6TH International Conference and Workshop on Engineering and Technology Research (ICWETR) LAUFET 2025: 217-224

Sustainable Urban Waste Management in Ilorin, Nigeria: Challenges, Opportunities, and Pathways for Improvement

[1]Mohammed S. A.

[1]Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University, Zaria

mohbashxp@gmail.com

https://www.laujet.com/

Keywords:

Sustainable waste management, Quantitative analysis, Environmental sustainability.

Corresponding Author:
mohbashxp@gmail.com
+2349031415869

ABSTRACT

Rapid population growth has added unmatched burdens to the urban waste management systems. Urban waste management is a critical challenge in rapidly growing cities like Ilorin, Nigeria, where population growth, urbanization, and industrialization have led to increased waste generation. Inadequate waste disposal practices, such as open dumping and burning, contribute significantly to environmental pollution and public health risks. The deterioration of the urban environment reinforces incorrect disposal habits as people do not see their impact on such an environment. This study aims to provide a quantitative assessment of waste generation, collection, disposal and management practices in Ilorin, by employing statistical techniques and the DPSIR (Drivers, Pressures, State, Impacts, and Responses) framework, to identify sustainable practices and pathways for waste management in the city. Data were collected through household surveys, waste audits, and interviews with waste management authorities. The findings reveal significant gaps in waste collection coverage, inadequate disposal methods, and limited public awareness of recycling. Food waste is the most generated waste, with 97% across the metropolis. A significant 87% of the population was aware of the need for proper waste disposal. Still, a mere although more than 87% of the respondents were aware of the need for proper waste management, only 27% adopted proper waste management practices within the metropolis. The study recommends integrating community engagement, policy reforms, public education, and investment in infrastructure for a more sustainable and efficient waste management system that aligns with global environmental goals.

INTRODUCTION

The evolution of urban population and technological advancement has a significant impact on the global generation of urban waste, as indicated by Oladipupo *et al.* (2024), Khosravani *et al.* (2023), Alkaradaghi *et al.* (2021), and Angmo and Shah (2020). With urbanization and population increases, there is a direct correlation with the rise in global urban waste production by individuals, households, industrial, and urban development activities (Gowda *et al.,* 2023; Uddin and Abedin, 2021; Sufiyan, 2020). Waste generation was estimated to be above 2.24 billion tonnes in 2020 and 2.1 billion tonnes in 2021 by the World Bank (2022) and Vishnu *et al.* (2021), respectively. This surge can be attributed to population growth and density, and the increased material demands for food and other essential materials to fulfill basic life necessities or improve lifestyles. These wastes have direct and indirect negative effects on livelihood, health, and environmental degradation.

Urban waste generated in Africa are estimated to be 80–90% of recyclable with an average of 57% of the waste being wet biodegradable organic waste, while 13% is plastic, paper 9%, glass 4%, metal 4% with others of textiles, construction and demolition waste etc recorded 13% and presents the opportunity of waste recycling as a

secondary resource since only 4% of the waste generated in Africa is currently recycled (Hoornweg and Bhada-Tata, 2013; Van Wyk, 2018). However, urban waste is an important source of income, especially in developing countries (Tahir *et al*., 2020). In most cases, the daily generated waste is indiscriminately disposed of in several places with total disregard for the environmental implications for the immediate populace and surroundings, such as land, drains, or water bodies (Olalekan *et al*., 2020). This poses a growing risk to human health, air, and water quality, and an increasing source of greenhouse gas emissions

The United Nations Environmental Programme (UNEP, 2020) highlighted the inability of most state and local government authorities in the collection and disposal of solid waste, probably due to inadequate financial resources and infrastructure, for the change in the dynamics of waste generation, leading to increased waste mismanagement, thereby resulting in pollution. Challenges of poor waste management in the developing countries and sub– Saharan African and in Nigeria particularly include amongst others weak organizational structures, lack of appropriate skills, inadequate budgets, weak legislation, lack of enforcement, low public awareness, corruption, conflict, political instability, lack of political will and essentially at the heart of the problem is the failure in governance (Godfrey *et al*., 2019).

Adeniyi (2014) observed that it is a widespread practice for most generated waste within urban areas to be indiscriminately disposed of within or outside the metropolis without any particular disposal or management strategies, especially where there is accessibility to open spaces, inadequate waste disposal facilities and inefficient laws to tackle offenders. Ilorin metropolis is largely bedeviled by waste mismanagement as many areas are characterized by indecent dumping of refuse in highly inappropriate places such as the middle and sides of roads, gutters, and other unauthorized disposal sites. This problem is easily noticeable during the rainy season, where gutters and roads are filled up with both solid and liquid waste they obstructing the free flow of water, thereby resulting in floods and unpleasant scenes. While the approved dump sites are quite few, illegal dump sites keep springing up in virtually every nook and corner of the metropolis.

A comprehensive framework is thus needed to address these issues, thus the utilization of DPSIR analysis framework in this study to understand underlying drivers and key factors of urban waste management and developing evidence-based responses that would ensure effective waste management strategies in Ilorin metropolis which will adequately that protect the environment, reduce land degradation, conserve resources, and improve the quality of life and overall well-being of the populace within the study area.

Ilorin, the Kwara State capital and a rapidly growing metropolitan city with unique socio-economic dynamics, is facing ardent environmental challenges related to urban waste management. These challenges must be effectively tackled to ensure the cleanliness and orderliness of the city, especially within the metropolis. The increasing volume of waste generation and the inefficiency in management of these waste is reflected in indiscriminate dumping and accumulation of waste on the streets and roadsides, and low rate of waste collection which not only puts strain on infrastructure and waste management systems, but also have socioeconomic impacts as well as reducing quality of lives, deterioration of the urban environment in the form of air, water and land pollution that poses risks to human health and the environmental wellbeing (Adeniyi, 2014; Mberu, *et al.,* 2016; Ibikunle, 2022). These issues require urgent and inclusive measures to review the current urban waste management

strategies within the Ilorin metropolis, though the limiting factors are the inadequacy or total absence of systemic data and a skeletal framework of standard urban waste management strategies.

MATERIALS AND METHODS

Ilorin is located on latitude 8° 24' N and 83° 6' N, longitude 4° 10' E and 4° 36' E (Figure 1) between the south-western and middle belt of Nigeria. The Ilorin metropolis housed the Ilorin East, West and South LGAs and comprises 35 electoral wards, with a land area of 765 km^2 and an estimated population of 1,392,650 (NPC, 2006). Ilorin metropolis is an agglomerate of government parastatals, private sector entities, companies, businesses, residential areas and various educational institutions, with an interconnectivity of roads and other public facilities.

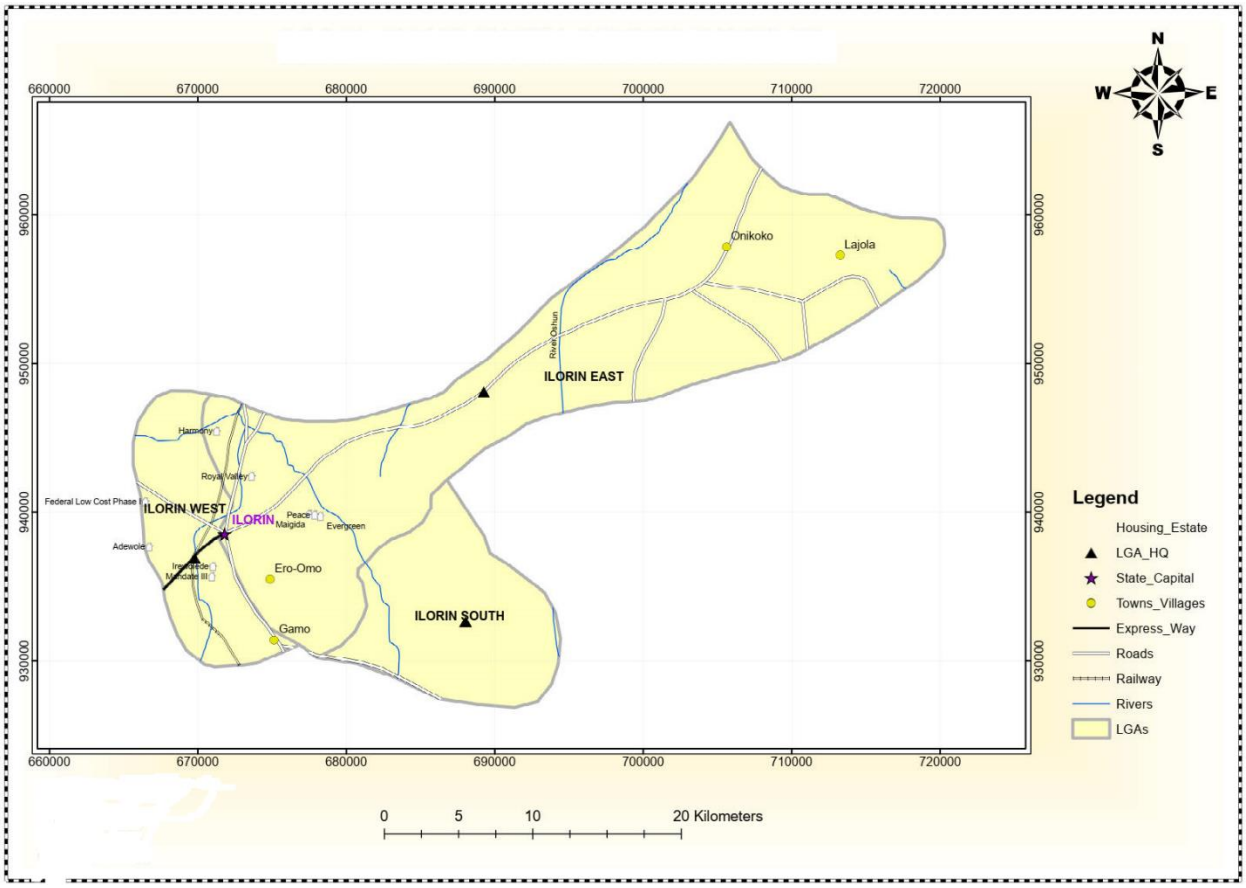

Figure 1: Map of Ilorin Metropolis

Data for this study were obtained from both primary and secondary sources. The primary data was collected through a field survey by distributing a structured questionnaire to 250 respondents within the study area. While the secondary data were obtained from relevant agencies, textbooks, a Multi-stage sampling technique was employed for this study. Purposive sampling was used in selecting the residential locations within the Ilorin metropolis, while random sampling was used in selecting respondents. Information was collected on the challenges of waste disposal and management for residents. Ilorin metropolis, comprising three (3) LGAs, was purposely chosen due to the high population concentration, human activities, and waste generation. Thirty (30) households, business premises and public areas were randomly selected to assess the rate of waste generation. Results were analyzed using inferential and descriptive statistics; frequency tables and charts were also employed in data presentation.

RESULTS AND DISCUSSION

The tables were generated from the field survey. A total of 250 copies of the questionnaire were administered to the respondents, however, only 216 (88.6%) copies of the questionnaire were retrieved and used for analysis.

Socioeconomic Characteristics of the Respondents

The socioeconomic characteristics of the respondents in the study area were generated from the questionnaires and the results are presented in Table 1. The majority of the respondents are still in their active years and this facilitates increased generation of urban waste and several management practices. This, therefore, means that each household could significantly contribute to larger and effective waste management practices in the study area.

Table 1: Socioeconomic Characteristics of Respondents

	Frequency	Percentage
Gender		
Male	134	61.9
Female	82	38,1
Total	216	100
Age group		
Below 20	22	10
21-40	79	36.4
41-60	86	39.8
➢ 60	29	13.8
Total	216	100
Marital Status		
Married	178	82.4
Divorced	10	4.8
Widow/widower	8	3.6
Single	20	9.2
Total	216	100
Education		
Postgraduate	38	17.5
HND / B.Sc	87	40.3
National Diploma (and others)	56	26
Secondary School Certificate	35	16.2
Total	216	100

The table showed that 61.9% and 38.1% of the respondents were male and female, respectively. The table also indicated that 10% of the respondents were below the age of 20 years, 36.4% ranged between 21 – 40, while 39.8% and 13.8% were between 41-60 and 60 years above, respectively. Thus, the majority of respondents are adults and young adults. The marital status of the respondents revealed that 82.4% of the respondents were married, 4.8% were divorced, 9.2% were single, and 3.6% were widowed. This implied that the majority of the respondents are married. Also, the majority of the respondents have higher formal education in varying degrees; 17.5% have postgraduate degrees, 40.3% are HND and University degree holders, 26% have National Diploma (and its equivalents), while only 16.2% of the respondents have a secondary school certificate. This result is in line with the work of Aderinoye-Abdulwahab *et al.* (2022) on Assessment of Waste Management Practices of Rural Dwellers in Kwara State, Nigeria

Urban Waste Generation

Different types of waste are generated in urban areas, but the common ones include food waste (including vegetables, organic and synthetic food materials), plastics, papers, clothes (and other human adornments), wood waste (from domestic and industrial uses, cooking and other related activities). These common types of waste are identified by respondents and presented in Table 2. Multiple responses were allowed to provide a comprehensive list of waste generated.

Table 2: **Types of Urban Waste Generated**

Types of waste	Frequency	Percentage
Food waste	210	97.2
Clothes, shoes, bags, waste	165	76
Plastics (all forms)	179	82.8
Glass, bottles,	157	73
Wood waste (including ashes)	74	34
Paper	129	

It is evident from the results that food waste is the most common type of waste in an urban area; this is keenly followed by domestic waste in the form of clothes, shoes, bags and other human adornment materials. 82.8% of the respondents stated that they generate plastic waste, while 59.7% of the respondents agreed that they generate paper waste. The least waste generated was wood waste due to the availability and ease of cooking with liquefied petroleum gas (LPG).

Waste Handling and Management Practices.

A list of methods of waste collection, separation and disposal in the study was generated and ranked accordingly in percentage from the responses of respondents. This is presented in Table 3.

The majority of respondents, 197 (54.4%), collect their waste in containers with covers; likewise, only 66 respondents (18.2%) separate their waste before disposal. This is in line with the outcome of the study by Modebe and Ezeama (2011), which reported that 85% of households in Awka stored their waste in closed containers outside the house and the majority of the respondents (87.8%) did not sort their waste prior to disposal. A poor waste while composting, land filling, and incineration, with 5.8%, 16.4 and 5.8% respectively, are the least adopted waste management practices in the study area was also revealed with 47% practicing open dumping,

22.5% preferred open (uncontrolled) burning, management practices in Ilorin, Kwara State. This finding, however, does not agree with the findings of Aderinoye-Abdulwahab *et al.* (2022), which reported incineration as the most favoured waste management practice of rural dwellers in Kwara State.

Table 3: Waste Handling and Management Practices

Practice items	Frequency	Percent
Method of waste collection		
Bags	52	14.4
Containers with covers	197	54.4
Containers without covers	113	31.2
Waste separation		
Waste separation before disposal	66	18.2
No waste separation before disposal	296	81.8
Frequency of waste disposal in a week		
Every day	70	19.3
Every alternate day	102	28.2
Once a week	190	52.5
Method of solid waste disposal practiced		
Open dumping	169	47
Composting	21	5.8
Burning	82	22.5
Burying	09	2.5
Land filling	60	16.4
Incineration	21	5.8

CONCLUSION AND RECOMMENDATIONS

The study established the common types of urban waste generated, methods of handling, disposal and management practices adopted within Ilorin metropolis. The majority of the respondents had a positive attitude towards proper waste management, even though there was evidence to the contrary, considering the discovery that the most prevalent methods of disposal were open dumping and burning. These are inappropriate as they constitute environmental pollution, foster land degradation and negative avenues for pests and diseases in the study area. Proper waste disposal management is essential to sustain healthy living conditions in any environment. Strict adherence to appropriate waste management practices in any community will insulate the inhabitants from detrimental and hazardous environmental conditions and improve the living standard of the people.

Education, awareness campaigns and general sensitization on waste management (collection, disposal, and reuse/recycling) should be adequately and effectively provided by relevant government parastatals and community-based NGOs. It is also recommended that Government agencies should enforce regulatory policy and

probably introduce payment plans according to the volume of waste generated and landfill bans to divert material waste from landfills. This will induce a reduction in waste generation and encourage reuse/recycling.

The DPSIR should be extensively deployed in further studies as it allows the involvement of stakeholders (residents, waste management authorities, environmental organizations, policymakers, researchers, and relevant government agencies responsible for waste management and environmental protection) in the assessment of sustainable urban waste management in the study area. This framework will provide encompassing solutions to a wide range of urban waste management issues intertwined with human activities, environmental pressures, ecological degradation and climate change impacts.

REFERENCES

Adeniyi, T. F. (2014). Assessment of Solid Waste Management in Samaru, Zaria, Nigeria. Unpublished M.Sc thesis, Ahmadu Bello University, Zaria

Aderinoye – Abdulwahab, S.A., Adesokan, J.B.,and Owutuamor Z.B., (2022). Assessment of Waste Management Practices of Rural Dwellers in Kwara State, Nigeria. *Journal of community development research (Humanities and Social Sciences)* 15(3) 71 – 84

Alkaradaghi, K., Ali, S. S., Al-Ansari, N., Ali, T., and Laue, J. (2021). Quantitative Estimation of Municipal Solid Waste in Sulaimaniyah Governorate, Iraq. Recent Advances in Environmental Science from the Euro-Mediterranean and Surrounding Regions (2nd Edition) : Proceedings of 2nd *Euro-Mediterranean Conference for Environmental Integration (EMCEI-2)*, Tunisia, 265–270.

Angmo, S, and Shah, S (2020). Assessment of waste-to-energy generation potential of municipal solid waste: a case study of South Delhi. *Journal of Science and Technology*, 5, 162-170

Godfrey, L., M.T. Ahmed, K.G. Gebremedhin, J.H. Katima, S. Oelofse, O. Osibanjo, and A.H. Yonli. 2019. Solid waste management in Africa: Governance failure or development opportunity. *Regional Development in Africa* 235 (10.5772):235–241

Gowda, B., Gurusiddappa, L., and Kalikeri, S. (2023). Study on occupational health hazards of municipal solid waste workers - a review. *World Journal of Environmental Biosciences*, 12(1), 24-31

Hoornweg, D., Bhada-Tata, P. and Kennedy, C. (2013) 'Waste production must peak this century'. *Nature,* 502(7473), 615–617

Ibikunle, R. (2022). Exploration and prediction of wet season municipal solid waste for power generation in Ilorin metropolis, Nigeria. *Journal of Material Cycles and Waste Management*, 24(4), 1591-1602.

Khosravani, F., Abbasi, E., Choobchian, S., Jalili G. Mahdi (2023). A comprehensive study on criteria of sustainable urban waste management system: using content analysis. *Scientific Reports* 13(1**)** 1-15

Mberu, B., Ziraba, A.K.., and Haregu, T.N (2016). A review and framework for understanding the potential impact of poor solid waste management on health in developing countries. *Archives of Public Health.* 74(55): 1-11.

Modebe, I. and Ezeama, N.N. (2011). Public Health Implications of Household Solid Waste Management in Awka South East, Nigeria. *The Journal of Public Health* (1)1 1 – 6

National Population Commission (NPC) (2006) Nigeria National Census: Population Distribution by Sex, State, LGAs and Senatorial District: 2006 Census Priority Tables (Vol. 3). http://www.population.gov.ng/index.php/publication/140-popn-distri-by-sex-state-jgas-and-senatorial-distr-2006

Oladipupo, S.B., Ayanshola, A.M., Adeleye, A.T. and John, K.I (2024) Assessment of plastic waste generation and management in residential locations, Ilorin, Nigeria: DPSIR analysis and circular economy pathway. *Journal of Umm Al-Qura University for Applied Science.* 10**(4)**, 624–639

Olalekan RM, Oluwatoyin O and Olalekan A (2020) Health Impact Assessment: A tool to Advance the Knowledge of Policy Makers: Understand Sustainable Development Goals: A Review. *ES Journal of Public Health*; 1(1); 1002

Sufiyan, I. (2020). Assessment of public participation on solid waste disposal in the southern Kaduna state, Nigeria. *Journal of Waste and Biomass Management,* 2(1), 15-18.

Tahir, N., Arshad, J., Ali, H., Syed, M.B., Waqas, A., Muhammad, A., and Syed, M. H. (2020). Chapter 14 - Types, sources and management of urban waste, Editor(s): Pramit Verma, Pardeep Singh, Rishikesh Singh, A.S. Raghubanshi, *Urban Ecology,* Elsevier, P. 239-263,

Uddin, S. and Abedin, M. (2021). Segregation of plastic waste from the solid waste stream: Bangladesh perspective. *International Journal of Engineering Materials and Manufacture* 6(4), 324-331

United Nations Environmental Programme (UNEP) (2020). Assessment of Solid Waste Management in Developing Countries

Van Wyk, L (2018). Towards distributed grids: A paradigm shift for waste infrastructure in Africa. In: Godfrey L, editor. *Africa Waste Management Outlook*. Nairobi, Kenya: UNEP (2018). 158-161. Available from: https://t.co/BYjYbHpwwz

Vishnu, S., Ramson, S., Senith, S., Anagnostopoulos, T., Abu-Mahfouz, A., Fan, X., Srinivasan, S. & Kirubaraj, A. (2021). IoT-enabled solid waste management in smart cities. *Smart Cities*, 4(3), 1004-1017.

World Bank (2022). Solid Waste Management. Understanding Poverty and Urban Development. Available at https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management.