

RESEARCH ARTICLE

IMPACT OF MADE-IN-NIGERIA PRODUCTS ON SOLID WASTE GENERATION AND PUBLIC HEALTH: CHALLENGES AND SOLUTIONS

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ABSTRACT

Made in Nigeria products are anticipated to expand the industrial sector, achieving proficiency and independence in production. This growth is expected to enhance the economy, create an export surplus, and integrate Nigeria into the global economy. However, increased production generates significant solid waste, posing public health and environmental challenges. This study aims to examine how Made in Nigeria products impact solid waste generation and the consequent effects on citizens' health. A survey method was used to collect data, and a descriptive method of analysis was employed. Tables and graphs were utilized to analyze the results. The study found that open waste disposal and poorly designed landfills contribute to environmental degradation, water and air pollution, and groundwater contamination. Many Nigerians are reluctant to separate their waste, leading to ineffective waste management practices such as inadequate separation at source, collection, transportation, treatment, and clearance. The ineffective management of solid waste has resulted in degraded environmental sanitation and poor quality of life. Proper waste management is critical for public health and environmental quality, yet current practices are insufficient. The study recommends providing the Ministry of Environment with resources to improve citizens' quality of life. Educating rural populations on modern waste management methods is essential. The government should reward firms with proper waste disposal equipment and sanction those without. Increased funding and personnel for waste management agencies, along with the involvement of the National Orientation Agency (NOA) to promote appropriate waste disposal practices, are crucial. Encouraging scavengers by providing machinery to expand their services is also recommended. This study highlights the significant impact of industrial growth on waste generation and underscores the necessity of effective waste management practices to ensure sustainable development and public health in Nigeria.

KEYWORD

Environmental sustainability, Industrial growth, Public health, Solid waste management

1. INTRODUCTION

Nigeria is striving to integrate into the 21st century global economy and become more self-sufficient. The country's GDP growth slowed to 2.31% in the first quarter of 2023, lagging behind developing nations like India, which saw a growth rate of 7.23% (Jacob, 2024). Nigeria's current account deficit was 0.3% of GDP in the same period, and its foreign exchange reserves increased from \$34.23 million in 2022 to \$36.5 million by the first quarter of 2023. These economic trends have made Nigeria more vulnerable to global shocks (Jacob et al., 2022). To mitigate these shocks and drive economic growth, the government must implement policies to revamp the industrial sector and boost productivity.

Encouraging the production of made-in-Nigeria products can significantly contribute to the nation's economic growth. This study has identified 25 sectors in manufacturing, infrastructure, and services that require increased focus. The Nigerian government's Industrial Revolution Plan, initiated in 2021, aims to raise the manufacturing sector's contribution to GDP from 4% to over 10% in five years (Jacob, 2023). This plan seeks to position Nigeria as a leading global manufacturing hub. Efforts to foster a conducive environment for manufacturing, innovation, and startups have

already enhanced the business landscape and economic growth (Jacob et al., 2019).

The Industrial Revolution Plan is expected to substantially increase production, distribution, and consumption capacities, leading to more solid waste generation. To sustain economic growth, Nigeria must adopt 21st-century waste management technologies (Jacob and Umoh, 2017). Without proper waste management, the anticipated growth could be undermined by issues like soil degradation, disease control costs, groundwater contamination, and air pollution.

Solid waste management is a critical environmental issue in Nigeria, encompassing municipal, industrial, agricultural, and hazardous wastes. Municipal waste includes residential and commercial waste, while industrial waste arises from manufacturing, mining, and agriculture. Household waste often contains harmful substances like old medicines and plastic bottles. Agricultural waste includes both organic and inorganic materials. Urbanisation has led to a rapid increase in solid waste, with towns generating 42 million metric tonnes annually, of which only 4 million are recycled. Effective solid waste management is essential for addressing the challenges posed by fast urbanisation, industrialization,

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and population growth at both national and state levels.

Urban cities in Nigeria face a complex combination of waste items, commonly known as garbage, refuse, rubbish, and trash. These are primarily generated from residential and commercial sources, and they include organic matter and inert materials like glass, metal, textiles, wood, and grass. Rapid urbanization, particularly in the last few decades, has resulted in a significant increase in solid waste. Many households, shops, and establishments dispose of their waste improperly, often throwing it outside their premises, on streets, in drains, open spaces, and in water bodies.

Reports from the Ministry of Environment in Nigeria reveal that urban areas generate 42 million metric tonnes of waste annually. Of this, around 4 million metric tonnes are recovered for recycling. However, with the rapid pace of urbanization, industrialization, and population growth, solid waste management has become a critical challenge for governments at both the national and state levels.

The diverse types of waste in Nigeria include municipal waste, industrial waste, agricultural waste, and hazardous waste. Municipal waste, typically generated in urban areas, includes commercial and residential waste in solid or semi-solid form, excluding industrial hazardous waste but including treated biomedical waste. Industrial waste, which results from manufacturing processes, mining, extraction, and pesticide-based agricultural practices, includes corrosive, highly inflammable, and explosive materials. Household waste, which includes items like old clothes, plastic bottles, shoe polish, paint tins, and old medicines, also contributes to the hazardous waste category. Agricultural waste consists of organic materials such as animal excreta, farmyard manure, mushroom compost, soiled water, silage effluent, and inorganic waste like plastic, scrap machinery, fencing, pesticides, waste oils, and veterinary medicines.

Improper management of agricultural waste can lead to several potential environmental impacts. Urban cities in Nigeria, faced with a mix of waste items, experience increased environmental degradation due to improper disposal practices. To address these challenges, the government must implement effective solid waste management strategies that align with global standards.

To make Nigerian economic growth sustainable and meet world standards, Nigeria should adopt 21st-century waste management machinery. If not addressed, poor waste management could undermine anticipated economic growth by causing soil degradation, increased disease control costs, groundwater contamination, and air pollution. Implementing modern waste management practices is crucial for ensuring sustainable development and maintaining public health. By improving waste management, Nigeria can enhance its environmental quality and overall quality of life for its citizens.

2. THEORETICAL FRAMEWORK

2.1 Life cycle assessment hypothesis

Life Cycle Assessment (LCA) is a framework used to evaluate the environmental impacts of industrial activities throughout a product's life cycle. This includes the extraction of raw materials, processing, manufacturing, distribution, use, reuse, and disposal. LCA examines both the negative and positive impacts on the environment.

According to LCA, industrial activities can enhance the environmental performance of products, systems, and services at various stages of their life cycles. This information aids decision-makers in strategic planning, priority setting, and redesigning products or processes. It helps select appropriate indicators of environmental performance and supports ecolabelling and marketing efforts.

The theory also highlights that some containers used in product manufacturing have less environmental impact than others. It reveals that certain containers can be more harmful to natural resources and the environment. LCA further argues that the size of the human population impacting the environment affects the availability of resources such as food, water, and habitat. The level of technology deployed to utilize these resources influences the Earth's carrying capacity.

LCA considers carrying capacity in terms of human population, ecosystems, and "biocapacity." Biocapacity specifically refers to the feedback mechanisms that ecosystems provide, such as the ability to absorb waste and the limitations of resource provision due to carbon sequestration rates.

2.2 Behavioral change model

This theory posits that well-informed individuals are more likely to recognize environmental problems and adopt environmentally responsible behaviors. It links knowledge to attitudes and attitudes to behavior, suggesting that increased understanding of how to protect and improve the environment fosters positive attitudes, which in turn lead to responsible environmental actions.

The theory argues that various factors interact at different stages to influence the adoption of environmentally responsible behavior. It provides a framework for exploring the relationships between environmental knowledge, awareness, and behavior. According to the theory, a better understanding of environmental issues does not necessarily lead to sustainable behavior. Conversely, a lack of environmental knowledge or awareness does not always result in poor environmental practices.

The theory also emphasizes that factors such as personal responsibility, locus of control, and intention to act are crucial for achieving environmental sustainability. It suggests that these factors must be considered to effectively promote and sustain environmentally responsible behavior.

2.3 Theory of planned behaviour

The Theory of Planned Behaviour examines the intention to act and objective situational factors as direct determinants of pro-environmental behavior. It posits that intention synthesizes the relationship between cognitive variables—such as knowledge of action strategies and issues, action skills—and personality variables, including locus of control, attitudes, and personal responsibility.

The theory suggests that human behavior is shaped by beliefs about consequences, expectations of others, and factors that may support or hinder the behavior. It primarily operates at a conceptual level, capturing the links among influences on behavior and their impacts through mechanisms or relationships within the model. According to the theory, when individuals perceive they have control over a situation, their behavioral intentions reflect this perception, alongside their beliefs about the outcomes of their actions.

2.4 The environmental citizenship model

The Hungerford and Volk model outlines three stages of educational involvement: first exposure (entry), real involvement (empowerment), and the development of knowledge and attitudes at each stage. This theory aims to cultivate a public deeply concerned about the environment, where individuals take primary responsibility for its protection.

The model suggests that for environmental sustainability, citizens must focus on generating, disposing of, and managing waste in ways that promote a developed environment. It emphasizes that individuals should prioritize sustainable waste practices, such as avoidance, reduction, reuse, and recycling. This approach fosters a commitment to environmentally responsible behavior, ensuring a sustainable future.

2.5 Empirical literature review

Researchers investigated the impact of oil and gas revenue on economic development in Nigeria, using data primarily from the Central Bank of Nigeria's statistical bulletin (Saviour et al., 2024). The study examined the environmental impact of the oil and gas sector and its implications for economic development, employing the ordinary least squares regression technique. The findings revealed that revenue from the Nigerian National Petroleum Corporation (NNPC) positively and significantly influences per capita income and national development. However, oil production has had detrimental environmental effects due to poor waste disposal practices and gas flaring. Thus, oil revenue has both positive and negative economic

impacts. The study noted that Nigeria, as a major oil exporter, experiences significant economic fluctuations due to oil price volatility, which affects the exchange rate of the Naira. The study recommended that the Nigerian government should use oil and gas revenue to address environmental damage caused by gas flaring and to develop and revitalize local refineries.

In a related study, researchers explored the relationship between natural gas, economic growth, and the environment in Nigeria (Aniefiok et al., 2022). Using annual time series data and the bound testing (ARDL) approach to test for co-integration, the study examined the long-term relationships between these variables. The results showed that natural gas utilization improves environmental quality in Nigeria, while economic growth leads to environmental degradation. Consequently, the study recommended that the government promote natural gas utilization to reduce carbon emissions and achieve environmental sustainability.

A study had investigated the effects of industrial development on environmental sustainability of Akwa Ibom State in Nigeria (Saviour and Uko, 2022). The study used Simple random sampling technique to select 13 registered industrial plants from the 276 registered industrial plants in the Area of the study. The study also selected 196 workers from the industries and an average of 15 workers were picked from each of industries. The study issued 280 questionnaires to 280 respondents. The data used in the study were gotten through questionnaire, interview, field observation, and documentary materials. The study used simple percentage ratio in analyzing the work and pie and bar graphs in the analyses and illustrations. The study found out that the residents of Abak were negatively affected in terms of: Industrial problems, Psychosocial effect, Pressure on urban facilities, Standard of living, State of employment and high cost of acquiring land as a result of industrial activities. Also, the study discovered some factors affecting the growth of these industries to include: erratic power supply, poor road network, poor market facilities, inadequate finance, one sided government policies and many others. The study therefore recommended that government should put policies in place that will enhance industrial investors to conform with world standard in waste disposable habits like having specified places for waste disposal. It also recommended that industrialists should regularly be involved in research so as to discover advanced technology of converting waste into wealth or for likely re-use of the resources so as to attain sustainable development by the industrial sector.

Researchers had in their study examined how globalisation has affected investment and thus Competitiveness in Nigeria (Saviour and Jacob (2021). The study basically investigated how investment has contributed to the development of a nation. The study adopted simple field survey where questionnaire was issued to workers in government and private organizations. The result revealed that Capital investment in the context of the study is not only financial capital, but includes fixed or physical capital equipment like machines used in industries and motor vehicles use in transportation of both human and capital resources. According to the result of the study, money is mobile and can be used inside and traded between countries but machines are used within the companies. According to the theory, the fund is attractive and environmentally friendly if it is borrowed from government since government might direct industries to maintain certain minimum standard in certain areas. The study also found out that fixed capital is not mobile, but regarded as vital factor in the attractions of firms, both domestic and international because of prodigious cost of the procurement and installation of substantial capital goods. This the study concluded that if government regulate the industrial investors, the environment will be saved for production and thus enhancing economic growth because of competitiveness.

Researchers examined the negative environmental impacts of industrial activities on residents in Ninth Mile Corner, Enugu, Nigeria (Alom and Uloma, 2000). The study employed convenience and stratified sampling techniques, with convenience sampling used for selecting residents. Direct observations identified 183 industries in the area, categorized into micro, small, medium, and large enterprises. A total of 580 questionnaires were distributed, of which 451 were completed and used for the study. The negative effects were classified into psychosocial and emotional impacts, political and economic effects, and impacts on the standard of living, accounting for 58.4% of the total negative effects. The study recommended that the government enforce compliance with proper waste disposal practices and that industrial operators invest in research to develop innovative recycling methods to promote sustainable development in

Ninth Mile Corner.

Researchers investigated the impact of industrial development on natural resource depletion in Nigeria (Ogunwusi and Ibrahim, 2019). Their study revealed that many of Nigeria's natural resources are being depleted rapidly, compromising their sustainability for industrial development. The research highlighted that Nigerian soils are typically light in texture with low Cation Exchange Capacity (CEC), ranging from 2.40 to 5.95 mc/100g. Soil fertility and nutrient content are diminishing due to factors such as insufficient use of mineral fertilizers, gully erosion, soil salinity, desert encroachment, inappropriate agricultural practices, oil spills, overpopulation, and poor land use planning. The study also noted increased groundwater depletion, deforestation at a rate of 300,000-400,000 hectares annually, loss of biodiversity, and depletion of fisheries resources. It was observed that both freshwater and oceanic fish populations are under severe threat. The study concluded that large-scale mineral resource exploration has caused significant environmental damage and emphasized the need to mitigate these impacts to ensure sustainable industrial development.

The impact of environmental sustainability on development in Nigeria, highlighting the gap between governmental rhetoric and actual practices (Leke and Leke, 2019). The study explored how environmental policies and governance often reflect contradictions, where conflicting policies undermine each other. Relying primarily on secondary data and literature review, the paper argues that government actions on environmental sustainability need to align with broader development policies to achieve structural harmony and significant impact.

A study in 2018 examined the role of labor in the growth of industrial activities and its effects on the local environment in Nigeria (Ogbu, 2018). The study utilized questionnaires distributed to the public, with responses analyzed and presented in tabular form. Findings revealed that entrepreneurs seeking to establish industries often consider factors such as labor costs, quality, quantity, labor unions, and the availability of skilled labor. As industries become more mechanized and automated, and as transportation improvements facilitate mobility, the availability of labor becomes less significant in attracting industries. This trend often leads to negative environmental impacts in Nigeria, as industrialization and labor dynamics influence environmental conditions.

A study was conducted in China to examine the factors influencing industrial growth in the region (Badri, 2007). Utilizing a random sampling survey method, the study distributed questionnaires to local residents. The findings revealed that changes in industrial location are driven by the construction of transportation routes, which enhance the competitive advantage of affected areas. The study highlighted that for a nation's economic development to progress, investment in transportation and communication infrastructure is essential. Low and affordable transportation costs are crucial in location decisions. The study recommended that authorities develop efficient transport networks to facilitate the smooth flow of goods and services both domestically and internationally.

The environmental impacts of industrial operations in their study, employing a simple survey method for analysis (Muro and Wong, 2007). Their results indicated that industrial agglomeration is more prevalent in the developed Western world compared to less developed nations. In Africa, including Nigeria, industrial agglomeration is primarily concentrated around markets and infrastructure development. The close proximity of firms engaged in similar production activities leads to intense market competition and information concealment regarding production techniques and input sources. This, in turn, has significant environmental consequences in the study areas.

3. METHODOLOGY

This research used data collected from the field. In carrying out this research, relevant data were collected from ten (10) states on the activities of randomly selected industries from these states and how the activities have affected the health situation of Nigerians. Four types of industries were selected and these include: breweries, textiles, paper industries and plastic industries. The data were collected through survey, questionnaires administered to the respondents and interview granted by workers of the industries and the state environmental agencies and boards and from randomly selected members of the public.

4. RESULTS AND DISCUSSION

Table 1: Amount of Waste Generated by Industries from Randomly Selected Ten Towns in South-South and South-East States of Nigeria.

S\N	Name of States and Companies	Products	Amount of Waste Generated in Tons
1	Delta (Asaba)- Unity Plastic Industry and Company Ltd, 211 Okobi Street, Owa, Agbor, Delta State	All form of plastics like plates, chairs, tables etc	0.34
2	Bayelsa (Yenagoa)- Berger Paints Plc, 70 Ordinance Road, Yenagoa	Maker of all form of paints for house marine paints	0.62
3	Rivers (PH)- First Aluminium Plc, 19 Onitsha Street, Trans Amadi Industrial Layout, Port Harcourt	aluminium profile sheets	17
4	Cross River (Calabar)- Niger Mills Ltd, 110 Murtala Mohammed Highway, Calabar	Flour for all sort of bakery work and Noodles production	10
5	Akwa Ibom (Uyo)- Champion Breweries Limited, Uyo,	Champion Beer and Malt Drink	6
6	Enugu (Enugu)- ANAMCO Plc, Plot 18 Airport Road, Industrial Layout Enugu	Vehicle manufacturing and assembly plants producing medium and heavy-duty trucks, buses, fire engines	12
7	Ebonyi (Abakaliki)- Eze Rome Oil Palm, 4 Adaeze Road, Abakaliki, Ebonyi	Crude oil, Palm kernel oil, Palm kernel cake and Industrial oil	5
8	Abia (Umuahia)- Mouka Foam Nigeria Plc, Km 4 Aba, Enugu Expressway	Mouka Foam	13
9	Anambra (Awka)- Sylflora Industries Ltd, Phase 2, Block 39, Plot 10, Unique Estate Nkwelle- Ogidi Road, Onitsha	Facial wipe, table tissue, serviette, tissue handkerchief, and disposable baby diapers	13
10	Imo (Owerri)- IhemDavis Press Ltd, Km 34 Uratta MCC Road, Owerri	Printing pappers and general printing press.	16

Source: Field Work by (Researcher, 2024)

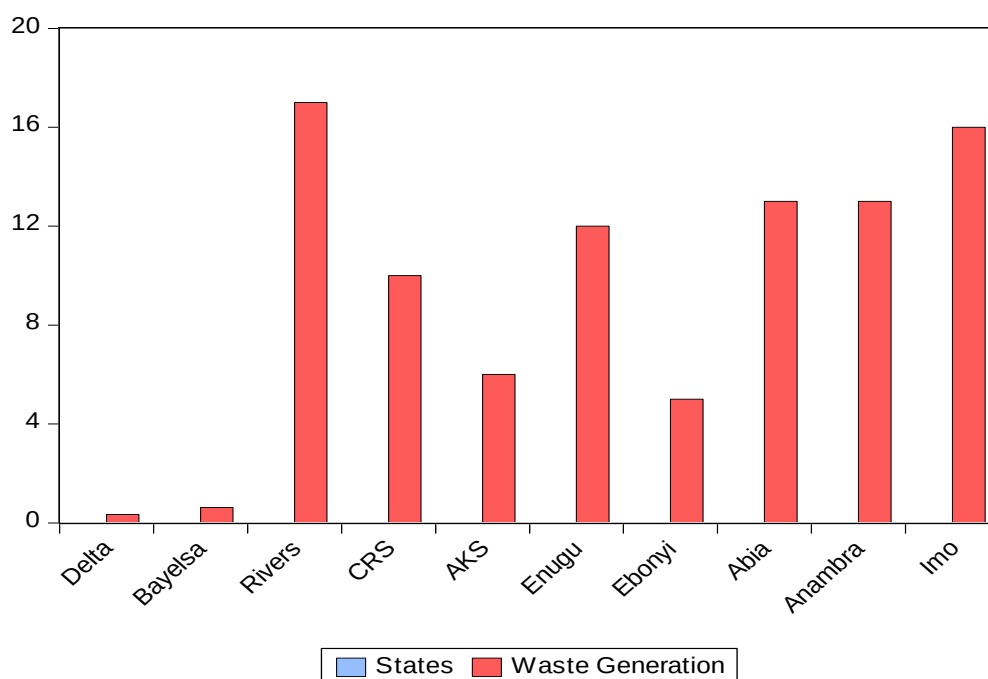


Figure 1: Bar Chart Representation of Variables in Table 1 (Waste Generated by Industries in the Study Areas)

The randomly selected industries as represented in table 1 above include: Champion Breweries Limited, Uyo, Akwa Ibom State. This company produce Champion Lager Beer and Champ Malta. The result from the table above reveals that the Champion Breweries Ltd has generated 6 tons of waste a day. The study also shows that Mouka Foam Nigeria Plc, Km 4 Aba, Enugu Expressway, Abia State a company that produce all form of mattress produce 13 tons- of waste a day; First Aluminium Plc, 19 Onitsha Street, Trans Amadi Industrial Layout, Port Harcourt, River state are producers of aluminium profile sheets. The result of this study shows that 17 tons of waste is generated in a day within the time of this investigation. Further, the study reveals, that ANAMCO Plc, Plot 18 Airport Road, Industrial Layout Enugu, a vehicle manufacturing company and assembly plants that produce medium and heavy-duty trucks, buses, fire engines has within the scope of this study generate 12 tons of waste a day. The study further reveals that Eze Rome Oil Palm, 4 Adaeze Road, Abakaliki, Ebonyi, producers of crude oil, palm kernel oil, palm kernel cake and industrial oil has also generated 5 tons of waste. Considering Sylflora Industries Ltd, Phase 2, Block 39, Plot 10, Unique Estate Nkwelle- Ogidi Road, Onitsha,

Anambra. They produce facial wipe, table tissue, serviette, tissue handkerchief, and disposable baby diapers. From the result it is observe that the company has generated an average of 13 tons of waste in a day. IhemDavis Press Ltd, Km 34 Uratta MCC Road, Owerri, Imo State. They are printing press and producers of all types of pappers for printing. They have generated average of 16 tons of waste in a day under the period of investigation. Berger Paints Plc, 70 Ordinance Road, Yenagoa. This company are makers of all form of paints for house and marine paints. The result of the study also reveal that the company has generated 0.62 tons of waste. Looking at Unity Plastic Industry and Company Ltd, 211 Okobi Street, Owa, Agbor, Delta State. This company is the producers of all form of plastics like plates, chairs, tables, spoons, tanks etc. The results of this research show that 0.34 tons of waste is averagely generated by this company in a day. Niger Mills Ltd, 110 Murtala Mohammed Highway, Calabar, Cross River State. They produce flour of all sort use in bakery work. From the table above it can be seen that the company has generated an average of 10 tons of waste in a day.

Table 2: Collection of Trash at Door Steps in Randomly Selected Ten Towns in South South and South East States of Nigeria.

S\N	Cities	Door to Door Collection of Waste		Percentage (%)
		Number of Areas Targeted	Number of Areas Covered	
Collection of Trash by Door Steps in South-South States				
1.	Agbor-Delta	26	13	50%
2.	Yenagoa-Bayelsa	192	96	50%
3.	PH-Rivers state	1658	869	52.4%
4.	Calabar- Cross River	3072	1697	55.2%
5.	Uyo-Akwa Ibom	232	136	58.6%
Collection of Trash by Door Steps in South-East States				
1.	Enugu-Enugu	24	4	16.6%
2.	Abakaliki-Ebonyi	444	92	20.7%
3.	Aba-Abia	3527	508	14.4%
4.	Onitsha-Anambra	5645	596	10.5%
5.	Owerri- Imo	57	6	10.5%

Source: (Ministry of environment various states, 2023)

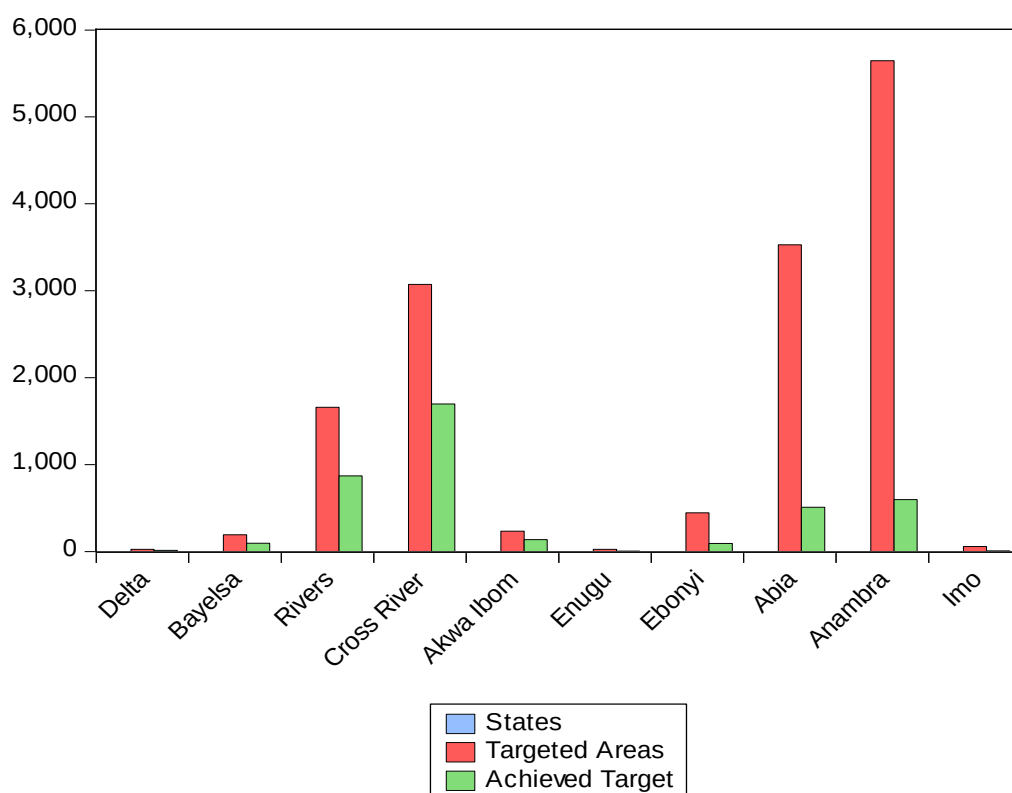


Figure 2: Bar Chart Representation of Variables in Table 2 (Collection of Trash at Door Steps in Randomly Selected Ten Towns in South- South and South-East States of Nigeria)

Table 2 and figure 2 above illustrate the door-to-door collection of trash in some randomly selected towns in South-South and South-East states in Nigeria. The results show that, the targeted areas to collect trash in Agbor of Delta state was 26 and only 13 areas was achieved and this showed 50% of garbage collections in the city. Yenagoa a town in Bayelsa targeted 192 areas according to ministry of environment but they were able to achieve 96 areas and this represents equally 50% of collection. The result of the investigation also revealed that Rivers state with Port Harcourt as the investigated town targeted 1658 areas to collect waste and were able to cover 869 areas and this showed 52.4% level of achievement. A closer look at the table shows that Calabar town in Cross River State made a target of 3072 but were able to cover 1697 areas in the town and this showed 55.2% level of success. Again, it has been observed that in Uyo in Akwa Ibom State the ministry had targeted 232 areas of coverage but were able to cover 136 areas which is a representation of 58.6%. Enugu town in Enugu state according to the result from the table had targeted 24 areas to collect waste from homes and yet they only were able to collect 4 areas within the period of one month. This equally showed 16.6% of coverage. The result of the investigation further revealed that Ebonyi targeted 444 areas to collect waste and were only able to collect in 92 areas which represents 20.4%

level of coverage. The result also revealed that Aba in Abia state that targeted 3527 was able to cover only 508 areas and this shows 14.4% of coverage. A closer look at the table further revealed that Onitsha in Anambra state had according to ministry of environment targeted 5627 areas and yet were able to cover 596 areas and this means only 10.5 % was covered. In Imo State, efforts to collect waste targeted 57 areas but only succeeded in collecting from 6 areas, which represents just 10.5%. Similarly, Anambra and Abia states, which together account for 25% of the study's population, fell short of their goals, collecting only 10% and 14% of household garbage, respectively. In contrast, cities like Port Harcourt, Calabar, Uyo, Delta, and Bayelsa managed to collect more than half of their targeted trash during the same period in 2023. Overall, trash collection across Nigeria has not met minimum standards, highlighting that the effectiveness of waste management largely depends on the effort and commitment of state governments. The link between population growth and rapid urbanization is contributing to a daily increase in solid waste generation in urban areas. This ongoing issue reflects a significant challenge for Nigeria's economy, as illustrated by the projected trends in Table 3 below.

Table 3: Projected Urban Solid Waste Generation in Nigeria

S/N	Year	Population (Millions)	Total waste generation Thousand Tons / Year	Per capita Generation (Kg)
1	2021	197.3	31.63	0.439
2	2031	260.1	47.03	0.498
3	2041	342.8	71.15	0.569
4	2051	451.8	107.01	0.649
5	2066	518.6	131.24	0.693
6	2061	595.4	160.96	0.741

Source: (Federal Ministry of Environment, 2022)

Waste generation in Nigeria is set to increase rapidly due to rising urban migration (Federal Ministry of Environment, 2022). As more people move to urban areas, incomes will rise, leading to higher consumption and, consequently, more waste. This surge in waste generation is also driving up the costs of waste collection and transportation. According to Table 3, solid waste in the ten states studied was 31.6 million tons in 2021 and is expected to reach 47.3 million tons by 2031, marking an increase of nearly 50%. Projections for 2051 estimate urban solid waste at 161 million tons for these states. Additionally, per capita waste generation is anticipated to grow from 0.439 kg in 2021 to 0.741 kg by 2061. This trend underscores the growing challenge of managing waste in rapidly urbanizing regions.

The study reveals that in many urban areas of Nigeria, waste is often discarded in nearby open spaces such as lands, drains, streets, uncompleted and dilapidated buildings, and unused portions of land. This indiscriminate disposal of waste in major cities results in unhygienic and health-threatening environments. Nigeria lacks the infrastructure for formal waste processing and recovery units in its major cities. Consequently, waste recovery and recycling are predominantly handled by small and medium-scale scavengers who collect waste to sell at low prices. These scavengers, without access to protective clothing, are at high risk of disease outbreaks. Their efforts, though commendable, are insufficient to address the vast financial and logistical demands of comprehensive waste recovery and recycling.

Approximately 1.5 million sweepers are engaged in manual scavenging work across both rural and urban areas in Nigeria. In response to the rapid urbanization, private individuals and government entities have initiated small-scale waste management efforts. Key organizations involved include the Federal Ministry of Environment (FMOE), State Ministries of Environment, Akwa Ibom State Waste Disposal Board (AWDB), Cross River State Environmental Agency (CREA), and Abia State Waste Management Authority (AWMA). Under the Resource Conservation and Recovery Act, the Environmental Protection Agency (EPA) regulates household, industrial, and manufacturing solid and hazardous wastes.

These boards and agencies are increasingly active in sanitation and waste disposal efforts. Although the operation and maintenance of State Waste Disposal Boards, State Waste Management Authorities, and Environmental Protection Agencies have not fully achieved their goals, they have significantly reduced waste accumulation in urban areas. Despite these efforts, waste piles still attract disease carriers such as mosquitoes and flies, leading to environmental degradation, unpleasant odors, and the proliferation of insects, rodents, and worms. These conditions contribute to the transmission of diseases like typhoid, cholera, tuberculosis, and hepatitis B (Federal Ministry of Health, 2022).

This situation underscores the urgent need for improved waste management systems in Nigeria. Enhancing waste processing infrastructure and expanding the roles of existing agencies could mitigate the health risks and environmental degradation associated with inadequate waste disposal practices.

4.1 Testing of hypotheses

Testing the hypotheses, we use the data collected from questionnaire distributed to respondents and test them at 5% level of significant using Chi-square. Thus, the formula for calculating chi-square is,

$$\chi^2 = \frac{\sum (F_o - F_e)^2}{F_e} \quad (1)$$

Where: χ^2 is Chi-square, F_o is Observed frequency, F_e is Expected frequency, Σ is Summation sign

The formula for calculating expected frequency (F_e) is

$$F_e = \frac{\text{Row Total} \times \text{Column Total}}{\text{Grand Total}} \quad (2)$$

The degree of freedom is calculated thus

$$Df = (R - 1)(C - 1) \quad (3)$$

Where: DF is Degree of Freedom, R is Row Total, C is Column Total, 1 is constant Total

4.1.1 Hypothesis 1

Ho: The presence of industries in your area does not cause health hazard to people in your locality.

Research Question 1: Does the presence of these industries in your area caused health hazard to people in your locality?

Table 4: Responses of the respondents to research question 1

Categories of respondents	SA	A	SD	D	TOTAL
Male	(a)55	(b)25	(c)10	(d)6	96
Female	(e)40	(f)10	(g)6	(h)5	61
Total	95	35	16	11	157

Source: field survey, 2024

Table 5: Chi-square computation of the responses to research question 1

Responses	F_o	F_e	$F_o - F_e$	$(F_o - F_e)^2$	$\frac{(F_o - F_e)^2}{F_e}$
A	55	58.1	3.1	9.61	0.2
B	25	21.4	3.6	12.96	0.6
C	10	9.8	0.2	0.04	4.1
D	6	6.7	0.7	0.49	0.1
E	40	36.9	3.1	9.61	0.3
F	10	13.6	3.6	12.96	0.9
G	6	6.2	0.2	0.04	6.5
H	5	4.3	0.7	0.49	0.1

Decision

Since the critical table value of 7.82 is less than the calculated value of 12.8 Thus, the alternative hypothesis (H_i) is accepted while the null hypothesis (H_o) is rejected.

4.1.2 Hypothesis II

Ho: The method and timing of waste collection and disposal by these companies in our locality is not environmentally friendly and above the world minimum standard?

Research Question 2: Is the method and timing of waste collection and disposal by these companies in your locality environmentally friendly and above the world minimum standard?

Table 6: Responses of the Respondents to Research Question II

Categories of Respondents	SA	A	SD	D	TOTAL
Male	(a)65	(b)20	(c)10	(d)5	100
Female	(e)25	(f)20	(g)8	(h)4	57
Total	90	40	18	9	157

Source: field survey, 2024

Table 7: Chi-Square computation of the Responses To research question 2

Responses	F_0	F_e	$F_0 - F_e$	$(F_0 - F_e)^2$	$\frac{(F_0 - F_e)^2}{F_e}$
A	65	51.3	7.7	59.3	1.0
B	20	25.5	5.5	30.3	1.2
C	10	11.5	1.5	2.3	0.2
D	5	5.7	0.7	0.5	0.1
E	25	32.7	7.7	59.3	1.8
F	20	14.5	5.5	30/3	2.1
G	8	6.5	1.5	2.3	0.4
H	4	3.3	0.7	0.5	0.2

Decision

Since the calculated value of 7 is less than the critical table value of 7.82, thus, the alternative hypothesis (Hi) is rejected while the Null Hypothesis (Ho) is accepted.

4.1.3 Hypothesis III

Ho: Apart from the companies disposing these wastes, government ministries do not come regularly to dispose the waste?

Research Question 3: Apart from the companies disposing these wastes, do government ministries come regularly to dispose the waste?

Table 8: Responses of the Respondents to Research Question 3

Categories of Respondents	SA	A	SA	D	TOTAL
Male	(a)70	(b)25	(c)7	(d)5	107
Female	(e)25	(f)10	(g)8	(h)7	50
Grand Total	95	35	15	12	157

Source: (Field survey, 2024)

Table 9: Chi-square Computation of the Responses to Research Question 3

Responses	F_0	F_e	$F_0 - F_e$	$(F_0 - F_e)^2$	$\frac{(F_0 - F_e)^2}{F_e}$
A	70	64.7	5.3	28.09	0.4
B	25	23.8	1.2	1.44	0.1
C	7	10.2	3.2	10.24	1.0
D	5	8.2	3.2	10.24	1.2
E	25	30.3	5.3	20.09	0.6
F	10	11.2	1.2	1.44	0.1
G	8	4.8	3.2	10.24	2.1
H	7	3.8	3.2	10.24	2.6

Decision

Since the calculated value of 8.1 is greater than the table values of 7.82, thus, the Null Hypothesis (Ho) is therefore rejected while the alternative hypothesis (Hi) is accepted.

4.2 Discussion on findings

In the study, research question 1 was "Does the presence of these industries in your area caused health hazard to people in your locality"?

Hypothesis 1 was also formulated to this effect. Data were collected from 157 respondents to test the hypothesis. The result of the data analyzed shows that 95 respondents strongly agreed that the presence of these industries in their area has caused health hazard to people in their locality. And, 35, 16, 11, of the total respondents agreed, strongly agreed and disagreed respectively.

When testing the hypothesis with the aid of chi-square statistical tool, the calculated value of 12.8 was greater than the critical table value of 7.82. This therefore leads to the acceptance of the alternative Hypothesis (Hi) and the rejection of the null Hypothesis (Ho) which states that the

presence of these industries in their area has caused health hazard to people in that locality.

The research question 2 was formulated to examine whether the method and timing of waste collection and disposal by the companies operating in the locality was environmentally friendly and above the world minimum standard. To analyze the question, data collected from the respondents to this effect were analyzed as seen in tables above. The result of the analysis indicates that, 90 respondents strongly agreed that the method and timing of waste collection and disposal by these companies in the locality was not environmentally friendly and above the world minimum standard. Also, of the 157 respondents, 18 agreed, 40 strongly disagreed and 9 disagreed, respectively.

When testing the hypothesis II using Chi-square, the critical table value of 7.82 was greater than the calculated value of 7. Thus, this leads to the view that, method and timing of waste collection and disposal by these companies in the locality was not environmentally friendly and above the world minimum standard.

The research question 3 was stated to examine whether, apart from the companies disposing these wastes, if government ministries pick up waste regularly to dispose.

To analyse this, the researcher collected data from the 157 respondents to test the hypothesis. The result of the data analyzed reveals that 95 respondents strongly agreed, that apart from the companies disposing these wastes, that government ministries do not regularly pick up the waste to dispose. The result also shows that, 35 agreed, 15 strongly disagreed and 12 disagreed, respectively. When the research tested the data using chi-square statistical tool, the calculated value of 8.1 was greater than the critical table value of 7.82. Based on this, the result reveals that, apart from the companies disposing these wastes, government ministries do not pick up the waste regularly to dispose.

5. CONCLUSION

The Government of Nigeria has implemented numerous transformational initiatives to create an enabling environment for companies to produce made-in-Nigeria goods that can compete globally. These initiatives include offering tax incentives, enhancing security, and providing training for experts both within and outside the country. The government has also designed programs and policies to support companies, encourage innovation, and provide startups with resources to boost domestic production. These efforts aim to position Nigeria as a self-reliant industrial nation capable of competing on a global scale. As a result, the made-in-Nigeria products initiative is projected to expand the manufacturing sector, achieving efficiency and self-sufficiency across all production aspects. This initiative is also expected to generate an export surplus, thereby making the Nigerian economy more productive and competitive internationally. However, the study found that the continuous activities of these industries in production, distribution, and consumption across different sectors of the Nigerian economy generate significant amounts of solid waste. Solid waste management has thus become a major environmental issue in Nigeria. The study observed that these wastes are often dumped along roads, on unused lands, in streets, drainage channels, and uncompleted buildings. This improper waste disposal has led to health challenges for both scavengers and citizens. The accumulation of waste in public spaces not only poses health risks but also contributes to environmental degradation. Addressing this issue requires improved waste management systems and infrastructure to handle the increasing waste generated by the growing industrial sector. Enhanced waste processing facilities, stricter regulations, and more effective waste collection and recycling programs are essential. By tackling the waste management challenge, Nigeria can ensure that its industrial growth does not come at the expense of public health and environmental sustainability. The study identified key challenges in Nigeria's waste management and recommended maintaining international standards by segregating and recycling waste at collection points. Proper transportation and treatment of waste to meet 21st-century standards are crucial. Adequate funding for the environment ministry and industries, driven by both individuals and the government, is necessary to manage waste and prevent health issues. Increased funding and personnel for state agencies will enhance waste management, contributing to GDP growth and reducing health costs. The National Orientation Agency should promote proper waste disposal practices. Encouraging scavengers with adequate machinery and rewarding firms with modern disposal equipment are also recommended.

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