

The Role of Waste Management in Achieving Sustainable Development Goals (SDGs) in Nigerian Cities

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Abstract. The management of municipal solid waste (MSW) in Nigeria poses significant challenges, particularly in rapidly urbanising cities. This paper examines the critical role of effective waste management in achieving Sustainable Development Goals (SDGs) within this context. With urbanisation leading to increased waste generation, the study highlights the urgent need for sustainable practices that align with SDGs. Through an analysis of current waste management practices, the paper identifies key players, including the government, the private sector, and informal waste collectors, while addressing the challenges they face, such as inadequate infrastructure and public awareness. Case studies from cities like Lagos and Abuja illustrate successful initiatives and the importance of inclusive policies that integrate informal sectors, public-private partnerships and their role in urban waste management. The paper advocates for strategic improvements in waste management systems, emphasising recycling and waste-to-energy technologies, integrating technological innovations for more efficient waste processing, and fostering public awareness campaigns and stakeholders' collaboration to promote responsible waste disposal. Ultimately, it calls for a concerted effort to enhance regulatory frameworks and promote sustainable waste management practices that not only mitigate environmental impacts but also contribute to public health and the achievement of SDGs in Nigerian cities.

Keywords: Waste Management, Sustainable Development Goals (SDGs), Urbanisation, Recycling, Nigerian Cities.

1. Introduction

1.1 Background on Waste Management in Nigeria

The world is facing unprecedented urbanisation, with cities experiencing rapid growth and transformation. Nigeria, Africa's most populous country, is no exception. The country's urban population is projected to increase from 50 million in 2015 to over 250 million by 2050 (United Nations, 2018).

Nigeria has one of Africa's highest urbanization rates, with over half its population residing in urban areas and projected to grow further in the coming decades (UN-Habitat, 2020). This rapid urban expansion, driven by rural-urban migration, has far outpaced the development of adequate infrastructure, leaving waste management systems strained and ineffective (Olukanni & Mnenga, 2015). Major cities such as Lagos, Ibadan, Abuja, and Kano face severe congestion and escalating waste generation from households, vehicles, and commercial establishments (Dauda & Osita, 2003). The country produces over 32 million tons of waste annually, yet less than 20% is collected through formal systems (FRN, 2020; Braimah, 2023). Consequently, most waste ends up in landfills or is openly burned, exacerbating environmental and health challenges (Aladelokun & Ayiti, 2024). This combination of growing urban populations and inadequate infrastructure underscores the urgent need for effective waste management to ensure urban sustainability and public health. The challenges of waste management in Nigeria are multifaceted. They include insufficient infrastructure for waste collection and disposal, lack of public awareness regarding proper waste management practices, and the predominance of informal waste management sectors that operate outside regulatory frameworks (Amusan et

al., 2023; [Ugwuanyi & Isife 2012](#)). In addition, environmental impacts such as flooding and the proliferation of vector-borne diseases are directly linked to poor waste disposal practices (Amusan et al., 2023; Agbo, 2023). Given this, effective waste management is crucial for enhancing the quality of life in urban areas and achieving sustainable development, particularly in Nigerian cities (FRN, 2020). This paper seeks to explore how effective waste management practices can contribute to achieving the Sustainable Development Goals in Nigerian cities. It analyses the current waste management systems and identifies the roles played by stakeholders in fostering sustainable urban development. It also provides actionable recommendations for enhancing waste management practices that align with the broader objectives of the SDGs while addressing the unique challenges faced by Nigerian cities.

1.2 Overview of Sustainable Development Goals with Emphasis on SDGs 11, 12 and 13

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, provides a global framework for addressing pressing social, economic, and environmental challenges. Among these goals are SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action) which are all relevant to waste management practices. The SDG 11 emphasizes the need for inclusive and sustainable urbanization. This will include effective waste management as a key component (Sheriffdeen, 2024). While the SDG 12 calls for responsible consumption patterns that minimize waste generation, reuse and promote recycling, the SDG 13 highlights the importance of climate action. Thus, recognizing that effective waste management can significantly reduce greenhouse gas emissions associated with landfills and incineration processes (Amusan, et al., 2023; [Ugwuanyi & Isife 2012](#)).

1.3 Current State of Waste Management in Nigeria

The rapid urbanization, population growth, and changing consumption patterns in Nigeria have led to a significant increase in waste generation across its cities. As at 2020, an approximate 32 million tons of wastes were reported to be generated annually, with urban areas contributing the majority (Braithwaite, 2023). Lagos, the largest city with an estimated population of 21 million, was reported to have produced about seven million tons of waste annually at a rate of 0.92 kg per capita per day whereas, other cities like Ibadan, Abuja, Kano, Kaduna, and Port Harcourt have also faced increasing waste generation rates ([Odiana & Ikudayisi, 2021](#)). The rates of waste generation have strained their existing management systems (Agbo, 2023). Despite varying scales of waste generation, these cities share common challenges such as insufficient infrastructure and inadequate regulatory frameworks for collection, disposal, and recycling (Braithwaite, 2023).

Waste management in Nigerian cities involves multiple stakeholders yet faces systemic challenges. Formally, responsibility has shifted from resource-constrained local governments to state authorities, with private companies engaged in major cities such as Lagos and Abuja (Muhammad & Marzuki, 2024; Basel-Nigeria, 2011). However, private sector operations are often hindered by inadequate infrastructure and a weak regulatory framework. Simultaneously, the informal sector plays a significant role through waste pickers who recover recyclables from dumpsites, though they frequently work in unsafe and exploitative conditions. Public participation remains limited due to insufficient education on proper waste practices, constraining the effectiveness of local initiatives (Muhammad & Marzuki, 2024; Basel-Nigeria, 2011).

Key operational challenges include a persistent data deficit on waste generation and sources, which undermines strategic planning and leads municipal authorities to rely on estimations.

This inefficiency contributes to inadequate collection coverage and frequent dumpsite overflows. Infrastructure gaps are also critical—many cities lack sufficient collection vehicles, bins, transfer stations, and treatment facilities, resulting in only 20–30% of waste being formally collected (Amusan et al., 2023). The scarcity of engineered landfills and incinerators perpetuates reliance on open dumping, while recycling efforts are stifled by limited facilities, outdated technology, and insufficient policy support (Amusan et al., 2023), (Ugwuanyi & Isife, 2012).

Low public awareness further complicates these issues, as limited knowledge of waste segregation and recycling encourages indiscriminate disposal (Ugwuanyi & Isife, 2012). The cumulative effect includes environmental degradation such as water contamination, clogged drainage, soil pollution, and biodiversity loss from non-biodegradable waste, alongside public health risks including cholera and respiratory infections. Strengthening data systems, investing in infrastructure, enhancing regulation, and promoting public engagement through civil society collaboration are therefore essential to improving segregation, recycling, and overall waste management outcomes (Amusan et al., 2023), (Ugwuanyi & Isife, 2012).

2. The Role of Waste Management in Achieving Sdgs

Waste management plays a vital role in advancing the United Nations Sustainable Development Goals (SDGs), contributing to environmental sustainability, public health, and economic prosperity. As outlined in national and academic sources (Sheriffdeen, 2024; FRN, 2020), effective waste systems prioritize waste reduction, recycling, and sustainable consumption, which in turn foster resource efficiency and climate resilience. This paper examines the contribution of waste management to three key SDGs: SDG 11, 12 and 13.

2.1 SDG 11: Sustainable Cities and Communities

SDG 11 aims to create cities that are inclusive, safe, resilient, and sustainable. Waste management is fundamental to urban sustainability as it directly impacts the cleanliness, health, and resilience of urban environments (Kaza et al., 2018). As cities grow, efficient waste management systems become critical to avoid health hazards, environmental degradation, and loss of resources (FRN, 2020).

2.1.1 Waste Management as a Key Factor in Making Cities Sustainable

Sustainable waste management is essential for creating resilient urban environments. Effective solid waste management (SWM) practices can significantly enhance urban liveability, reduce pollution, and promote public health. Cities that implement sustainable waste management strategies can mitigate the adverse effects of rapid urbanization, which often leads to increased waste generation and environmental degradation (Green.org, 2024; Abubakar et al., 2022). Improved SWM contributes to SDG 11 by promoting efficient resource use, reducing landfill reliance, and fostering community engagement in waste reduction initiatives. For instance, cities that adopt comprehensive recycling programs not only divert waste from landfills but also create job opportunities in the recycling sector, thus supporting local economies (Green.org, 2024; Bowan, 2023).

Cities that have implemented waste management systems that focus on recycling and waste-to-energy technologies contribute not only to waste reduction but also to creating cleaner air and reducing environmental damage. This approach is integral to achieving SDG 11's goal of creating sustainable cities and communities (United Nations, 2015).

2.1.2 Strategies for Improving Waste Collection, Recycling, and Waste-to-Energy Projects

To enhance waste management systems in urban areas, several strategies can be employed:

i) **Enhanced Waste Collection Systems:** Investment in efficient and equitable waste collection to improve service delivery is critical. This includes increasing the frequency of collection in high-density urban areas and ensuring waste collection services reach informal settlements (BurCell Technologies, 2025).

ii) **Recycling Initiatives:** Promoting segregated waste collection (e.g., separating recyclables from general waste) is essential for effective recycling initiatives. Establishing community-based recycling programs encourages residents to participate actively in waste segregation and recycling efforts, leading to high recycling rates and diverting a large portion of waste from landfills (BurCell Technologies, 2025; Koop et al, 2019). Cities that invest in robust recycling programs not only reduce the volume of waste sent to landfills but also recover valuable materials, contributing to environmental sustainability by conserving natural resources and lowering greenhouse gas emissions (BurCell Technologies, 2025; Abdulhamid et al., 2024). Public awareness campaigns can further educate citizens on the importance of recycling (SDG Action, 2024; Ram & Bracci, 2024)

iii) **Waste-to-Energy Projects:** Investing in waste-to-energy technologies not only reduces the volume of waste sent to landfills but also generates renewable energy. These projects can help cities meet their energy needs sustainably while minimizing environmental impacts (Green.org, 2024).

2.2 SDG 12: Responsible Consumption and Production

SDG 12 encourages sustainable consumption and production patterns; it is directly linked to waste management. Minimising waste and optimising resource use across industries and households is fundamental for achieving this goal (United Nations, 2015). Waste management thus, reduces the environmental impacts of overproduction and consumption, promoting sustainability in consumer behaviours and industrial practices.

2.2.1 Promoting Recycling, Reuse, and Reducing Waste through Public Awareness Campaigns

Effective public awareness campaigns are vital for fostering responsible consumption patterns. These campaigns should emphasise the principles of reduce, reuse, and recycle (the 3Rs), encouraging individuals and businesses to minimise waste generation (Ram & Bracci, 2024; Don't Waste Services, 2022). Educational programs that highlight the environmental benefits of recycling can lead to increased participation in local recycling initiatives.

2.2.2 Role of Industries in Waste Management (e.g., packaging and waste reduction)

Industries are vital in reducing waste through the adoption of circular economy principles. The production processes in various industries (especially in packaging), produce large volumes of waste, much of which is not recycled or reused. However, several industries have begun implementing sustainable production strategies, such as:

Eco-Friendly Packaging: Companies are increasingly adopting biodegradable or recyclable packaging. For instance, Coca-Cola have committed to reducing plastic waste and switching to recyclable packaging for many of their products through their “World Without Waste Strategy” that has signalled a renewed focus on our entire packaging lifecycle—from how

bottles and cans are designed and produced to how they're recycled and repurposed (The Coca-Cola Company, 2020).

Designing for Environment and Reusability: Manufacturers are incorporating designs that make products easier to disassemble and recycle. This “design for the environment” approach reduces waste and promotes resource efficiency. For example, many furniture products nowadays in Nigeria, be it local or imported, such as bookshelves, chairs, and tables, are made with modular parts that can be easily separated into different material types (wood, metal, plastic) for recycling at the end of their life (Bourgeois, 2023).

Closed-Loop Systems: Industries are investing in closed-loop systems, where materials are reused within the same manufacturing process. This not only reduces waste but also minimises the extraction of new resources. Good examples of such initiatives in sustainable waste management in Nigeria are in the Plastic Recycling Industry and Agricultural Industry. These industries are adopting innovative practices, such as transforming plastic waste into reusable products and utilising organic fertilisers, to reduce waste and promote sustainability (SME, 2025).

2.3 SDG 13: Climate Action

SDG 13 focuses on taking urgent action to combat climate change and its impacts. Waste management practices play a crucial role in mitigating climate change, particularly in addressing greenhouse gas (GHG) emissions. Landfills are significant sources of methane emissions, a potent greenhouse gas. Reducing waste sent to landfills and investing in waste-to-energy technologies can play a critical role in achieving SDG 13 (Amusan et al., 2023; [Ugwuanyi & Isife, 2012](#)).

With respect to the contribution of Waste Management to GHG emissions, it directly impacts climate change mitigation efforts. By improving SWM practices such as increasing recycling rates and reducing reliance on landfills, cities can substantially decrease their greenhouse gas emissions (Ram & Bracci, 2024; Abubakar et al., 2022). According to the Intergovernmental Panel on Climate Change (IPCC), methane reduction in waste management can play a significant role in achieving climate goals (Bogner et al., 2007). Additionally, several countries have implemented landfill gas capture systems that collect methane for energy generation, reducing harmful emissions and contributing to climate change mitigation. Nigeria is actively pursuing landfill gas capture systems, particularly in Lagos, as a means to reduce methane emissions and contribute to climate goals (Global Methane Initiative, 2012). While progress has been made through specific projects, significant challenges remain that require ongoing attention and investment to ensure effective implementation and sustainability.

Furthermore, waste-to-energy (WtE) projects, besides their roles in promoting Sustainable Cities and Communities (SDG 11) are a growing sector in combating climate change (SDG 13). These technologies convert non-recyclable waste into electricity, heat, or fuel, generating renewable energy while reducing landfill waste. WtE processes include incineration, gasification, and pyrolysis, contributing to the goals of SDG 13 by reducing environmental impacts and diverting waste from landfills (UNEP, 2019).

WtE technologies have been effectively implemented in numerous countries, proving their waste management and electricity generation capability. Globally, there are 1795 WtE plants, with 80% located in developed nations and 20% in developing countries, predominantly in Asia. (UNEP, 2019), (GIZ, 2017). The total installed capacity in 2023 was 72.4 Gigawatt (GW) (Global Energy Monitor, 2024). Leading this effort are China, Japan, Europe, and the USA, which have advanced WtE systems that convert a significant portion of their waste into energy.

These countries use technologies such as incineration, anaerobic digestion, and gasification to achieve high energy recovery rates while minimising environmental impacts (Joshi et al., 2024), (Khan, 2022).

3. Waste Management Initiative: A Case of Lagos And Abuja

3.1 Innovative Approaches

Effective waste management is vital for maintaining a clean and healthy environment, and it plays a critical role in achieving multiple SDGs, particularly SDGs 11, 12, and 13. By improving waste collection, recycling, and waste-to-energy projects, as well as adopting better waste management practices, cities can significantly contribute to creating sustainable urban environments, promoting responsible consumption, and mitigating the impacts of climate change. In Nigeria, Lagos and Abuja have emerged as exemplary models through their innovative approaches to waste management, and this section explores the successful initiatives implemented in these two cities.

3.1.1 Lagos State: Waste Management Policies and Practices

Lagos, being the most populous city in Nigeria, faces significant waste management challenges. To address this, the Lagos State Government established the Lagos Waste Management Authority (LAWMA) in 1977 (LAWMA, 2025).

i) Overview of Lagos Waste Management Authority (LAWMA) and its Impact. The Lagos State Waste Management Authority (LAWMA) is a parastatal of the Lagos State Government, responsible for managing waste generated in the state through a structured waste collection, transportation, and disposal system. LAWMA's primary goal is to improve the environment, positively impacting living conditions, health, and sanitation. The Authority evolved from the Lagos State Refuse Disposal Board (LSRDB), which was established in 1977 (LAWMA, 2025).

Over the years, LAWMA's responsibilities have expanded to include the management of commercial, industrial, and medical waste, highway sanitation, drainage cleaning, and the construction of waste management facilities. LAWMA collaborates with the Lagos State Ministry of Environment and has initiated reforms in waste bill collection and increased waste recycling efforts. In 2020, LAWMA established an academy to educate and sensitise the public on waste management practices (LAWMA, 2025).

ii) Public-Private Partnerships and their Role in Urban Waste Management

The waste management system in Lagos State is overseen by the Ministry of the Environment, with a strong emphasis on private sector participation (Adeyemi, 2004). Historically, the Lagos State Government has enlisted the help of competent foreign companies to handle municipal waste collection, equipped with advanced waste compactors and recycling machinery (Adeyemi, 2004). PSPs, have been participating in Lagos' waste management since 1997, aiming to provide cost-effective waste disposal services. Funding for PSP projects comes from a diverse range of sources, including government budgetary allocations, private initiatives, multilateral agencies, stock exchange market bonds, bank loans, and external donors, showcasing a collaborative approach to tackling waste management challenges in the state (Idowu et al., 2011).

LAWMA plays a crucial role in waste management in collaboration with PSPs, who are private companies responsible for collecting, transporting, and disposing of various types of waste. These companies specialise in managing domestic, commercial, marine, drainage, and medical

waste, utilising their own vehicles and adhering to the guidelines and operating procedures set by LAWMA, which oversees and regulates their activities to ensure effective waste management (Idowu, 2023), (Chikezie, 2021).

A study carried out by Idowu in 2023 found that over 420 PSPs are operating across Lagos State's 20 Local Government Areas. This collaboration between PSPs and LAWMA has proven to be mutually advantageous. Under the collaborative arrangement, the PSPs receive a percentage of the waste bill payments collected, while the rest goes to the government. This arrangement ensures PSPs are compensated for their services, while the government gets revenue to support waste management initiatives (Idowu, 2023).

Lagos State has made history as the first state in Nigeria and the first mega city in Sub-Saharan Africa to pioneer a ground-breaking approach to waste management by collaborating with Private Sector Partners for waste collection. This innovative strategy has proven highly effective, with PSPs and LAWMA successfully handling municipal solid waste collection and disposal in Lagos State for over a decade. The fruitful partnership between LAWMA and PSPs underscores the vital importance of public-private collaborations in tackling the complex waste management challenges of a cosmopolitan city like Lagos (Aliu et al., 2014).

The Lagos State Government is taking proactive steps to tackle plastic waste management by introducing policy guidelines and a legal framework for plastic utility. This move aims to ensure sustainable plastic waste management and promote a cleaner environment. The government also plans to educate the public on effective waste management practices through public awareness initiatives, thereby fostering a culture of sustainability and environmental responsibility (Adeshina, 2020).

The Lagos Waste Management Authority (LAWMA) has made significant strides in improving waste management in Lagos through successful partnerships with private companies. These collaborations have yielded numerous benefits, including job creation and poverty alleviation through the Private Sector Participation (PSP) system. This initiative has not only generated employment opportunities in the private sector but has also enhanced the efficiency and effectiveness of waste management services (Keesman, 2020).

The partnerships have also facilitated access to funding, with private companies investing in waste management infrastructure and thereby reducing the financial burden on the government. Notable examples of successful public-private partnerships in Lagos include the Blue Box Recycling Initiative and the partnership with RecyclePoints. The Blue Box Recycling Initiative encourages households to separate recyclable materials from general waste, which are then collected and sorted at Community Recycling Centers. The partnership with RecyclePoints has registered 8,000 households, enabling them to exchange recyclables for goods or cash, while also employing waste pickers. These initiatives demonstrate the effectiveness of public-private collaborations in improving urban waste management (Keesman, 2020).

3.1.2 Abuja: Addressing Waste Management in the Federal Capital

Abuja, the capital city of Nigeria, faces unique challenges related to rapid urbanization and population growth with attendant high rate of waste generation. Waste management in Abuja is overseen by the Abuja Environmental Protection Board (AEPB) (Abuja Digest, 2023).

i) Approaches to Waste Segregation and Recycling in Abuja: The AEPB is committed to building a cleaner and greener Abuja. A variety of measures aimed at reducing the environmental impact of waste, including segregation of waste at the source has been implemented in the city by various stakeholders.

a) AEPB's Recycling Initiatives among others include (Abuja Digest, 2023):

Development of facilities for solid waste management in the FCT, including transfer stations, a plastic recycling plant, and a bailing plant.

Blue Bin Program: The AEPB has a "Blue Bin Program" to facilitate the collection of recyclable materials.

AEPB, in conjunction with UNIDO, is raising awareness among stakeholders to reduce and manage the hazards of plastic waste.

The Federal Capital Territory Administration's (FCTA) commitment to recycling plastic waste to protect the environment and safeguard residents' lives.

Development of Strategic Solid Waste Management Plan for 2011-2015 and 2017-2021 (Abuja Digest, 2023), (AEPB, 2022).

b) Collaborative Projects and Awareness:

Abuja Urban Lab: The AEPB is part of the collaborative effort in the Abuja Urban Lab initiative, which aims to address solid waste management challenges in Abuja Municipal Area Council (AMAC). The Urban Lab seeks to raise awareness about responsible waste disposal and recycling through strategic partnerships (Echono, 2023), (Baldeon, 2023).

- **UNIDO Partnership:** UNIDO is working with AEPB to strengthen its Data Management System by fully engaging digitization for greater efficiency (Abuja Digest, 2023).
- **City-to-City Exchange with Lagos:** The Abuja Urban Lab participated in a city-to-city exchange with the Lagos State government to learn from Lagos's successful waste management models (Moreiras, 2024).

c) Broader Recycling Initiatives:

Chanja Datti Recycling Co Ltd: Chanja Datti is involved in collecting and processing plastic waste and provides incentives for waste collection (Chanja Datti, 2024).

Reverse Vending Machines: Nigeria is automating plastic waste management with locally fabricated reverse vending machines to boost recycling efforts in Abuja (UNIDO, 2024)

Eco-Green Africa: This organization implements recycling programs, including designing color-coded bins to easily sort waste and trading recyclable waste for cash (WAFA, 2025).

Cash4Trash initiative: The Cash4Trash initiative is a community development program that aims to promote recycling and change consumption habits among individuals and communities (Chanja Datti, 2022).

ii) Challenges and Successes in Implementing Waste Management Systems:

While Abuja has made strides in waste management, several challenges remain (Imam et al., 2007), (Oyeniyi, 2011). The rapid population growth, driven by labour migration and the relocation of government headquarters, has led to a significant increase in waste generation (Agbo, 2023), (Oyeniyi, 2011). There is a need for more effective waste sorting at the source to reduce the amount of waste requiring disposal (Imam et al., 2007). Waste collection has been a challenge for several years in Abuja with increasing generation rates, urban development and expansion, changes in consumption patterns and life styles (Ondachi et al., 2023).

However, there have been successes, such as collaboration with private waste management companies and initiatives like AEPB (Abuja Environmental Protection Board) and Recycling Initiative Nigeria to streamline collection services and increase public participation in waste sorting. Cooperation among communities, the informal sector, the formal waste collectors, and the authorities is necessary if recycling rates are to increase (Imam et al., 2007). Furthermore, Abuja is exploring waste-to-energy projects that help to mitigate the environmental impact of waste disposal, transforming waste into electricity (Ondachi et al., 2023). Small-scale waste composting plants could promote employment, income generation, and poverty alleviation (Imam et al., 2007).

3.2 Government Policies and Regulations

The National Policy on Solid Waste Management (2020) is a key guiding document, but it's not the only relevant National Policy on Waste Management. A comprehensive overview also includes policies listed below, as they provide additional context and address specific aspects of waste management (FRN, 2020; ELRI, 2008).

i) National Policy on Environmental Sanitation (2005): This policy sets out to achieve a clean and healthy environment for all Nigerians and recommends effective, efficient, and sustainable waste management strategies, including waste minimization, reuse, recycling, and energy recovery. While strong on strategy, its impact has been limited by inconsistent implementation and funding, leading to a persistent gap between policy goals and on-the-ground sanitation. Effective policies require dedicated budgetary allocation and a clear, accountable implementation framework at sub-national levels.

ii) National Environmental Standards and Regulations Enforcement Agency (NESREA): NESREA is the key agency responsible for enforcing environmental regulations and standards in Nigeria, including those related to waste management. The agency's enforcement capacity is often hampered by inadequate resources, logistical constraints, and overlapping jurisdictional mandates with other agencies. Regulatory effectiveness depends not just on legal authority but on sustained institutional capacity-building and inter-agency coordination.

iii) National Environmental Policy (NEP) (1999): The NEP provides a broad framework for environmental management in Nigeria, setting out principles and goals for protecting the environment and promoting sustainable development. As a broad framework, it lacks specific, time-bound targets and measurable indicators, making progress difficult to assess and enforce. Overarching policies should be coupled with specific action plans and monitoring benchmarks to translate principles into tangible outcomes.

iv) National Waste Management Policy (NWMP) (2007): The NWMP provides a comprehensive framework for waste management in Nigeria, outlining strategies for waste reduction, collection, transportation, treatment, and disposal. The framework has not been uniformly adopted across states, leading to fragmented execution and weak integration of the waste hierarchy. National frameworks must be explicitly tailored and adopted at state and local government levels to account for varying capacities and conditions.

v) Waste Management Regulations (2013): These regulations provide detailed guidelines for waste management in Nigeria, specifying the responsibilities of waste generators, collectors, and disposers. These guidelines are often poorly enforced, with limited monitoring and few penalties for non-compliance, reducing their deterrent effect. Regulations without consistent enforcement and monitoring mechanisms fail to change behavior; compliance requires visible accountability.

vi) Extended Producer Responsibility (EPR) Policy (2019): The EPR policy requires manufacturers to take responsibility for the waste generated by their products, incentivizing them to design products that are easier to recycle or reuse. Overtime, rollout has been slow, with unclear implementation modalities, weak monitoring of producer obligations, and limited incentives for compliance. EPR schemes require strong regulatory oversight, clear operational guidelines, and incentives or sanctions to ensure manufacturer engagement and system viability (FRN, 2020; ELRI, 2008).

3.2.1 National Policy on Solid Waste Management

Nigeria has developed a National Policy on Solid Waste Management aimed at guiding effective and sustainable waste management practices (FRN, 2020), (Odogwu, 2021). This policy was officially presented to stakeholders on May 10, 2021, to promote a clean and healthy environment that supports socio-economic development (Odogwu, 2021). Key objectives include encouraging private sector investments in waste management, conserving natural resources, creating wealth and employment from waste, and reducing public health issues associated with waste accumulation. The policy also focuses on developing waste management infrastructure and promoting the "Reuse, Reduce, Recycle, and Recovery" initiative (FRN, 2020), (Olugbode, 2021).

The policy addresses historical challenges in Nigeria's waste management, including the lack of comprehensive frameworks, inadequate infrastructure, and ineffective monitoring mechanisms. It emphasises sustainability by integrating economic and ecological principles (FRN, 2020). The Federal Government plays a crucial role in implementing this policy by developing and updating guidelines, setting standards for equipment, preparing a Solid Waste Master Plan, and providing technical assistance to states and local governments. Additionally, the government is tasked with sourcing funds for capacity building, establishing a national data bank on waste management, and promoting environmental education and awareness. Compliance with the policy is mandatory for all involved in waste management services (FRN, 2020), (Olugbode, 2021).

3.2.2 Evaluation of the Effectiveness of the Policies in Promoting Sustainable Practices

The effectiveness of Nigeria's solid waste management policies in promoting sustainable practices is heavily dependent on their implementation (Odogwu, 2021). The National Policy on Solid Waste Management was developed to transform waste into a valuable resource, thereby addressing the increasing volume of solid waste through innovative management techniques (Olugbode, 2021). This policy aims to create wealth and employment by harnessing waste, emphasizing private sector involvement, establishing small-scale recycling plants, and enhancing technical capacities in both public and private sectors. Additionally, it highlights the importance of regulations, enforcement mechanisms, and public awareness campaigns to ensure efficient waste management practices (Mande, 2005).

Despite these efforts, several challenges persist, including the need to update outdated legal frameworks, address inadequate funding, and improve monitoring and evaluation systems. Furthermore, solid waste management in Nigeria is a concurrent legislative responsibility shared among the Federal Government, States, and Local Government Councils. This means that alongside national policies, various state and local regulations also play a crucial role (FRN, 2020). Effective implementation of these policies requires collaboration and coordination across all levels of government, as well as active participation from the private sector and the public.

4. Discussion and Conclusion

4.1 Summary of Key Findings

The review of existing literature highlights that effective waste management is crucial for achieving the Sustainable Development Goals (SDGs) in Nigerian cities (Amusan, 2023). The importance of proper waste disposal cannot be overstated, as it has significant impacts on public health, environmental sustainability, and economic development (United Nations, 2020). However, Nigerian cities face numerous challenges in managing waste, including inadequate infrastructure, insufficient funding, and lack of public awareness. Despite these challenges, several successful waste management initiatives have been implemented in cities like Lagos and Abuja, demonstrating the potential for effective waste management in Nigeria (Amusan, 2023).

Furthermore, government policies and regulations, such as the National Environmental (Waste Management) Regulations, have been instrumental in promoting sustainable waste management practices, including recycling, waste-to-energy, and composting (FRN, 2020; Mande, 2005). These initiatives and policies demonstrate the potential for effective waste management in Nigerian cities and highlight the need for continued investment and support in this area.

4.2 Recommendations for Policymakers and Stakeholders

To improve waste management practices and mitigate environmental impacts, while also contributing to public health and the achievement of Sustainable Development Goals (SDGs) in Nigerian cities, the following policy strategies are recommended:

4.2.1 Strengthening Regulatory Frameworks to Support Sustainable Waste Management: A strong regulatory framework is the cornerstone of effective waste management. Governments should enact and update policies that align with sustainability goals and provide clear guidelines for waste generation, disposal, and recycling (FRN, 2020). This can include establishing national waste reduction targets, mandates for recycling, and clear criteria for waste classification. Regulatory frameworks should also integrate circular economy principles, promoting a system where waste is minimized, resources are reused, and materials are continually cycled through the economy (Omeiza-Michael, 2021). Furthermore, strengthening waste management infrastructure through adequate funding and technical assistance is essential to ensure that policies can be effectively implemented at local and regional levels (Mande, 2005).

4.2.2 Strengthening Waste Management Regulations and Enforcement: Robust enforcement mechanisms are critical for ensuring compliance with waste management regulations (FRN, 2020). Governments should strengthen existing waste management laws by providing clear penalties for non-compliance, along with incentives for good practices (Mande, 2005). Enforcement should focus on major sources of waste generation, such as industrial facilities, commercial establishments, and municipalities. Additionally, waste management regulations should be regularly reviewed and updated to adapt to new challenges and emerging waste streams, such as electronic waste and single-use plastics (Odogwu, 2021; FRN, 2020). (Empowering local authorities to monitor waste practices, conduct audits, and implement corrective measures will also improve compliance and ensure that waste management systems are functioning effectively (World Bank Group, 2018).

4.2.3 Incentivising Recycling, Waste-to-Energy and Composting Initiatives: These initiatives have the potential to promote sustainable waste management practices in Nigeria.

Incentives such as financial rewards, low-interest loans or tax breaks can be offered to companies and individuals who actively engage in recycling, waste-to-energy, and composting programs (EU, 2019; Mande, 2005). Additionally, promoting the use of compost as a soil conditioner can also be an effective strategy. Public-private partnerships can further enhance these initiatives; create employment and wealth opportunities while achieving a clean and healthy environment for all Nigerians (Mande, 2005).

4.2.4 Integration of Technology to Improve Efficiency in Waste Collection and Processing: The integration of technology can improve efficiency in waste collection and processing. Appropriate technologies and digital solutions should be adopted. Also, technological innovations can improve waste sorting, processing, and disposal (Allen-Taylor, 2023).

4.2.5 Public Awareness and Education: Campaigns should be organized to promote waste reduction and responsible disposal. Local communities should be engaged in waste management solutions (Allen-Taylor, 2023). Sensitizing all relevant stakeholders and enabling them to agreeably adopt a realistic action plan for implementation is also very important. There is a need for attitudinal changes of Nigerians through re-orientation, sound education and technological innovations in the development of a new sustainable approach for Municipal Solid Waste (MSW) management in Nigeria (Amusan et al., 2023). People should be made aware of waste separation and sorting through the school curriculum, social media, television, radio, and billboards (Allen-Taylor, 2023).

4.2.6 Collaboration between Stakeholders: Collaboration between the government, private sector, and civil society is essential (Allen-Taylor, 2023). A community-private sector participation policy for MSW management is recommended (Amusan et al., 2023). The Lagos State Waste Management Authority, policymakers, waste collectors, community representatives, residents, and other relevant stakeholders should decide which waste belongs in the 3-in-1 and 2-in-1 bins and set the bin prices for the pay-as-you-throw system after proper consultation (Allen-Taylor, 2023).

4.2.7 Engaging International Organizations: International organizations can provide support and expertise (Ram & Bracci, 2024; Abubakar et al., 2022). Sustainable SWM can help meet several United Nations' Sustainable Development Goals (SDG), such as ensuring clean water and sanitation (SDG6), creating sustainable cities and inclusive communities (SDG11), mitigating climate change (SDG13), protecting life on land (SDG15), and demonstrating sustainable consumption and production patterns (SDG12) (Abubakar et al., 2022).

4.3 Conclusion

In conclusion, achieving sustainable waste management in Nigerian cities requires a collaborative call to action, urging the government, stakeholders, and citizens to work together towards solutions that benefit urban communities (Adeodun, 2024). This collaboration should involve public-private partnerships, as seen in successful models in cities like Lagos and Abuja, where private contractors enhance waste collection efficiency (Adeodun, 2024; Idowu, 2023). It is crucial to foster a culture of accountability and responsibility through public education, promoting waste reduction, reuse, and recycling (Idowu, 2023). By integrating innovative recycling programs, strategic partnerships, increased awareness, consistent enforcement of waste management laws and monitoring mechanisms, urban centres can turn the tide on pollution and create healthier, more sustainable environments that align with the goals of sustainable development (Covenant of Mayors in Sub-Saharan Africa, 2024; Idowu, 2023).

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