

# Assessment of Household Solid Waste Management Techniques in Nassarawa “A” Ward in Minna, Niger State, Nigeria

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## Abstract

The most pressing environmental challenge encountered by the urban areas of Nigeria is domestic solid waste management. With its population reaching 200 million, Nigeria sustains its position as one of Africa's largest producers of solid waste. It is indicated that more than 30 million tons of solid waste are generated annually, mostly by households (URL1). Insufficient collection and disposal of municipal waste and lack of reliable transport infrastructures, including inadequate budgetary provisions make the implementation of waste management processes across the States very difficult. Despite the measures put in place by governments across the country, waste management is still a challenge to tackle in high-density residential areas, specifically in informal settlements. Public awareness and participation are critical components in waste management programs besides appropriate legislation, resilient technical support, and adequate funding if certain accomplishments are required.

Based on this perspective, the research focuses on understanding what kind of solid waste is generated and how it is disposed of in a selected high-density residential area, the Nassarawa “A” Ward in Minna city where the existence of rising informal settlements is a pressing issue. A household survey is conducted amongst informal settlers to assess the connection between the level of education of households, their awareness of the topic, and also, willingness to participate in the process. The research results proved that majority of the residents were concerned and affected by the poor state of their environment due to the lack of an appropriate solid waste management approach. Very few residents had awareness regarding the stages of waste management such as reusing, recycling, and composting. The research concludes that based on the results obtained from the survey, any waste management strategies introduced should encourage the education of residents and their active participation in the process.

*Keywords: domestic solid waste management, informal settlement, public participation, Minna, Niger State*

## 1. Introduction

The growing capacity and complexity of solid waste produced in cities today pose a great threat to our ecosystems and health and also generate challenges for local governments. The United Nations Environment Programme indicates that an estimated 11.2 billion tonnes of solid trash are collected globally each year and that organic garbage degradation contributes to over 5% of global greenhouse gas emissions (URL 2). Poor waste management, from insufficient collection methods to poor disposal, contributes to air pollution, water, and soil contamination whereas open and unclean landfills increase the pollution of drinking water, which leads to disease infection and transmission (URL

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2). Anaerobic waste decay produces methane gas that contributes to pollution in the air and on the ground; the ground is contaminated through direct waste contact or leachate; garbage burning pollutes the air, disease transmission through birds and insects, and the uncontrolled release of methane contributes to air pollution (Schertenleib & Meyer, 1992, Mozhiarasi et.al., 2022, Siddiqua et.al, 2022). Today, with growing urban economies and populations waste cannot be avoided, however, it can be minimized if managed wisely. With appropriate waste management strategies, materials cannot only be recovered; but energy can be produced, whereas remanufacturing and recycling can help generate usable products and provide job opportunities in low-income societies. With limited budgetary allocations of governments in developing countries, public awareness, and participation in solid waste management programs have become highly significant issues in the accomplishment of sustainable development.

education (goal 4), decent work and economic growth (goal 8), industry, innovation, and infrastructure The United Nations Member States' adoption of the 2030 Agenda for Sustainable Development in 2015 places a pressing call for action on all nations, developed and developing, to join forces in a global partnership to work toward sustainable development (URL 3). The key objectives to be taken into account when implementing waste management strategies continue to be the quality of (goal 9), sustainable cities and communities (goal 11), sustainable consumption and production (goal 12), and partnerships for the goals (goal 17) remain as the key goals to be considered when adopting waste management strategies. The United States Environmental Protection Agency Office of Resource Conservation and Recovery on the other hand works towards developing guidelines for decision-makers regarding how to manage solid waste in developing countries. Similarly, European Environment Agency issues legislation that targets recycling markers for municipal, construction and demolition, and electronic waste (URL 4). These guidelines and legislation are of utmost importance for governments as domestic solid waste can have a detrimental impact on the environment, creating health risks for communities if not managed appropriately.

Based on the framework laid out, the paper aims to highlight what kind of solid waste is generated in Nassarawa “A” Ward of Minna City and how it is disposed of. To develop a deeper understanding of the issue, a household survey is conducted amongst informal settlers to assess the connection between the level of education of households, their awareness of the topic, and also, willingness to participate in the process so that management strategies can be developed.

## **2. The Impact of Solid Waste Disposal on the Environment and its Management in Informal Settlements**

One pressing challenge for local councils around the world -specifically in developing countries- is how to deal with municipal solid waste management (MSWM), where the volume and type of MSW has grown and transformed substantially as a result of the rapidly expanding urban population, advancement of technology, and changing consumption patterns (Adebayo et al, 2006). MSWM in developing countries are required to tackle with elementary issues such as safe disposal of waste, where due to lack of resources, basic treatment and disposal technology and necessary regulative framework

cannot be put into action (Anikwe and Nwobodo, 2002). Solid waste generated by domestic activities has increased rapidly in recent years, posing serious health risks to the people who live in these communities. Improper solid waste management has serious consequences for the environment and human health, including the contamination of surface and subterranean rivers, unpleasant smells, insect swarms, and gas explosions (Ayo and Mohammed, 2010). Inappropriate waste disposal causes leachate to seep into surface and groundwater, while burning of garbage and anaerobic waste decomposition emit methane into the air. Solid waste management experts need to be aware of the hazards of inappropriate waste disposal and the environmental health effects of such waste handling. There may be inconceivable health risks if waste pollution is not properly managed (Chen and Fujita, 2010). The increasing indiscriminate dumping of MSW may be attributed to a number of issues, including poor governance, population expansion, deteriorating living circumstances, and a lack of environmental awareness.

Another pressing issue for organizations managing waste collection and disposal in developing countries is the lack of necessary resources and manpower to meet the rising demand, which makes it difficult to sustain an acceptable quality of life for the citizens (Pokhrel and Viraraghavan, 2005). Collection, transportation, processing, or disposal of waste, as well as its management and monitoring, all fall under the umbrella of waste management. To achieve a sustainable environment, the waste management approach must take into account the lifecycle of products to lessen the negative environmental, social, and financial implications for contemporary societies. Waste begins before a product is even made in our present linear economy.

According to Siddharth (2019) informal workers gather, sift, and recycle more than 20% of the rubbish produced in developing countries in return for some earnings. Non-governmental organizations (NGOs) and small businesses are also part of this "informal economy," as are community organizations (CBOs), and non-profit organizations (NPOs). Because of chemical and biological hazards, musculoskeletal injury, mechanical stress, and poor mental health, informal recyclers are at a higher risk of illness (Gutberlet et al., 2013). An "open-dump" is a site where illegal rubbish is dumped (Izugbara and Umoh, 2004). Normally, waste is disposed of in an unregulated way in informal settlements. Irresponsible waste disposal can also lead to severe economic losses, as well as environmental damage (Kalu et al, 2009). There has been an increase in the ability of individuals to create waste as the result of growing urbanization, health, and safety risks of living near these open-air dumps. To avoid this, it is vital to look into how much waste is generated, what waste management techniques are used, and what readily available disposal facilities are. Additional problems may include shortages of cars, personnel and government support. According to Golit (2001), an effective SWM program is hindered by the lack of funds and technical resources. However, there is an increasing need especially in Nigeria's urban areas to have different waste disposal systems and more importantly, waste reduction strategies (Nwude, 2006; Ukpong, 2006; Osse, 2006).

### **3. The Case Study: Solid Waste Management in Nassarawa “A” Ward Neighborhood of Minna, Niger State**

The current population of Niger State is 26,124,110 based on Worldometer elaboration of the latest United Nations data (URL 5). The study area is within the borders of the capital of Niger State, Minna, which today possesses a population of 479,000 (URL 6). The city is located at 60.331° East and 90.371° North latitude. Minna's population density is around 3448 people per square kilometre (UNDP/NISEPA, 2009). Because of its closeness to Abuja, Nigeria's administrative capital, the city was chosen as the focus of the research. Because of its high population and hot, dry environment, the town is particularly prone to the spread of infectious illnesses due to the inappropriate disposal of waste (Manaf et al, 2009). At the same time, the rising tide of human population adds to the difficulty of properly disposing of municipal solid waste. For decades, the Niger State Environmental Protection Agency has been in charge of disposing of the town's garbage. Minna has a total number of eleven wards (neighbourhoods) Minna Central, Angwan Daji, F-Layout, GRA, Limawa, Makera, Nassarwa, Sabon Gari, Tundunwada South, Tundunwada North, Tunga (Idowu, et. Al, 2020). For the purpose of this research, Nassarawa “A” Ward was chosen because it is a high-density residential area and comprises the highest number of informal settlements. These areas include: Stadium road, Emir's road, Kuta road, Paida junction, Ogbomosho Street, Central mosque road, Sayako area, Unguwar Sarki, Unguwar Gabas, Sokoto Street.

To conduct this study, a modified version of Post's Waste Reduction Study Questionnaire Survey (WRSQS) (2017) was used. There were a total of 150 survey questionnaires sent at random to families in the specified informal settlements in Nassarawa “A” Ward, Minna, of which 100 were returned. Interested respondents were free to engage in any or all of the following areas of the survey. The respondents shared their demographical information and were questioned on what they understood about the natural environment and environmental health, how they disposed of their solid waste, and whether they were satisfied with the waste management methods that the local council was applying. SPSS was used to do an in-depth analysis of the gathered data. For the purpose of presenting and discussing the findings, Microsoft Word was utilized to create tables and figures. The data for this study were obtained using the Stratified Random Sampling method.

#### **3.1 Waste Generation and Management in Minna**

Minna's solid waste consists primarily of domestic waste, commercial waste, and industrial waste. Households, marketplaces, food centers, and commercial establishments such as hotels and restaurants create solid waste. The figures for solid waste deposited in Minna City during the last two decades (1997-2021) display a dramatic increase, especially in domestic waste (UNDP/NISEPA, 2021).

As a result of the aforementioned factors, there has been a rise in total waste. Niger State Environmental Protection Agency's (NISEPA) current waste collection method and its efficacy are presented below.

**Table 1** Present Waste Collection Technique used in Minna and its Efficiency (NISEPA, 2022)

District	Method/ technique of disposal	Frequency of collection	Efficiency
Chanchaga	Exposed dumps, burning and disposal into rivers	Four times a week.	poor
Bahago roundabout Tudun Fulani	Exposed dumps, burning and disposal into drainage.	daily	poor
Tunga	Exposed dumps, dumpsite, waste bins.	daily	Average
Govt house area	Waste bins	daily	Good
Kpakungu - mawo	Exposed dumps, burning and disposal into drainages	Three times a week	poor
Dustsen kura, fadikpe	Exposed dumps, burning and disposal into drainages	Three times a week	Very poor
Maitunbi/ Anguwan daji	Open dumps and dumpsite	Once a week	Very poor
Old secretariat	Open dumps and burning	Two times a week	very poor
Pot roundabout – new secretariat	Open dumps, waste bins.	daily	Good
Mobile roundabout bahago round about	Open dumps, waste bins	Working days	Average
Mobile roundabout- federal secretariat	Open dumps, waste bins	daily	Good
New secretariat – M I Wushishi estate.	Open dumps, waste bins	Working days	Average
Pot roundabout – mobile Paiko, IBB road.	Open dumps , waste bins	daily	Average

Illegal open dumps dominate waste disposal in eight districts, and this is exacerbated even more by the fact that these wastes are dumped out into open spaces and left to pollute the environment and the environment's natural cycles of wind, rain, and sunlight. There is no regular collection in places with no tarmac roads, so rubbish is left to build up into heaps before it is packed and, in most cases, it is burned to decrease volume. Adequate provisions for waste collection are totally inadequate. Streams and rivers that are polluted, eroded, and depleted of fish and other aquatic life are the result of this dumping process



Fig.1 Pictures displaying the current state of Minna (2022)

**3.2. FINDINGS AND DISCUSSION OF RESULTS**

Tables and figures are arranged in accordance with the parts of the WRSQS questionnaire. The environmental threats posed by waste disposal and their potential solutions are discussed in each section.

**Table 2**

	Correct Definition (%)	Wrong definition (%)	No idea (%)			
1. Aptitude to describe the Natural environment	32.7	6.6	60.7			
2. Concern over the present situation of the Earth	75	14	11			
	Automobile exhaust (%)	Sewage pollution(%)	Individuals (%)	Institutional (%)	Household garbage (%)	Yard trimmings(%)

3. Most important environmental issue	6.7	38.3	6.7	3.1	42.1	6.7	
	No impact (%)		Some impact (%)		A lot of impact (%)		No option (%)
4. Respondent's impact on the environment	3.4	23.3	55.3	18			

As seen in Table 2, 60.7 % of the participants in the research area had little idea about what "natural environment" meant. However, 75 % were concerned about the state of their natural environment. The majority of respondents (42.1 %) underlined that their environment is negatively affected by household waste. 55.3 % agreed that the average person had the greatest impact on the surrounding environment.

**Table 3:** Household Solid Waste Management in Nassarawa 'A' Ward

1. Method of household garbage storage	Sealed container (%)	Uncovered container (%)	Plastic bags (%)	Other (pile in the yard)(%)							
	26.7	43.3	10.0	20.0							
2. Method of household garbage disposal	Burn (%)	Bury (%)	Dump In gutter (%)	Dump in yard (%)	Dump on road (%)	EHO Dumps (%)	Garbage truck (%)	Recycle (%)	Reuse (%)	Compost (%)	Other (%)
Biological waste	16.7	3.3	10.0	3.3	3.3	40.0	6.7	0.0	6.7	10.0	0.0
Garden Waste	53.4	3.3	3.3	0.0	3.3	23.4	0.0	0.0	13.3	0.0	0.0
Paper/card board	73.4	3.3	0.0	0.0	0.0	13.4	3.3	0.0	3.3	0.0	3.3
Plastic	40.0	6.7	3.3	0.0	0.0	26.7	0.0	6.7	13.3	0.0	3.3
Metals	13.4	3.3	3.3	3.3	0.0	26.7	3.3	30.0	0.0	0.0	16.7
Glass	6.7	6.7	10.0	6.7	0.0	43.3	3.3	16.6	0.0	0.0	6.7
AVERAGE	33.9	4.4	5.0	2.2	1.1	28.9	2.8	8.9	6.1	1.7	5.0

According to Table 3 of this survey, the majority of people in Nassarawa "A" Ward disposed of their waste in open bins (43.3 %). 33.9 % of respondents indicated that burning was their preferred method of waste disposal. Other options such as composting, recycling, reusing, and collection with a garbage truck were utilized only by a small percentage (the EHO dumpsite is used by 28.9% of those polled).

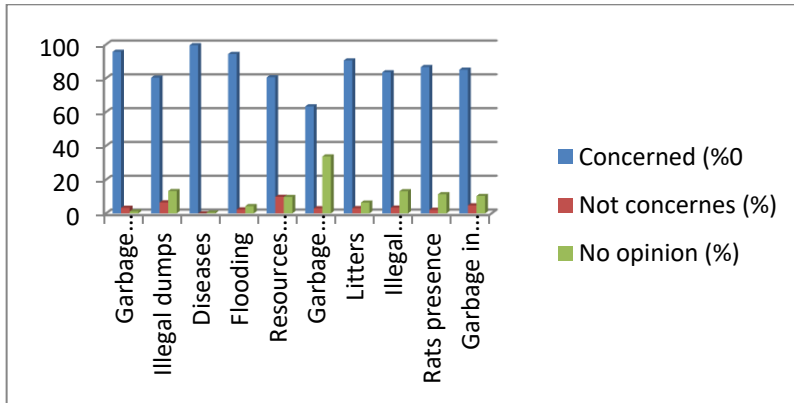


Figure 4: Solid Waste Management Concerns

The majority of respondents expressed their concerns regarding the management of solid waste. Many were disturbed about the existing infections and the possibility of their spread and pinned this to poor waste management (99.5 %). Only 1.1 % stated that burning garbage poses a health hazard.

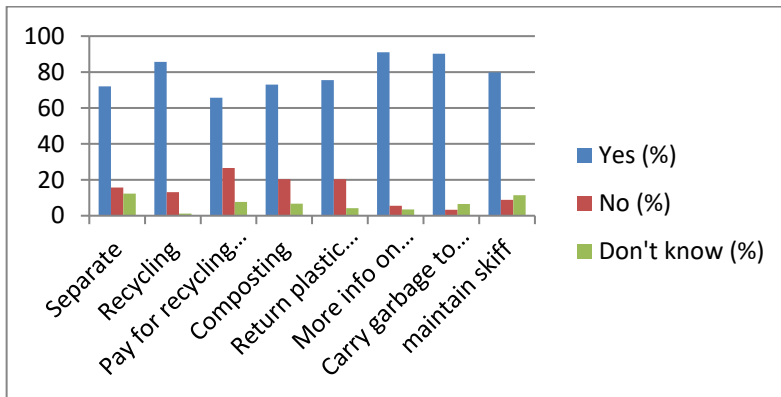


Figure 5: Willingness to Participate

The majority of people of Nassarawa 'A' are interested in decreasing waste through recycling and composting, and they wish to learn how they may do so.

**Table 4:** Solid Waste Management Attitude Scale in Nassarawa ‘A’ Ward

S/N	Statement	Agree (%)	Disagree (%)	No opinion (%)
1	I have a significant role in the management of garbage in Minna.	66.7	23.3	10
2	Schools should incorporate environmental education into their curricula.	90	10	0.0
3	Depending on what I buy, I have the power to either raise or decrease the amount of garbage my family produces.	83.3	13.3	3.4



4	Even if burning rubbish is harmful to my health and the health of others, it is of no concern to me.	13.3	83.3	3.4
5	People have no other option except to dispose of their garbage in the streets, drains, and gullies.	26.7	66.7	6.6
6	The government is failing to do enough to address the issue of waste.	93.3	6.7	0.0
7	Schools should not be the place where proper trash management is taught.	10	90	0.0
8	A waste-free neighbourhood is not as essential to me as other personal concerns (such as crime, unemployment, and the expense of living).	26.7	66.6	6.7
9	The only way to deal with the garbage problem is to have it collected regularly.	83.3	13.3	3.4
10	It's my job to pick up trash in my neighbourhood.	50	43.3	6.7
11	One solution to the garbage challenge is to educate the public about effective waste management.	90	6.7	3.3
12	Minna's government must implement comprehensive recycling policies and initiatives.	83.3	13.3	3.4

According to Table 4 of the findings, 66.7 % of respondents believed that they play a critical role in waste management, however, 93.3 % of respondents thought that the local council was not doing enough to solve the waste management problem. Accordingly, some respondents stated that recycling legislation and programs should be adopted in Minna, as well as purchase decisions should be regulated; the best approach to deal with the city's waste problem is regular waste collection. 83.3 % of those questioned agreed with this. 90 % of the residents of Nassarawa "A" Ward indicated that environmental education must be taught in schools in order to assist the city's rubbish problem to be resolved. Many respondents (66.6%) stated they didn't think having a garbage-free area was more important than other personal issues, such as their health and safety. Waste burning was opposed by an overwhelming majority of respondents (83.3 %).

**Table 5:** Environmental Health of Nassarawa 'A' Ward

1. Toilet types	Water closet connected to main sewer (%)			Water closet not connected (%)		Pit latrine (%)	None (%)
	13.3			30.0		50.0	6.7
		Yes (%)			No (%)		
2. Toilets located on-site		86.7			13.3		
		Private use (%)			Shared Use (%)		
3. Usage of toilet facilities		73.3			26.7		
4. Source of drinking water	Public supply (%)	Private tank (%)	Public stand pipe (%)	Way side tank (%)	Well (%)	Others (%)	
	13.3	26.7	6.7	10.0	23.3	20.0	
5. Presence of ailment and breeding sites	Yes (%)			No (%)			
	83.3			16.7			
6. Main building material used in the	Wood (%)	Zinc (%)	Concrete (%)	Concrete and zinc (%)	Wood and zinc (%)	Others (%)	

construction of the house	6.7	6.7	13.3	46.7	16.6	10.0
7. Category of tenancy	Owner (%)		Tenant (%)		Rent-free (%)	
	60.0		30.0		10.0	
8. Home-grown food for consumption	Vegetables (%)	Fruits (%)	Animals (%)		Others (%)	No (%)
	43.3	13.3	6.7		10.0	26.7

Table 5 shows that more than 50% of respondents indicated that they relied on pit toilet facilities. Less than one-third of the toilets in the Nassarawa "A" Ward were shared, while 73.3 % of the facilities were in private ownership. It was feasible for the households to cultivate a variety of crops and animals, including vegetables, fruits, and poultry, because most of the dwellings were owned by the family members (60 %).

**Table 6:** Demography of Respondents in Nassarawa 'A' Ward

1. Age categories (%)						2. Gender (%)		3. Level of Education (%)				
18-24	25-34	35-44	45-54	55-64	65-Above	Male	Female	Primary	Secondary	Tertiary	No school	Do not know
20.0	26.7	23.3	16.6	6.7	6.7	33.3	66.7	13.3	36.7	40.0	6.7	3.3
4. Employment (%)						5. Income range per month (%)						
Employed	Unemployed	Student	Retired	Not of working age	Do not know	No income	Less than ₦10000	₦10000-₦30000	₦30000 or more	No response		
26.7	36.7	20.0	6.7	3.2	6.7	46.7	13.3	6.7	3.3	30.0		

In these informal settlements, most people were educated, with 40 % having completed a postsecondary degree. 36% were out of work. Most respondents (46.7%) reported no source of income, and a considerable number (30%) did not want to specify their salary range.

#### 4. Conclusion

The survey was carried out in one of the most populated neighbourhoods of Minna city, Nassarawa "A" Ward where the majority of the respondents were women and between the ages of 18-44 years old. The survey results have proven that there are two major problems relating to domestic waste disposal in the area: The first one is the high usage of pit latrines resulting in sewage problems and related health risks, and the second one is the open disposal of waste, that leading to bad odour, unpleasant view and health risks due to leakage of refuse to riverbeds and causing pollution of water. The survey proved that the majority of respondents were homeowners and therefore willing to

participate in the management of waste disposal, and collection, as well as the introduction of appropriate toilet facilities and a sewage collection system. The majority of respondents stated that they believe these issues should be prioritized by the local council and in case of appropriate action they would be willing to help in the process. A high percentage of residents interviewed were educated and aware of the environmental and health outcomes of domestic waste and therefore willing to take part in recycling programs for the betterment of their environment.

Today, matters regarding the environment are prioritized by many countries of the world due to the targets set for zero carbon cities. To tackle climate change at a global level, policies relating to the environment have been structured as binding prioritizing urgent action. For example, in the European Union, environmental policies are fundamental laws, being mandatory for all the member states. In this context, the European Waste Framework Directive (2008/98/EC) needs to be applied in all member states. The directive promises a waste hierarchy system from disposal, recovery, recycling, and reuse to prevention. First and foremost, the directive highlights the significance of minimizing waste; and where it cannot be avoided, it recommends waste to be repurposed. Recycling waste that cannot be reused directly is the third step in the hierarchy system which helps reduce landfilling. In addition, the directive suggests that non-recyclable waste should be recovered in the form of energy. Finally, only waste segments for which none of the above-mentioned treatments are accessible are authorized to be disposed of in landfills under applicable regulations. Additionally, the directive obliges its application progressively and through the inclusion of all relevant stakeholders. It indicates that waste management facilities at MSW treatment plants must have the capacity to sort recyclable materials, run recycling operations, and dispose of waste through on-site composting or burning in accordance with Europe's zero-waste laws (also known as "zero waste Europe") (Directive 2008/98/EC on waste (Waste Framework Directive) - Environment - European Commission, 2022).

Within this perspective, Minna as the capital city of Niger State and a rapidly growing city should seek appropriate funding opportunities to develop such guidelines of global value and enforce their implementation. This is an issue of utmost importance, especially in informal settlements where uncontrolled and unplanned growth is inevitable. Informal settlements developing without the existence of any authoritarian codes, tend to lack the necessary legal frameworks to promote the management of domestic solid waste. However, what is usually valuable in such environments is the strong sense of belonging to the community. These cultural codes may prove beneficial in motivating stakeholders to take collective action towards the management of solid waste. To maintain and develop a healthy and sustainable environment, the community, environmental health authorities, the private sector, and the government must all work together to accomplish success.

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