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Impact Assessment of Waste-to-Resources Management for Circular Economy Development and Green Growth in Nigeria and Ghana

Opeyemi Anthony Amusan[a,b,c]

a University of Ibadan, Center for Petroleum, Energy Economics & Law, Nigeria Email: amusanope@gmail.com
b Development Impact West Africa, ECG, Safisana, GIMPA - Ghana; Hewlett Foundation & CEGA - USA
c Amiesol Resources Konsult, P.O. Box 23039 University of Ibadan Post-office Agbowo, Ibadan, Nigeria

Abstract

Poor waste management results in environmental and socioeconomic problems in Nigeria and Ghana. Attempts at managing waste through burning can lead to climate change while landfill leachate reduces soil and ground water quality. Hence, the need to look for better alternative. This research looks at the current challenges in the waste management system in Nigeria and Ghana, as well as proposes a more contemporary system that will move the two Anglophone Countries towards attaining a circular economy. Environmental Kuznets Curve hypothesis provided theoretical framework. Purposive sampling of major landfills in Nigeria and Ghana with their waste generation pattern using structured questionnaires (250) on spatial variation, challenges and prospect of waste management practices were done. The results were validated at expert workshop for key officials within the waste management industry. Data were analyzed using descriptive and inferential statistics. Waste Habits of Nigerians were 57.0% organic, 27.0% plastics, 5.0% glass, 5.0% metal and 4.0% others, ending up mostly on landfills or dumpsites. Only 28.1% and 41.8% separated waste at source, 46.2% and 58.5% used private collection services in Nigeria and Ghana respectively. The major waste management challenges were pollution and health risks (69.1%), limited resources (44.8%), lack of technical skill (23.8%) and inadequate management skill (18.1%). As part of waste management practices, 95.2% and 97.6% were willing to participate in circular economy, 94.3% and 98.1% supported polluter pays principle, 96.2% and 98.5% supported dissemination of public information on waste-to-resources in Nigeria and Ghana respectively. Waste management challenges significantly influenced health issues and pollution in both Countries ($p=0.05$). A theory of change was established to capture the activity, outputs, results, outcomes, impact and the sustainable development goals (SDGs) realized. With the implementation of waste-to-resources projects in Nigeria and Ghana, some of the outputs are; production of clean energy, improved sanitary conditions of markets and slaughter houses, production of compost fertilizer for urban agriculture, and cultivation of green vegetables. Both Countries are now benefiting from the operations and services of the Pioneers, customers also patronize, buy and recycle products. The impact cut across clean environment, health, food security, increased income and eight (8) SDGs realisation. Government has a role in creating an enabling environment and stimulating demand to sustainably transits from current linear to circular economy in the West African Countries.

Keywords: Challenges of Waste, Circular Economy, Green Environment, Theory of Change, Waste-to-Resources

1.0 Introduction

Waste, both from domestic and commercial sources has grown significantly in Nigeria and Ghana over the past decade (see table 1). This can be connected to increasing population growth: every time people shop in stores or open markets; they contribute to the mountains of waste generated in their environment and the country at large with attendant environmental health and socioeconomic implications. These implications of depict that waste management is both a national and global concern. One of the main effects that the population is beginning to suffer is the lack of government attention to urban cities centers. In other words, they are forming makeshift urban centers, and do not receive timely intervention by the government (local, state and federal) as multiple situations that result in the degradation of the populace appears. One of these absences is the proper waste management, sanitation (lack of urban toilet services) and drinking water supply in these urban centers, causing a lack in adequate personal hygiene in the areas in which they live, as well as excessive accumulation of waste because in these areas of new urban centres there is no planning for the provision of waste disposal and collection services. The quest for sustainable development, clean environment and resources recovery has led to the emergence of a circular economy as a viable and better choice as opposed to our current linear economy. From linear to circular economy, there is a need for a paradigm shift in the product economy regarding the curtailing of environmental impact and waste of resources through increased efficiency at all stages. With a circular economy, waste is seen as a viable resource and not an undesirable end product of society. Waste is seen as input material for the creation of valuable products as new outputs. For this to be successful, all hands must be on deck and all stakeholders actively involved. There must be seamless synergy in the products development, infrastructure, equipment and services sector with the conventional waste managers rightly supported to take the driver's seat. (Amusan 2018, 2019 & 2020).

Table 1: Types and Sources of Waste

SOURCE	TYPE	COMPOSITION
Municipal Solid Waste (MSM)	Residential	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood glass, metals, ashes, special wastes (e.g. bulky items, consumer electronics, white goods, batteries, oil, Tires), household hazardous wastes, e-wastes.
MSM	Industrial	Housekeeping, wastes, packaging, food wastes, wood, steel, concrete, bricks, ashes, hazardous wastes.
MSM	Commercial & Institutional	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes, e-wastes.
MSM	Construction & Demolition	Wood, steel, concrete, soil, bricks, tiles, glass, plastics, insulation, hazardous waste.
MSM	Municipal Services	Street sweepings, landscape & tree trimmings, sludge, wastes from recreational areas.
Process Waste		Scrap materials, off-specification products, slag, tailings, top soil, waste rock, process water & chemicals.
Medical Waste Medical Waste		Infectious wastes (bandages, gloves, culture, swabs, blood & body fluids), hazardous wastes (sharps, instruments, chemicals), radioactive wastes, pharmaceutical wastes.
Agricultural Waste		Spoiled food waste, rice husks, cotton stalks, coconut shells, pesticides, animal excreta, soiled water, silage, effluent, plastics, scrap machinery, veterinary medicines.

2.0 Material and Methods

2.1 Survey Methods

Environmental Kuznets Curve (EKC) hypothesis provided theoretical framework. Purposive sampling of major landfills and dumpsites in Nigeria and Ghana with their waste generation pattern using structured questionnaires (250) on spatial variation, challenges and prospect of waste management practices were done. The results were validated at expert workshops for key officials within the waste management

industry both in Nigeria and Ghana. The data generated were analyzed using descriptive and inferential statistics.

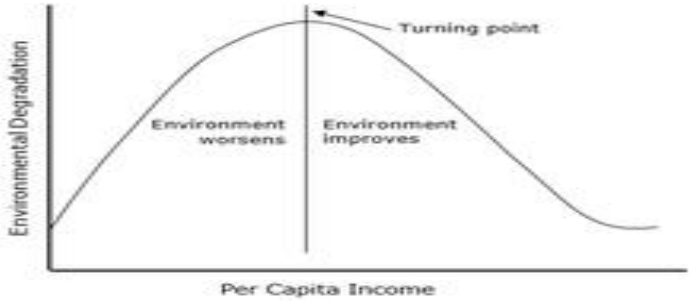

Figure 1: Environmental Kuznets Curve (EKC)

2.2 Survey Areas

Nigeria, a developing nation with population of approximately 200 million people and land area of 923,768 km square is the most populous country in Africa and 9th most populous in the world. Whereas about 50% of its population live in urban areas (48.3%), 52.7% live in rural areas and population density at 139 people per square km. The GDP per capita is about $1,800 with above 50% living below poverty line. Nigeria is located in Western Africa on the Gulf of Guinea. The country land borders with the Republic of Benin in the West, Chad and Cameroon in the East, and Niger in the North and has a coastline of at least 853km. Ghana, a developing nation with population of about 32 million and land area of 238,535 km square (92,099 sq. mi) is a West African country located in the Economic Community of West African States (ECOWAS) and the second most populous country in the region, after Nigeria. It abuts the Gulf of Guinea and the Atlantic Ocean to the south, sharing borders with the Ivory Coast in the west, Burkina Faso in the north, and Togo in the east. Its land-cover spans diverse biomes ranging from coastal savannas to tropical rain forests. Accra is the largest city capital with Tema as its industrial area, while Kumasi, Tamale, and Sekondi-Takoradi are other major cities.

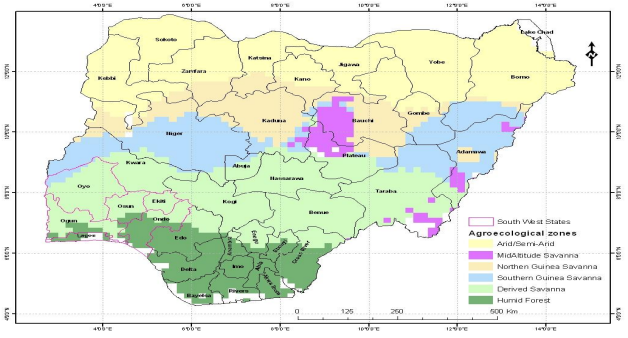

Figure 2: Map of Nigeria

Figure 3: Map of Ghana

3.0 Results and Discussion

Waste Habits of Nigerians were 57.0% organic, 27.0% plastics, 5.0% glass, 5.0% metal and 4.0% others, ending up mostly on landfills or dumpsites. Only 28.1% and 41.8% separated waste at source, 46.2% and 58.5% used private collection services in Nigeria and Ghana respectively. The major waste management challenges were pollution and health risks (69.1%), limited resources (44.8%), lack of technical skill (23.8%) and inadequate management skill (18.1%). As part of waste management practices, 95.2% and 97.6% were willing to participate in circular economy, 94.3% and 98.1% supported polluter pays principle, 96.2% and 98.5% supported dissemination of public information on waste-to-resources in Nigeria and Ghana respectively. Waste management challenges significantly influenced health issues and pollution in both Countries ($p=0.05$). A theory of change was established to capture the activity, outputs, results, outcomes, impact and the sustainable development goals (SDGs) realized. With the implementation of waste-to-resources projects in Nigeria and Ghana, some of the outputs are; production of clean energy, improved sanitary conditions of markets and slaughter houses, production of compost fertilizer for urban agriculture, and cultivation of green vegetables. Both Countries are now benefiting from the operations

and services of the Pioneers, customers also patronize, buy and recycle products. The impact cut across clean environment, health, food security, increased income and eight (8) SDGs realisation.

3.1 Survey Pictures

Figures 4-11: Pictures for Field Works and Experts Workshops

3.2 Results in Diagrams

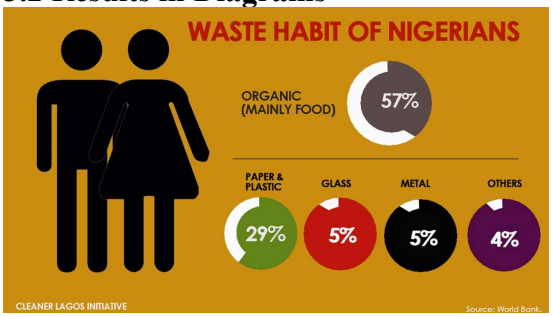

Figure 12: Waste Habit in Nigeria

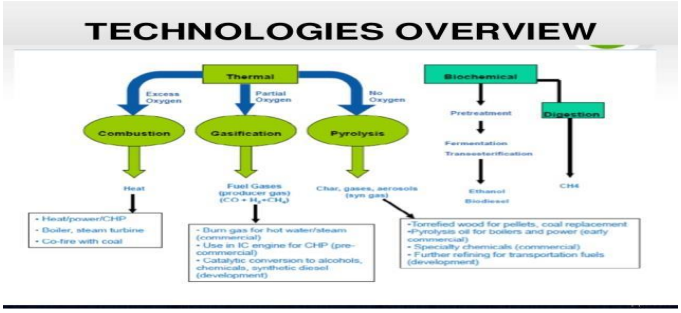

Figure 13: Waste-to-Resources Technologies

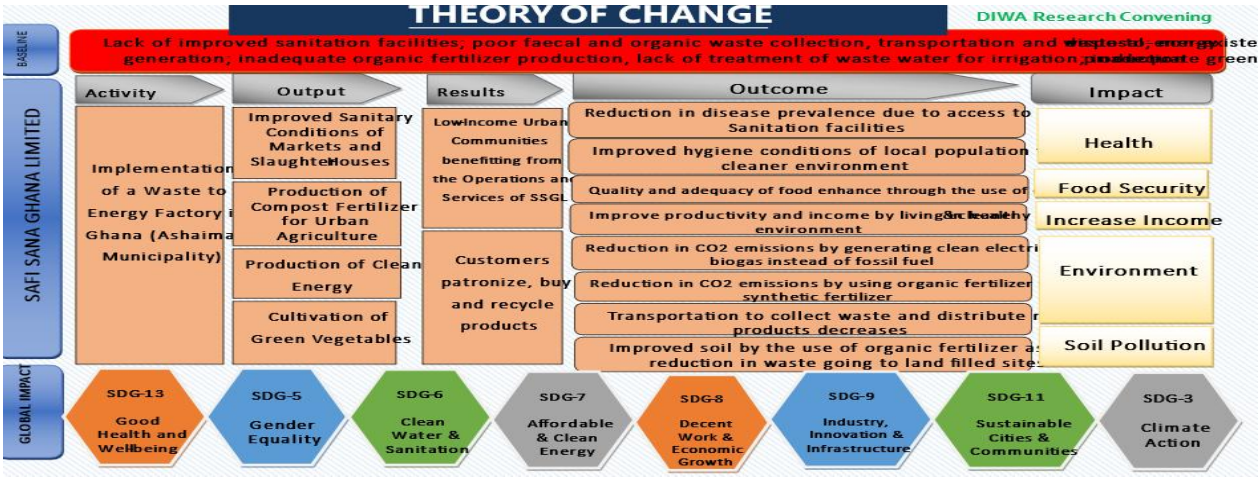

Figure 14: Theory of Change for Circular Economy & Green Socioeconomic Growth

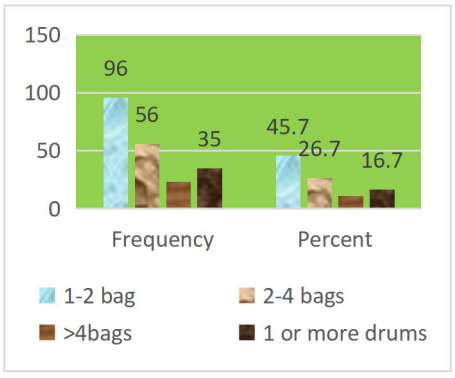

Fig.15: Household Weekly Waste Generation

Fig.16: Waste-to-Resources Plant in West Africa

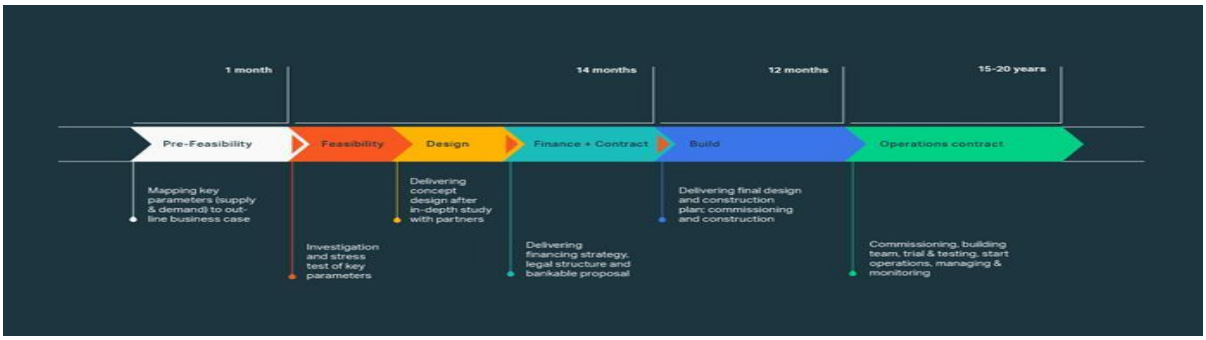

Fig.17: Waste-to-Resources Model for Circular Economy & Green Growth Development in West Africa

Conclusions and Outlook

A theory of change was established to capture the activity, outputs, results, outcomes, impact and the sustainable development goals realised. With the implementation of waste-to-resource projects in Nigeria and Ghana, some of the outputs are; production of clean energy, improved sanitary conditions of markets and slaughter-houses, production of compost fertilizer for urban agriculture, and cultivation of green vegetables. Both Countries are now benefiting from the operations and services of the Pioneers, customers also patronize, buy and recycle products. The impact cut across clean environment, health, food security, increased income and eight Sustainable Development Goals realisation. The government has a role in creating an enabling environment and stimulating demand to sustainably transits from current linear to circular economy for green growth development in the West African Countries. It is recommended that emphasis should be placed on following "REDIPODI" to foster effectiveness in circular economy and unlock the potentials in waste as a viable resource; **R** – reduce process waste; **E** – encourage recycling; **D** – develop markets for recycled materials; **I** – invest in infrastructure; **P** – promote reuse; **O** – optimize life cycle through alternative consumption; **D** – design better products; and **I** – improve collection

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