



# REVIEWING THE CONCEPT WASTE HIERARCHY GUIDELINE AND THE ENVIRONMENTAL PROBLEM OF WASTE MANAGEMENT IN LAGOS STATE, NIGERIA

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## ABSTRACT

Environmental and human health problems associated with waste are not limited to littering, pollution, disposal etc. Over the years waste has become a major problem in many developing countries as their population increases. As the volume of waste continues to increase in Lagos State, there is a need to adopt an efficient sustainable policy framework such as the Waste Framework Directive 2008/98/EC (WFD) - also known as the Waste Hierarchy Guideline – that will help resolve part of the plastic waste problems in Lagos State. In this review article, Lagos is used as a case study due to its growing population, urbanization, and industrialization. This literature examines the environmental problems caused by the failure to implement the Waste Hierarchy Guideline as a policy that allows the pursuit of proper waste disposal, management, and environmental protection in Lagos State. As a result, the paper recommends incorporating waste hierarchy options into Lagos state waste management policies to achieve resource conservation, an aftercare-free waste treatment system, and protection for mankind (human health) and the environment.

**Keywords:** *Environmental Problems, Lagos State, Nigeria, Plastic Recycling, Plastic Waste, Waste, Hierarchy Guideline.*

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## **INTRODUCTION**

Improper waste management is characterized by environmental and human health issues arising from industrial production, population growth, and changing consumption patterns. The annual rate of global municipal waste generation has reached approximately 2.01 billion tonnes, according to World Bank estimation, and is expected to increase significantly to 3.4 billion tonnes by 2050 (Kasa et al., 2018). Also, a report from the UN HABITAT, (2010) confirmed that cities around the world spend a larger portion of their recurrent budget on solid waste management. Waste is known as a pressing environmental issue, especially in developing countries like Nigeria, where some states are rapidly becoming urban cities. For example, Lagos state is one of Nigeria's emerging urban states, with a dense population, rapid urbanization, and a rapid rise of the middle class over the last decade. The increasing in human population, economic progress, and urbanization in Lagos state have exacerbated the environmental problem of waste management. Likewise, the improper waste management is harmful to mankind (human health) and the environment. Similarly, waste burning, and open dumping pollute the environment with harmful gases and soil pollution through leachates (Iqbal, 2020). However, the growing improper waste management in Lagos state is of concerned to various environmental manager, which require immediate appropriate solutions, as well as the effectiveness of a strong policy framework. Adopting a sustainable policy framework that extends the life cycle of these scarce resources and thus conserves nature is therefore required. One such policy is the Waste Framework Directive 2008/98/EC (WFD), also known as the waste hierarchy guideline. The failure to implement the Waste Hierarchy Guideline policy in Lagos state has resulted in environmental problems, according to this review paper. This literature review article proposes the integration of waste hierarchy to achieve resource conservation, an aftercare-free waste treatment system, and protection for mankind (human health) and in the pursuit of environmental protection and proper waste disposal management.

## **WASTE MANAGEMENT IN LAGOS STATE**

Lagos state transforms into a mega-city, and one of the world's fastest growing cities (LBS, 2010). It is divided into 20 local government areas (LGA) and 57 local council development areas (LCDA), with a population of approximately 23 million people in 2015. (Demographic Dividend Lagos State Government, 2015). The state is in southwestern Nigeria, sharing borders with neighboring states as well as the Guinea Coast of the Atlantic Ocean (Lagos Eko project, 2013). The city is known as Nigeria's commercial center, with a population growth rate of approximately 600,000 people per year and a population density of 5,926 people per square kilometer (Oshodi, 2013). According to the Lagos Eko Project (2013), the metropolitan area of the state covers approximately 37% of the landmass and is home to approximately 85% of the city's residents. Lagos state is growing faster each year due to rising population, urbanization, and industrialization. The rate and density of population growth have serious implications for waste generation and management. As the volume of waste generated increased significantly between 1945 and 2020, this could explain the commendable services provided by the Lagos state ministry of environment through the Lagos state waste management authority (LAWMA) (see Table 1) (Orsanya and Olukanni, 2018).

**Table 1:** A Synopsis of Lagos Solid Waste Management

<b>Year</b>	<b>LAWMA Coverage</b>	<b>Population Estimate</b>	<b>Generation Rate/Person/Day</b>	<b>Tons/Day</b>	<b>Collection Trucks</b>
1945	> 200	40,000	0.1 (E)	4+	1
1967	1,200	1, 500, 000	0. 12 (E)	180	6 (2Trucks)
1976	1,500	3, 200, 000	0. 2	640	100 (35Trucks)
1990	3,500	5, 000, 000	0. 25	1, 250	210 (70Trucks)
2006	> 4,000	18, 000, 000	0. 4	7, 200	1,200 (400-500 Trucks)
2008	> 4,000	18, 000, 000	0. 5	9, 000	1,500 (500-650 Trucks)
2020	> 4,000	30, 200, 000	0.7	20, 000	4,000 (1000 Trucks)

**Source:** (Orsanya and Olukanni, 2018)

The Lagos state government is responsible for waste management in accordance with Nigeria's federal system of government, which is accomplished by LAWMA. According to the administrative structure, the Lagos state ministry of environment delegated responsibility for waste collection, transportation, and disposal to LAWMA to achieve the goals of environmental sustainability and sanitation in Lagos. Previously, the Lagos State Government established the Lagos State Refuse Disposal Board (LSRDB) in 1977, and it was renamed the Lagos State Waste Disposal Board (LSWDB) in 1981 due to the added responsibilities of waste management (Oresanya and Olukanni, 2018). The organization was renamed Lagos State Waste Management Board in 1995. (LAWMB). By 1999, the establishment had gained veto power over all waste fractions in the state, and the name was changed to the Lagos State Waste Management Authority (LAWMA) (Oresanya and Olukanni, 2018). The majority of LAWMA services are delivered through public-private partnerships (PPPs) led by groups of investors known as Private Sector Participants (PSPs) operators. PSP operators' activities have improved waste collection, management, and disposal to a certain extent in Lagos State (Idowu et al., 2011). Furthermore, PSP operators' activities are decentralized to maximize productivity in waste collection, management, and disposal (Lawal, 2010). Even with the efforts of decentralization, sustainable waste management remains a pressing issue due to the lack of a substantial policy framework that should have aided in waste prevention, reuse, reduction, and recycling. The implementation of policies such as the waste hierarchy will help the state of Lagos achieve environmental sustainability.

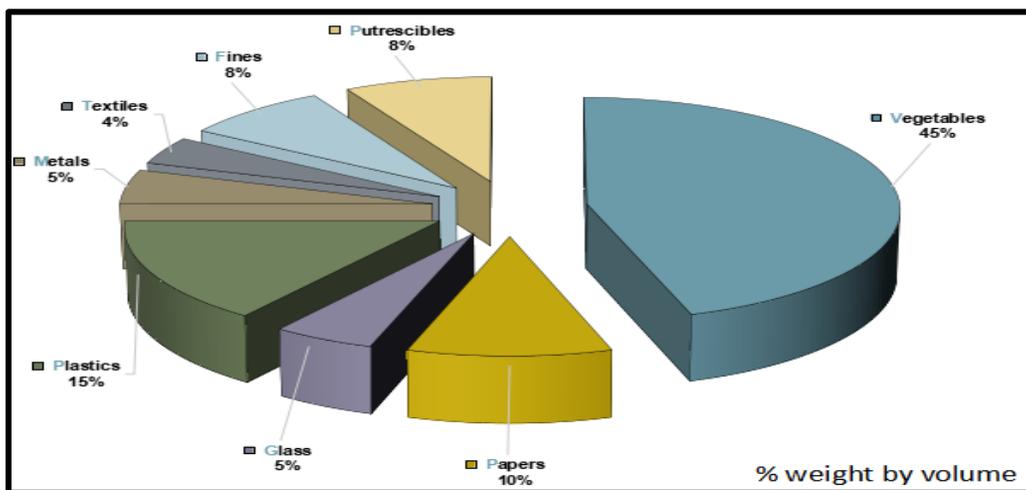
## WASTE GENERATION, COLLETION AND MANAGEMENT IN LAGOS STATE

The process of disposing of waste materials is known as waste management (normally those produced because of human activities). Waste management encompasses several processes, including waste collection, transportation, processing, recycling, disposal, and monitoring. Population, urbanization, and industrialization, as in Lagos state, have significant implications for waste generation and management. This explains why different types of waste are generated daily (see Table 1 and Figure 1 and 2).

**Table 1.** Lagos State Waste Characterization

Types of waste	w/v%
Vegetables	45
Plastic	15
Paper	10
Fines	8
Putrescibles	8
Glass	5
Metal	5
Textile	4

Source: LAWMA, 2015



**Figure 1:** Lagos State Waste Characterization

Source: LAWMA, 2015



**Figure 2:** Example of Waste Generated in Lagos

As waste is generated in a mass volume, in Lagos, it is necessary institute proper collection, disposal and management mechanism. Waste should be managed in a way that they are harmless to human and animal life, the ecology, and the environment. To put it another way, the primary goal of waste management is to protect humans, animals, the environment, and the environment. On the other hand, the household waste collection system in Lagos state is completely unsustainable. This is since household residents do not have waste disposal, including the recyclable (blue recyclable bin), which should have encouraged plastic waste separation and sorting. However, the waste bins provided by the Lagos state government are limited and can be purchased residents at exorbitant prices ranging from 30,000 to 40,000 Naira (50-60 Euro or 40-50 USD, respectively) online or at LAWMA office (Lawmabin.com, 2022). Given this, some Lagos residents have discovered alternative methods of disposing of their waste, such as using plastic sacs and bags instead of bins (see Figures 3 A and B).



**Figures 3 A and B:** Waste Collection Disposal Bins are Used by Some Residents

Furthermore, the situation deteriorated to the assigned collector collecting a mixed fraction of all types of waste together, primarily with waste bags, sacks, and plastic buckets (Figures 4A and B)



**Figures 4 A and B:** Waste Collection System in Lagos State

As shown in Figures 4 A and B, there was no separation as waste was prepared to be transported directly to dumpsites. Scavengers then search and sort for all other types of recyclable materials on dumpsites. Scavengers on dumpsite recover valuable materials such as aluminum, scrap metal, glass, and paper and sell to recycling companies. Scavenger activities are considered environmentally and economically beneficial because they have become a major source of income for some people. As the scavengers recover valuable materials, the remaining waste is burned. This is a type of waste treatment used in most Lagos state dumpsites to reduce waste volume. In Lagos state, waste is treated directly by open burning on dumpsites, which is an unsustainable practice that pollutes the environment and endangers residents' health. Furthermore, Lagos operates three landfill sites, also known as dumpsites, located in Oloshosun, Agege, and Iyana-Iba, where the combustion method is used. Dioxins and furans are also released when plastics are burned. An outbreak of fire at the Oloshosun dumpsite in 2018 highlighted one risk of settling near the dumpsite (Figure 5).



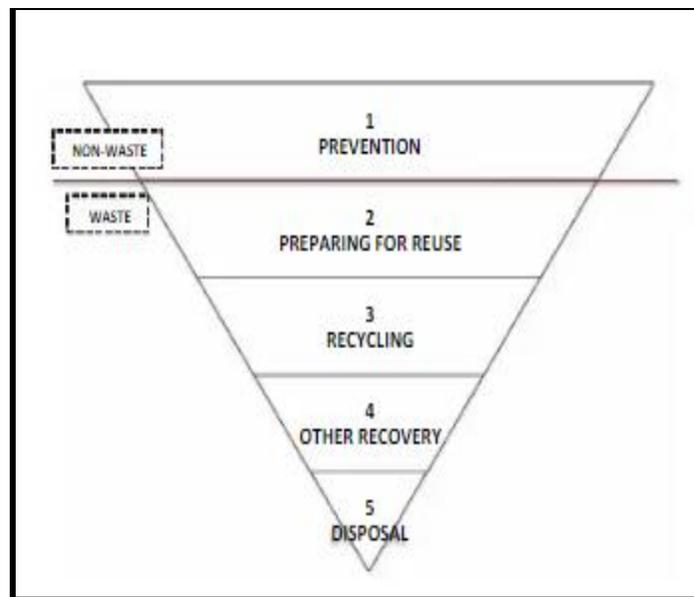
**Figure 5:** Fire outbreak at Olusosun landfill in Lagos State in 2018

**Source:** [www.von.gov.ng](http://www.von.gov.ng)

This fire destroyed some vehicles, refuse evacuation trucks, and goods in a nearby warehouse worth millions of Naira in Nigerian currency. Thus, to realize the planned Lagos smart city, a sustainable waste management policy, such as the waste hierarchy, must be implemented.

### WASTE HIERARCHY GUIDELINES

The concept of waste hierarchy was generated in pursuit of environmental sustainability which is a vital element that forms the basis of a sustainable waste management policy that is globally accepted (ISWA, n.d.). The waste hierarchy guidelines structured the basic requirement and concept for waste management options in achieving waste prevention (non-waste is generated) from the source of generation as well as seeking to reuse (starting point of waste generation), reduce, and recycle before disposal. (Gharfalkar et al., 2015) (see Figure 6).



**Figure 6:** The Waste Management Hierarchy

A waste management directive 1975/442/EEC was adopted to incorporate the waste hierarchy concept into the European waste policy framework (European Commission, 2008). The concept of this directive at the time emphasized the importance of waste minimization, environmental protection, and human health. Following these directives, European Union members incorporated the waste hierarchy policy framework into their legislation. According to the European Commission's Community Strategy, the waste hierarchy was formalized in 1989 into the management of 3Rs options (reduce, reuse, and recycle) and recommended for further review due to pressure from various environmental groups, academics, and researchers. The European Union then revised waste legislation in 2008 and reintroduced a new Directive (2008/98/EC) that prioritized the 5-tier waste hierarchy guidelines (European Commission, 2008). The new EU's waste hierarchy included zero-waste guidelines for prevention, re-use, recycling, recovery, and disposal, which were accepted by the European Union's other 28 members. Similarly, as described in Muiyiwa (2018)'s master thesis, the United States Environmental Protection Agency (EPA) adopted the 4-tier waste

hierarchy in 1989 to form the basis of state recycling laws, which incorporated the ranking from reducing, re-use, recycling, recovering energy, and disposal (Jeremy K. and O'Brien, 2008). Since then, the waste hierarchy guidelines have served as the foundation for waste legislation and policies in every state in the United States. It was also reported that the Canadian Council of Ministers of Environment (CCME) adopted the concept of three-tier hierarchical waste management guidelines, with the first three being reduce, reuse, and recycle (Giroux and Bury, 2014). It is important to note that the impact of implementing waste hierarchy guidelines has had a positive impact on waste management in these developed countries. In contrast, many developing countries, particularly Nigeria, have not included waste hierarchy guidelines in their waste legislation in order to achieve environmental sustainability. Many developing countries, including Nigeria, must follow the waste hierarchy guidelines to achieve a zero-waste environment. The interpretation of the waste hierarchy guidelines may differ slightly due to indigenous knowledge; however, as previously discussed, its main goal of waste minimization is undeniable.

### **PREVENTION**

Prevention, as defined in the EU Waste Framework Directive 2008/98/EC, is simply defined as measures taken before a substance, material, or product becomes waste. These measures reduce harmful substances, waste volume, and the negative effects of waste generation by reusing products or extending their life span (European Commission, 2008). Similarly, the US EPA (2017) incorporated waste prevention options to achieve the goals of waste reduction and reuse of materials, products, packaging items, and so on. This indistinguishable situation was also observed in Canadian waste policy, where waste prevention was achieved using the 3Rs reduce, reuse, and recycle waste before disposal (Giroux and Bury, 2014). To maintain the purpose of introducing the waste hierarchy, it would be prudent to educate Nigerian citizens about waste prevention habits.

### **PREPARING FOR REUSE**

To avoid becoming waste, products or materials can be reused for the same purpose for which they were manufactured, as directed by the EU Waste Framework Directive 2008/98/EC (European Commission, 2008). It allows materials to be used for secondary purposes. Scavengers working on dumpsites in Nigeria rummage through reused items. The idea of scavengers rummaging through reused items on dumpsites without proper gear and protection endangers their health and well-being. As a result, considering the growing population, materials facility centers in Lagos State where reused items can be stored, sold, or given away will be the better option.

### **RECYCLE**

This procedure entails gathering and processing discarded materials or products for re-manufacturing. The operation necessitates the reprocessing and regeneration of waste materials into other useful products or materials that can be recycled into the economy (European Commission, 2008). The recycling process is primarily determined by the type of waste (The Open University, England, 2017). Using the waste hierarchy mission, German and Canadian plastic recycling options have demonstrated a high rate of success. Recycling is viewed as one of the waste diversion options, particularly in Lagos state, where private and government recycling plants can be established.

## **RECOVERY**

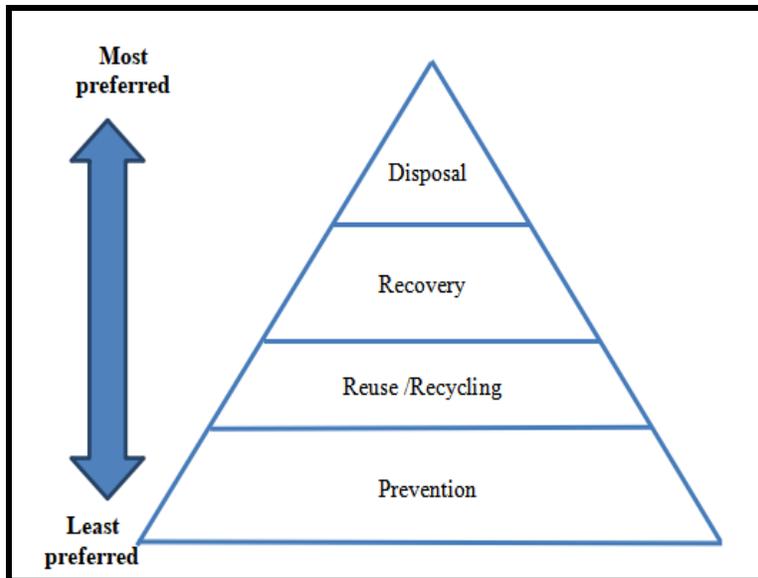
The EU Waste Framework Directive 2008/98/EC defines the recovery system in Europe as a method of reusing waste materials or products for another useful purpose. The EU Directive identified energy generation as one of the benefits of reusing waste materials (European Commission, 2008). This was demonstrated when food waste and other organic materials were converted into biogas (Filho and Kovaleva, 2015). Similarly, Sweden has demonstrated the ability to achieve a high recovery rate for most of its waste materials from households. They have nearly recovered 100 percent of their waste, which was primarily generated for energy recovery (Swedish Institute, 2013-2018). Energy recovery is seen as one of the options, particularly in Nigeria, where energy demand is rapidly increasing.

## **DISPOSAL**

Despite being widely regarded as the least desirable option, landfills are the most used method of waste disposal. The US EPA (2017) and the EU Waste Policy Framework provide guidelines for proper landfill treatment prior to the disposal of new waste on-site. These directives have aided in the control of pollution in groundwater and soil, as well as the containment of greenhouse gases that could endanger human life and the environment. Germany has already set a deadline for closing all its landfills in order to limit waste disposal options. Several studies, including those by Agbesola (2013), Ndubuisi-Okolo et al. (2016), Abila and Kantola (2013), and Batagarawa (2011), have highlighted unsustainable waste management in Nigeria, where open landfills endanger human life and the environment. To avoid a growing waste problem in the environment, it is critical to adopt the use of sanitary landfills.

## **WASTE MANAGEMENT ENVIRONMENTAL PROBLEMS IN LAGOS STATE AND FAILURE TO APPLY THE WASTE HIERARCHY GUIDELINE**

The review study on waste management and waste hierarchy guidelines has established some clear evidence on how to manage waste in Lagos State. The waste hierarchy principles promote sustainable development by ranking waste management options according to what is environmentally preferable. The top priority to preventing waste in the first place when waste is created gives priority to preparing it for re-use, then recycling, then recovery and last comes disposal. The management of waste according to the waste hierarchy guideline has been turned upside-down in Lagos state as represented in figure 7 below.



**Figure 7:** Waste management according to the waste hierarchy guideline has been turned upside-down in Lagos State.

Figure 7 depicts waste management practices in Lagos state, with disposal being the most common practice, followed by recovery and recycling, reuse, and finally prevention. In Lagos State, there is clear evidence that the waste hierarchy's recommended principles have failed. It is also undeniable that the failure to implement these principles has resulted in the state failing to achieve sustainable waste management. This can be attributed to waste accumulation, which has resulted in specific environmental issues in the state. To target the collection and management system for waste through reduction, reuse, and recycling, the waste hierarchy guideline must be properly integrated into waste management policies.

## **CONCLUSION**

Lagos's rapid economic growth has resulted in a variety of urban challenges. Among these challenges is unsustainable waste management, which has impacted environmental quality and poses a threat to the aquatic environment. As a result, there is a need to integrate waste hierarchy options into Lagos state waste management policies to achieve resource conservation, an aftercare-free waste treatment system, and protection for mankind (human health) and the environment. As difficult as it may be, implementing the waste hierarchy policy is a step toward a circular economy.

## **CONFLICT OF INTEREST DISCLOSURE**

Authors declare that no conflict of interest exist.

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