Impact Assessment of the Current Waste Management Practices in Nigeria

IMPACT ASSESSMENT OF THE CURRENT WASTE MANAGEMENT PRACTICES IN NIGERIA

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Abstract: Waste management practices differ from nation to nation depending on the waste sources, types, and characteristics. It plays a vital role in nature's ability to sustain life within its capability. In many developing nations of the world, it has become a recurrent challenge, especially in urban areas. Waste generation in Nigeria is on the increase due to the rise in population resulting from the techno-economic development in cities and the pattern of production and consumption of materials. The current waste management practices in the nation are fast becoming a national issue and unsustainable, leading to apparent environmental risk. This study presents a systematic review of existing literature, significant aspects of the existing novels was assessed: waste characterization, waste management practices, ecological impacts, public-private partnership, ethical issues, and legal framework and challenges militating against the current waste practices. This study shows that the existing waste management methods are ineffective and the demand for an all-inclusive waste management approach, proper execution, and enforcement of environmental regulations and laws.

Keywords: Additives; Management; Nano; Treatment; Waste; Wastewater

1.0 Introduction

Waste management entails generation, collection, handling, transfer, disposal, reuse, recycling, reclaim and auditing of waste at a minimal cost[1]. These practices differ from nation to nation depending on the waste sources, types, and characteristics[2]. It plays a vital role in nature's ability to sustain life within its capability. In many developing nations of the world, it has become a recurrent challenge, especially in urban areas [3][4]. The land use is greatly affected by urbanization and when out of control results in the advent of unauthorised structure and informal settlements that are common within the nation. Ultimately this affects

the city blueprint and services like waste collection and subsequently causing indiscriminate dumping of refuse[5]. Waste represents a vital developmental and environmental issue; it is an inevitable result of human activity. In recent times, humans generate more waste, not only because of an increase in population but also due to the change in the pattern of consumption and various composition of waste[6]. Thus necessitating the need for a shift towards waste reduction and away from waste deposition at the dumping site[7]. Waste generation in Nigeria is on the increase due to the rise in population resulting from the techno-economic development in cities and the pattern of production and consumption of materials[8]. Nigeria estimated waste generation rate per capital per day is between 0.65kg and 0.95kg,This constitutes over fifty percent of the total amount of waste generated in sub-Sahara Africa[9]. The current waste management practices in the nation are fast becoming a national issue and unsustainable, leading to apparent environmental risk[10][11]. Numerous studies have identified the impacts of poor waste management practices to include environmental pollution, energy consumption, climate change, and environmental degradation[12][13].

2.0 Definition and Characterization of Waste

The understanding of waste definition and classification is becoming essential as current waste management practices become multifaceted with regulations, actions and services are modified to distinguish between different types of waste materials[14]. Thus, a need for detailed characteristics of waste. Waste can be defined as any unwanted, castoff, rejected, excess material anticipated for recovery, reuse, reconditioning, or purified by an independent process from the same source material. Waste classification often extends beyond the actual waste. Various classification is mostly applied through different pathways, which include collection, disposal, recovery, transport, and treatment[15]. For this paper, we classify waste into industrial waste, electronic waste, municipal solid waste(MSW), and medical waste.

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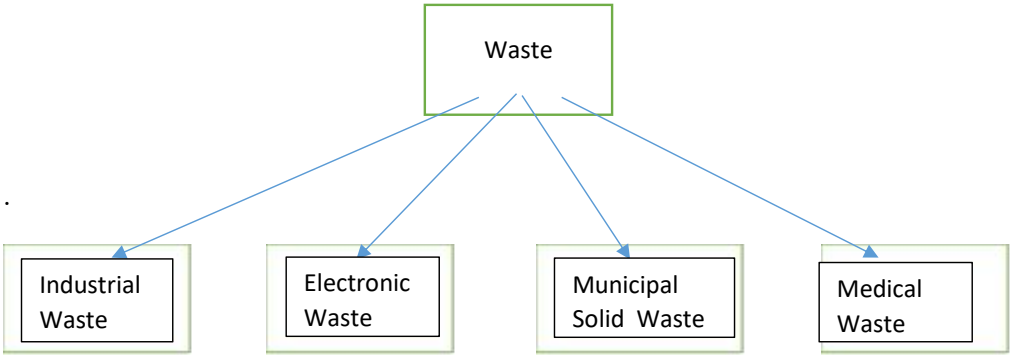

Fig 3.0 Classification of Waste

2.1 Industrial Waste

Industrial waste comprises a broad range of materials of different levels of environmental toxicity. Usually, this range of metals, cloth, waste from food processing, straw, solvents, sludge, resins, ceramics, glass, abrasives, leathers. Paper. Etc. Exact generation rates are unknown due to the absence of an updated and systematic database on industrial waste. The generation rates vary from country to country at various development stages[14][16]. They are often produced as a residue or unused substances from industrial activity. These are also one of the low cost adsorbents employed for the decontamination of metallic contaminated wastewaters. Most industrial waste does require minor processing to improve its adsorptive capabilities. Sludge, slag, fly ash, and red mud are good examples of industrial wastes that

have been utilized for the removal of toxic substances from wastewater. These are also good alternatives to viable adsorbents due to their availability, high performance, and inexpensive nature[17].

2.2 Electronic Waste

Electronic waste is an expansive and increasing range of electronic devices, ranges from consumer electronics to computers and household gadgets such as cell phones, air conditions, refrigerators, gas cookers, washing machines that are unwanted by the users[18][19]. They are commonly regarded as e-waste. These wastes contain valued substances like metals and plastics and also a broad range of toxic products(brominated flame retardants(BFR), heavy metals)[20]. The emergence of electronic wastes has led to two major global issues: sustainability of electric industry due to dearth of mineral resources[21] and likely human health risk and environment related hazards subject to informal recycling process[22][23][24].

2.3 Municipal Waste

Municipal solid waste comprises of domestic waste, and it also includes waste from other sources, for instance, waste from both the industrial and commercial sectors[25].Across the world, the volume of MSW generated has been increasing significantly. Globally, approximately over two billion tonnes of MSW is generated.currrently,85% of this waste is collected, while 15% is being recycled[26]. The Social-economic status of a nation is determined by the makeup of MSW [27][28]. Generally, high-income nations are the largest producers of MSW, with a large amount of plastic, paper, and other inorganic waste material. At the same time, middle and lower-income countries have their waste stream comprises a higher fraction of organic materials[29][30]. Developed nations of the world usually conduct proper treatment of municipal waste with cutting edge technologies such as sanitary landfills, thermal and biological processing for specific categories of waste. These processes involve an enormous venture and technical expertise for the operations; nevertheless, they are from nullifying the negative impacts of municipal wastes. In most of the developing nations, a significant proportion of the MSW is openly burned or dumped in a dumpsite with or without successive gas and leachate treatment techniques [20][31]. The present environmental challenges like global climate change, depletion of ozone layer, public health hazards, ecosystem damage are attributed to improper waste treatment through open air burning, indiscriminate dumping of refuse, and unhealthy landfilling[12][32]. Besides, decision making in managing MSW necessitates a comprehensive assessment in other to reduce the risk associated with the negative impacts[33].

2.4 Medical Waste

Besides domestic wastes, there are several other waste materials with major environmental impacts, created from agricultural , industrial and construction endeavours, and medical care services [34]. Precisely, healthcare service delivery activities often led to the generation of certain waste materials. These products are potential risk to the environment and the public health. Healthcare facilities are primarily responsible for the generation of medical waste(MW). Storage of MW at the health facilities and the movement of these potential hazardous waste to treatment centres are unsafe activities. The former involves an occupational risk associated with the storage and transfer of these materials, while the latter entails a public health hazard related to transportation of these dangerous materials[35]. Generally, eighty-five percent of the waste generated from medical infrastructures are

classified as general waste. However, the other fifteen percent are highly contagious or toxic wastes [36][37][38]. Collection and disposal of MW are of great importance owing to its prospective environmental risk and public health hazards with great tendency of resulting into an epidemic. This remains a significant challenge mostly in medical facilities of third world countries where it is impeded by social-economic constraints and inadequately trained personnel liable for the handling of such waste materials. There is a major health hazard and pollution of the environment owing to the contagious nature and foul smell of the waste as a result of poor conduct, inappropriate waste disposal and management technique used during medical waste handling and disposal. Current healthcare waste management practices vary from one healthcare facility to another. However, the area of challenges is alike for all medical units and all phases of managing waste [39].

3.0 Waste Management Practices

3.1 Open Air Burning

Among various waste disposal methods, open-air burning is a common disposal practice used by numerous businesses and individuals. This involves an act of setting waste materials on fire, and it is done in an open environment, usually on the floor and the back of buildings. Often kerosene is added to aid burning when the higher temperature is required. Waste materials comprise of recyclables, for example, cardboard, paper, polythene, and plastics; these materials are simply set ablaze without the use of kerosene because they are combustible material[40]. Due to the reduction in the volume of waste, this method is being practiced by a large number of urban centers and thereby prolonging the life of the dumpsites. The release of gases such as halo-hydrides, nitrogen oxides, and carbon oxides through this process has a significant effect on the environment. They were thus contributing the global climate change, ozone depletion, and acid rain. Also, the reaction of sunlight with carbon monoxide a greenhouse gas yields harmful ozone layer [41]. Aside from its detrimental effect on both humans and the environment, respiratory diseases such as asthma can be intensified by the emissions from this practice. Furthermore, a group of toxic chemicals generated from this method which could rest on plants or deposited in waterways. Thereby affects the end-user of such water or plants[20].it is considered as a cost-effective and easy way of waste disposal[42].

3.2 Landfilling

Waste deposition upon or into an area of land is regarded as a landfill. The objective of this practice is to avoid interaction between waste substances and the surrounding environment, mainly surface water. It is a primary waste disposal method used in urban areas, and it continues to be a vital technology for managing MSW. A large portion of MSW collected globally is disposed of in landfills. This practice is a low cost method of disposing of waste, and it available in most communities[43]. However, it does pollute the environment to a large extent[44]. It is a common practice in developing nations of the world such as Nigeria[45], this practice is at a low position on disposal method hierarchy in comparison to other waste disposal practices such as composting, landfilling, incineration, and it accounts for over 50% of MSW both in high and low-income nations except few Europeans nations. Residuals from other waste disposal practices end up in landfills[46]. Therefore, it is an essential part of solid waste management gear towards the conservation of resources and ensuring the protection of the environment and health. Though developed nations have achieved the latter while developing countries like Nigeria are still contending with health and environmental protection arises from poor solid waste management[47]. There specific adverse environmental impacts due to poorly managed landfills, which include vermin and soluble pollutants that are capable of leaching into the groundwater, thereby polluting it [48].

3.3 Composting

Composting is a controlled technique aimed at enhancing the aerobic process of degrading organic wastes, yielding a humidified product that is mainly recyclable for agricultural intent. This practice is one of the most vital instruments for waste management. Recently, it has been progressively utilised as a form remedial measure to get rid of decomposable pollutants from the soil and to control the availability of heavy metals in plant remediation strategies. This practice aids the optimization recovery of resources from wastes, which could as well enrich fertility of the soil, and promoting its usage in bioremediation of contaminated soil[49]. Compost is never a fertilizer. It has preferably been used for oil structural improvement. Though, superior quality fertilizer can be obtained through the addition of sufficient nitrogen, phosphorus, and potassium. This practice can be executed under aerobic and anaerobic states. For a most composting system operating under aerobic condition, due to the less energy/unit weight of the organic matters separated is required. However, compost formation time is lengthy; the challenge of odour remains owing to exposed material and lower temperature of the composting organisms[50]. Fertilizers are being produced; this waste practice serves as a good conditioner for soil, ideal for Nigeria soil yielding good crops. This can serve as a locally made supplement to inorganic fertilizers to ensure agricultural sustainability also to secure the challenge of food insecurity in Nigeria like other nations of the world[51]. The effective utilization of this practice improves healthy plant production, cost-effective, promote conservation of natural resources. It is environmentally acceptable compared to other waste disposal methods[52].

3.4 Incineration

Incineration is a controlled process for converting combustible wastes into gases and ash at high temperatures, between 900^0C and 1200^0C. Wastes are subjected to burning during this process. Also, this is a volume reduction technique, when the process is conducted properly,90% of the waste size will be reduced. However, this process is not a substitute for landfilling but reduces the quantity of waste to be burn off. During incineration, toxic wastes are annihilated. It is an accepted practice in developing nations like Nigeria, yet being criticized for ruining energy, raw materials, and other natural resources used for producing it[41]. The waste combustion determines the waste mechanism at high temperatures. This process can destroy pathogens or contaminants, and does not get rid of waste, but slightly reduce the size and convert it into other forms, this also necessitate disposal in landfills. There are numerous fears about incineration owing to operational challenges for instance air quality depreciation, toxicity, prospective leaching of heavy metals, and disposal of generated ash. Management of waste by burning is estimated to be seven times more than landfilling[53]. The integration of gas scrubbers and the flue gas cleaning system into incinerator has been suggested with a view of reducing the pollutant load being released into the atmosphere[54]. Incineration has become a good alternative since landfills are expensive, and required spaces for them are limited. This practice has a comparative advantage over discharges and composting. It is more effective and efficient in handling wastes due to relatively small space, waste reduction, and generation of electricity. Though there are issues related to this practice, such as wrong locations, excessive fly ash production, and absence of environmental impact assessment. Consequently, it is essential to ascertain the safety of this practice for public health and the environment[55].

4.0 Environmental Pollution Impact

4.1 Surface-Water

Surface-water pollution arises not only from municipal sources but also from industrial sources. However, it has been established that industrial sources are majorly responsible for

surface water pollution due to their relative pollution possibility, volume, and chemical constituents of industrial wastes. A deep understanding of the soil structure of an area and wastewater becomes vital because a large portion of all used water, both for domestic and industrial purposes, eventually ends up as waste water[56]. Folami et al. [57] in their study, affirmed dumpsite as a critical source of pollution to surface water and a significant threat to the surrounding environs, The physicochemical variables, and heavy metals concentration of the surrounding water bodies were above the safe limits specified by the World Health Organisation /Federal Environmental Protection Agency. Hence, the need for wastes sites to be located at a safe distance to water bodies to minimize leaching of leachates into water bodies. It is essential to assess the impact of pollutants loads from the dumpsites on surface water quality. Also, precautionary measures should be taken due to human activities such as waste disposal within or around water bodies as support of aquatic life and domestic use of water. Besides, an adequate knowledge of leachate characteristics could be employed in planning and proffering of remedial actions to preserve water quality in such zone[58-60].

4.2 Air Pollution

The challenge of air pollution is a result of landfilling and open-air burning, which should be addressed via a unified approach, to minimize these practices. There is a need to assess the level of pollutants emitted from these indiscriminate practices. There is a possibility of hazards as a result of human exposure to contaminants. However, unlike the developed nations where monitoring of air quality is being carried out periodically, there is a need for environmental researchers in sub-Saharan African, countries like Nigeria, to take up the obligation of assessing air quality [61]. Environmental protection agencies, city administrators will need this information, and residents for the buffer zones to the dumpsites in other to protect public health and wellness[62]. Considering the emission method, it has been established that open-air burning practice in many Nigerian cities contributes appreciably to pollutant levels. However, policymakers need to understand that doing nothing about air pollution is costlier than attempts at managing air pollution[63-65].

Moreover, numerous options have been suggested for the utilization of waste in Nigeria, which includes waste conversion into organic fertilizers, reuse, and recycling. The extremely deprived state of energy in the nation recommends that waste-to-energy technology should be given consideration[66]. The level of concentration of gases evaluated in the dumpsites was found to differ over locations and seasons. Generally, the concentration level of measured gases at the dumpsites is higher concerning other zones. Also, aside from the pollution from dumpsites, human exposure to chemicals emitted from dumpsites fires specifically C.O., CO_2 SO_2, and NO_2 are probably present a significant risk to humanmms health, most notably the dumpsite personnel [67].

4.3 Public-Private Partnership

There are several private waste management operating in Nigeria, and these entail essential technical support, specifically in the aspect of capacity building.one of the key factors that will enhance the success of the private waste sector is the capacity of the government to uphold, implement and maintain written contracts. These depict the required services and declare penalties and other injunctions that are applicable in the case of service delivery failure. It is essential to put a system in place to ensure and encourage the sustainability of the private sector in waste management[68]. Several factors militate the productivity and performance of private sector organizations in terms of quality of services. Insufficient funds hindered these organizations by the operators, poor management of dumpsites, most notably during the wet seasons, ineffective service monitoring, and lousy policy implementation. Also, these private companies performed above average in high-income areas and below

average in middle and low-income areas, indicating the varying service quality amidst the income groups in the nation. The disparity in the quality of service is due to the following factors: years of experience of operations, frequency of vehicle maintenance, number of trips per day[69-70]. Low revenue generation caused by the refusal of residents to pay for service provided, poor road and road network, and the high cost of operation are the issues raised by the private sector companies. However, residents' complaint was hinged on the billing system and regularity of waste collection. Also, there is a need to reinstate cart pushers for inaccessible areas, and cart owners can then be mandated to work with waste trucks, in other resolve the problem of arbitrary dumping of waste [71].

4.4 Ethical Issues and Legal Frameworks on Waste Management Practices

Nigeria is one of the major producers of waste sub-Sahara Africa with a population of over 200millions. In spite of policies and regulations, waste management practices in the nation are worrisome each passing day. Over 32million tons of solid wastes were generated annually, of which one-third of the generated waste is collected. Indiscriminate disposal has resulted in blockage of drains, and obstruction of water bodies. Inappropriate collection and disposal of wastes are gradually leading to an environmental disaster as the nation presently lacks sufficient budgetary requirements for implementing integrated waste management systems across the states[72].In most of the developing countries like Nigeria, laws, policies, statutes, and regulations on waste management are underdeveloped, and even the existing ones are poorly implemented. Generally, laws involving waste management were mainly formulated and articulated. The poor state of waste management system in the nation is a reflection of its laws and policies [73]. There are several loopholes in the governmental policies on waste management, though the public is encouraged to partake in the monthly clean-up exercise. However, the government has failed in providing disposal sites as a form of compliment for the efforts of the citizens. In some of the states in the nation, it has been reported that there is no articulate piece of legislation that deals with waste management, and it has been argued that it's owing to a weak institutional, legal framework, and administration of policies. Most government policies that are in place lack strategies for actualization. In addition, a review of the legislative aspect of waste management has been suggested in other to work towards achieving set objectives on sustainable waste management.

Furthermore, an all-inclusive management approach has been proposed which entails waste prevention, reuse, reclaim, recycle, composting, and generation of energy. Despite some good policies that are in place, proper implementation remains a significant challenge; for instance, a comprehensive environmental impact assessment is meant to be submitted during project planning before approval. However, this critical regulation is frequently overlooked. Several authors have criticized the implementation and enforcement of environmental laws in Nigeria. Enforcement of environmental laws remains an issue of concern, control, and management of environmental legislation that has achieved very little success[74]. Some of the enforcement challenges in Nigeria have socio-political and economic nuances. In other to make sustainable waste management, appropriate policy and proper planning, in addition to enforcement of waste management legislation, must be implemented [75].

4.5 Challenges

One of the principal constituents of developed nations is the advanced waste management techniques, and unfortunate sanitation habit is often linked with poverty[76-77]. Nigeria is a developing nation with limited and often time mismanaged resources[78]. Wastes heap is a common scene in shantytowns, urban areas, and shack communities close to human settlements. The ever increasing population of the nation, drive for industrialization, and

internal migration has led to an increasing waste generation. The challenge confronting efficient and effective waste management in Nigeria is traceable to unplanned settlements proliferation, traffic congestion, ignorance, insecurity, poor implemented policies, and inability to enforce of environmental laws[79]. Waste disposal is one of the most challenging elements of waste management system in many developing nations. Several other challenges associated with waste management identified are as follows: the high cost of waste management, ignorance over diverse factors affecting waste management at different stages, inadequate waste management infrastructure and expertise, fast growing economic development and links necessary to enhance the functionality of waste handling system.[80-81]

5.0 Conclusion

Waste management practices differ from nation to nation. However, the negative impacts upon the country are apparent. This study presents a systematic evaluation of the present-day waste practices in Nigeria and its environmental impact. There are several challenges associated with existing waste management practices: informal settlements, low budgetary provision, small private sector participation, poorly implemented policies, and enforcement of environmental laws and regulations. Some other notable challenges associated with effective waste management are as follows: the high cost of waste management, ignorance over diverse factors affecting waste management at a different stage, inadequate waste management infrastructure and expertise, economic development, and lack of environmental impact assessment. Addressing these challenges, necessitate the need for an all-inclusive waste management approach. Proper implementation and enforcement of waste management laws and policies, review of the current waste management legislation across the states of the nation, private-public participation should be encouraged, adequate budgetary provision, periodic comprehensive appraisal of the environmental effect of the waste management practices, knowledge sharing on global issues affecting ecological conditions and sustainable development.

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