation. Furthermore, poor involvement of local authorities (Mean = 2.20) and irregular discussion of waste issues at development meetings (Mean = 2.45) reflect weak institutional support and communication mechanisms.

The grand mean score of 2.64 indicates an overall moderate level of awareness and participation in liquid waste management across the study area. While individual awareness is relatively strong, organized community participation and official engagement remain areas requiring significant improvement.

Research Question 2: To what extent are residents ofAkure Metropolis informed about liquid waste management issues and engaged in relevant practices

Table 2: Responses from Respondents on the Extent to Which Residents of Akure Metropolis Are Informed About Liquid Waste Management Issues and Engaged in Relevant Practices.

SN	Items	SA (%)	A (%)	D (%)	SD (%)	Mean	SD	decision
1	Lack of public awareness on liquid waste issues	50	30	15	5	3.25	0.78	High challenge
2	Inadequate infrastructure for liquid waste disposal	40	35	15	10	3.05	0.85	High challenge
3	Poor enforcement of sanitation laws	45	30	15	10	3.10	0.88	High challenge
4	Lack of community-based initiatives and programs.	30	35	20	15	2.80	0.92	Moderate challenge
5	Limited involvement of local leaders and stakeholders.	35	30	20	15	2.85	0.91	Moderate challenge
6	Financial constraints among residents.	40	30	20	10	3.00	0.89	High challenge
7	Absence of regular government/community collaboration.	25	35	25	15	2.70	0.93	Moderate challenge
8	Indifference or poor attitudes among residents toward waste management.	30	40	20	10	2.90	0.87	Moderate challenge
9	Inconsistent waste collection by relevant agencies.	35	30	25	10	2.90	0.91	Moderate challenge
10	Political interference or lack of political will to	20	25	30	25	2.40	1.00	Low challenge

support sanitation efforts.

Grand mean = 2.90

Table 3. provide insights into the major challenges and barriers that hinder effective community participation in liquid waste management in Akure Metropolis. Respondents strongly agreed that lack of public awareness (Mean = 3.25), poor enforcement of sanitation laws (Mean = 3.10), and inadequate infrastructure (Mean = 3.05) are significant barriers affecting community engagement. These factors suggest critical institutional and informational deficits that must be addressed to enable effective waste management participation. In addition, financial constraints (Mean = 3.00) and indifference or poor resident attitudes (Mean = 2.90) were identified as consistent behavioral and economic barriers. Lack of community-based initiatives, limited leadership involvement, and absence of collaboration between community and government all registered mean scores in the moderate challenge range (2.70–2.85), signaling gaps in grassroots mobilization and stakeholder engagement. Meanwhile, political interference received the lowest mean score (2.40), indicating that although it is a concern, it is perceived as less influential compared to structural and behavioral challenges.

The grand mean of 2.90 falls in the moderate barrier category, highlighting that while certain challenges are severe, the overall barrier landscape is moderate, with several issues nearing the high-risk threshold. The findings call for multi-level interventions including infrastructure improvements, policy enforcement, community sensitization, and inclusive leadership to enhance participation and promote sustainable liquid waste management in Akure Metropolis.

8. Discussion of Findings

This study investigated the dynamics of liquid waste management in Akure Metropolis with particular focus on three core areas: community awareness and participation, the extent of engagement and information among residents, and the challenges and barriers hindering effective participation. The findings from the three research questions provide a comprehensive understanding of both the behavioral and structural dimensions of liquid waste management in the study area. Also, the results indicate that individual awareness of liquid waste management is generally high. Many respondents acknowledged the importance of proper waste disposal (Mean = 3.30), expressed willingness to adopt new management technologies (Mean = 3.15), and reported practicing appropriate household disposal methods (Mean = 3.00). These findings suggest a promising foundation for public engagement at the individual level.

However, this individual awareness does not necessarily translate into strong community-wide participation. Participation in public sensitization programs (Mean = 2.60), sanitation activities (Mean = 2.80), and engagement in community discussions (Mean = 2.40) were rated moderately to poorly. Moreover, respondents rated local authority involvement (Mean = 2.20) and the inclusion of waste topics in community development meetings (Mean = 2.45) as low. This indicates a disconnect between personal responsibility and institutional/community involvement.

The grand mean of 2.64 for this section reflects a moderate level of awareness and participation, reinforcing the idea that while individual understanding is present, organized efforts and institutional collaboration are lacking.

Further analysis revealed that structural and systemic challenges significantly affect residents' ability to actively engage in waste management practices. Respondents identified several critical barriers including lack of public awareness campaigns (Mean = 3.25), poor enforcement of sanitation laws (Mean = 3.10), and inadequate infrastructure (Mean = 3.05) as major hindrances.

Financial limitations (Mean = 3.00), inconsistent waste collection services (Mean = 2.90), and behavioral issues such as public indifference (Mean = 2.90) were also highlighted. Although these scores fall within the moderate range, they are close to the high threshold, indicating their significant influence on overall community engagement. Interestingly, political interference (Mean = 2.40) was ranked lowest, suggesting that day-to-day operational challenges are more impactful than governance-related concerns.

The grand mean score of 2.90 for this research question affirms that engagement is constrained not by lack of interest, but by environmental, infrastructural, and social limitations.

Challenges and Barriers to Participation The third component of the study further emphasized the severity of the challenges facing effective community participation. The most pressing barriers identified include lack of awareness (Mean = 3.25), poor law enforcement (Mean = 3.10), and infrastructure deficiencies (Mean = 3.05). These mirror the findings from the second research question, reinforcing their significance.

Other issues such as limited community-based initiatives (Mean = 2.80), financial hardship (Mean = 3.00), and poor attitudes among residents (Mean = 2.90) reflect both institutional and behavioral gaps. Again, political interference (Mean = 2.40) ranked lowest, aligning with earlier insights that residents are more concerned with practical failures than political ones.
The grand mean of 2.90 for this section reflects a moderate overall barrier level, but one that borders on high, indicating a critical need for immediate and comprehensive intervention.

Table 4

Hypothesis One

H_{O1}: There is no significant difference in the opinions of respondents (residents, local officials, and waste management officers) on the barriers to effective community participation in liquid waste management in Akure Metropolis.

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	5.61	2	2.81	4.37	0.017*
Within Groups	34.75	54	0.64		
Total	**40.36**	**56**			

Post Hoc Test (Tukey HSD)for H_{O1}

Groups Compared	Mean Difference	Std. Error	Sig.
Residents vs Local Officials	0.42	0.16	0.018*
Residents vs Waste Officers	0.39	0.15	0.021*
Local Officials vs Waste Officers	0.03	0.13	0.875

p < 0.05 indicates statistical significance

Hypothesis 1 (H_{O1}):

The one-way ANOVA results ($F = 4.37$, $p = 0.017$) indicate that there is a statistically significant difference in the opinions of respondents regarding the barriers to community participation in liquid waste management. Therefore, the null hypothesis (H_{O1}) is rejected.

The Tukey HSD post hoc analysis shows that: Residents significantly differ in opinion from local government officials ($p = 0.018$) and waste management officers ($p = 0.021$).

There is no significant difference between the views of local officials and waste management officers ($p = 0.875$).

These results suggest that residents perceive greater or different barriers to effective participation in liquid waste management, possibly due to limited access to resources, inadequate communication, or weak program visibility. In contrast, officials and practitioners being more involved in planning and implementation may hold more optimistic views or may underestimate the challenges experienced at the community level.

Table 5

Hypothesis Two

HO_2: There is no significant difference in the opinions of stakeholders (residents, local officials, and waste management officers) on the major challenges hindering effective community participation in liquid waste management in Akure Metropolis.

Source	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	6.48	2	3.24	5.12	0.009*
Within Groups	34.07	54	0.63		
Total	**40.55**	**56**			

Post Hoc Test (Tukey HSD)for H_{O1}

Groups Compared	Mean Difference	Std. Error	Sig.
Residents vs Local Officials	0.41	0.15	0.014*
Residents vs Waste Officers	0.37	0.14	0.018*
Local Officials vs Waste Officers	0.04	0.12	0.765

p < 0.05 indicates statistical significance

Hypothesis Two (HO_2)

The ANOVA results ($F = 5.12$, $p = 0.009$) show a statistically significant difference among stakeholder groups in their perceptions of the challenges and barriers affecting community participation in liquid waste management. Therefore, the null hypothesis is rejected.

The Tukey HSD post hoc test reveals that: Residents perceive significantly greater challenges than local officials ($p = 0.014$) and waste management officers ($p = 0.018$),

There is no significant difference in perception between local officials and waste officers ($p = 0.765$). These findings suggest that residents experience the burden of the challenges more directly, such as the lack of awareness programs, infrastructure deficits, and financial barriers, and therefore report them more acutely. On the other hand, officials and practitioners who are involved in planning and oversight may not fully perceive or experience these obstacles at the grassroots level.

The grand mean of 2.90 supports this, indicating that the challenges are moderately severe overall, but residents' responses push some issues into the high-barrier category.

9. Conclusion

This study examined the level of community awareness, extent of engagement, and the challenges hindering effective community participation in liquid waste management in Akure Metropolis, Ondo State, Nigeria. The findings revealed that while individual awareness and willingness to adopt good waste management practices are relatively high, community-wide participation remains moderate, largely due to systemic and infrastructural challenges. Respondents highlighted major barriers such as lack of public awareness campaigns, poor enforcement of sanitation laws, and inadequate infrastructure. These were

confirmed by both descriptive statistics and inferential analysis. The grand mean scores (2.64 and 2.90) for the research questions suggest that engagement is present but constrained by various economic, institutional, and behavioral factors.

The ANOVA results revealed a significant difference in the perceptions of residents, local officials, and waste management officers. In particular, residents perceived the barriers to participation more acutely than the other groups, likely due to their direct experience with poor waste services, limited infrastructure, and insufficient government outreach. Officials and waste officers, on the other hand, tended to underestimate these challenges, possibly due to their position within policy and implementation structures.

These findings underscore the need for a multi-stakeholder, inclusive approach that recognizes the lived experiences of community members, while also holding institutions accountable for creating enabling environments for effective waste management.

10. Recommendations

1. Implement regular public awareness campaigns and integrate waste management education into school curriculums to foster a culture of responsibility.
2. Implement strict monitoring and enforcement mechanisms to ensure compliance.
3. Develop digital platforms for reporting, monitoring, and managing liquid waste issues. Conduct workshops and training programs for community members, local government officials, and waste management personnel.
4. Regular community meetings to discuss waste management issues and gather feedback.
5. Introduce incentives for communities and individuals who demonstrate exemplary waste management practices.
6. Ensure the provision of adequate and accessible liquid waste disposal facilities throughout the metropolis.
7. Develop and maintain efficient liquid waste collection systems with regular collection schedules.
8. Involve community members in monitoring and evaluating waste management practices.
9. Implement training programs to build capacity in effective liquid waste management practices.
10. Develop comprehensive regulations outlining responsibilities and penalties related to liquid waste management.

By addressing these recommendations, Akure Metropolis can develop more effective and sustainable waste management systems, ultimately improving the quality of life for its residents and protecting the environment.

11 References

Adeleke, B. O. (2017). Urbanization and its Impact on Waste Management in Akure Metropolis. Journal of Environmental Management.

Adeleke, B. O. (2017). *Environmental sanitation and waste management in Nigeria: Problems andprospects*. Lagos: Greenfield Publishers.

Adewumi, I. K., Ogedengbe, M. O., Adepetu, J. A., & Fabiyi, Y. L. (2010). Planning organic

Adefemi, S. O., & Awokunmi, E. E. (2009). The Impact of Industrial Effluents on Water Quality of Asa River, Ilorin, Nigeria. Nature and Science.

Adewole, A. T. (2009). Waste Management towards Sustainable Development in Nigeria: A Case Study of Lagos State. International NGO Journal.

Afolayan, O. S., & Ogunbode, E. B. (2011). Waste Management Practices in Nigeria: Impacts and Implications. Journal of Environmental Science and Engineering.

Agunwamba, J. C. (1998). Solid Waste Management in Nigeria: Problems and Prospects. Waste Management.

Agunwamba, J. C. (2003). Analysis of socioeconomic and environmental impacts of waste stabilization pond and unrestricted wastewater irrigation: Interface with WHO guidelines. *Water Resources Management*, 17(1), 55–72.

Akinbile, C. O., & Yusoff, M. S. (2011). Environmental Impact of Leachate Pollution on Groundwater Supplies in Akure, Nigeria. International Journal of Environmental Science and Development. fertilizer industry in Nigeria: Prospects and challenges. *Journal of Applied Sciences Research*, 6(3), 248–256

Akinola, A. O. (2018). Community participation in environmental sanitation in Nigeria: A study of selected communities in Oyo State. *African Journal of Social Sciences*, 9(2), 15–27.

Akinola, S. R. (2018). Participatory Planning and Involvement of Community-based Organisations in Waste Management in Nigeria. African Journal of Environmental Science and Technology.

Arimah, B. C., & Adinnu, R. A. (1995). Market Failure in Urban Solid Waste Management in Nigeria: A Theoretical Framework for Sustainable Development. Journal of Waste Management.

Awomeso, J. A., et al. (2010). Waste Disposal and Pollution Management in Urban Areas: A Workable Remedy for the Environment in Developing Countries. Environmental Research Journal.

Bello, I. A., et al. (2016). Challenges and Opportunities in Waste Management in Nigeria. Environmental Management.

Cointreau, S. J. (2006). Occupational and Environmental Health Issues of Solid Waste Management: Special Emphasis on Middle- and Lower-Income Countries. World Bank Group.

Cornwall, A. (2008). Unpacking 'Participation': Models, Meanings and Practices. Community Development Journal.

Cleaver, F. (1999). Paradoxes of Participation: Questioning Participatory Approaches to Development. Journal of International Development.

Ekong, E. E. (2015). Rural Sociology: An Introduction and Analysis of Rural Nigeria. Dove Educational Publishers.

Fewtrell, L., & Kay, D. (2008). Health Impact Assessment for Sustainable Water Management. IWA Publishing.

Fewtrell, L., & Kay, D. (2008). Microbial quality of water supply. In *WaterQuality: Guidelines, Standards and Health* (pp. 59–82). London: IWA Publishing.

Goni, M. (2016). Solid waste management in Maiduguri, Nigeria. *Environmental ManagementJournal*, 1(2), 23–35.

Goni, I. B. (2006). Water and Sanitation Challenges in Developing Countries: The Nigerian Experience. Journal of Water Resources Development.

Hanjra, M. A., Blackwell, J., Carr, G., Zhang, F., & Jackson, T. M. (2012). Wastewater irrigation and environmental health: Implications for water governance and public policy. *InternationalJournal ofHygiene and Environmental Health*, 215(3), 255–269.

Henry, R. K., et al. (2006). Municipal Solid Waste Management Challenges in Developing Countries – Kenyan Case Study. Waste Management.

Kumar, H. D., & Puri, A. N. (2012). *Environmental management: Concepts and approaches*. New Delhi: Anmol Publications.

Marshall, R. E., & Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. *Waste Management*, 33(4), 988–1003.

Nwanta, J. A., Onunkwo, J. I., & Ezenduka, E. V. (2010). Analysis of parasitic helminths found in fresh faecal waste from different locations in South-Eastern Nigeria: Public health implic ations. *Asian Pacific Journal of Tropical Medicine*, 3(5), 367–370.

Okot-Okumu, J., & Nyenje, R. (2011). Municipal solid waste management under decentralisation in Uganda: Present status and challenges. *Waste Management*, 29(2), 1026–1031.

Onwughara, I. N., Nnorom, I. C., Kanno, O. C., & Chuka, M. (2010). Urban solid waste generation in Port-Harcourt metropolis and its implications for waste management. *Research Journal of Environmental and Earth Sciences*, 2(4), 209–215.

UNEP. (2015). *Global waste management outlook*. United Nations Environment Programme. https://www.unep.org.

WHO. (2018). *Sanitation safety planning: Manual for safe use and disposal of wastewater, greywater and excreta*. World Health Organization.

Wilson, D. C., & Scheinberg, A. (2010). Valorisation of recyclable materials in developing countries. *Waste Management & Research*, 28(2), 82–90.

World Bank. (2003). *Water resources sector strategy: Strategic directionsfor World Bank engagement*. Washington, DC: World Bank.