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# **Sustainable Waste Management in Developing Countries and Emerging Economies: Case study Nigeria**

## **ABSTRACT**

Migration from the rural settlement to the urban centers has led to considerable increase in population in the urban areas. The lack of infrastructure to provide basic facilities for these immigrants coupled with the high rate of industrialization has increased solid waste production, inevitably leading to poor waste disposal and management in most developing countries. These solid wastes are mostly undesirable by-products of economic development and industrial activities. They may be flammable, toxic, carcinogenic, and corrosive making them dangerous to life if not properly manage. Solid wastes have elicited strong international concerns due to their possible, socioeconomic, environmental and public health impacts. In an attempt to guide against the release of hazardous contaminants from solid wastes which are capable of polluting the environment and harming biotic communities, different methods of wastes management such as incineration, landfilling, recycling, composting, disposal into sea and waterways, burning along major roads and surface dumping is being utilized worldwide.

Solid waste management (SWM) is a multidimensional issue that incorporates political, institutional, social, environmental, and economic aspects. Improving SWM in developing countries requires efforts to raise public awareness, increase funding, build expertise, and invest in modern infrastructure. To make progress communities will need to embrace new systems for SWM that are participatory, contextually integrated, complex, and adaptive.

There are numerous solid waste issues facing developing countries, Nigeria inclusive. These include lack of appropriate legislation and policies for implementing realistic, long-term goals. This is because most government policies on environmental related issues are usually disorganized and poorly implemented, as well as insufficient training on waste handling and poor methods of collecting reliable data. Most settlements in the developing countries are without proper design leading to unsuitable storage and limited collection of waste especially among the poor urban dwellers that receive minimal or no waste collection services when compared to the high-income areas that receive an average of 70% coverage. Also, the lack of good waste disposal methods

which include the use of ill-managed dump sites that are usually without liners and covers which encourage human scavenging and animals feeding on these sites is a great set back to solid waste management. The use of dumpsite is on the rise in Nigeria due to the no cost or low cost of siting and operating of these dump sites whereas very few properly operated sanitary landfills are available basically because of siting difficulties, higher capital and operating costs, and lack of engineering know-how. The use of unsuitable technology for solid waste management which includes poor monitoring, ineffective surveillance method and insufficient knowledge of the basic principles of operation are also on the rise due to financial constraint.

However, one of the key adapting solutions in waste management for rural and urban areas in developing countries is capacity building in the management of solid waste. Capacity building is basically to increase the knowledge of solid waste management of all members of the community including the stakeholders. There are basically two types of capacity building which are the public officials and the general public. Strategy for public officials' capacity building involves developing and putting into practice specific programs for each of the important categories (elected officials, the permanent employees in local government, and members of environmental solid waste management, public health, and related areas) in the public sectors. The strategy for public education must be developed in close cooperation with professionals knowledgeable of the local condition, and must also rely on all methods of communication popular in the specific area. Public education must involve the use of simple language, use of dialect as needed, leverage participation of school children and universities.

In solid waste management, some factors are required as keys to success which include; political will to solving problems of waste management, instituting measures to retain properly trained personnel in offices, willingness to put cost recovery mechanisms into place, encouraging the development of realistic plans. These factors can be attained by the use of appropriate technologies, securing available resources (financial and human sustainable operations), and determining the availability of markets for recyclables (product quality).

This article reviews explicitly the factors increasing solid waste production, constraints to solid wastes management, the benefits of solid wastes management, and potential solutions to solid wastes management in Nigeria.

**Keywords:** capacity building; key adapting solutions, considerable population increase; solid waste issues; solid waste management

## **Environmental and Public Health Challenges of Livestock Waste Management in Nigeria**

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**ABSTRACT:** Nigeria with the largest human population in Sub Sahara Africa is experiencing incase demand and production of livestock to meet her animal protein need. Intensive agriculture, periurban and urban livestock production activities generate huge volume of biosolid and bioliquid wastes (effluents). Livestock effluents comprise majorly organic materials laden with microorganisms, also provide good medium for growth and multiplication of pathogenic and non pathogenic microbacta. Moreover, drugs and chemical residues used for livestock production are excreted in the effluents thereby constituting biological and chemical pollution of environment and surface water with attendant public health risks. Unregulated livestock production which is a common practice in Nigeria involves dumping and discharging of untreated waste into the environment. Zonotic pathogens are spread at the dung hills and along the course of the discharge, while scavenging man and animals could also contribute to epidemiological events through these routes. Also the streams and rivers used for drinking and other domestic activities are also prone to pollution by effluent dumping and discharges. Livestock waste is also implicated directly and indirectly for 18% green house gas (GHG) emission that also contribute to global warming and loss of biodiversity.

However, in Nigeria, livestock wastes are utilized as manure for urban and rural crop farming as well as feeding of fish in aquaculture. Improper utilization of untreated wastes also implies spread of microbes and chemicals into environment, crop and fish. Sustainable development with rising food animal demand and production therefore will require sound waste management that promotes safer recovery of any form of waste and the promotion of environmentally sound waste treatment that enhances integration of and changes to a more sustainable pattern. Therefore there is need for establishment of safe, efficient and sustainable livestock waste management in Nigeria. Also, the interaction at EXCEED 2016 summer school will enhance for collaboration for the design and implementation of sustainable livestock waste management in developing countries.

# **Introduction to Waste Management** **(Risks and Challenges)**

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## **ABSTRACT**

**Keywords:** Resource management, climate change, marine litter, water protection, waste avoidance, recycling, capacity building, governance

The thread of this presentation is structured around the aspects risks and challenges. Negative aspects such as pollution, emissions and their effects are explained. The need for action will be derived from the risks and the resulting challenges explained.

The presentation tries to show direct and indirect impacts on water quantities and water qualities. Marine litter—certainly not only the currently most well-known, serious form of pollution to our lakes, oceans and waterways, but also one with the greatest long-term consequences—is attributable to improper waste management. It is well known that climate change has significant impacts on water as a system; what is less known is the fact that waste management represents one of the largest sectors for greenhouse gas emissions caused by improper landfilling. In contrast, recycling measures can in turn reduce energy consumption and thereby minimize greenhouse gas emissions.

An overview of the various solutions is provided. The conclusion is clear that the waste management sector has undergone a paradigm shift in recent years. Sustainable waste management contributes to climate and water protection. Just as importantly, it forms the most critical construct for securing future resources.

Most developing and emerging countries have great potential to implement sustainable waste management. An intensive exchange of – both positive and negative -- experiences with countries that already have extensive sustainable waste management programs in place is helpful to minimize errors, save time and deploy financial resources efficiently. Methods for sharing expertise are shown.

# **Waste Management in Hong Kong**

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Global waste generation is predicted to reach ~2.5 billion tonnes per year by 2025 in the metropolitan areas alone, exerting an acute pressure on almost all countries, not just to their environment but also to the natural resource due to the cradle to grave approach in waste management. In Hong Kong, 14,859 tonnes/day (tpd) of solid waste including municipal solid waste (66%), construction waste (27%) and special waste (8%) were landfilled in 2014. Considering the unavailability of landfill space, it is a hectic challenge to manage the tremendous amount of waste generated. In the last decade, the per capita waste disposal rate decreased from 1.38 kg/person/day in 2005 to 1.27 kg/person/day in 2011; and from there an increasing trend was noted again reaching 1.35 kg/person/day in 2014.

Looking back to history, the ‘Waste Reduction Framework Plan 1998-2007’ was the first attempt to maximize the life of the landfills through waste recycling and incineration. However, the failure of building the incineration led to the failure of this framework thus eventually “A Policy Framework for the Management of Municipal Solid Waste (2005-2014)” was launched in December 2005 that emphasized a basket of waste management strategies including waste charging, and installation of biological treatment facilities and incineration. The framework set the targets of reducing MSW generation by 1% every year, reaching a waste recovery rate of 50% by 2014, and reducing landfill disposal to <25% by 2014. Once again, by 2013, most of the targets listed in the Policy Framework did not come into realization except for the partial implementation of the Producer Responsibility Scheme for plastic bags. With extensive education program on source separation of domestic waste, a recovery rate of 48% was achieved in 2012 well ahead that of the targets set; however, the other two targets could not be achieved. The main issue is the increase in the total amount of MSW without a corresponding implementation of waste reduction policies and treatment facilities.

In view of this pressing situation, the “Hong Kong Blueprint for Sustainable Use of Resource 2013 - 2022” was released in 2013 emphasizing waste as a resource. The Blueprint has put a target to policy change supplemented with the installation of biological treatment facilities, a waste to energy facility and the extension of existing landfills for the final disposal. In addition, “A Food Waste & Yard Waste Plan for Hong Kong 2014-2022” was also released focusing on the reutilization of putrescible wastes. The waste reduction rate is expected to increase to 55% with the waste charging policy and Producer Responsibility Scheme being implemented. Thus by 2020 we expect a 40% reduction of MSW and the amount of waste going to the landfills will be 22% of the total MSW while those going to incineration will be around 23%.

Hong Kong is now at the crossroad of developing effective waste reduction policy to introduce economic initiative to engage the community in waste reduction and separation.

This together with appropriate selection of waste to energy technology will divert waste from landfill disposal providing a viable option for a densely populated city like Hong Kong.

**Keywords:** Hong Kong, MSW, food waste, waste management

## **Sustainable Waste Management in Nigeria** **Olubodun Olasimbo**

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Nigeria with a population of over 170 million, is in the Western part of Africa, has 36 states and a Federal Capital Territory. The increase in population, urbanization, globalization and industrialization and has increased the challenges of solid waste management in the country. This increased the demand for good waste management service for public health and environmental service. In Nigeria generally, the average rate of generation is estimated at 0.5/capital/day with biodegradable waste accounting for over 50% of the waste generated with other component estimated at different composition in different states of the country.

Lagos state in south west Nigeria act as a good model for sustainable waste management for other states in the country by carrying out recycling activities on selected valuable materials. Examples of recycling activities in Lagos state includes:

A Compost plant at Ikorodu for the treatment of market waste - is generates 24,000 tonnes and maximum of 42,000 tonnes of compost in the second half of 2011;

Waste- to -Energy plant at ikosi market – generates biogas from the market waste that powers the 2KVA generator at the market;

Plastic recycling plant at olushosun which converts water sachets into garbage bags - the government introduces a buyback programme for water sachet, carton paper and glass; Formulation of recycling clubs in secondary schools to instil recycling habit in young people. In other part of the country, waste are disposed in dumpsite at designated places either owned by government or private owners and some cases in burrowed pits and empty spaces illegally.

The challenges often encountered in waste management includes: service delivery; Lack of comprehensive legal framework and enforcement of existing one; Low investment (private) in infrastructure; inadequate human capacities for administrative and technical use; wrong attitude of the public towards solid waste disposal; Financing- cost recovery is low in most state and also no funding; Poor planning – inefficient data management and uncontrolled urbanization; uncoordinated institutional functions; low academic research and industry leakage.

Waste disposal habit of the people, corruption, work attitude, inadequate plants and equipment among others are militating against effective waste management to attain sustainable development in Nigeria as a whole.

There is therefore the need for a sustainable development in waste management in Nigeria, the availability of land (for landfill), human resources, plant and equipment and other tools including capital must be readily available. We need to protect future for the next generation by cleaning up our environment of all types of waste, taking into consideration both physical and population development of the state. As such waste management must mean the collection, keeping, treatment and disposal of wastes in such a way as to render it harmless to human and animal life, the ecology and the environment generally.