

Waste Management and Environmental Conservation: An Overview



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Abstract: Managing waste and conserving the environment confronts the government, the community, the people and the industry. There is a conceptual and sustainable framework to be imbibed in tackling the menace of waste. The waste management profile at hand and environmental status quo defeats the strides of conservation of wastes which debar any sustainable economy. However, beyond all reasonable doubts, best practices for waste management gives most-sought results in the future ahead. At large, a beam of global light into the radical and rational trend of waste management programs leads to economic sustainability based on the capacity of innovation; Nigeria vies to make a mark in innovation outcome in the direction of appropriately curtailing wastes at all levels. Despite being tagged an under-developed nations, Nigeria still positions itself as a great and conscious manager of wastes of all sorts in Africa. This study assessed the cultural management of wastes in Nigeria.

Keywords: Waste, Management, Environmental, Disposal, Recycle, Challenge, solution, Prospects.

I. INTRODUCTION



Figure 1: Lagos Waste Dumping (Source: www.businessdayNG.com)

Twenty centuries ago, the preservation of the diversity of life was a major target of universal action concerning a sustainable world. This resulted to a glaring fall in biological diversity which led into the localization of industries which spread broadly, destroying the ecosystem and causing climatic change effect at the tail-end of the nineteenth century, spilling into the twentieth century [1].

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The population of Nigerian is on the increase with a rate of close to 3 percent per year; with the growth rate in the urban at about 6 percent per year. This increase caused challenges linked with making available adequate solid waste management facilities and programs. Solid waste management is a main environmental difficulty in several Nigerian communities.

The generation rate of waste in Nigeria is evaluated at about 0.7 to 1.0 kg per capital per day which converts to a mean of about 43 million tons of generated wastes yearly. This is close to the derived 62 million tons of generated waste in sub-saharan Africa yearly [2]. The challenges of generating and managing waste in most communities especially in developing countries is counted as a part of the trauma in the urban areas. This state could be ascribed to low class of technological facilities that are less sophisticated to handle the high waste generation rate [3]. The head count and rural to urban migration has heightened through continuous birthing, industrialization, urbanization; but, yet the waste management service provided is not sufficient to match the high volume of solid waste produced in urban locations, leading to the despicable and destructive influence of the urban environment [4]. Presently, waste generation rate is approximately 70 percent compared to the total waste disposal rate of 30% [5]. Undoubtedly waste is anything which may directly not be beneficial to man [5].

With the growth of cities, the use of land gets complex and the consequently, increased amount of generated wastes [6]. The resulting generated waste hits a danger line of the alarming challenge in the environment, which constitutes a reproach to Nigerians. The Nigerian legislation and regulations pertaining to the management of solid waste have not been sufficiently accepted or enforced by Nigerians [7].

Beyond 80 percent of Nigerians do not know what sustainable waste management is all about, and do not comprehend the consequence associated with inappropriate disposal of waste [8]. Dumping and disposing of waste indiscriminately has become popular in the cities of Nigeria [9] and [10], of which a lot of the refuse dumps are situated near roadsides, markets, residential areas, farmlands, and river-banks [11].

1.1 Waste:

The World Health Organization (WHO) made reference to waste as ‘anything that is no longer needed by an owner at a particular space and time; and which has no present accountable market significance’; even though, what someone perceive as waste may be absolutely useful when recycled to manufacture brand products [11].



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Going by Izeze position [12], a lot of the challenges likened to disposing waste stem from the exploding population in the urban areas; rapid and haphazard industrialization; and the inevitable upsurge in the generation of waste. Nwankwo [13] pointed out that the increasing populations, growing income proceeds and varying consumption trend accumulate to complicate the challenges of solid waste in Nigeria.

1.2 Waste Management

Waste Management is simply managing (i.e. collecting, storing, and disposing) of waste materials. The major objective of Waste Management is to reduce the impacts and detriments of wastes on the health of man and his environment. The challenge intensifies with rapid urban-civilization, revolution of industries and humongous pressure of the number of people stressing the universal space.

The ideology of the 4 - R theory (as seen in table 1 and figure 2) has been applied to the basic principles of Waste Management. In India tactics, Waste Management depends on generating, collection, treatment, storing, transporting, recycling and disposing of waste. Most of the usual waste management techniques are incinerating, land-filing, composting and gasifying [14].

The challenge of waste management of solids in present day communities is characterized by mounds of mishandled garbage; refuse dumps littering road ways sides; piles of junks blocking water channels; which pose a threat and hazard to urban settlements. NEST, [15] estimated that in Nigeria, about 20kg per capital per annum of generated wastes are solids which invariably converts to about 2.2 million tons per annum, considering its approximate population of greater than 100 million people.

II. ENVIRONMENTAL CONSERVATION

It is worthy for us to conserve our natural resources and ascertain its protection, which can be done in diverse ways, of which the central concepts is utilizing it optimally using principle of reduce, reuse and recycle of consumable products. Mostly, managers of the environment projects by planning ahead on waste reduction. The general challenges of environmental conservation are quality-degradation of the terrestrial and aquatic habitat, which most times cause loss of vegetation and animal wildlife; and serious interference of the ecosystem [16].

Table 1: Solid waste Management Hierarchy

#	Waste management	Additional Information
1.	Refuse / Prevention	Prevention involves smartly buying less and only what is needed. Some materials can be borrowed or rented, instead of buying new possessions [17].
2.	Reduce	Reduction of source is mostly viewed as the greatest stage of the on the ladder of the waste minimization since it has the highest potential for preventing raw material, energy and waste generation. Its technology involves variation to the purchase of brand new instrumentation, production design process and control of operating standards.
3.	Reuse	Involves reusing waste materials generated on-site and off-site, directly during the production process, with little or no role modification to the product in question. The assets that one is tired of are given out by donating or selling them to people who need them in a second-hand outlets [17].
4.	Recycle	Recycling involve putting recyclable products (i.e. huge amounts of biodegradable wastes such as packaging materials, cans, plastics, paper, metals, usually conducted at recycling points). It helps to reduce the quantity of wastes disposed cut-down the cost of recycled products. Recycling schemes can be practiced such as glass wastes for glass production; paper wastes into tissue papers; plastics wastes for plastic production [18]. Recycling reduces the stress on the origin of raw materials utilized for production. In so doing, products tagged as waste gets classified as significant raw materials [7].
5.	Recover	Recovery involves production of energy, biochar, biogas and heat [17].
6.	Compost	Composting process involves breaking down of solid organic waste by micro-organism which converts them into humus product that is essential for soil fertility, and made available to plants (Venter, 2006). Establishing compost centers is best practice to convert piles of waste into composts, which when properly managed, cut-down the consumption of fertilizer and consequent economy gains [18].
7.	Incinerate	Incinerators technology helps to reduce the amount of waste minimally as wastes are burnt down absolutely, with control and effectively. It can even convert poisonous waste into less-hazardous cinders before been disposed; and is advantageous in burning out gas and liquid attached to solid wastes [18]; reducing the quantity of the waste disposed by approximately 90 percent, especially those streams of waste with high volume of packaging [19].
7.	Land-fill	Land-fill is the process of dumping inorganic solid wastes in a land-fill, i.e a piece of land with less estate importance, buried with soil particles in order to reduce hazards of odour, fire, surface-water influx, and infection [18].





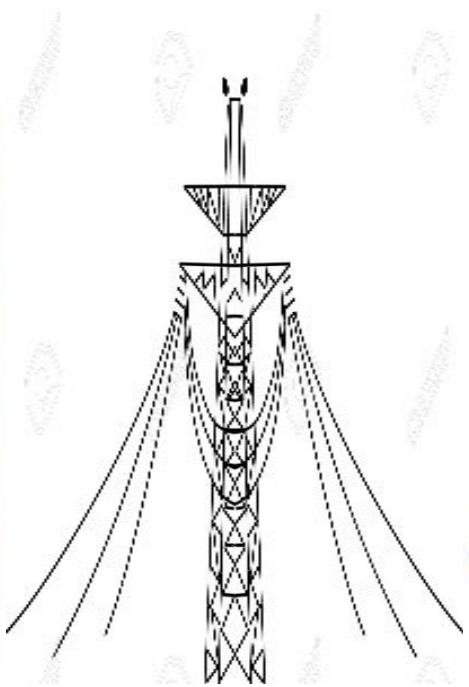
REFUSE/PREVENT



REUSE



RECYCLE



RECOVER ENERGY



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RER DISPOSE







Figure 2: Waste Hierarchy

Environmental Sustainability

Environmental Sustainability is an elementary principle for sustainable living i.e. ‘making the people cater for their environment and ensuring good life for up-coming generations’. This helps to provide vitality, restore balance to the earth and its ecosystems; preserve animal lives and assure the sustainability of resources that are renewable. Implementing environmental sustainability is a universal problem by the people, industries and the governments at large.

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Table 2: Sources of Wastes

Waste	Illustration	Additional Information
Municipal	 <p style="text-align: center;">(www.freepik.com)</p>	<p>Municipal wastes are solid wastes that can be adequately managed without resulting into pollution [20]. Challenges attached to it in developing countries displays include: inappropriate and inadequate methods of disposal and unusual waste collection services [21]; hence, resulting in several environmental and health problems [22]. Municipal solid waste of 25MT is generated yearly in Nigeria which ranges from (0.40 to 0.66) kg per capital per day in rural to urban regions as opposed (1.8 to 0.7) kg per capital per day in developed countries [23].</p>
Sewage (Waste Water)	 <p style="text-align: center;">(www.indiawaterportal.com)</p>	<p>Universally, approximately 359 billion M³ of wastewater is generated annually, which is equal to 144 million times the size of Olympic swimming pools [24], in which 48 percent of that waste water is presently released into nature without treating or processing.</p>
Agricultural	 <p style="text-align: center;">(www.dreamstime.com)</p>	<p>Agricultural wastes are manures, and other waste derived from harvest remains, poultry, farms, and veterinary drugs, slaughter shops, run-off of herbicides, fertilizers and pesticides which flow into the soil, water or air. Globally, agricultural waste generated about 998 MT yearly. More than 90 MT of waste is produced from palm oil industry, yearly [25]; 4.34 MT of rice straw, 0.9 MT of rice husk, and 19.5 MT of cow dung are also generated.</p>
Industrial	 <p style="text-align: center;">(www.solidwastemanagement.com)</p>	<p>Industrial wastes are wastes produced from industrial events and factory businesses which include textiles, paints, breweries, plastics, papers, chemicals, grease, pesticides, oil remains. Generated waste from academic and administrative, residential, and utility quarters were accounted to be approximately 103.9, 1599.8 and 81.7 kg per day respectively [18].</p>
Domestic	 <p style="text-align: center;">(www.davidhelmwastedisposal.com)</p>	<p>Domestic wastes are commercial and household waste generated from day-to-day events and activities such as rubbish sewage, used water, remains of animals, humans and plants; as well as waste from chemical laboratories [26] and [27].</p>
Hazardous/ Nuclear	 <p style="text-align: center;">(www.spiegel.com)</p>	<p>Hazardous waste is the waste that has the inherent ability and characteristics of toxicity, ignitability, corrosiveness, flammability, [28], infectious, carcinogenic and radioactivity [29]. Similar to some developing nations, the management of nuclear wastes in Nigeria is proved as ineffective [30]. Presently, Nigeria generates the largest volume of hazardous wastes in Africa at approximately 2.47MT per year [31].</p>



<p>Mining</p>	 <p>(www.duraroot.com)</p>	<p>Enormous amounts of waste rocks are produced from surface mining operation [32]. These waste rocks are extracted from the overburden having little or no mineral quality, with example as gold waste rocks [33]. Mercury waste may leak to the environment while amalgamation or separation of gold from its ore is conducted. [34]. The chemicals (like Mercury and Cyanide) used in processing are poisonous and hazardous even in small amount [33].</p>
<p>Construction</p>	 <p>(www.bioenergyconsult.com)</p>	<p>According to Zero Waste, [35], during demolition or renovation, about 10 to 15 percent of the waste generated during construction works is from building materials, while the remaining 85 to 90 percent becomes waste. This is strongly peculiar to Nigeria, as huge amount waste is generated at construction locations, most especially in Lagos [36].</p>
<p>Metallurgical</p>	 <p>(www.srkconsulting.com)</p>	<p>Mill tailings wastes consisting of fine particles are eliminated from processing raw materials, milling and screening [33]. Also, wash- slimes are useless by-products or waste of mineral production [37] produced from low solid content slurries, mostly stored in large ponds, there are no definite uses for wash slimes posing challenges of safe disposal in the mineral industries in Nigeria.</p>
<p>Medical</p>	 <p>(www.dalysun.com)</p>	<p>The interview and questionnaire survey of Olufunsho et al., [38], at BMC Public Health recorded the waste volume generated from some hospitals: The range of generated wastes is from (0.116 - 0.561) kg per bed per day and the cumulative waste is derived at approximately 215.56 kg per day, converting to estimate of 181 kg per bed per day.</p>
<p>Petroleum</p>	 <p>(www.channelstelevision.com)</p>	<p>It was posited that gas flaring impacts critically on the environment, and on social-economic and health status of the oil producing hosts [39]. Spills and oil waste from exploration and oil production results in contamination of soil, groundwater [40] and air, especially on farmlands and food produce [41]. Approximately 97 percent of vegetation was destroyed [42].</p>
<p>Polymer</p>	 <p>(www.businessday.ng)</p>	<p>Nigeria is the seventh most-generating plastic waste country, globally having between (4.8 to 12.7) MT of plastic waste yearly with a higher amount of these waste ending up in the rivers and lagoons, instead of the land-fills [43]</p>

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Wood	 (www.biocycle.com)	<p>In Nigeria, wood wastes residue are dumped in water channels or open sites which causes pollution. At present, Nigeria generates sawdust and wood wastes approximately 1.8 MT per year 5.2 MT per year respectively. The impact of improper disposal of waste wood on the environment affects both the aquatic and terrestrial ecosystems [44].</p>
Paper	 (www.indiamart.com)	<p>The volume of papers wasted yearly in Nigeria is enough to warm up 50 million apartments for two decades. According to Obiora [45], approximately 41 and 60 percent of the waste collection made was achieved in 2018 and 2025 respectively. In these two years, i.e. 2018 and 2025, the rate of paper collection in the urban is estimated as 5.65 MT per year and 7.04 MT per year respectively.</p>
Glass	 (www.stopbatura.com)	<p>Wastes generated from glass include shattered windows, windscreens of vehicles, lamps, bulbs, plates, doors. The mean amount of glass waste in Nigeria is estimated as 2.8 percent of the total solid waste generated. Statistics of UDBN, [8] show data of waste generated in few Nigeria states as: Port Harcourt (3.8 percent); Yola (5.9 percent); Warri (5.7 percent); Sapele (5.2 percent); abuja (4.5 percent); and Abuja (4.4 percent); asaba (0.7 percent); Minna (0.8 percent); Gombe (1.3 percent) and Makurdi (1.3 percent).</p>
Textile	 (www.newshub.com)	<p>Textile household waste generated in some cities of Nigeria is accounted as: Abuja (1.42 - 1.6); Ibadan (3.67 - 4.9) and Lagos (1.6 - 5.4) percent respectively [46].</p>
Electrical / Electronics	 (www.theguardiannews.com)	<p>Electrical and Electronic wastes are expired, rejected and abandoned electrical and electronic equipments [47]. These include computers, telephones, radio transistors, television, printers, ovens, air conditioners, batteries, video dvd, photocopier machines, fax machines, mobile phones, refrigerators, washing machines and clocks. Presently, about 44.7 MT of electronic wastes was generated globally in 2016, out of which 20 percent (i.e. 8.94 MT was recycled [48].</p>
Distilleries	 (www.saxonmachineryB.com)	<p>Distillery waste which are on a high rate universally world [49], are by-products of chemicals used in production of beverages, drugs, rubber, pesticides, fertilizers, solvents, and so on. The waste from this industry is prominent in more than 130 world-wide countries since about 88 percent of its raw materials are transformed into wastes and directly discharged at a huge quantity [50].</p>

1.3 Classification of Wastes

Wastes can be classified based on:

- (i) sources, i.e. household, electronic medical, industrial, radioactive and nuclear
- (ii) matter, i.e. solids, liquids and air emissions
- (iii) degrading features, i.e. biodegradable and non- biodegradable
- (iv) environmental impact, i.e. hazardous and non-hazardous [51].

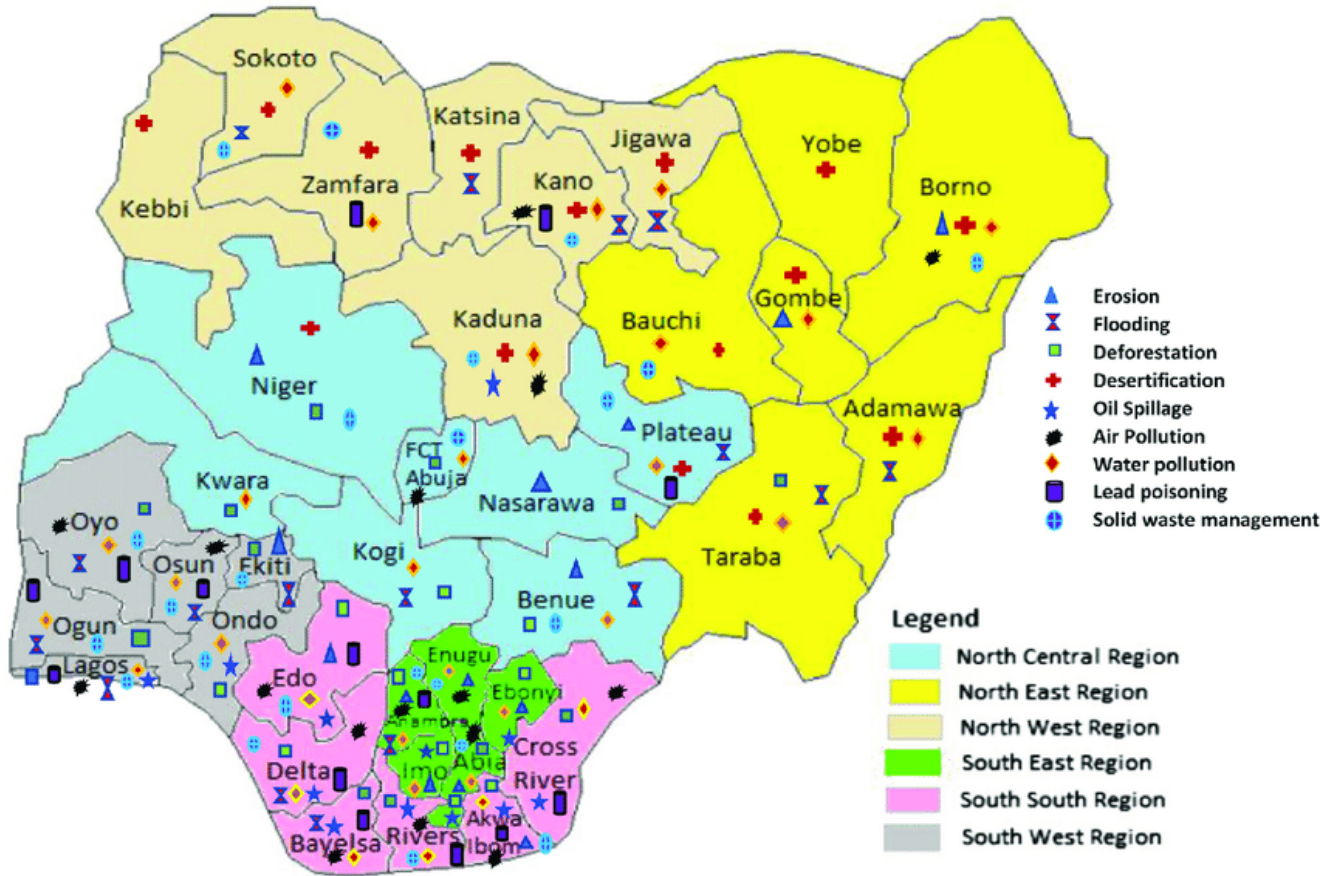


Figure 3: Map of Nigeria showing different locations of environmental problems (Source: www.researchgate.com).

Community Participation in Environmental Conservation

Community participation is the process of engaging participatory activities of stakeholders (i.e. people, legal luminaries and companies in planning and managing the environment; identifying and protecting salient components linked with sustainable development, most especially the implementation of various policies and laws set on ground for achieving the aims of the protection acts of the environment [52].

1.4 Challenges of waste

These include:

- (i) unchecked, unorganized and unstructured urbanization;
- (ii) handling, containment and transporting of wastes; poor mindset of Nigerians in dumping and disposing waste [53], indiscriminately;
- (iii) uncontrollable population ; inadequate provision of efficient system of waste management;
- (iv) restricted residence-to-residence waste gathering system; inaccessibility to waste gathering services; poor composting and incinerating facilities;
- (v) dropping national standard of living; inadequate funding of waste agencies; irregular collection of tenement from people;

- (vi) weak governance and ineffective programs and policies of governmental; insufficient campaign and awareness of the environment;
- (vii) poverty and;
- (viii) indiscriminate building of squalid, shanties and crowded substandard accommodation [7].

1.5 Solutions to the Challenges of wastes

These include:

- (i) adequately funding the waste management and institutions;
- (ii) involving professionals in the formulation of policies, to be backed up with punitive strides against offences;
- (iii) providing of added skips and facilities for disposing waste;
- (iv) reducing and minimizing rural - urban migration of people;
- (v) sensitizing and educating people (i.e. urban and rural) about protecting the quality of the environment through workshops and seminars, organized by the industries and government [7];

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- (vi) involving other contract hands, councils and private agencies and services in waste management;
- (vii) engaging community participation to involve households, organisations, environmental personnel, schools, and other functionaries;
- (viii) publicizing the effects of inappropriate disposing of waste, using electronic-media jingles, newspapers and campaigning bill boards;
- (ix) establishing appropriate Environment impact Assistant (EIA) which focus on minimal degradation of the environment;
- (x) reintroducing the every-month environmental sanitation [54];
- (xi) tagging open dump sites to be 'out of bound'[55].

1.6 Prospects of Waste

These include:

- (i) Wealth derived from transforming waste is a national heritage;
- (ii) Revenues, rents, royalties and levies gotten from disposing waste can be economically directed to advancing structural projects, and
- (iii) Employment opportunities which mesmerize entire disciplines such as environmental, medicals, engineering, educational, manufacturing, geological and so on.

1.7 Consequence of Wastes

These include:

- (i) destruction and degradation of the aesthetics of the environment;
- (ii) breeding and harbouring of mosquitoes, rats, flies, fleas and so on;
- (iii) polluting of water bodies destroying aquatic lives;
- (iv) contributing pollutants of poisonous and airborne gases from by-products resulting in heart diseases.

Harnessing Wastes for Gain

While helping to protect and preserving the environment, waste are recycled using simple science-supported approaches such as:

(i) Burning technology

Waste from plant and animal can be burnt up through pyrolysis process to produce biochar (i.e. anaerobic condition) which is significant for the aim of adding nutrients to amend the soil, and to reduce the level of carbon dioxide that is present in the atmosphere [17]. This was practised in Niger State (Bosso Project) using burnt rice husk to improve the yield of sorghum.

(ii) Biomass Energy

The wastes from agriculture are useful for the generation of biofuel/biogas [17]. Calorific-wise, about 1000 Kilogram mass of cow dungs produces about 8000 Kilojoules of energy; and also provide 450 cubic metres of biogas, in the absence of air. When utilized as fuel, it has the capacity of giving 1260 Kilowatt per hour of energy. For instance, rice waste comprising 0.9 and 4.34 MT of rice husks and rice

straws respectively generates approximately 337 Megawatt of electricity annually using the conversion rate of 1.7 kg of rice husk per straw per KWH of electricity. Using waste to produce biofuels/gas decreases global warming effect and greenhouse effluents; it creates employments and revenues, and provides balance to atmospheric gas.

III. LITERATURE REVIEW

The challenge of the management of solid wastes is a universal aspect which confronts developed and developing countries, first observed at the onset of the industrial revolution of 18th century [56]. This plague is more pronounced and becoming incurably complex in Africa causing environmental and public health concerns [57]; like in Uganda, carelessly disposed waste plugs the drainages that are constructed for flooded water run-off resulting in deface of landscape aesthetic and health problems [58]; and in Somalia, there is widespread open defecating and urinating in open, indiscriminate dumping, stockpiling of wastes, inside and around homes and offices which poses potential health and environmental [59]. Presently, Nigeria does not have any functioning policy concerning waste management or recycling of electronic waste which may help enforcement by environmental regulators. So also is the inadequacy concerning environmental impact assessment (EIA) and the application of its principles, planning, programs, yet to be fully imbibed in Nigeria [60].

Nigeria is having the capacity for policy-making, but slacks on implementation, mostly due to corruption in waste generation by industries. In order to improve the circumstance, cooperation is needed at the level of communities, voluntary sectors, official waste authorities and collectors; especially in recycling which cuts down the quantities and cost of residual wastes drastically [6].

Inadequate financing is a major challenge of waste management in Nigeria, especially for the Environmental Protection Agencies (EPA) to employ workers and hire vehicles on full-time basis [7]. The World Bank, 2012 pointed out that the status of solid waste management has been weak in most developed, posing a general threat to quality of environmental health and life, residentially [61]. Health concerns are linked to all the steps involved in handling, processing and disposing wastes [62].

2.1 Material and Methods

This study targets the waste management and environmental conservation in Nigeria.

2.2 Data Mining and Methodology

Data Collection, Review and Analysis






The review method was applied in this paper. The data captured in table 3, and 4 where reviewed for the result and discussion part of this project, i.e. solid waste generation in some Nigerian cities on per monthly basis, stream compositional characteristics of waste in some Nigeria communities (in the federal ministry of environment and mass flow of wood waste generated in southwest Nigeria.



Table 3: Solid Waste Generation in some Nigerian Cities on per Monthly Basis

Nigeria Community	Tonnage		Total Tonnage	Average
Aba	95000	90000	185000	92500
Abakaliki	90000	69000	159000	79500
Abeokuta	46000	46000	92000	46000
Ado Ekiti	35000	85000	120000	60000
Bauchi	70000	50000	120000	60000
Benin	46000	49500	95500	47750
Birnin Kebbi	88000	60000	148000	74000
Ilorin	25000	95000	120000	60000
Jos	90000	55000	145000	72500
Kaduna	125000	140000	265000	132500
Katsina	70000	19000	89000	44500
Lafia	10000	25000	35000	17500
Lagos	270000	17000	287000	143500
Maduguri	25000	49000	74000	37000
Makurdi	80000	18000	98000	49000
Nsukka	16000	170000	186000	93000
Owerri	85000	85000	170000	85000
Port Harcourt	130000	25000	155000	77500
Uyo	50000	67000	117000	58500
Yanagoo	24000	70000	94000	47000
Yola	48000	35000	83000	41500

Table 4: Stream Compositional Characteristics of Waste in some Nigeria Communities (in the Federal Ministry of Environment [63].

City	Paper	Plastics	Glass	Textile	Others Wastes	Metal
	 (www.waditex.com)	 (www.brinknews.com)	 www.recyclinginternational.com	 (www.scrapnews.com)		 (www.qualitymag.netite.com)
	Tons					
Ibadan	10000	24000	700	1200	18000	800
Kano	30000	9000	500	3000	31000	15000
Lagos	33000	7000	1300	300	35000	10000
Nnsuka	13000	18000	2500	3000	17500	18000
Makurdi	21000	14000	1000	500	26000	1000
Maduguri	9000	32000	7000	6500	4100	12000

Source: Ogwueleka, [60]

Table 5: Mass flow of wood waste generated in southwest Nigeria

#	Nigeria City	Wood Residue (Ton/day)
1.	Abeokuta	1380
2.	Ado-Ekiti	10
3.	Akure	5
4.	Ibadan	90
5.	Ile-ife	35
6.	Ilorin	80
7.	Lagos	790

Source: [60]

IV. RESULTS AND DISCUSSION

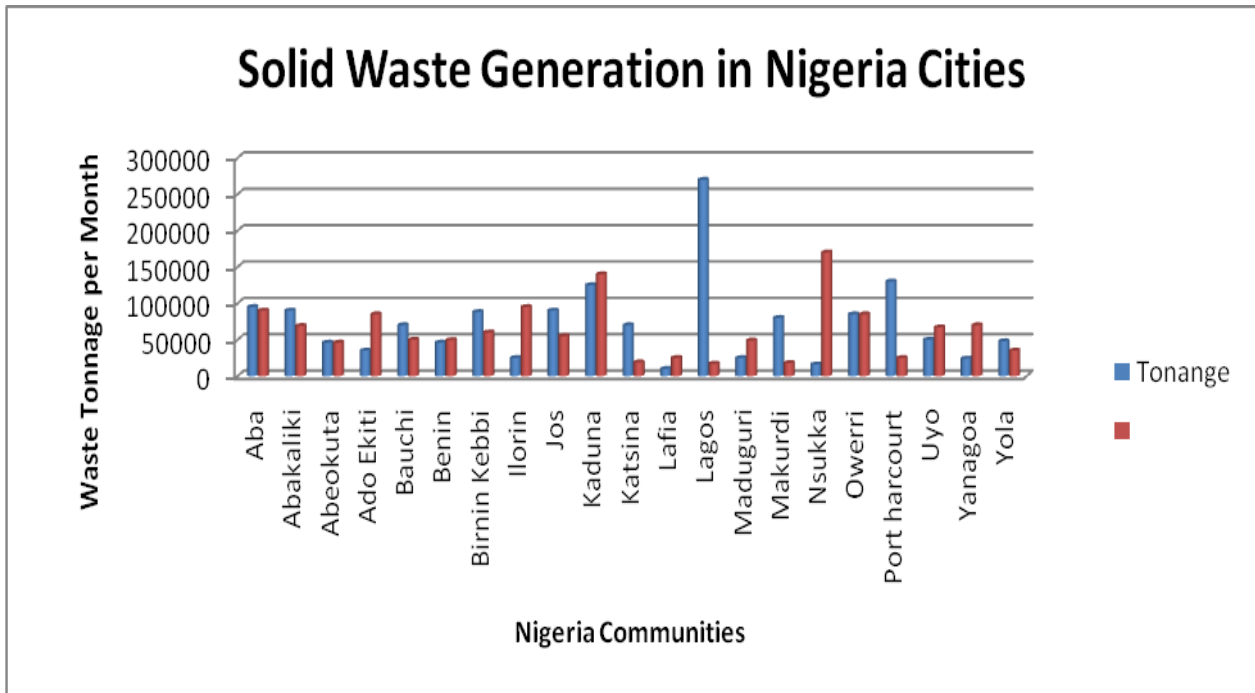


Figure 4: Solid Waste Generation in Nigerian Cities Tons Per Month, Source: Department Of Sanitation/Solid Waste Management, Federal Ministry of Environment Abuja Nigeria [63] Estimated Values.

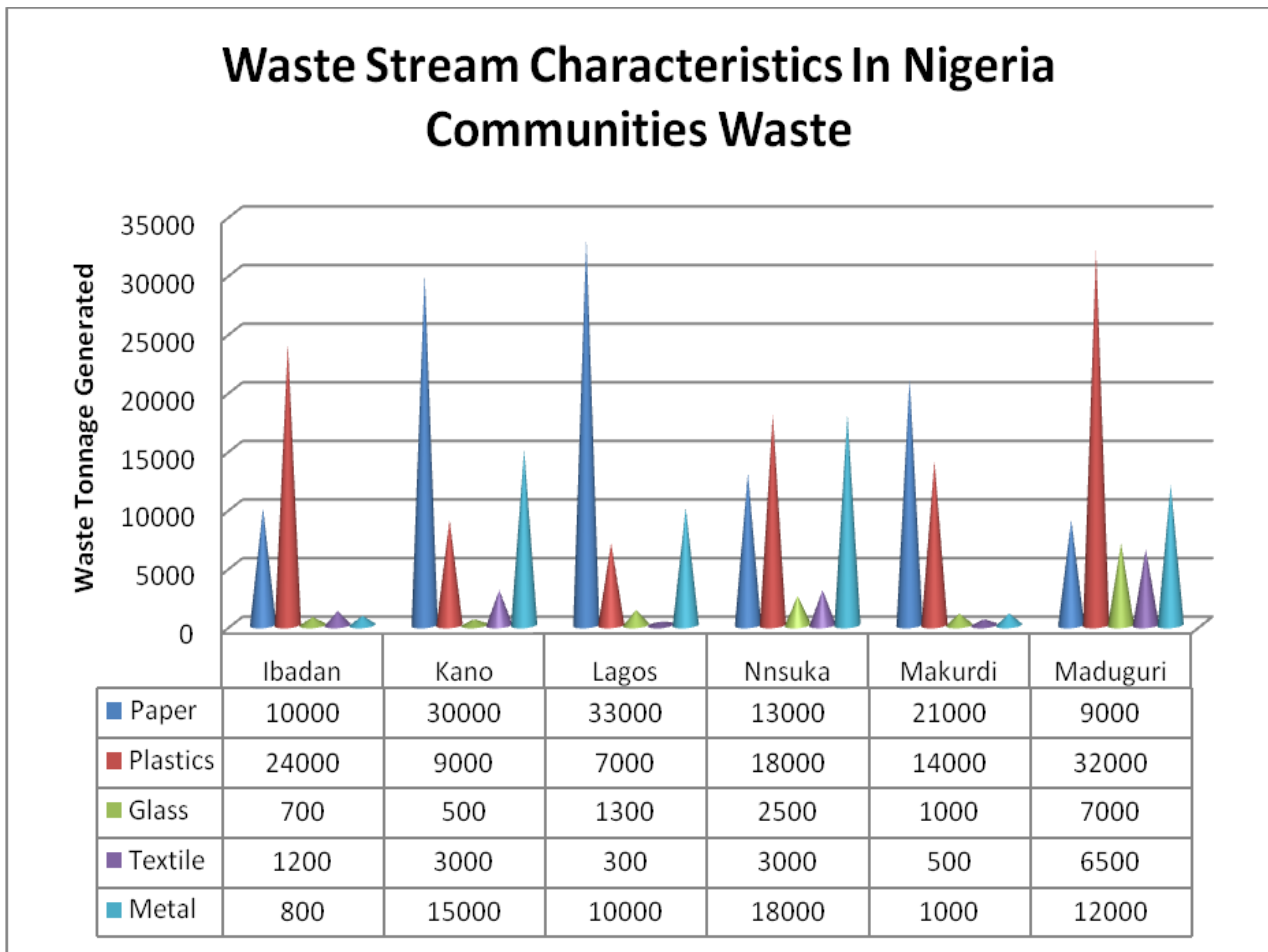


Figure 5: Waste Stream Characteristics in Nigeria Communities Waste

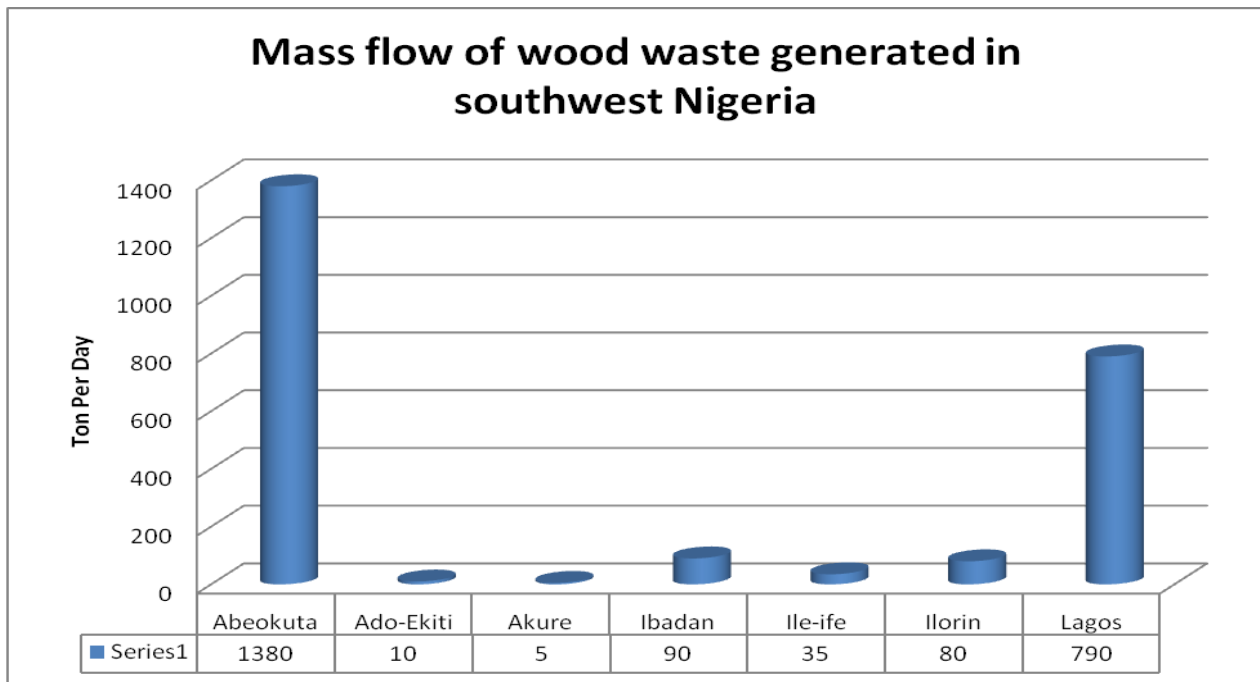


Figure 6: Mass flow of wood waste generated in southwest Nigeria

In Figure 4, the display of the solid waste-generating capacities (per month) of some Nigerian cities is shown. The highest waste generating city was Aba with average of 92,500 tons per month. This was followed by Abakalilki with 79,500 tons per month, and Abeokuta coming third with 46,000 tons per month. The least waste-generating city was Yola, and Yenagoa with 41,500 and 47,000 tons per month respectively. In Figure 5, the plot of the 2010 approximate capacities of solid waste-generation in Nigerian cities (in tons per month), from the Department Of Solid /Sanitation Waste Management of the Federal Ministry of Environment in Abuja, Nigeria was rendered. Ibadan generated more of the plastic waste than other products with 24,000 tons per month; followed by the paper waste with 10,000 tons per month, and the least was the glass waste with 700 tons per month. Kano most generated waste was from paper with 30,000 tons per month; followed by the metal waste with 15,000 tons per month, and the least was glass waste with 500 tons per month. Lagos most generated waste was paper with 30,000 tons per month; followed by the metal waste with 10,000 tons per month, and the least was textile waste with 300 tons per month. Nnsuka most generated waste was plastics and metals with 18,000 tons per month respectively; followed by the paper waste with 17,500 tons per month, and the least was the glass waste with 2500 tons per month. Makurdi generated the paper waste with 21,000 tons per month; followed by the plastic waste with 14,000 tons per month, and the least was the textile waste with 500 tons per month. Maduguri generated the highest waste from plastic with 32,000 tons per month; followed by the metal waste with 12,000 tons per month, and the least was the glass waste with 7000 tons per month.

In Figure 6, the plot of the mass flow of wood wastes generated in southwest Nigeria is displayed. Abeokuta generated the highest waste with 1380 tons per day; followed by Ado-Ekiti with 10 tons per day, and the least Lagos with 790 tons per day.

V. CONCLUSION AND RECOMMENDATION

Waste is a national issue that has been identified as a deterrent to livelihood and wholesome environment especially for those countries still in the developing stage like ours who generates so much waste in different forms. Nigeria is entrenched with humongous quantity of waste, which is turning into a detriment to hinder good living such as uncontrolled and unplanned urbanization; poverty; and decreasing standard of living. Nigeria as a main participator globally must follow this pattern by ensuring that all communities combine the sustainable development procedures and concepts, into the local, states and federal governance, nationally. Due to the influence of waste generation all over cities in the federation, pursuing the management of the wastes will not be a displaced priority. However, supporting infrastructure and policies must be engrafted to ensure the sustainability of the management of differing waste products and as such, our homes, industries and the government should explore and dig into the potential resources of achieving sustainable development. Since the wastes-generating rate is high in the zonal and state level in Nigeria, It is already glaring and obvious as becoming threatening and a nuisance to our local environment, then more waste treating measure should be provisionally and deliberately built and positioned for processing them, promptly. The 4-R methods of processing and other highlighted methods should be imbibed and boosted. If the processing and treatment programs of wastes are intentionally increased locally, it will definitely sustain Nigeria’s and its environment.



DECLARATION

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Authors Contributions	We, Amosu C. O. and Morakinyo K.O. have conspired to put this work together with all hands-on deck and maximum support for success.
Code Availability	Not applicable.

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