PLASTIC POLLUTION:
A CASE STUDY OF BENIN CITY METROPOLIS
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With current review and update carried out by Hon. Barr. Igbuan Precious of Prosperity Law firm consulting for ERA on the GAIA project.

This publication which aimed at mobilizing citizens and government to take preventive actions that will stem waste induced flooding in our cities was supported by GAIA. Although, it focuses on Benin metropolis, but it has wider implications for cities across Nigeria where drainage are hardly maintained.
Executive Summary

Plastic waste which is prevalent on our environment has increasingly caused some serious environmental concerns and has increased Municipal Solid Waste (MSW) due to poor waste management system, its non-degradability and absence or inefficient recycling plant. The increase of plastic waste on our environment is largely due to the affordability and durability of plastic packaging, industrialization and consumption pattern of goods by the geometrically increasing population of urban dwellers; a case study, Benin City. The focus of this research therefore is to look into how plastic waste impacts our environment (water and land) with a view to gradually reducing its presence on our environment and its adverse effects on human health.

The huge demand for packaged products with plastic materials for domestic and commercial uses and activities is the main causes of plastic waste. Leakage of plastic material into the environment comes in various patterns due to habitual disregard for the environment. And this has impacted the Ikpoba River, one of the major rivers in Benin City that receives erosion activities, because the drainage system has been clogged with all manner of solid waste (especially plastic which are non-degradable) deposited by road users, including pedestrians. The dump sites located in Benin City are not in accordance with internationally acceptable standards they also create public health, environmental and psychological concern for neighboring communities.

Sustainable plastic waste management in Benin City is challenging because of observed incoherent policies, lack of appropriate tools for the job, and the fact that it is also being used as a means of political patronage and tool of oppression. There are also inadequate receptacles. Policies on waste management still lack some technicalities and the instrument for sanction of environmental offenders, and sustainable waste management practices. The dire need for good governance in the management of plastic waste has become imperative. The best way to manage waste is seeing it as a resource, and by avoiding materials becoming 'waste' in the first place. The roles of waste managers need to be expanded to incorporate more visibly the upstream prevention actions.
Introduction

Benin City is one of the ancient cities in Nigeria. The last known population of the city is 1,495,800 people. By geometric growth in population and by demographers' projections, the population of Benin City would have been increased to 2,682,158 people by 2022.

Increase in the population of a city is influenced by urbanization and development. With the rapid development of urban economy and urbanization, municipal solid waste (MSW), generation has also increased dramatically. Municipal Solid Waste (MSW), more commonly known as trash or garbage, consists of everyday items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and business places.

The most common property of municipal solid waste is plastic. Consumption of disposable plastic bags, bottles, straws, utensils, polystyrene cups, film, food packaging and more has spiraled out of control. These items are used for seconds, hours or days, but their remains last forever. Due to the fact that most plastics are not biodegradable, an enormous sum of plastic waste continues to build up worldwide; with industrialized nations contributing the largest amount of plastic waste and pollution (Pinto, et al., 2008). Plastic pollution is the accumulation of plastic products in the environment that adversely affects wildlife, wildlife habitat, or humans (Encyclopedia 2013).

Plastics that act as pollutants are categorized into micro-, meso-, or macro debris, based on size (Hammer et al., 2012). Plastics are inexpensive and durable, and as a result levels of plastic production by humans are high (Hester et al., 2011). However, the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade (Lytle 2015). Together, these two factors have led to a high prominence of plastic pollution in the environment. There are currently no widely accepted scientific estimates of the quantity of plastics waste generated in the city that are found among the leakages of waste into drains, land-based and water bodies in Benin.
This research is aimed at forecasting and extrapolating the quantity of plastic bottles used for the packaging of materials that are being released into the city daily and the quantity of plastic waste often generated daily. The research therefore assessed the contribution of plastics to urban flooding and coastal erosion and also designed models for plastics withdrawal. Public perception of how wastes affect residents living nearby waste disposal facilities was also investigated.

Data and information presented in this research were gathered through the use of structured questionnaires, interviews with relevant actors, observation, photographs and review of existing literatures on the subject matter.
01 SOURCES AND CLASSIFICATION OF PLASTICS
This chapter examines the nature, sources and Classifications of plastics. Plastic waste refers to the debris generated from a wide range of synthetic or semi synthetic organic amorphous solid materials derived from oil and natural gas.

1.2. Classifications of plastics

Plastic is an essential component of numerous consumer products, including water bottles and product containers such as plastic materials. “Plastic material” is a term that refers to a large class of polymers, separated into various groups and sub-groups. Plastics are generally categorized into two types:

 Ø **Thermoplastics:** Thermoplastics or *Thermosoftening* plastics are the plastics which soften on heating and can be molded into desired shape such as PET, HDPE, LDPE, PP, PVC, PS, etc.

 Ø **Thermosets:** Thermoset or thermostetting plastics can be heated, but cannot be remolded or recycled such as Sheet Molding Compounds (SMC), Fiber Reinforced Plastic (FRP), Bakelite etc, are the examples of the same.

**Table 1: Different Types of Plastics and its Uses**

<table>
<thead>
<tr>
<th>No.</th>
<th>Short Name</th>
<th>Scientific Name</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PET</td>
<td>Polyethylene terephthalate,</td>
<td>Soft drink bottles, furniture, carpet, paneling etc.</td>
</tr>
<tr>
<td>2</td>
<td>HDPE</td>
<td>High-density polyethylene,</td>
<td>Bottles, carry bags, milk pouches, recycling bins, agricultural pipe,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>base cups, playground equipment etc.</td>
</tr>
<tr>
<td>3</td>
<td>PVC</td>
<td>Polyvinyl chloride,</td>
<td>Pipe, Window profile, fencing, flooring, shower curtains, lawn chairs,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>non-food bottles and children's toys etc.</td>
</tr>
<tr>
<td>4</td>
<td>LDPE</td>
<td>Low-density polyethylene,</td>
<td>Plastic bags, various containers, dispensing bottles, wash bottles,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>tubing etc.</td>
</tr>
<tr>
<td>5</td>
<td>PP</td>
<td>Polypropylene,</td>
<td>Auto parts, industrial fibers, food containers, dishware etc.</td>
</tr>
<tr>
<td>6</td>
<td>PS</td>
<td>Polystyrene</td>
<td>Cafeteria trays, plastic utensils, toys, video cassettes and cases,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>clamshell containers, insulation board etc.</td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td></td>
<td>Thermoset Plastics, Multilayer and Laminates, Bakelite, Polycarbonate,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nylon SMC, FRP etc.</td>
</tr>
</tbody>
</table>
1.3 Daily plastics (bottles and sachets) usage in Benin City

In Nigeria, water is commonly packaged in sachet or bottles. Over the years, plastics (sachet & bottles) have replaced glass and metal as a cheaper and more efficient means of packaging water and other items (Idiata, et al., 2013). About 325 Table Water Companies are registered in Benin City and on the average, each of the company produces and distributes 310 packs of bottled water and 1055 bags of sachet water daily and more during the dry season.

This excludes bottled water imported into the City which translates to the release of more than 1,209,000 plastic bottled water and 6,857,500 sachets of packaged water supplied to Commercial outlets. Based on the evidence of this research, we observed that there are more than 31,000 stores and over 6,000 food vendors and 1,500 street hawkers in Benin City that sell sachet water, bottled water and other plastic packaged items that generate plastic waste.

Hotels and big eateries also generate plastic wastes. Statistically, 154,600 bags of sachet water which translates into 3,080,000 sachets of water are being sold in Benin City daily, while 2,155,400 bottles of water and soft drinks are also sold daily in this sector of the economy of the City.

This does not include the quantity sold by Hotels and big eateries.

As observed by De Akarz an interviewee, “The problem here in Nigeria is that there are too many items packaged with plastic materials. Even if this advocacy for phasing out plastics from the environment may work, we would still have the problem of sachet water because it has no recycling value and this is the more reason sachet water should be banned. Here in Nadia Bakery we make use of plastics, both bottles and cellophanes. But we are very mindful, because we practice waste separation before they are dropped for collection by waste mangers, and there is a dedicated staff that handles the separation and proper management of the waste generated in this establishment. We generate more than 100 dozens of plastic bottle waste with unaccounted cellophane wastes. We understand that our staff has contacts of artisans/recyclers that often demand for the used plastic bottles and they make much money from it.
What I think ERA/FoEN can do this to advocate for the outright banning of plastic water in all forms and the establishment of used plastic recovery. Not everyone is environmental conscious; hence this debate is essential for public awareness creation, to encourage waste segregation, especially those with recycling values, as contribution to waste minimization approach”.

Hotels and Eateries in Benin generate higher number of plastic (bottles) waste, but these wastes are effectively managed by the Hotel and Eatery staff. In the course of the research we interviewed a total of 10 busy Hotels and 10 Eateries, it can be deduced from the interviews, that each Hotel generates a total of 1000 units of plastic (bottle) from both bottled water and soft drinks daily. Daily, 20 of these establishments generate 20,000 plastic bottles (wastes).

From survey, there are more than 100 Hotels and Eateries in Benin City. Statistically, the amount of plastic waste in bottles generated from these sectors will be equivalent to 100,000 units of plastic bottles daily. We gathered that staff of these establishments enjoys some form of revenue for putting the plastic together for sale to local fruit juice (locally called Zobo, soya milk and kunu) producers, while waste managers pick up the left over.

These findings on daily plastics (bottles and sachet) usage in Benin City, compared favorably well with the research of Idiata, et al., (2010 and 2013) who confirmed that with the population growth rate of 3.3% the resultant volume of sachet water consumed will be between the range of 4,322,700 to 7,034,931 by 2025.

Precious Palm Royal Hotel corroborates this. According to the hotel,

“we make use of the materials packaged with plastics and the most common among them are used plastic bottles resulting to plastic waste (bottles and cellophanes) generated in this sector cannot be tracked and we don’t have established model for recovery/ withdrawal. It has been the responsibility of the Edo State Waste Management Board to clear waste generated from the hotel premises. The cleaners here gather all waste material in designated points for disposal but most of them gather some used plastics for themselves, probably for sale or re packaging of water for domestic uses. The way forward is to encourage recycling, following the model of the Lagos State Government by collaborating with a private firm”.

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All the commercial outlets visited in the course of this research confirmed that they depend on the waste managers who are not effective and diligent in the disposal of their solid waste. They all agree that the use of plastic packaging is a problem but for now. But for now, there is little or nothing they can do as far as an alternative means of packaging is concerned, because it remains the cheapest and most presentable way of doing business. They all agree that the use of plastic is a problem for the environment, since all the streets of Benin are flooded with empty plastic waste and cellophane floating in the flood water. The culpability of motorists cannot be excluded hence past administration had compelled all commercial vehicles to carry waste baskets.

1.4. Pattern of leakages of plastics into the environment

Benin City like most cities in Nigeria is faced with a multitude of problems ranging from poor state of roads, unreliable and inefficient electrical power supply, inadequate solid waste management etc. Among this multitude of problems solid waste management appears to be the most prominent in recent years. In Benin City, there are not enough public wastes receptacles, and solid waste dumps are located on the sides of the highways. When solid waste accumulates, households and businesses pile up the waste in the median of major roads and set them on open fire without pollution control (Walling et al, 2004).

A large proportion of the waste are dumped indiscriminately around homes, market places, by the road side and on any piece of unused land. These waste dumped indiscriminately find their way into drainage system and waterways. And this has resulted to serious environmental crisis for communities in the metropolis.

The leakage of plastic and municipal solid waste into the environment (land-based and water bodies) are from different sources. The most common source of waste leakage into the environment is the dropping off of used items such as plastic bottles, used sachets of water, ice cream, biscuit and Gala by road users (passersby, passengers and drivers). When plastic waste are collected and transported to the dump sites, it can be at risk of escaping into the environment. Even when it is in landfills, plastic is at risk of blowing away and ending up in rivers or oceans. In Benin City, almost all the plastics that leaked into the environment are left in the environment because of ineffective waste management system.
These plastic items can be carried by wind and rain into our drainage networks and they end up in the river. While we were excited about the level of plastics withdrawn from the environment by local fruit juice producers, our interview with some of them revealed that the plastic bottles collected by the local juice producers from hotels, eateries and other places for reuse are left to litter the environment by the consumers of these juices.

Nothing captures this more than the testimony of Osameda Osawegie, a 45 years old Okada rider and formal staff of Edo State Waste Management Board (waste trunk driver)

“We thought locating this site here could attract development in our community. We were carried away with the promises (building of health centre and pipe born water) that accompanied the project, but today, we have been deceived, because none of the promises has been implemented. We often experience the pollution of the Egwi river, our only source of drinking water during the dry season, after we must have exhausted the water in our reservoir collected from the rain. We use to drink the water collected from the river but some scientist, who did some work here, told us to stop drinking from the river, that it has some toxic chemicals inside it. That all that lactates produced in the waste dump site is infiltrating into the ground to affect ground water, while others are flowing into the stream to pollute it directly. Flies and mosquitoes are giving us trouble. I use to work with the waste management board but had to resign because of the health implication of the job on me”.
1.5. State of the Ikpoba River (Consequences of plastics on the Ikpoba River)

A major observation is the gradual blockage of the drainage system which was constructed by the Adams Oshiomhole's administration. It is now common sight to see solid waste blocking the free flow of drains in the metropolis. This is more evident during the rainy season, when most roads are heavily flooded due to a downpour. The unwholesome practice of dumping refuse in the drainage system has impact on the Ikpoba River. It is well known in Benin City that all the flood water end up in Ikpoba River because the drainage system of the city are inter connected and linked to the river. The river is in a state of total neglect as it has been overgrown by weed and solid waste among which is plastic waste. Residents confirmed that the river is gradually changing physically as the shoreline has expanded beyond where it used to be.

Consequently, as debris accumulates, habitat structure may be modified, light levels may be reduced in underlying waters, and oxygen levels may be depleted. These changes can undermine the ability of open water and benthic habitats to support aquatic life. As a result, habitat alteration is already taking place in the river. The aesthetic value of the environment has been eroded. Also the health of the water for drinking is now being questioned. Residents of Benin used to troupe to the river decades ago whenever the public water supply had any major fault.

The accumulation of debris over time under the bridge of the Ikpoba River has impacted the old bridge constructed during the colonial administration. The residue from deposit of plastic and other harmful waste has led to hastening the corrosion of the old bridge, which has now collapsed. The bridge used to serve as alternative route for motorists, whenever there was an accident on or around the Ikpoba River Bridge. An anonymous car wash artisan sums up the impact like this: “The Ikpoba River is known as plastic receptacle, where plastic clog every part of the river around the Ikpoba Bridge. We operate a car wash here and we depend on the water from the river and the constant widening of the river is of great concern to us. We have often suspected the invasion of this session of the river by plastics as the cause of the upsurge of the Ikpoba River which influences its flow pattern. We have to battle with the plastics to create space for us to collect water for washing. Other issue is the weeds that have covered the whole river”.

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1.6. Consequences of plastic waste

Plastic is versatile, lightweight, flexible, moisture resistant, strong, and relatively inexpensive. Those are the attractive qualities that lead us, around the world, to such a voracious appetite and over-consumption of plastic goods (Claire 2018). However, plastics are very slow to degrade, plastic materials that are used in the production and packaging of so many products and the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade (Hester and Harrison 2011).

The Executive Governor of Edo State, Godwin Obaseki has taken some measures to curb urban pollution but this approach of commissioning street sweepers to clean up the city has not yielded positive result in reducing urban litters. Plastic pollution leads to the clogging of drainages meant to offload excess water from the city during rainfall. The flooding and urban erosion often experienced during rainfall in Benin City is directly link to plastic pollution. All the drains in the City are clogged with plastic bottles and cellophane which makes rain water flow back to the environment and make the drain to be counter-productive in this regard.
All the drains in Benin City end up in either Ogba River or Ikpoba River. Plastics are often transported into these rivers during rain fall. Giacovelli (2017) reported that about 8 million metric tons of plastic wastes enter the ocean every year and confirmed that “by 2050, there will be more plastic than fish in the world's oceans”. In Ikpoba River we confirmed the presence of plastic pollution which utters its flow because of the clogging effects. Plastic pollution has been described as being highly detrimental to large marine mammals.

Daniel (2004) reported that some marine species, such as sea turtles, have been found to contain large proportions of plastics in their stomach. When this occurs, the animal typically starves, because the plastic blocks the animal's digestive tract. Marine mammals sometimes become entangled in plastic products such as nets, which can harm or kill them (Daniel 2004). There is no scientific proof to show that the fauna in the Ikpoba River have negatively impacted by the presence of the plastic pollution.

Plastic creates toxic pollution at every stage of its existence: manufacture, use, and dispose. In the environment, plastic breaks down into small particles that attract toxic chemicals.

These particles are ingested by wildlife on land and in the ocean; contaminating the food chain. Harmful chemicals leached by plastics are present in the bloodstream and tissues of almost every one of us, including newborns. Due to the use of chemical additives during plastic production, plastics have potentially harmful effects that could prove to be carcinogenic or promote endocrine disruption. Some of the additives are used as phthalate plasticizers and brominated flame retardants (Barnes et al., 2009). Not only do plastics harm animals externally, but plastic ingestion has also been shown to inhibit animal growth and make them more prone to tumor development, less successful in reproduction, and less able to detect and evade predators (Rochman et al., 2013).

The potential impact on people from plastics moving up the food chain is an important question that is actively being researched. Mr. Bojie Egbo throws further light “We are into cleaning, recycling and fumigation. There are solid and liquid wastes, but the one that is harmful to the environment is the solid wastes which include plastic waste.

Anywhere you go, you will find plastic littering the drains and the impact on the environment is negative.
First, it does not decay easily, because it can take twenty-five and sometimes up to fifty years for it to decay. These plastics end up in our environment and sometimes affecting the yield of our farm produce, because the plastic remain in the soil and it can even lead to flooding. Anytime it rains in Benin City, you see flood everywhere because plastic waste from soft drinks and water are not properly disposed.

The Government should provide an alternative to plastic such as paper container, which can decay easily. If this is not feasible, the people can be sensitized on the proper use as dustbins. Recycling plants can be established and the Government can encourage the recycling business. This will also help to reduce unemployment in the society. The people too should cultivate the habit of keeping their environment clean, while the Government should hold every landlord responsible for their dirty environment. We make laws, but we do not enforce them, hence transporters do not use the waste basket they are supposed to carry. The Waste Management Board is only interested in collecting money from commercial vehicles, upon which, they give them waste basket for their vehicles. The waste management law should be written in a way that anyone can arrest anybody for dumping waste along the road”.

Plastics in rivers and ocean have significant impact on maritime natural capital. While the total economic impact is still unclear, initial studies suggest that it is at least in the billions of dollars (World Economic Forum 2016). According to Valuing Plastic, the annual damage of plastics to marine ecosystems is at least USD 13 billion per year and Asia-Pacific Economic Cooperation (APEC) estimates that the cost of ocean plastics to the tourism, fishing and shipping industries was USD 1.3 billion in that region alone (UNEP 2014).

Better waste management systems will not only help these critical economic sectors to survive, but they will also help to create new jobs, increase wages and improve working conditions for those in the waste sector.

1.7. Problem Observed at Government Dump Sites

There are three government approved dumpsites in Benin City located at Otofure (Oluku by-pass), Iguomo and Ikhueniro along Benin Auchi by-pass. Investigating the consequences of plastic pollution, we visited two major waste dump sites in Benin-City.
The first dump site visited which looked like a decommissioned site is located along Benin-Lagos Express Road in Ikhueniro community located at Ikpoba Okhai Local Government Area of Edo state. The second waste dump site is in Otofure community located along the Express Road leading to Ora community in the in Ovia North East Local Government of Edo State with an estimated population of more than 2,000 people. Observation carried out by ERA field monitors showed that the dump sites are the major dump sites in Benin-City and have similar characteristics because, dumping of waste in these sites have the same processes and the sites receive the same kind of waste (ERA 2013).

We observed that all the waste that goes into the sites is collected from four Local Government Areas in Edo State (Oredo, Egor, Ikpoba-Okha and Ovia North East). Much of the wastes are packed with plastics and biodegradable wastes which experiences prolonged degradation (ERA 2013). Improper disposal of municipal wastes has created unsanitary conditions, and these conditions in turn have led to pollution of the environment and the outbreaks of vector-borne diseases. Residents confirmed that odour, nuisance and smokes are considerably on the increase during the raining season as a result of the decay processes and dry season as a result of the incineration (open burning) of the waste; this is from the nearest villages.
After the sites have been filled up, residents have difficulty in identifying the type of smell due to the increase in odour level and high exposure to methane gas, that exudes from the sites. During both surveys, elderly persons complained about the potentially adverse health impacts of long-term exposure to odour from these sites. This research still agrees with the complained of Williams Ugiagbe, Clan Head of Otofure who spoke to ERA Field monitor in 2013 and confirmed that “the dump site was located here since 2002 during Lucky Igbinedion's administration as the Governor of Edo State.

Before they brought the site here they came with the promise of building a health centre and good pipe borne water for us, but all turned out to be a white elephant projects. We don't want the site in this community again, and this has been our agitation. My secretary has written to the government to this effect, but reply was not given to us. Before the dump site came you could hardly see flies around, but since it came flies have been disturbing us, our people falls sick regularly without knowing the kind of sickness and, this is making us put all our earnings into treatment. Scorpions and strange Snakes are terrorizing us in this community, but the most annoying one is that anything they called waste, even dead bodies are dumped at the site, which produces more offensive odour.

The water they promised us was not given to us, the borehole we have in this community was done by us and even the water is not safe for drinking because of the waste. We don't have a primary school, our children go to our neighbouring community for schooling and this waste is also affecting them in their classes, because the school is also close to the dump site”.

However, the awareness level on potentially adverse health impacts of Municipal Waste Disposal is still very low, in both residence and on the part of the scavengers going into the sites for isolating their desired item (waste). The task of waste disposal in Benin-City has presented complex technical challenges. It has also posed a wide variety of administrative, economic, and social problems that must be managed and solved.

Mr. Samson who is the Director, Phantom Energy Services, a waste management firm in partnership with Edo State Government, reveal some of their challenges. “We are in partnership with the Edo State Government to evacuate waste from a section of the City so that the environment will be healthy.
We engage evacuators who go from house to house removing solid waste which usually include plastic and other items. What people do not know is that the business of waste disposal is capital intensive and when clients do not pay their bills, it affects our work.

The Government has arranged it in a way that the bills go directly to the clients who in turn pay to the bank. We do not collect money directly from people who are our clients, so that when they default, they are summoned from the Governor's office. The plastic waste comes with the solid waste and the evacuators collect them from street to street and they use our vehicles to evacuate them to the dump site at Ikheniro.

There is no doubt that plastic waste has caused serious environmental problem in Benin and this can be seen when erosion takes over the roads whenever it rains. Recently, I was called to evacuate heaps of solid waste including plastic from the Ikpoba Slope Road after a heavy rain fall and it took our evacuator two days to effectively evacuate and clear the road of all the solid waste especially plastic waste.
02. CHALLENGES OF PLASTICS WASTE MANAGEMENT
Waste management is one of the essential utility services underpinning society in the 21st century, particularly in urban areas. Waste management is a basic human need and can also be regarded as a 'basic human right'. The consequences of doing little or even nothing to address waste management can be very costly to society and to the economy overall. The challenges of sustainable plastic waste management in Benin City are:

2.1. Incoherent Policies: We have a situation where the money collected from residents is paid directly into government accounts and the waste managers are paid by the government. This creates a problem for the waste managers because whatever the government declares as accruing to them is what they are going to get.

2.2. Lack of Appropriate Tools for the Job: It was discovered that most of the waste managers do not have the right equipment for the job. This is obviously responsible for the way the business of waste management is done because most waste managers use old vehicle that break down very often and this may be responsible for their inefficiency.

2.3. Means of Political Patronage: Most of the waste managers were awarded contracts because they belong or are connected to the ruling party. Those who have the passion to do the work genuinely did not get the contracts.

2.4. Tool of Oppression: The people see the waste managers as oppressors. Anyone who defaults in payment of bill, which was never negotiated, is arrested and tried by a mobile court which sentences immediately with an option of fine.

2.5. Inadequate Receptacles and Cultural Habit: It is expected that most major roads should have waste bins by road sides but this not the case. Most streets in the city are littered with debris, because residents have the unenviable habit of throwing solid waste on the roads. When it rains, residents come out with glee to empty their dustbins in the drains.
03. PLASTIC WASTE POLLUTION AND THE LAWS OF THE LAND
As part of efforts being made by the Edo State Government to address the issues of pollution and indiscriminate waste disposal in the state, the “Edo State Sanitation and Pollution Management Law, No. 5 of 2010” was enacted.

The law seeks to regulate sanitation and control pollution in Edo State, this desire led to the establishment of the Edo State Waste Management Board which also includes the creation of the State and Local Government Technical Committees on matters connected to sanitation and pollution control. The law has 45 pages with 105 sections with focus on relevant environmental concerns. It still lacks some technicalities and the instrument for sanction for environmental offenders as has been recommended by the law, it lacks the merit to hold both individuals and corporation accountable.

Another challenge to the enforcement of the law is that no appropriate mechanism has been put in place to monitor the level of compliance by individuals and industries to the various provision of the law.

The law was able to recommend the establishment of special environmental protection court which is the legal instrument for enforcement of all the provisions contained in it. And is has not been successfully utilized. Section 15, 35, 36, 37, 39, 40, 44, 45 of the law failed to critically recommend good strategies for sanitation and pollution control by individuals and corporations.

### Roles of potential stakeholders in plastic waste management

<table>
<thead>
<tr>
<th>Governments (National, State and Local)</th>
<th>Private sector</th>
<th>Civil society and community organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage regions or provinces to develop detailed action plans to reach agreed targets on waste management,</td>
<td>Support best-fit collection and separation for an integrated recycling and treatment system,</td>
<td>Evaluate the impact of different policy and practice interventions</td>
</tr>
<tr>
<td>Facilitate collective waste services like shared landfills or treatment facilities across cities, consistent with the Sustainable Development Goals (SDGs) and, as appropriate, The Paris Agreement on Climate Change, and develop detailed action plans to reach agreed targets,</td>
<td>Apply business expertise to improve waste management through interventions like improving logistics of waste management transport or using marketing prowess to change dumping and burning culture,</td>
<td>Mobilize citizens, drawing on local traditions of coordination and cooperation to change waste culture and embrace agreed upon local waste strategies,</td>
</tr>
<tr>
<td>Set attainable waste management targets at the economy-wide and municipal levels in consultation with affected stakeholders,</td>
<td>Collaborate among producers, brands and recyclers to review and improve the recyclability of plastic disposable products,</td>
<td>Serve as implementation partners with cities and governments,</td>
</tr>
<tr>
<td>Development finance institutions and grant funders</td>
<td>Academics, engineers and scientists</td>
<td>Individuals</td>
</tr>
<tr>
<td>Provide recycling and treatment capital expenditure investment funds for quality projects,</td>
<td>Innovate on product and delivery system redesign,</td>
<td>Comply with various environmental regulations</td>
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<td>Fund start-up operational costs (grant funders) and infrastructure for best-fit collection and separation of an integrated recycling and treatment system,</td>
<td>Conduct further research on the volume and impact of plastic marine leakage,</td>
<td>Engaged in sustainable waste management practices,</td>
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<tr>
<td>Fund recycling and treatment seed research (i.e., feasibility study, technical assistance) with leveraged partner,</td>
<td>Develop innovations for recycling and treatment technologies that enable unrecyclable waste to become recyclable in environmental friendly ways,</td>
<td>Make waste collection easier for waste managers</td>
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3.1. Proposal for Plastics Waste Withdrawal from the Environment

Plastic pollution is one of the greatest threats to ocean health worldwide. Inspite of society's much efforts to properly dispose plastic waste. Between 4 and 12 million metric tons of plastic waste enter the ocean each year; enough to cover every foot of coastline on the planet. One of the reasons that plastic pollution is such a problem is that it doesn't go away: “plastics are forever!” Instead, plastic debris simply breaks down into ever-smaller particles, known as micro-plastics whose environmental impacts are still being determined. In the course of this research we propose the following steps as possibility of plastic withdrawal from the environment.

3.1.1. Effective Environmental Regulations: Government should place restrictions on the sale of unnecessary single-use plastic items, including sachet water. Increase financial responsibility on those who profit from plastic with regard to waste collection and recycling, and make rules to ensure products allowed are safe, reusable and recyclable. Many municipalities around the world have enacted bans on single use plastic bags, takeout containers, and bottles. We therefore encourage the Edo State Government to adopt this policy into their environmental decision making processes.

3.1.2. Participatory Waste Management Decision Making: The Government should ensure multi-stakeholder participation in decision-making process, by involving Non-Governmental Organization (NGOs), Community Based Organization (CBOs), rag pickers, private sector, residential and commercial communities.

3.1.3. Recycling and Reuse: Plastic items that cannot be reused should always be recycled to ensure they do not end up in the environment.

3.1.4. Expanding the Waste Management Sectors: Waste mangers are contracted only to collect waste deposited by consumers and individuals in a stationary point neglecting the plastic waste that have clogged drainages. Urgent measures should be put in place to expand the sector to increase waste collection from the streets and drainages. We encourage the government to provide trash cans positioned in every 400 meters apart for effective waste management with appropriate sanction for defaulters.
3.1.5. Adopting and implementing a zero waste action plan: Zero waste programmes (transformative knowledge) would provide proactive support strategies to motivate behaviour change towards responsible and sustainable resource consumption practices.
04. CONCLUSION AND RECOMMENDATION
Waste management concentrates pollutants and contaminants from the material life-cycle which would otherwise be discharged to air, water or land. Waste needs to be properly managed in order to protect public health and the environment. But that does not imply an exclusive focus on treatment and disposal.

The best way to manage waste is seeing it as a resource, and by avoiding materials becoming 'waste' in the first place. The role of waste managers needs to be expanded to incorporate more visibly the upstream prevention actions.

Data from stakeholders packaging water in sachets and plastic bottles reveals that the consumption pattern rate of portable water per day is huge, because every household in Benin City depend on either sachet or plastic water. Data also shows that beverages are packaged in plastic bottles to enhance preservation and profit.

This research reveals that the agency responsible for managing solid waste in Edo State is grossly handicapped and inefficient hence the Edo State Government took a proactive step by sacking the Environment Commissioner and dissolving the Waste Management Board. It is evident that the board has failed to carry out assigned responsibilities and duties, because it lacks adequate man power, equipments, and proper waste disposal outfits. In addition, the residents in Benin metropolis lack adequate awareness on the policies for waste management. There is also a lack of full participation of the local government councils.

For an effective and robust plastic waste pollution management in Benin City, focused should be placed on the following recommendations.

4.1. Investing in Infrastructures

Lack of infrastructures for environmental monitoring and pollution control is a major part of the lack of value for nature. Wastes generated in our society are managed conventionally, which focuses largely on waste collection, treatment (composting and incineration) and disposal (landfills). But with available infrastructure, an integrated waste management practices would be adopted which involves waste segregation, reduction (resource recovery and recycling) from the source.
The resource value of waste cannot be realized unless separation of wastes is practiced effectively from the source. Government will need to promote public-private partnerships to implement infrastructure projects in different stages of municipal waste management such as collection, transport, recycling, composting, waste to energy, etc.

4.2. Encouraging Environmental Policing

The Edo State Government has done well by empowering actors to prosecute traffic offenders. Such strategy can be employed to set up a committee that will employ capable hands to act as environmental police to monitor, protect the environment and natural resources of Edo State through enforcement of the key provisions in the law, education, and public outreach. The Office is further charged with protecting the health, safety, and individual rights of the public and preserving our environment for future generations.

4.3. Good Governance and Social Inclusion

For the Edo State environmental protection law to be effective it requires attention to a wide range of governance issues and involving citizens in decision making as well as tackling corruption issues that can influence the peoples change of attitude and behaviors. Good governance system as indicator of pollution control will aid in implementing legislation, assigning clear roles and responsibilities, building professional capacity, instituting management information systems.

It is therefore worthy of note that the cleanliness of a city can be used as proxy indicator for good governance. Good waste governance systems will encourage a shift from 'waste management to resources management' and helps to addressing more than half of the high-level sustainable development goals within the Post-2015 Development Agenda, and promises significant early reductions in greenhouse gas emissions throughout an economy.
05. TESTIMONIES

Plastic Pollution and General Waste Management in Edo State

“The problem here in Nigeria is that there are too many items packaged with plastic materials. Even if this advocacy for phasing out plastics from the environment may work, we would still have the problem of liters of sachet water because it has no recycling value and this is the more reason sachet water should be banned. Here in Nadia Bakery we make use of plastics both bottles and cellophanes, but we are very mindful because we practice waste separation before they are dropped for collection by waste managers and there is a dedicated staff that handles the separation and proper management of the waste generated in this establishment.

We generate more than 100 dozens of plastic bottle waste with unaccounted cellophane wastes. We understand that our staffs have contacts of waste pickers/recyclers that often demand for the used plastic bottles and they make much money from it. What I think ERA/FoEN can do is to advocate for the outright banning of plastic water in all forms and the establishment of used plastic recovery methods by sectors. Not everyone is environmentally conscious, hence this debate is essential for public awareness creation to encourage waste segregation most especially those with recycling values as contribution to waste minimization approach.”... De Akarz (Private Sector)

“We make use of materials packaged with plastics and the most common among them are used plastic bottles resulting to plastic waste and we cannot quantify the plastic wastes generated in this establishment. Our water factory is into water and bread production and the plastic wastes (bottles and cellophanes) generated in this sector cannot be tracked and we don’t have established model for recovery/withdrawal. It has been the responsibility of the Edo State Waste Management Board to clear waste generated from the Hotel Premises. The cleaners here gather all waste materials in designated points for disposal but most of them gather some used plastic for themselves probably for sale or for repackaging of water for domestic uses. The way forward is to encourage recycling, following the model of the Lagos State Government by collaborating with a private firm”... Precious Palm Royal Hotel(Private Sector)
“There is no sector of the economy that does not contribute to waste generation. Our commonest wastes here are food and plastic wastes. Cellophanes foil papers, disposable food packs and plastic bottles are the classes of the waste generated across all our more than 15 branches of this establishment in Benin City. Daily we generate more than 200 dozens of used plastic bottles but we are very conscious of how they are disposed and we don’t default in paying our levies so that Edo State Waste Management Board will also meet up with their own bargain to do a daily collection of the waste that is generated. We don’t separate our waste because it is not our responsibility to do so. We don’t engage in recycling and don’t have idea of what can be done to reduce plastic consumption”...Anonymous (Private Sector)

“I am the production Manger of the UNIBEN Table Water located at Ekenwan Campus. The plastic bottles used for the packaging of water are produced by the UNIBEN Table Water but the sachets are produced by a contracting firm. We produce an average of about 300 dozens of bottled water and up to 1000 bags of sachet waters. We do not engage in recycling activities neither do retract/withdraw all used plastic bottles and sachets from the environment”...Ujie Usunobun Lawrenta (Private sector)

“Every day we receive application for small scale businesses. We are happy that businesses are springing up as one of the mandates of the Ministry but the more industries we have the more the public health and environmental concerns. This Ministry works in collaboration with other Ministries which include Environment, Energy & Water Resources etc. At the level of environmental compliance, it is the responsibilities of the environment Ministry for enforce that. I know that plastic is very dangerous both in content especially health concern and its exposure to the environment.”...Joel Uhunnoma Edionwe, Director of Commerce at the Ministry of Commerce and Industry, Edo State (Public Sector)

“The Edo State Waste Management Board has a Public Private Partnership agreement in the area of waste management. This agreement empowered some private firms to do a regular collection of waste from designated points to the dumpsites. This agreement is aimed at increasing effective waste management system as well as revenue model for the state. The Edo State Government is currently in discussion with a recycling firm but I not sure is she has entered into any concrete agreement with the company. The street sweeping project is an approach to keep the environment clean. Despite all the efforts made so far by the Government waste management system is still poorly organized in the state due to inadequate waste management infrastructures.
The Edo State Sanitation and Pollution Management Law of 2010 is also one of the numerous efforts being put in place for effective waste management and pollution control by the government. Plastic pollution in the environment need special attention for it to be controlled”  .Igho Igbínosa (Public Sector)

“We thought locating this site here could attract development to our community. We were carried away with the promises (building of Health Centre and pipe born water) that accompanied with the project, but today we have been deceived because none of the promises have been implemented. We often experience pollution of the Egwi River our only source of drinking water during the dry season after we must have exhausted the water in our reservoir collected from the rain. We used to drink the water collected from the river but some scientist who did some work told us to stop drinking from the river that it has some toxic chemicals inside it that all the leachates produced in the waste dump site is infiltrating into the ground to affect ground water while others are flowing into the stream to pollute it directly. Flies and mosquitoes are given us troubles. I used to work with the waste management board but had to resign because of the health implication of the job on me.”... Osamede Osamwegia a 45 years old Okada Rider and former staff of Waste Management Board (Waste Trunk Driver) Otofure Community

“The Ikpoba River is known as plastic receptacle where plastics clog every part of the River around the Ikpoba Bridge. We operate a Car Wash here and we depend on water from the River and the constant widening of the River is of great concern to us. We have often suspected the invasion of this session of the river by plastics as the cause of the upsurge of the Ikpoba river which influences its flow pattern. We have to battle with the plastics to create space for us to collect water for washing. Other issue is the weed that have covered the whole river.”...(Anonymous Artisan)

“We are in partnership with the Edo State Government to evacuate wastes from a section of the City so that the environment will be healthy. We engage evacuators who go from house to house removing solid waste which usually include plastic and other items. What people do not know is that the business of waste disposal is capital intensive and when clients do not pay their bills, it affects our work. The Government has arranged it in a way that the bills go directly to the clients who in turn pay to the banks. We do not collect money directly from the people who are our clients, so that when they default, they are summoned from the Governor’s Office. The plastic waste comes with the solid waste and the evacuators collect them from street to street and they use our vehicles to evacuate them to the dump site at Ikheniro.
There is no doubt that plastic waste has caused serious environmental problem in Benin and this can be seen when erosion takes over the roads whenever it rains. Recently, I was called to evacuate heaps of solid waste including plastic from the Ikpoba Slope Road after a heavy rain fall and it took our evacuator two days to effectively evacuate and clear the road of all the solid waste especially plastic waste.”...Mr Samson, Director Phantom Energy Services (Waste Managers)- Private sector

“I am working as an evacuation personnel to take care of my needs. Usually, we can be up to six evacuators attached to one vehicle. We go from house to house and street to street collecting solid waste. Our customers know that everything must be in cellophane bags so that we can easily carry them into our vehicles. All the waste we gather are taken to the dump site at Ikheniro where scavengers take their time to separate the plastic from the iron waste which they sell to people who come to buy them for recycling.” ...Mr Daniel Nwajei, Waste Evacuator (Private sector)

“We are into cleaning, recycling and fumigation. There are solid and liquid wastes but the one that is harmful to the environment is the solid waste which includes plastic waste. Anywhere you go, you will find plastic littering the drains and the impact on the environment is negative. Firstly, it does not decay easily because it can take twenty five and sometimes up to fifty years for it to decay. These plastics end up in our environment and sometimes affecting the yield of our farm produce because the plastic remain in the soil and it can even lead to flooding. Anytime it rains in Benin City, you see flood everywhere because plastic waste from soft drinks and water are properly disposed. The Government should provide an alternative to plastic such as paper container which can decay easily. If this is not feasible, the people can be sensitized on the proper use of dustbins. Recycling plants can be established and the Government can encourage the recycling business to reduce unemployment from the society. The people too should cultivate the habit of keeping their environment clean while the Government should hold every landlord responsible for their dirty environment. We make laws but we do not enforce them hence transporters do not use the waste baskets they are supposed to carry. The Waste Management Board is only interested in collecting money from commercial vehicles upon which they give them waste baskets for their vehicles. The waste management law should written in a way that anyone can arrest anybody for dumping waste along the road.” ...Mr Bojie Egbo (Private Sector)