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Assessment of the Impact of Solid Waste Management in Densely Populated Areas of the Kaduna Metropolis, Nigeria

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Abstract. The waste and its management have been a persistent issue in densely populated areas of Nigeria despite the government's efforts to address the menace. The study was motivated by the desire to enhance our understanding of the impact of waste and its management in a metropolitan town. The study investigated the causes, impacts, techniques, and challenges of solid waste management in the Kaduna metropolis. Data was sourced using the survey method. from the residents and officers of the Kaduna State Environmental Agency. A multistage sampling technique was applied where by a structured questionnaire and interview guide were used for the data collection. A descriptive analysis was used to compute the results. Findings from the study reveal that households (61.9%), and petty traders (30%) are the main sources of solid waste in the study area. Residents (56.9%) are not satisfied with services rendered by the institutions that regulate waste due to a lack of coordination (40.6%) and political influence (27.2%). The most common challenge of waste management faced by residents is the lack of formal waste collectors within their proximity. Therefore, open dumping (46.9%), waterways (10.6%), and other places (25.6%) are used to dispose of waste in the study area. From these findings, it was recommended there should be wide publicity and awareness by the national orientation agency on environmental laws, and the dangers of violating them, in addition, there should be a well-coordinated policy implementation plan properly spelt out, identifying the roles and responsibility of both formal (public and private) and in formal waste managers.

Keywords: Impact, Causes, Techniques, Challenges, Waste, Management.

1. Introduction

Solid waste management is considered within the context of this study as the combination of all actions taken to prevent, control or reduce the effect of waste caused by human activity on the environment, and to properly administer it in a way that will not be harmful to both humans and the environment at large. According to Jerry (2010), it involves collecting, treating, and disposing of discarded solid materials that have served their purposes or are no longer useful. Improper disposal of solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and outbreaks of vector-borne disease spread mostly by rodents and insects (Butu, Agenda, & Bichi 2013). Samah et al, (2013) opined that population growth; industrialization, urbanization, and globalization are some of the main factors responsible for the increase in waste generation. According to the World Bank (2009), the world's cities generate tons of solid waste amounting to a footprint of 0.74 kilograms per person per day. With the rapid population growth and urbanization, annual waste generation is expected to increase to 3.40 billion tonnes by 2050. According to Dangiwa. (2020) waste management problems emerge due to policy failure, which brings about institutional failure visa-vis market failure

Africa like other continents is facing a growing waste management crisis. Available data from the work of Linda, et al (2019) shows that 125 million tons per annum of Municipal Solid Waste (MSW) was generated in Africa, of which 81 million tons (65%) were from sub-Saharan Africa and is expected to grow to 244 million tons by the year 2025. The study maintains that nearly half of all Solid Waste generated in Africa, remains within our cities and towns, dumped onto sidewalks, open fields, storm water drains, and rivers.

Nigeria like many African countries is experiencing waste and management crises. In riverine areas, waste is dumped in the water to be washed away, and in other areas in the opened fields. The techniques currently used for managing most solid waste include

incineration, landfills, fertilizers, fuel for cooking, open dumping, land open burning, reuse/recycling, and landfilling (Adeyemi, 2013). With the development of modern technologies, it is expected that every state government will come up with effective policies and programs that will tackle the impacts and challenges of solid waste management. Also, to provide mechanisms to help alleviate and control the growing rate of waste and indiscriminate disposal in States in order to ensure a clean and healthy environment for people to inhabit. Since the establishment of the Federal Environmental Protection Agency (FEPA) decree in 1988 and its subsidiaries in the States to ensure a clean and healthy environment the agencies have fallen short of their responsibilities.

One of the principal challenges facing solid waste management in Nigeria has been identified as improper planning of towns and cities (Abila, & Kantola, (2013). Other challenges have to do with governance and the rules and regulations controlling the management of waste. Dangiwa (2020) rightly described the challenges as "institutional failure" which include a weak mechanism for participation in policy and planning, legal constraints, weak staff morale and incentives encouraging corruption, and the difficulties faced when powerful stakeholders (private and public) are not supportive of the institutional responsibilities". Ezhicheah (2010) observed that solid waste management in Nigeria is still at an emerging stage because of improper organization and for that reason gross inefficiencies are common.
Agencies responsible for waste management in Kaduna State, Nigeria include the State Ministry of Environment, the Kaduna State Environmental Protection Authority (KEPA), and private companies like Cape Gate Investment company limited are still performing below expectations. Adjunct to others is the Kaduna State Traffic and Environmental Law Enforcement Agency whose functions are limited to metropolitan public road networks, traffic, and vehicular inspection only.

The tremendous effect of this process, therefore, falls back on the residents causing air pollution and making breathing difficult which may result in serious health problems, this also puts residential homes and businesses at risk of fire disaster. Waste deposit that ends up in waterways forms blockage and creates stagnant water for insect breeding and flood during raining season, it also creates a safe haven for rodents like rats and reptiles which are the carriers of the deadly diseases like Cholera and Lassa Fever Endemics that recently claimed 118 lives in 8 weeks from 18 States in early 2020 (NCDC, 2020).

Densely populated areas are found in every city in Nigeria including Kaduna State, and these areas have many households with the majority of the population living there. These areas are characterized by low-level of income, average level of education, and lower economic status. Studies show that most municipal solid waste are generated from such areas because of different human activities (Hussein, & Mona 2018, and Nabegu 2010). Such areas do not sufficiently benefit from government programs and services (Sani (2003). Despite the existing literature (Ajibuah and Terdoo (2013Abila & Kantola (2013), Abur, Oguche and Duyuna (2014) Butu, Ageda and Bichi (2013), on waste material and management in Nigeria, not much or few empirical studies had identified the challenges that are specific to densely populated areas. Given these developments, the researcher, therefore, sees the need to conduct an empirical investigation in other to find a lasting solution to the problem.
It is therefore against this premise the study is undertaken to answer these research questions:

- What are the causes of solid waste in densely populated areas of the Kaduna Metropolis?
- What are the challenges hindering solid waste management among residents of densely populated areas of Kaduna Metropolis?

This study is guided by the Cradle to cradle theory initiated by William McDonough and German Michael Braungart. The theory is designed to stop the cycle of use-waste-pollute, which suggests that certain products could be reused endlessly to make similar products (cradle to cradle), rather than recycled into lower-grade products until the last stop is a landfill (cradle to grave).

2. Methodology

Location of the Study: This study was conducted in Kaduna Metropolis, Nigeria which is sighted at the heart of Kaduna State. It comprises Kaduna North, Kaduna South, part of Chikun, and Igabi Local Government Area. With an estimated population of 1,104,933 (NPC 2017). Most inhabitants of the study area are civil servants, traders, artisans, and so on (James, 2017). The Metropolis is an industrial and trade Centre and a major transportation hub for the surrounding areas. The prevalence of military, industries, educational and commercial establishment attracts people from different ethnic groups across

Nigeria that serves as a major source of waste emission.

The population of the Study: The key elements of this study are adult residents in the densely populated areas of the Kaduna metropolis, both male and female, from various social strata, and religious and cultural groups. Included also in the study are experts and other relevant stakeholders in waste management like the Kaduna State Ministry of Environment, Kaduna State Environmental Protection Agency (KEPA), and Private waste managers.

Sampling Size & Sampling technique: Krejcie and Morgan's sample size determinant table is used to select a sample of 384 from a projected population (1,104,933) of the metropolis. Kaduna Metropolis is made up of two major local governments, which is Kaduna North (12) wards, Kaduna South (12) wards, and Parts of Chikun (8) wards and part of Igabi (3) with a total of thirty-two (32) wards. From these Local Government Areas, 18 densely populated wards with high volumes of waste were purposively selected. In the second stage, purposive sampling was applied to select two major sub-urban streets from each ward. These are the streets with a high density of residents. In the third stage, 22 households were selected from each of the two identified streets using a systematic sampling procedure. The choice of 22 households is to enable the researcher to get a representative population in the study area. In selecting the households, the researcher used existing house numbering, and every fourth house from both sides was sequentially picked to meet up the required 22 households. In the last stage, questionnaires were served to the head of the households. In the absence of the head, the next in line was selected to respond to the questions.

In addition to the survey questionnaire, the researchers interviewed four (4) key informants who are experts in solid waste management drawn from two Public Organizations-Kaduna State Environmental Protection Authority, Kaduna State Ministry of Environment, and Two Private organizations-(formal) Abu-Rahima Royal Ventures (Informal) scavengers, and truck pusher.

Method of Data Collection: Data for this study was generated primarily through a questionnaire survey. The questionnaire was administered to respondents who could read and write in English, and for those with a low level of education, the researchers read out the questions in a convenient language, and responses were filled in accordingly. The key informant interview KII was done at the interviewee's convenience i.e. office or a designated location.

Method of Data Analysis: Qualitative data were transcribed and subjected to content analysis and presented in Pros. The transcriptions were reviewed to enable the researcher to compile the related quotations that will capture the themes and ideas in each question. While Quantitative data collected from the survey (questionnaire) was checked to ensure its reliability before editing, after which it was coded, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS), IBM version 26, and presented in frequency tables and percentages.

3. Result and Discussion

Data analysis is based on three hundred and sixty (360) copies of questionnaires that were retrieved from the three hundred and eighty (384) questionnaires that were administered as well as four (4) interviews with care givers.

Socio-Economic Characteristics of Respondents

Survey respondents' socio-economic characteristics such as sex, age, marital status, educational qualification, occupation, employment status and monthly income are presented in Table 1 below.

Table 1: Socio-demographic information of Respondents

Variables Categories		Frequency	Percentage
Location	Kaduna North	109	30.2
	Kaduna South	92	25.5
	Chikun	84	23.4
	Igabi	76	21.2
	Total	360	100.0
Sex	Male	191	53.1
	Female	169	46.9
	Total	360	100.0
Ethnic Groups	Hausa	177	49.2
	Igala	46	12.8
	Nupe	39	10.8
	Kanuri	25	6.9
	Others	73	20.3

	Total	360	100.0
Marital Status	Single	78	21.7
	Married	260	72.2
	Divorced	6	1.7
	Widower	16	4.4
	Total	360	100.0
Number of Children	None	10	2.8
	1 – 3	184	51.1
	4 – 6	146	40.6
	7 – 9	20	5.5
	Total	360	100.0
Religion	Islam	231	64.2
	Christianity	113	31.4
	Traditional	11	3.1
	Others	5	1.4
	Total	360	100.0
Educational Level	No formal education	13	3.6
	Less than full primary education	38	10.6
	Full primary education	18	5.0
	Less than full secondary education	64	17.8
	full secondary education	78	21.7
	Post-secondary education	83	23.1
	Others	66	18.3
	Total	360	100.0
Occupation	Mechanic/vulcanizing	24	6.7
	Bricklayer/laborer	14	3.9
	Farming/grass cutter	6	1.7
	Artisanship	19	5.3
	Petty trading	18	5.0
	Unemployed	93	25.8
	Others	186	51.7
	Total	360	100.0
Type of Resident	Personal house	136	37.8
	Family house	100	27.8
	Official/government quarter	25	6.9
	Rented house	97	26.9
	Others	2	0.6
	Total	360	100.0

Source: *(field survey 2021)*

It can be seen in the Table that 30.2 % are from Kaduna North while 25.5% are from Kaduna South as against 23.4% who are from the Metropolitan part of Chikun and the rest 21.2% from the Metropolitan part of Igabi in Kaduna.

In terms of age group, 8.6% of the respondents fall within 18-25 years against 30.9% who are within 26-35 years while 43.9% are between 36-45 years and the remaining 31.9% are within the age group of 46-60 years. This shows that most of the respondents are within the age group of 36-45 or from 46-60 years. Data on the Sex of the respondents shows that 53.1% of the respondents in this study are males and the rest 46.9% are females. This shows that both males and females are well represented in the study.

Concerning the ethnic group of the respondents, it can be seen that 49.2% are Hausa while 12.8% are Igala against 10.8% Nupe while 6.9% are Kanuris and the remaining 20.3% are other tribes such as Yoruba Igbo, Ebirra, etc. This shows that the majority are Hausa by trib. Data on religious affiliation shows that 64.2% are from the Islamic faith while 31.4% are of Christian faith against 3.1% who are of the Traditional religions and the rest 5 or 1.4 % said others such as no religious beliefs etc. This shows that both Islamic and Christianity religions are well represented in this study.

On the respondents' marital status, 21.7% of the respondents are single while 72.2% are married as against 1.7% that are divorced, and the rest 4.4% are widowed. Data on the respondents' number of children shows that 2.8% have no children, with an overwhelming majority (90%) of the respondents indicating they have children between 1-5, as against (6.4%) who claim to have children between 6-8, and the remaining 0.8 of the respondents claim they have 9 children and above.

On the respondents' level of education, (3.6%) had no formal education, while (10.6%) possess Less than full primary education as against (5.0%) that possess full primary education compared to (17.8%) who possess Less than full secondary education. (21.7%) of the respondent possess full secondary education, while 23.1% possess post-secondary education, and the rest 18.3% had other forms of education such as

Quranic or adult education. Findings on respondents' employment status indicate that (25.9%) are unemployed, and (6.7%) are in the mechanic/vulcanizing profession, 3.9% are bricklayers/laborers, 1.7% are farming/grass cutters while 5.3% are in Artisanship as against 5.0% who are petty trading and the rest 186 or 51.7% are in other occupation such as students, private business or self-employed apprenticeship.

On the type of residence, the respondents live, 37.8% live in personal houses as against 27.8% who live in family houses while 6.9% live in official/government quarters, 26.9% live in a rented house and the rest 0.6% live in other sources such as living with friends or not having their houses.

4. Causes of Waste in Densely Populated Areas of Kaduna Metropolis

Solid waste disposal in densely populated areas of Kaduna metropolis is attributed to many sources as shown in Table 2

Table 2: Causes of solid waste in Densely Populated Areas.

	Frequency	Percent
petty traders	108	30.0
Household	223	61.9
Agricultural	16	4.4
Industries	7	1.9
Others	6	1.7
Total	360	100.0

Source: *(field survey 2021)*

Table 2, documented a variety of sources of solid waste in the study area as, household emissions that seems to be the most prevalent as indicated by (61.9%) of the respondents. Furthermore, 30% of the respondents indicate that petty traders are responsible for generating solid waste in the study area. While a fraction of 4.4% and 1.9 believe that agricultural and industrial emissions. Similarly, 1.7% identified other sources responsible. However, a 38-year-old participant during the interview said:

The quality of products consumed in the high-income density areas is mostly superior to that of the high-density low-income areas which are mostly substandard and have a lesser lifespan, which has higher chances of becoming waste in the shortest possible time as against the standard quality products. Also, any human interaction as a result of our domestic activities, our industrial and commercial activities, waste must be generated.

The opinion above clearly states that apart from household consumables that cause waste, level of awareness and the quality of products among others are factors that cause waste in densely populated areas of Kaduna Metropolis.

Similarly, an officer of the environmental agency said:

Solid waste management issue is the biggest challenge to Kaduna State Government. Sources of solid waste are not limited to households, industries, and the like but due to the increase in population and increasing generation of such solid waste and the burden posed on the municipal budget.

The above view reiterates that solid waste should be viewed in a wider dimension.

5. Challenges Hindering Waste Management

Challenges of waste management are due to numerous causes as discovered in the study. This arises from institutional, waste disposal and technology. Table 3 shows the institutional challenges.

Table 3: Institutional Challenges Hindering Effective Waste Management in Kaduna Metropolis

Challenges	Frequency	Percent
political influence	98	27.2
lack of coordination	146	40.6
conflict between organization	60	16.7
duplications of responsibility	56	15.6
Total	360	100.0

Source: *(field survey 2021)*

Table 3 shows how institutional challenges hinder effective waste management on streets. The challenges include political influence, according to 27.2% of the respondents, while 40.6% said lack of coordination against 16.7% said the challenge of conflict between organizations and the rest 15.6% said the challenge of duplications of responsibility. This shows that most institutional challenges hindering effective waste management in densely populated streets include lack of coordination and political influence.

The finding is contrary to the responses gotten from the Key Informant from KEPA KII. While responding to the question, a Key informant presented his opinion in the following manner:
When you talk of institutional challenges, manpower is there, in the whole of Kaduna state in KEPA we are sixty, field officers alone we are forty and we are to cover the whole state. by the time you put forty people just within the metropolis is not enough not to talk of Zaria and Kafanchan which are the Major areas, then you talk of other small areas like Samunaka, Soba, Birnin Gwari, you see this is a serious challenge.

The statement clearly shows that the major institutional challenge experienced by waste regulators is the shortage of workers. It also proves that the Kaduna Environmental Protection Authority is not having sufficient staff to cover the whole state even though it performs the supervisory role. Unlike the opinion of the respondent of the survey questions, other challenges according to another respondent from Aburahim who took part in the KII identified equipment key challenges. He presented his opinion as follows:
There is personal protective equipment that is needed for the workers like boots, hand gloves, face masks, disinfectants and the rest, but it is not available. Manual labour is mostly used in most cases, based on UN standards there is a certain volume of waste that is not supposed to be evacuated with manual labour, it has to be automated, but most of these types of equipment are not available because of their cost.

The opinion shows that some private contractors do not have the required equipment to effectively carry out their duties, and the workers are also directly exposed to the dangers of contracting diseases or sustaining serious injuries while operating, which poses a serious challenge.

The study also sought to identify the major challenges faced by residents when disposing of waste in the study area. The views of the respondent are presented in table 4.

Table 4: Challenges Faced with Waste Disposal in Kaduna Metropolis

Options		Frequency	Percent
	lack of time to dispose	26	7.2
	lack of money	27	7.5
	lack of waste-bin within the proximity	239	66.4
	waste collectors	68	18.9
	Total	360	100.0

Source: *(field survey 2021)*

Table 4 reveals that challenges of waste disposal include lack of time (7.2%) to dispose of while 7.5% said lack of money as against 66.4% who said challenged by lack of waste-bin within the proximity and the rest 18.9% said, waste collector. This shows that the lack of waste-bin within the proximity is the main challenge people face with waste disposal.
Some of those who took part in the KII shares a contrary opinion, with those who responded to the survey questionnaire. While responding to the question a stakeholder in waste management shared his opinion in the following manner:

The very key issue is attitude. Attitudinal issues! this is a practical experience I am going to share. There was a time I was supervising a contractor in Nasarawa, these women usually go out early in the morning to sweep, areas that they have swept, and you will see somebody will throw dirt from his house on that same spot, by the time you ask why; they will tell you that these women are already paid to sweep. So, every individual has a responsibility, if the government does its own part what about the citizens? People don't really bother, a time we have to go house by house to tell people to sweep the front of their houses and clean the drainage, this is something that it's supposed to be done naturally.
The opinion clearly shows that the resident's careless attitude is also a contributing factor to the failure of sustainable waste management in densely populated areas, it also proves that despite government efforts, some residents don't feel the responsibility to properly manage waste and clean their environments.

Table 5: Respondents' Views on Where Waste is Being disposed in Kaduna Metropolis

	Frequency	Percent
No response	33	9.2
Gutter	38	10.6
Open fields	169	46.9
Landfill	28	7.8
Others	92	25.6
Total	360	100.0

Source: *(field survey 2021)*

Table 5 shows that a total of 33 or 9.2% declined to comment. The table shows that open fields (46.9%) are the main areas of waste disposal. While 38 or 10.6% said gutter as against while 28 or 7.8% said landfill and the rest 92 or 25.6% said other places.

Table 6: Waste management services in densely populated areas of Kaduna Metropolis

	Frequency	Percent
Satisfied	155	43.1
not satisfied	205	56.9
Total	360	100.0

Source: *(field survey 2021)*

As shown in Table 6, given the growing rate of waste in the study area, more than half of the respondents (56.9%) are not satisfied with the agencies that regulate waste, while the remaining 43% are quite satisfied with the services. This is to show that most people are not satisfied with the services of the agencies that regulate illegal waste disposal/manage waste.

6. Discussion of Findings

This study examines the conditions that lead to the causes of solid waste, and the challenges hindering effective waste management in densely populated areas of the Kaduna metropolis. Findings from both quantitative and qualitative data indicate that, Household emissions are the most prevalent as indicated by (61.9%) of the respondents. This agrees with the findings of Butu et al (2013) in Karu Nasarawa State and Nabegu (2010) in Kano, that households are the major components of solid waste by discarding material like food wastes, polythene bags/sachets, paper, plastics, glass bottles and metals mostly gotten from domestic and commercial activities.

The study also noted that given the growing rate of waste emission in the study area, the majority of the respondents (56.9%) are not satisfied with services rendered by the institutions that regulate waste due to lack of coordination (40.6%) and political influence (27.2%). This confirms the findings of Nabegu & Mustapha (2015) who observed that the legal provisions for Solid Waste Management show a clear gap leading to a lack of coordination and conflict between the federal, state, and local governments.

The study found that the variety of solid waste in the environment is a set-back in its management. The study revealed that there no waste bins within their proximity (48.1%) and formal waste collectors (18.9%). The inability to have the waste collectors around them led to open dumping (46.9%), waterways (10.6%), and other places (25.6%) are for disposal of waste. Ojo (2014) who observe that 87% of Nigerians use unsanitary methods of solid waste disposal like open fields, streams waterways, further stressed this. Ogwueleka (2009) also revealed that Nigeria adopts open dumping or uncontrolled landfills as their disposal route.

7. Conclusion

The problems of waste and waste management are increasingly becoming persistent in the study area, in as much as human activity continues, therefore sustainable and efficient means of managing it needs to be harnessed, the main factors responsible for its generation must be properly regulated through proper formations and effective implementation of policies in this regard. The consequences of poor management have delayed the socioeconomic health and environmental development of the people.

Recommendation

It is recommended there should be wide publicity and awareness by the national orientation agency on environmental laws, and the dangers of violating them, in addition, there should be a well-coordinated policy implementation plan properly spelt out, identifying the roles and responsibilities of both formal (public and private) and in formal waste managers. In addition, Government should provide

adequate skilled workers and waste bins within proximity as well as provide modern incinerators and waste enclosures in all the strategic places of the study area.

References

Abila, B, & Kantola, J, (2013). Municipal solid waste management problems in Nigeria: Evolving knowledge management solution. *International Journal of Environment, Earth Science and Engineering.* 7 (6), pp.1-6.

Ajibuah, B. J (2013). "Urban Flooding Consequences and Preparedness in Kaduna Metropolis" A paper presented at CRUDAN Open-day programme, held a Hekan Cathedral, Katsina Road, Kaduna on 28th June. 9-11

Butu, A.W, Ageda, B.R, and Bichi,A.A (2013). Environmental Impacts of Roadside Disposal of Municipal Solid Wastes in Karu, Nasarawa State, Nigeria, in *International Journal of Environmental and Pollution Research*, Vol. 1, No 1, 1-19.

Hussain I.A and Mona S.M. (2018). Solid Waste Issue: Sources, Composition, Disposal, Recycling, and Valorization. *Egyptian Journal of Petroleum.* Vol. 27, Issue 4, December 2018, Pages 1275-1290

Nabegu, A.B. (2010). An Analysis of Municipal Solid Waste in Kano Metropolis, Nigeria *Journal of Human Ecology Volume* 31, Issue 2, Pages 111-119

Nabegu, A.B. & Mustapha, A. (2015). Institutional constraints to municipal solid waste management in Kano metropolis, Nigeria. *International Journal of Innovative Environmental Studies Research.* 3(3), p.13

Linda G, Mohamed T. A., Kidane G., Gebremedhin, Jamidu H.Y. Katima, Suzan O, Oladele O, Ulf HR and Arsène H.Y. (2019) '*Solid Waste Management in Africa: Governance, Failures and Developmental Opportunities'*. In Book: Regional Development in Africa 2019. DOI:10.5772/intechopen.86974

Ojo, M.O. (2014). SWM in Obantoko Area of Abeokuta, Nigeria. *Journal of Emerging Trends in Engineering and Applied Sciences*. 5 (2), pp. 111-115.

Ogwueleka, T.C. (2009). Municipal Solid Waste Characteristics and Management in Nigeria. *Iran Journal of Environmental Health Science and Engineering*. 6 (3), pp. 173-180.