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REVIEW ARTICLE **OJER0301002-301**

ASSESSING THE ENVIRONMENTAL PROBLEMS OF PLASTIC WASTE IN LAGOS STATE, NIGERIA

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ABSTRACT

Plastic waste has now become a global issue, causing widespread concern about its impact on our oceans and our well-being. Nonetheless, a global paradigm shift has brought to the attention of stakeholders about the growing environmental problems of plastic waste in a linear economy. Plastic waste has exacerbated the environmental problem in several developing countries, including Nigeria. Lagos state, for example, 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. Lagos state's growing human population, economic progress, and urbanization have exacerbated waste management and generation issues. This review paper, on the other hand, examines the environmental issues associated with plastic waste. It also identifies the parameters that will promote long-term plastic waste management in Lagos state. This paper addresses a portion of the plastic waste problem in Lagos, which can then be expanded to other Nigerian states.

Keywords: *Environmental Problems, Lagos State, Nigeria, Plastic Bottles, Plastic Waste, Waste Management*

INTRODUCTION

The emerging economy of plastics production played critical roles in minimizing the health implications of Nigeria's traditional packaging methods. Plastics production capacity has increased over the years, which can be attributed to the existence of petrochemical companies because of oil exploration activities in Nigeria. The existence of petrochemical companies has reduced the cost and ease of access to polymers and plastics, which can also be attributed to the increasing economy of plastics production. This growing economy of plastics production has resulted in the linear economy model's 'take-make-consume-throw away' pattern. This means that the long-term linear economy of plastic production has resulted in environmental issues in the modern era. Furthermore, the unsustainable management of plastic end-products discarded as waste into the environment is indicative of a linear economy. This linear economy of 'take-make-consume-throw away' pattern has resulted in serious pollution, littering, and extensive use of limited natural resources. Furthermore, this 'take-make-consume-throw away' pattern of linear economy has turned useful raw materials into waste, despite the potential economic benefits. As a result of this tense situation, several environmentalists have expressed concern about how to achieve waste separation in Lagos state. Although it is the Lagos state responsibility to manage its waste nonetheless, the suggestions of various stakeholders, including environmentalists, are required. Thus, the Lagos state ministry of environment according to the administrative structure delegated responsibility for waste collection, transportation, and disposal to the Lagos state waste management authority (LAWMA) to achieve the goals of environmental sustainability and sanitation in Lagos. LAWMA has provided commendable services in meeting these objectives, but they are grossly ineffective as waste generation rises on a daily basics due, to population, urbanization, and industrialization growth among other (see Table 1). (Orsanya and Olukanni, 2018).

Table 1: A Synopsis of Lagos Solid Waste Management

Year	LAWMA Coverage	Population Estimate	Generation Rate/Person/Day	Tons/Day	Collection Trucks
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)

Table 1 shows that the volume of waste generated and population in Lagos increased significantly between 1945 and 2020, assuming a high proportion of plastic waste. This assumption is supported by Olowoopejo's (2018) report, which quotes the Lagos state commissioner for environment as saying in a vanguard newspaper that Lagos state contributes 450,000 tonnes of plastic waste to the ocean each year. Despite this, the Lagos State Environmental Protection Agency (LASEPA) and the Lagos Waste Management Authority (LAWMA) have established some initiatives to address the evolving environmental problem of plastic waste, such as environmental education, advocacy, and awareness, among other things (LASEPA and LAWMA, 2022). These initiatives have proven to be ineffective to some limited extend as the scope of environmental problems caused by plastic waste has grown. Hence, the author can attribute this situation to a lack of sorting systems, recycling processes, unsafe solid waste disposal methods, insufficient transportation vehicles, and administrative issues, among other things. All of this could be attributed to the lack of parameters such as substantial infrastructures, expanding institutions, excellence in the policy framework, and environmental education and awareness. The absence of the parameters has exacerbated the problem of plastic pollution, which is still on the rise in Lagos state. Therefore, this review paper presents its findings on the environmental issues caused by plastic waste, as well as some necessary parameters that will promote sustainable plastic waste management in the state of Lagos. This paper is required to address a portion of Lagos' plastic waste problem, which can then be extend to other Nigerian states.

PROPORTION, SOURCES AND CONSEQUENCES OF PLASTIC WASTE IN LAGOS STATE

Lagos state is identified as one of the most rapidly growing cities in Nigeria and the world (see Figure. 8) (LBS, 2010). Lagos city as it is being called by its residents is the commercial center of Nigeria with a population density of 7,878 persons per square in kilometer (Demographia World Urban Areas, 2021). The city is important to its neighboring states because of its seaport and manufacturing centers with the highest number of multinational companies (Phillips and Horwood, 2007). The current metro area population of Lagos in 2022 is 15,388,000, a 3.54% increase from 2021(www.macrotrends.net) within the 20 local government area of the state. Lagos state's population, urbanization, and industrialization are all increasing daily. Population growth rates, size, and density all have significant implications for waste generation and management in the state. This could explain why plastic waste constitutes 15% of total waste volume generated in Lagos state (see Table 2 and Figure 1) (LAWMA, 2015).

Table 2: 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

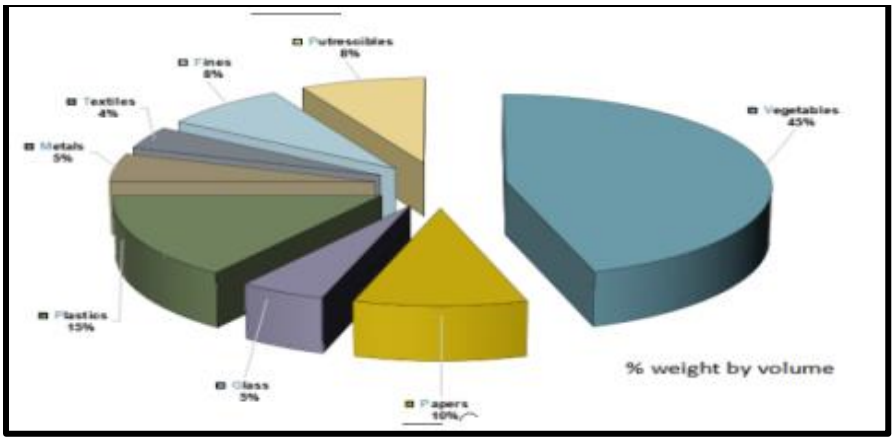

Figure 1: Lagos State Waste Characterization

Source: LAWMA, 2015

Plastic waste accounts for 15% of total waste volume generated, according to a waste characterization report obtained from LAWMA. This waste characterization report is consistent with Rigamontiet al [25], who discovered that plastic waste accounts for 1350 in volume and 15% in proportion in Lagos, as shown in Tables 3 and 4, which show the percentage plastic fraction in bottles, soft, hard, and non-recyclable materials based on their weight average.

Table 3: Characterization of Waste Proportion

Category	Volume(tonnes)	Percent proportion
Organic	5580	62
Plastic	1350	15
Paper	900	10
Glass	360	4
Silts	630	7
Ashes	180	2
Total	9000	100

Source: Rigamonti *et al*, 2014, Adekomaya & Ojo , 2016

Table 4: Weight Fraction of Plastic According in Lagos State

Proportion of plastic fraction	% weight average
Bottles	27
Soft	36
Hard	11
Non-recyclable	26

Source: Rigamontiet al, 2014, Adekomaya & Ojo , 2016

Thus, the most common type of plastic associated with waste environmental problems in Lagos state is polyethylene, which is composed of polyethylene terephthalate (PET) or high-density polyethylene (HDPE), soft plastic or plastic films composed of low density polyethylene (LDPE), and hard plastic composed of HDPE (Figures 2 A, B and C).

Figures 2 A, B and C: Common types of Plastic Associated with Environmental Problems in Lagos

It is reasonable to assume, however, that Lagos residents consume a variety of plastic bottles of water, soft drinks, and sachet water. Furthermore, the use of plastic bags and other single-use plastic products such as food packs, spoons, cups, straws, and so on contribute to the Lagos state's plastic waste problem. It can be assumed that plastic waste derived from polyethylene will more than double the total number of municipal waste tonnes if a sustainable management are not implemented urgently. Despite this, residents' daily habits of dumping, throwing, or discarding plastic waste into the Lagos environment contribute to plastic pollution, particularly during the dominant raining season (hot and dry season) due to Lagos atmospheric and meteorological conditions. As previously stated, discarded plastic into the environment indiscriminately exacerbates the environmental problem of plastic waste, resulting in street littering, clogged drainage systems, and polluted waterways (see Figures 3 A-D).

Figures 3 A, B, C, D: Different Kinds of Plastics Pollution

Consequently, this situation is further complicated as the Lagos government waste disposal (blue recyclable bin) bin, which should have encouraged plastic waste separation and sorting, is limited, and residents must purchase them individually from LAWMA at exorbitant prices ranging from 30,000 to 40,000 Naira (50-60 Euro or 40-50 USD, respectively) without considering the average Lagos resident (Lawmabin.com, 2022). This situation have not supported waste separation and sorting because some of the Lagos residents have found alternative ways of disposing their waste in plastic sacs and bags rather than bins (see Figures 4A and B).

Figures 4A and B: Disposal Waste Bins are Used by Some Residents in Lagos State

Also, this situation further degenerated to complete collection of mixed fractions of all types of waste together and mainly with waste bags, sacks, and plastic buckets by the assigned collector (Figures 5A and B)

Figures 5 A and B: Waste Collection System in Lagos State

As seen in Figures 1A and B, there was no separation none assigned collector for recyclable items such as plastic as waste has been prepared to be transported directly to the dumpsites. On the dumpsites scavengers then searches and sorts of out plastic waste such as plastic bottles, water sachets and other forms of recyclable materials The activities of the scavengers are divided into two parts which are mainly on-site and off-site recovery of recyclable materials of interest before selling it to the resource merchants (middleman) or the recycling industry enterprises (large and small-scale industries) (see Figure 6).

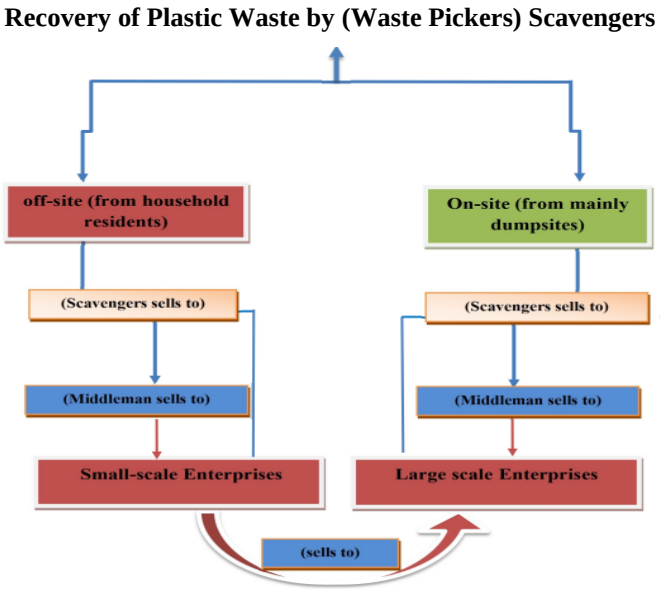

Figure 6: Scavengers Recovery and Selling of Plastics Waste

The on-site waste recovery system on the other hand requires the scavengers to collect and sort plastic waste by scrambling on the dumpsites. As previously mentioned, they recover not only plastics but also other materials like aluminum, scrap metal, glass and paper which are all valuable materials.While, the off-site waste recovery system requires the scavengers to go to residents' homes to collect and recover plastic waste by scrambling from waste bins as they are deposited outside awaiting the waste collector trucks (see Figure 7).

Figures 7A and B: Activities of Scavengers on a Dumpsite in Lagos State

Source: Researcher input

Many scavengers are living in self-built makeshift houses located around the dumpsites which expose them to pollution of all kinds as well as dangerous animals that inhabit the dumpsites. Additionally, they suffer from various infections because of cuts by sharp objects in the trash due to the unprotected manner of scrambling for valuable waste materials on the dumpsites. Both the recycling companies, middlemen and the Lagos government view the activities of scavengers as environmentally and economically beneficial. Scavenging (waste picking) thus becomes their major source of livelihood for some people. Due to all this, the previous Lagos state government has tried to improve the working conditions of the scavengers through the introduction of the initiative of a plastics buyback scheme by building up a plastic recycling facility in one of the dumpsites (see figures 8A and B).

Figures 8A and B: Olushosun Buy-Back Recycling Facility (Lagos State Government)

Source: www.lawma.gov.ng

This initiative allows scavengers to sell their sorted recyclable plastic waste at the dumpsite recycling facility, which has worked for some time; however, this system has since collapsed due to government negligence and insufficient financial funding, which is very unfortunate as this is an initiative that should have helped solve part of Lagos State's plastic waste problem. It is therefore a clear that the Lagos government has not invested in reprocessing recycling waste since the last initiative failed. Besides, recycling companies like Envirocycles Ltd, We-cyclers and Recycling Points who purchase plastic specifically plastic bottles and other recyclable materials from scavengers has also played a vital role towards environmental sustainability in Lagos. They have successfully planned collection methods as a bonus system where every plastic bottles collected from households or consumers accumulates points that can be exchanged for a reward at various local designated redemption centers in the areas (see figures 9 A and B).

Figures 9 A and B: Collection strategies for Plastic Waste Used by Recycle Points and We-Cyclers

Source: Recycle Points and We-Cyclers

These initiatives have helped in minimizing plastic waste pollution and littering. It has also provided many jobs for mostly unemployed youths in Lagos State. Thence, as shown in the tables, figures, and pictures above, plastic waste accounts for a sizable portion of the waste generated in Lagos; therefore, it is necessary to discuss some parameters that will promote sustainable plastic waste management in Lagos state (see Figure 10).

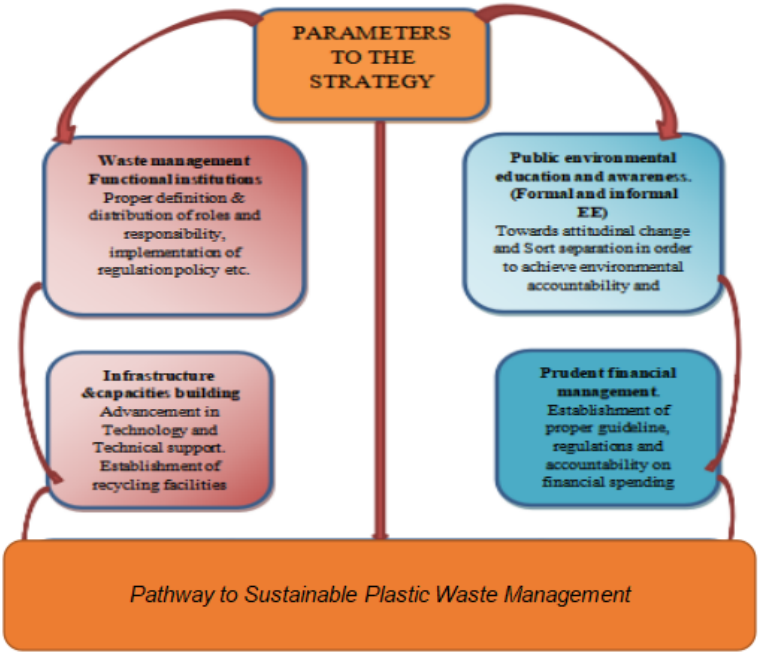

Figure 10: Parameters Necessary for Sustainable Plastic Waste Management in Lagos State.

FUNCTIONAL INSTITUTIONS FOR WASTE MANAGEMENT

The establishment of functional waste management institutions with appropriate responsibilities will determine the long-term management of plastic waste in Lagos State. To achieve a functional waste management system in the state, policymakers must focus their attention on institutional restructuring. The designated institutions must take responsibility for enforcing or implementing those policies at various levels of society. These policies should be consistent with the waste hierarchy principle, which prioritizes the goal of reducing, reusing, and recycling plastic waste in Lagos State. Creating functional institutions will improve the chances of achieving long-term plastic waste management in Lagos State.

INFRASTRUCTURE AND CAPACITY BUILDING

To achieve sustainable plastic waste management in Lagos state, infrastructure and capacity must be improved, such as increasing the number of waste collection trucks, providing technical support and know-how, and establishing functional recycling facilities and stations. Furthermore, capacity building could be done in conjunction with the integration of human labor and the use of functional technological resources to improve the plastic waste collection system and recycling facilities. Waste infrastructure and capacity building are methods of reducing waste volume and saving many recyclable items before they enter the waste stream. One of the most important ways to reduce plastic littering in Lagos state is to build functional recycling facilities and technology to deal with the growing volume of plastic waste in the environment.

INTENSIVE PUBLIC ENVIRONMENTAL EDUCATION AND AWARENESS

Intensive environmental education and public awareness are important steps toward achieving long-term plastic waste management. To achieve participatory environmental responsibilities and to target behavioral changes, environmental knowledge is required. According to the author's assumption, community participation in environmental decision-making processes will have a positive environmental impact on society. Following from this assumption, it is necessary to comprehend the significance of environmental education and public awareness as a means of achieving a sustainable environment. Environmental education must therefore be integrated into school curricula to raise environmental awareness, knowledge, and attitudes. This formal environmental education integration in schools can be offered at the primary and secondary levels, along with new content curricula for a sustainable environment. Similarly, non-formal education systems will be implemented in communities at the local and national levels through training, advocacy, and public awareness. The researcher can assume that successful sustainable waste management requires community and public participation. To address the current and future plastic waste problem in Lagos State, extensive environmental education and public awareness are required.

PRUDENT FINANCIAL MANAGEMENT

Financial prudence is one way to achieve long-term plastic waste management in Lagos. To avoid mismanagement, funds must be spent in accordance with guidelines, regulations, and accountability. Also, funds must be spent on the appropriate running costs of the waste management system as well as other environmental damages accidents that may occur in the waste management sector. The effective and efficient use of these funds, along with proper financial accountability, will improve long-term functional plastic waste management in Lagos State. Accountability in financial prudence is thus a means of achieving long-term plastic waste management in Lagos State.

CONCLUSION

As Lagos state transforms into a mega-city, it is beset by a slew of environmental issues, including plastic waste, that require immediate attention. It is, therefore, necessary to consider the set of parameters in this paper to achieve environmental sustainability. Thus, the set of parameters as discussed in this paper will help resolve part of the plastic waste problems in Lagos State and other parts of the country if necessary.

DECLARATION OF COMPETING INTEREST

Author have declared that no competing interest exist.

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