

Effective & Sustainable Waste Collection System in a Developing Economy

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Paper Outline

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- ▶ Waste Definitions and classifications
- ▶ Waste management
- ▶ Evolving Innovative tools for Waste Management
- ▶ Effective & Sustainable waste collection
- ▶ Waste collection crew
- ▶ Components of effective & sustainable waste collection system
- ▶ Constraints to effective & sustainable waste collection system
- ▶ Waste collection equipment
- ▶ Source Segregation as a tool
- ▶ Waste Hierarchy as a tool
- ▶ Extended Producer Responsibility (EPR) as a tool
- ▶ Circular Economy as a tool
- ▶ Paradigm shift
- ▶ Benefits of evolving innovative tools for Waste Management
- ▶ Conclusions

Introduction:

Lagos

- One of the 36 states of Nigeria with 57 LGA/LCDAs
- Size – About 3577 Sq. Km (0.39% of Nigeria's 923,773 Sq. Km)
- Population of about 22 million people
- 2.5 Million household with 6% annual Growth rates
- Commercial hub of Nigeria & the West African sub-region



Map of Nigeria

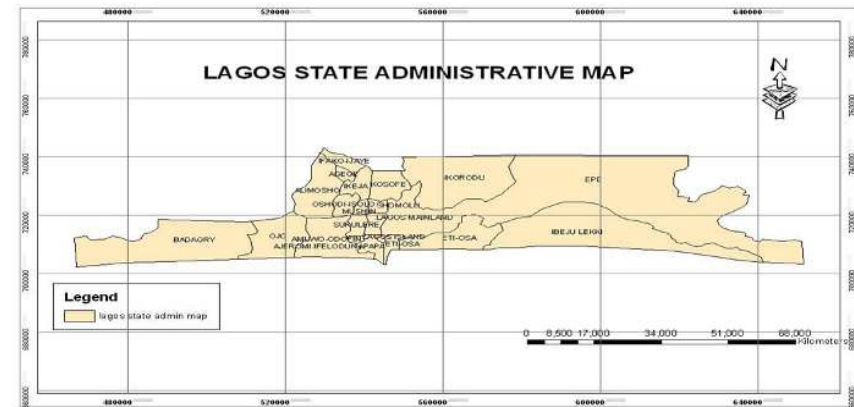
Introduction 2:

Lagos

- o In 2015 Lagos became the 3rd largest megacity in the world. Currently working on transforming it into Smart City.
- o PSP in waste management commenced in Lagos in the 80s
- o Over 70% of the total industries in Nigeria are cited in Lagos
- o Generate between 17 & 20,000 MT of waste daily
- o The generation per capital (GPC) is put at btw 1.2kg & 1.5kg/person/day (WB)
- o A typical waste composition shows that over 50% of waste generated in the state is organic fractions



Welcome to Lagos



Map of Lagos state

Waste Definitions and classifications

► What is waste?

- Waste generation is as old as human existence, it occurs as a result human activities in consumption and production.
- There are so many definitions of waste depending on who is defining it.
- Generally, wastes can be defined as substances or materials that are of **no further value or use** to its generator.
- It can also be said to be substances or materials thrown away or about to be thrown away by the owner or generator. - Out of sight and throw away culture.

Waste Definitions and classifications

► What is waste?

- The Basel Convention (Global convention on the transboundary movement of hazardous wastes -1998) defined wastes as substances or objects that are disposed or are intended to be disposed or are required to be disposed of by the provisions of the National laws.
- To a recycler or an economist or an industrialist; Wastes is a raw material or resources in a wrong hand or wrong place.
- To a waste picker; waste is a hidden treasure yet to be discovered or waiting to be explored
- Waste is not a waste unless you waste it - Circular Economy

Waste classifications

► Waste Types

- Broadly speaking, there are 2 types of wastes namely; general wastes (Non-Hazardous waste and Hazardous wastes).
- **General wastes:** These are also known as non-hazardous wastes, they are usually harmless and do not pose an immediate threat to man and the environment. G.W includes household wastes, C&D wastes, commercial waste, garden waste etc. G.W may however become hazardous if not properly managed.
- This is because most wastes in developing countries, especially household wastes are disposed in a comingled manner (dry cell batteries, Insecticides cans, Asbestos etc)

Waste classifications

- **Hazardous waste:** HzW can be defined as substances or materials that are injurious or harmful or dangerous (even in low concentrations) to human health, animals, plants and the environment.
- HzW can be in so many forms; it could be in solid, liquid, gaseous, effluent or powdery forms. Most time they are discharged by the industries as effluent, gaseous emission and solid waste. It could also be found in unsorted household waste, healthcare waste and from construction and demolition waste in form of asbestos.
- HzW could be explosive, flammable liquids, flammable solids, Poisonous-Acute, corrosive, toxic, & _with Radioactive properties etc

Waste classifications

- ▶ There are several classifications of wastes, however it is mostly classified by:
 - **Origin:** e.g Healthcare wastes, C&D wastes, MSW, Industrial wastes, agricultural wastes, nuclear waste etc.
 - **Form:** e.g Solid, liquid gaseous and powdery wastes.
 - **Properties:** e.g Toxic, explosives or volatile, carcinogenic, reactive, acidic and alkaline
 - **Legal Definitions:** These includes special, controlled, household and industrial waste etc where specific definitions or criteria are used.
 - For the purpose of **Conversion**, waste can be broadly classified into 3; **The Recyclables, The Compostable and The Combustibles**

Waste management

- **Waste management** can be defined as all efforts of humans including storage, collection, transportation, recovery, processing and disposal of all substances or materials that are no longer needed by the original generator.
- The Oxford Advanced Dictionary defines Management as the act or skill of dealing with people or situations in a successful way. Equally, Wikipedia defines Management as the act of getting people to accomplish desired goal and objectives using available resources efficiently and effectively, it includes *Planning, Organizing, Staffing, Leading or Directing and controlling* an organization or system for the purpose of accomplishing a goal.

Waste management

- It went further to describe **management** as a human action including designs to facilitate the production of a useful outcome for a system
- Therefore waste management can also be described as human actions including *Designs, Planning, Organizing, Staffing, Leading or Directing and controlling* an organization or system for the purpose of accomplishing a goals.
- The goals to be accomplished with waste management are;
 - ✓ To reduce the effects of waste on human health. (Public Health reasons)
 - ✓ To reduce the effects of waste on the Environment. (Prevent air, water and soil pollution) - Our existence...
 - ✓ To maintain and improve the aesthetics of our Environment
 - ✓ And lastly, for resource recovery (Food, Raw-materials, Energy etc)

Evolving innovative tools for Waste Mgt.

- Globally, waste management has moved from the traditional / basic waste Collection and Disposal.
- Innovative Technologies plays crucial role in modern waste management practices, this has made effective and sustainable waste management more seamless.

KEY STEPS TO SUSTAINABLE WASTE COLLECTION /MANAGEMENT

- Set your vision: Ensure that the vision is SMART - Specific, Measurable, Attainable, Realistic & Timely.
- Set the goals you want to accomplished
- Policy Development - Including Legal/Regulatory framework, Institutional Development, Funding source/ Plan, Socio-Political issues (SWOT Analysis should also be deployed).
- Adoption of tools - Effective & sustainable collection system + Effective Cost Recovery System.
- Policy Implementation & Monitoring
- Evaluation & Feedback
- Political WILL is key

Effective & sustainable waste collection

- **Waste collection** is a part of the process of waste management. It involves the collection and transfer/transportation of waste from the point of generation (Residential, Industrial/Commercial, Institutional or Markets etc) to the point of treatment or landfill.
- Different methods of Waste collection can be adopted depending on the types, form and volume of waste to be collected.
- Collection methodology adopted is dependent on the peculiarity of the area and the time/period of collection.
- Sources of waste generation is a factor in waste collection and the choice of equipment to be deployed.
- Domestic or Residential- Carts, Tricycles, Compactors, Open trucks
- Commercial/Industrial -Compactors, Roll-on- Roll-off, Dino bins, 1100L bins
- Public/ Social waste - Compactors, Open truck tippers,
- Medical - Small vans and mini truck
- **NOTE:** Waste collection trucks **MUST** be LOW bedded chassis trucks. An ideal waste collection trucks must have a good sitting area for the operatives (Crew) to seat when transporting the waste to a treatment or disposal facility.

Effective & sustainable waste collection

- **Methods of Waste collection:**
 - a) **Door to Door/House to House** - This is the best method of waste collection, it involves moving from house to house to collect the waste generated on a scheduled day. It is based on a PPP arrangement
 - b) **Curbside/Kerbside** - This is similar to house to house waste collection method, sometimes it is called Kerbside recycling/Pickup. It is usually accomplished by personnel using purpose built vehicles to pick up household waste in containers acceptable to or prescribed
 - c) **Automated Vacuum Collection (AVAC)/Pneumatic** - Highly automated in nature, either attached to buildings or sited by the walkways. Works with Censors through intake Portholes
 - d) **Communal/Community Bin** - This is a direct opposite of house to house waste collection. Residents take their waste to a communal bins placed strategically within a neighborhood. Collection is done when the bins are filled up. Informal services providers also use the communal bins.

Effective & sustainable waste collection

- **Waste collection crew:** This are the personnel that are directly involved in waste collection, transportation, monitoring and cost recovery. It includes a driver, 2 or 3 waste evacuators and a supervisor
- **Functions of waste collection crew:**
 - a) Ensure that the collection truck is checked on daily basis
 - b) Ensure that the route plan is strictly adhered
 - c) The evacuators should ensure that all waste placed outside or in an accessible areas are all collected.
 - d) The supervisor should ensure that he monitors the operations and mark all houses served during a particular trip
 - e) The supervisor should educate the waste generators on the best practices of waste handling, like proper storage, waste segregation & encourage prompt payments etc.
 - f) Ensure that the collection trucks are keep clean at all time etc

Components of Effective & Sustainable Waste Collection System.

- Functional waste collection trucks and other equipment
- Waste handling equipment e.g Appropriate containers/Bags – Encouragement of 3Rs through source segregation of waste
- Effective Route plan for waste collection
- Sustained public enlightenment and engagements
- Cost Recovery is key to the sustenance of effective & sustainable waste collection system - Inconsistency and natural collapse of the system may occur when CR is not adequate
- Adequate Budgetary allocation either by the Government or the private sector
- Prompt accessibility to treatment/disposal facilities is KEY too
 - The bedrock of any meaningful /sustainable waste collection system is the treatment/disposal facilities (MRFs, TLSs, WTFs, WtE facilities etc)

Components of Effective & Sustainable Waste Collection System Cont...

- Enforcement is key too - Adopt Carrot & Stick approach, The Environmental Health Officers has a major role to play
- Health & Safety - Personal Protective Equipment is important for waste handlers
- Political will on the part of government, Inadequate Budgetary allocation
- Operational procedures must be set
- Performance metrics / index must be defined
- Service Level Agreement **MUST** be strictly adhere to

Constraints/ hindrances to Effective & Sustainable Waste Collection System.

- Inconsistency of government policy
- Inadequate infrastructure - bad/narrow roads, inadequate disposal facilities, (MRF, TLSs & Treatment facilities etc)
- Effective Route plan for waste collection
- Inability to manage available disposal facilities in a sound environmental manners.
- Lack of adequate public enlightenment and engagements
- Attitudinal problem - lack of interest on the part of the waste generators.
- Lack of political will on the part of government. - It affects compliance, enforcement and cost recovery
- Inadequate Budgetary allocation/ inadequate investment for waste collection services.
- Lack of enabling environment that can attract adequate investment

Waste Collection Equipment.

- The choice of waste collection equipment is largely dependent on the types, form and volume of waste to be collected. Generally, waste collection equipment includes - **The humble beginning!**



Waste Collection Equipment. In Pix



Waste Collection Equipment. In Pix..2



Waste Collection Equipment. In Pix..3



Waste Collection Equipment. In Pix..4



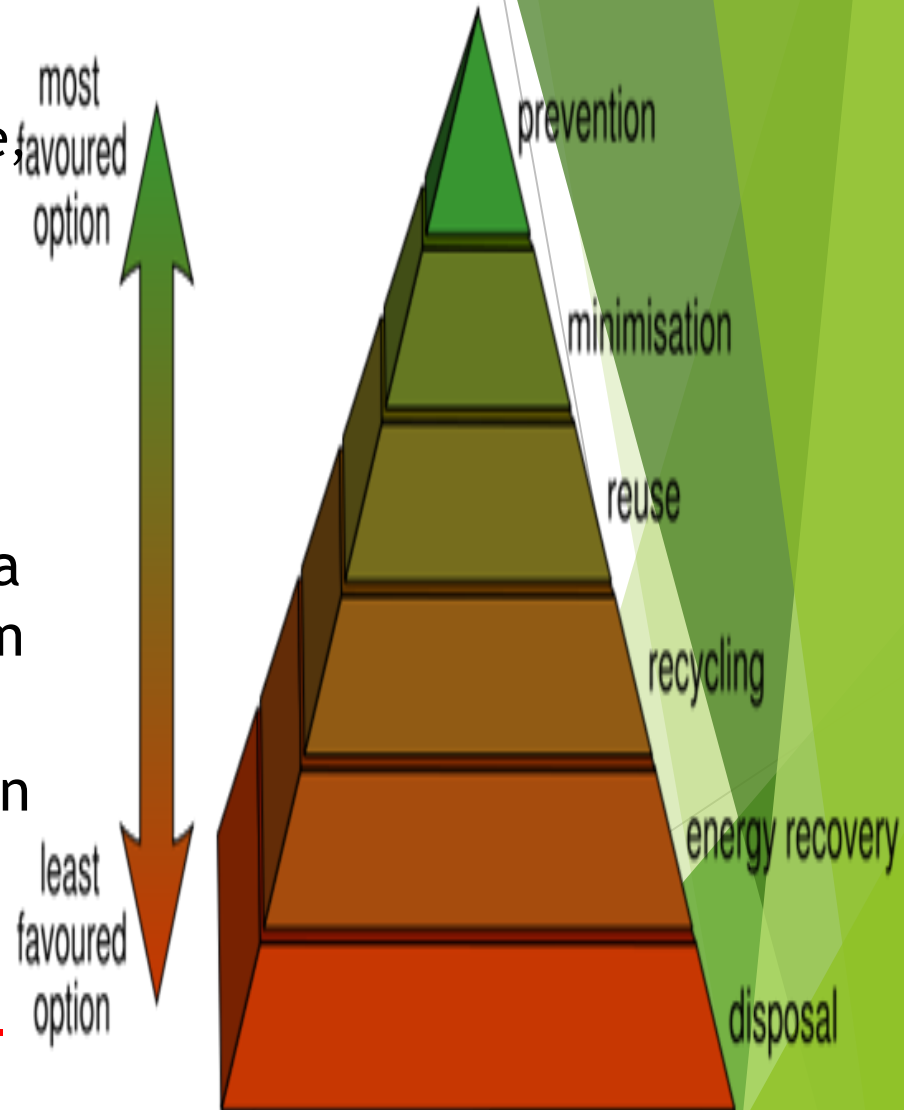
Source Segregation as a Tool

- Waste segregation is one of the simplest strategies of implementing waste to wealth.
- Source segregation of waste is the process of separating the generated waste into different component at the point of generation.
- The separation could be as simple as sorting into dry and wet waste, it could also be as complex as sorting into as many as 6 to 8 or more components
- It encourages Recycling & Recovery
- It could be a source of income
- It provides clean & uncontaminated waste materials to the Recyclers
- It reduces the volume of waste disposed at the disposal sites



Waste Hierarchy as a Tool

- Waste hierarchy is one of the widely adopted WM concept
- It is supported and promoted by the UN, through the popular 3Rs (Reduce, Reuse and Recycle).
- The concept classify WM strategies according its ability to promote or encourage Zero Waste.
- The concept is hinged on the extraction of maximum usage of a product and to generate minimum waste.
- There are some new arguments on the hierarchy.
- Another widely adopted WM concept is **Polluter Pays Principle**.
- It also encourage resource recovery



Extended Producer Responsibility (EPR)

► What is EPR?

- It is a strategy designed to promote the integration of environmental costs(PPP) associated with goods throughout their life cycles into the market price of the products.
(Thomas Lindhqvist , April 1992)
- It is therefore an environmental protection strategy to reach an environmental objective of a decreased total environmental impact of a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the **take-back, recycling, treatment** and **final disposal**.
- The concept was first introduced in Sweden in the 1990s by L, T in conjunction with Swedish Ministry of environment.
- In Nigeria EPR is promoted by NESREA, unfortunately the implementation is a bit challenging

The Goals/Benefits of EPR?

- ▶ The goals and benefits of EPR programs are numerous; below are just few:
 - It encourages producers to redesign their products (at source) for effective usage and recycling.
 - It helps to “avoid everyone’s responsibility is no one’s responsibility” - Someone must be responsible.
 - It ensures the recovery and recycling of waste in the most economically efficient and Environmentally Sound Manner (ESM)
 - It supplements PPP & waste hierarchy through higher utilization of products & materials (3Rs)
 - Effective collection system.

Circular Economy as a Tool

- Circular Economy is another strategy of implementing total waste utilization.
- It is aimed at maximizing waste usage for a more competitive resource efficiency economy.
- C.E simply means reusing, repairing, refurbishing, recycling and energy recovery of existing materials & products, Usually called “Waste” (Not Take , Make & Dispose)
- It helps in the conservation of the natural resources.
- It encourages Recycling & Recovery
- It provides clean & uncontaminated waste materials to the Recyclers
- It reduces the volume of waste disposed at the disposal sites



Do you know?



=



28 PET bottles = 1 T-shirt

Do you know?



=



670 Aluminum cans = 1 Bicycle

Do you know?



=



19,000 tins (steel) = 1 small car

Paradigm Shift

- ▶ The time for paradigm shift from the old way of seeing waste as a 'throw away materials' is NOW!
- ▶ Nigerian manufacturers (importers/ distributors) need to embrace the EPR strategy to ensure effective take-back, recycling , treatment and safe disposal of all end of life products manufactured by them.
- ▶ Manufacturers should begin to Think out of the box, in terms of products re-design, resource efficiency and the management of their waste packaging materials in the most economically efficient and environmentally sound manner.
- ▶ It is time to begin to see **cash** in our **trash**.
- ▶ Take note 'waste is not waste unless you waste it'

Paradigm Shift

- ▶ The manufacturers should begin to invest in technologies and equipment that will convert their waste into energy - Needed in their productions.
- ▶ The manufacturers should begin to fund effective collection of their packaging materials and end-of-life products for effective treatment and recycling.
- ▶ It is time for the establishment of recycling and treatment facilities in Nigeria to utilize the waste from the industrial sector and residential homes.
- ▶ It may be possible for manufacturers to earn some income from Carbon Credits for reducing the volume of Carbon released into the atmosphere. ?

Benefits of Effective & Sustainable waste collection

- ▶ The benefits of effective and sustainable waste collection cannot be overemphasized.
- ▶ It ensures that all waste generated are effectively collected
- ▶ It prevent improper/indiscriminate waste disposal
- ▶ It encourages the adoption of both PPP and resource efficiency thereby ensuring fullest utilization of products.
- ▶ The benefits includes, economic benefits, environmental benefits, social benefits and health benefits.

Benefits...

► Economic benefits:

- Job creation, both direct and indirect jobs.
- It creates new line of Green businesses, such as transportation, resource recovery, processing and selling of recovered materials.
- Reduces the cost of production, through energy conservation, e.g aluminum production
- Reduces the cost of waste disposal
- Increased tax income for the government.
- Foreign exchange earnings

Benefits...

► Environmental benefits:

- Reduced pollution of the air, water and land/soil.
- Saves or reduce the exploration of the natural resources.
- It helps to prolong the life span of disposal sites.
- Reduces deforestation.
- Reduces the generation of Green Houses Gasses which are released to the atmosphere when wastes are burnt, thereby causing climate change and global warming.
- Recycling brings about green economies

Conclusions 1...

- ▶ Using Lagos as a guide, it is pertinent to emphasise that **Political WILL** is key to a sustainable, effective & efficient integrated waste management system in developing a Smart City. In order to return Lagos state back to the path of Honour when her PSP model was a benchmark for other states in Nigeria and Africa, I will also like to recommend the following;
 - Set Vision that is SMART (Specific, Measurable, Attainable, Realistic & Timely)
 - Set Goals that are SMART too
 - In developing a WM model, every identified stakeholder must be carried along - Town hall meetings, Sustained Public Enlightenment & Education, NGOs
 - Creation of enabling environment through legislation & institutional frameworks. (Stick & Carrot Approach)
 - Policy Implementation, Monitoring and Feedback must be taken seriously
 - Increase budgetary allocation on WM
 - Develop local technology for WM (Think Globally - Act Locally) - My Cairo experience
 - Adequate agreements and guarantees **MUST** be given to the Private Sector to ensure sustained funding of WM Strategies/Models

Conclusions 2...

- ▶ The government should ensure sustainable waste management system, including Waste Avoidance, waste storage, Door to Door collection, transportation, recovery, recycling, composting and Waste to Energy activities.
- ▶ Both government and all identified stakeholders should prioritize capacity development, through training and re-training of staff, study tours and exposures etc.
- ▶ Bridge the GAP between the Town and the Gown
- ▶ The time for paradigm shift from the old way of seeing waste as a 'throw away materials' is NOW!
- ▶ Nigerian manufacturers need to embrace the EPR strategy to ensure effective take-back, recycling and safe disposal of all end of life products manufactured by them.
- ▶ Manufacturers should be socially responsibility (CSR)
- ▶ Advocacies aimed at institutionalizing sustainable recycling activities should be embarked upon by Government and all other identified stakeholders.

Ponder on this!!!

I will like to leave you with these parting words -
Ponder on them!

“The Environment is our commonwealth and heritage, let us all preserve it by living right” - Adebola Olugbenga

“It is whatever you give to the Environment, that the Environment gives back to you” - Adebola O.

“Our lives begin to end the day we become silent about things that matters” - Dr. Martin Luther King Jr.

“The time is always ripe to do what is right” - Dr. Martin Luther King Jr.



Thanks for your attention!

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