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## UNLOCKING THE VALUE OF WASTE: A CASE STUDY OF MINNA METROPOLIS

By H. Ummulkhair and A.M Emigilati

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### ABSTRACT

Effective management of waste is now a national priority. Recycling of waste, encompasses a method of classification, sorting, leveling, lessening and reuse of waste products. In Minna, toxic and non-toxic wastes are not collected separately by waste management agencies, but are deposited in the same dumpsite or in sanitary landfills, usually close to communities and available to scavengers, creating challenges to human health. Recycling is still at an elementary level in Minna due to lack of requisite data on accumulated waste, unavailability of facilities to transform waste to useful products, lack of proper environmental awareness and inability of the government to promote waste recycling by drafting policies and offering support to private waste management companies. Therefore, the goal of this study is to identify various types of recyclable solid waste generated in Minna, their sources and destinations, and potentials for wealth creation and a sustainable environment. Field survey, Questionnaires administered to scavengers, and interviews with waste dealers and fabricators revealed various types, sources, destinations and potentials of recyclable solid waste. Data acquired was analysed using Descriptive statistics. Scavengers acquire various types of recyclable solid wastes from different sources. These wastes are collected and sold to waste dealers within Minna, who sell to recycling companies outside the metropolis, due to lack of government policies or interventions and necessary facilities for recycling. Solid waste recycling has the potential to provide financial stability, income and job opportunities for the residents, while still reducing the volume of waste in circulation and conserving the environment of Minna metropolis. Proper environmental awareness and Government intervention to promote waste recycling by drafting policies and offering support to private waste management companies will improve the level of recycling practices within Minna.

**KEY WORDS** Waste to wealth; management; Recycling, Reuse, Biodegradable, Non-biodegradable

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# 1. INTRODUCTION

Resourceful treatment of waste is a vital factor in any nation’s developmental evolution and its people’s wellbeing. Effective management of waste is now a national priority. Recycling of waste, encompasses a method of classification, sorting, leveling, lessening and reuse of waste products (Bonnie 2006). Recycling is an alternative way of municipal solid waste management and is more environmentally desirable because it decreases the volume of waste, that is required to be collected, transported and discarded, and also extends the lifespan of disposal facilities such as landfills and dumpsites (Ruzi, 2001). Any undesirable and unwanted waste material that is discarded by people in dry form, is solid waste. This waste could residential, (household, refuse or domestic waste) institutional, industrial, commercial, agricultural waste, or even waste generated after cleaning the streets. Industrial wastes and Municipal solid wastes (MSW), are further categorizations of solid waste (Miller and Spoolman, 2012). Municipal waste refers to solid waste that is collected by the municipality i.e., local government (EPA 2020).

Pollution of the natural environment, due to inappropriate management of solid waste, is a global cause for concern. Dumping in open spaces and open burning are the majorly used as waste treatment and final disposal options, especially in low-income countries (Ferronato and Toretta 2019). The activities of man in the environment results in the generation of solid wastes and many parts of our cities have become chaotic due to environmental degradation and pollution, caused by indiscriminate management of solid wastes. The management of solid wastes presents challenges to city authorities in Nigeria, because the volume of wastes generated in different cities has increased over the years. (Abubakar *et al.*, 2019). The public sector is mainly responsible for services of solid waste management, though a few states partner with private organisations in order to handle solid waste (Tobore 2012).

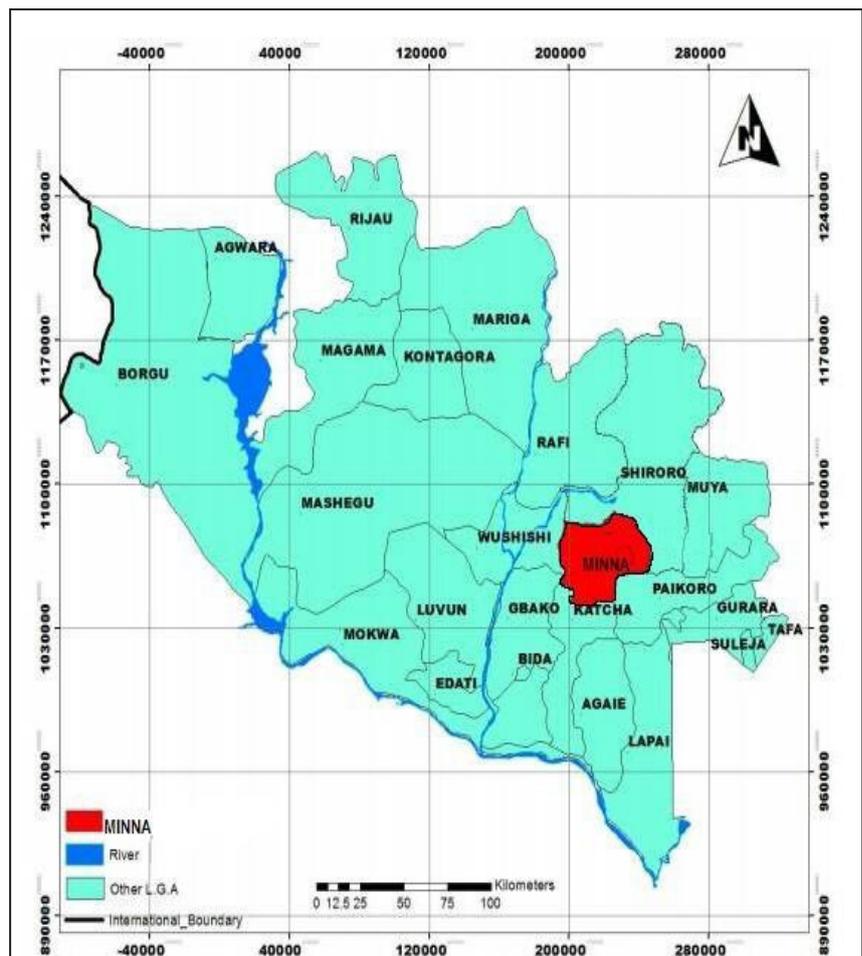
Municipal solid waste is a principal environmental problem in Minna, just like it is in many developing towns of Nigeria, such as Kano and Lagos. Improper waste disposal methods such as open dumping, open burning, discharge into drainages, water channels and roadsides are still used in various parts of Minna (Adeoye *et al.*, 2011). *There is inadequate provision of waste collection bins in many areas and no provision of segregation bins in any part of Minna.* Toxic and non-toxic wastes are not collected separately by waste management agencies, but are deposited in the same dumpsite or in sanitary landfills, usually close to communities and available to scavengers, creating challenges to human health (Abubakar *et al.*, 2019). The main factors inhibiting proper solid waste management in Minna include insufficient data on accumulated waste, low public awareness on economic value of waste and MSW management, outdated waste management policies and inadequate equipment and informed personnel (Abubakar 2016).

Therefore, the goal of this study is to identify the various types of recyclable solid wastes generated in Minna, their sources and destinations, and potentials for wealth creation and a sustainable environment.

## 1.1. Study Area

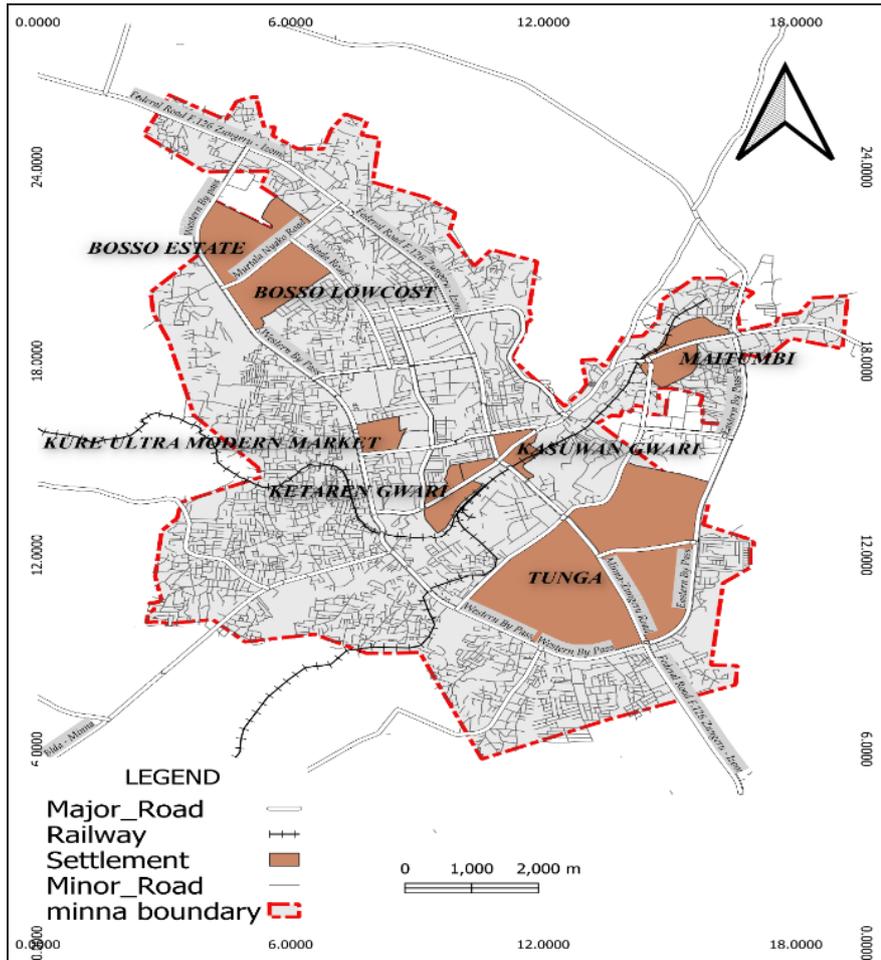
Niger State is one of the 36 states in Nigeria. Minna town is the capital of Niger State and is located between Latitudes 9°33 and 9°4N and Longitudes 6°29 and 6°35E.

Figure 1: Map of Niger State



Source: Author's, 2021

Figure 2: Map of Minna



Source: Author's, 2022

Archaeological findings show that Minna was created as a result of influx of Muslims through the ancient Saharan trade routes. Minna expanded after the Kano-Baro railway was opened in 1911, and the Lagos- Jebba line expanded in 1915. It became a primary location for accumulation of agricultural products such as Ginger, Yams, Tropical fruits, Cotton and Shea nuts and has expanded as an administrative centre. Minna metropolis has an estimated population of 463,000 people, comprising 54% males and 14% females (Niger State Planning Commission, 2011).

### 1.1.1. SCOPE OF THE STUDY

Seven areas were considered for this study and they are; Bosso Low-cost, Bosso Estate, Keteren Gwari, Kasuwan Gwari, Kure Market, Tunga, and Maitumbi. This was because they are settlements with a high mix and concentration of land uses and activities, numerous scavenging activities, and regular transportation of waste materials, suggesting a presence of small-scale recycling. Therefore, Recyclable solid waste generated in these areas can be a representation of those generated in the entire metropolis.

## 2. REVIEW OF RELATED LITERATURE

### 2.1. Conceptual Framework

#### 2.1.1. CONCEPT OF THE 'THREE RS' IN WASTE RECYCLING

- **Reduce:** The best way to manage the amount of waste in circulation is simply not to create it. Ensuring management of waste by making sure there is a reduction in the quantity of materials being bought, is the most vital option. The idea is to purchase only goods that are necessities and in the required amount (Abdul-Rahman 2014).
- **Reuse:** If goods have to be acquired, already used goods can be obtained. Reuse of materials comes from assuming that already used products can be a source of wealth or resource than refuse. Trash to one person can be seen as a treasure to another person (Abdul-Rahman 2014).
- **Recycle:** Recycling creates jobs, because of an increasing supply of generated materials that have to be refurbished. For proper utilization of recycled products, there has to be an emergence of manufactured facilities that will find uses for these products (EPA, 2020).

The 3Rs, give possible answers to the sustainable control of the wastes and meets dreams of reaching zero waste discharges at the same time (Diaz 2011). They offer ecologically approachable alternatives to deal with increasing levels of waste generation and its effects on human health, economy and natural environment (Mohanty 2011).

**2.1.2. RECYCLING PROCESSES**

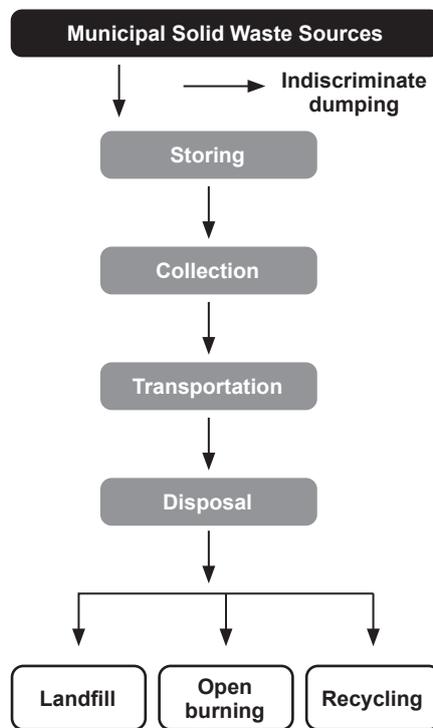
According to Rousta (2008), the processes of recycling solid waste include;

- i. Waste generation – involves all procedures that lead to production of undesirable materials throughout the procedure of manufacturing, supply and consumption (Rousta 2008).
- ii. Waste handling- entails gathering waste materials and then storing them in different vessels, on the basis of types or potential uses. Handling describes movement of loaded containers to an area of collection (Rousta 2008).
- iii. Waste collection - involves assembling and transporting of solid waste that has already been separated, to a location that containers will be emptied (Everett 2012)
- iv. Separation, processing and transformation- separation can include, could be; machinery shredding, magnetic separation, manual methods or volume reduction (compacting and combustion). Biological or chemical reduction of waste, is transformation (Rousta 2008).
- v. Transfer and transport- this is the transfer of waste from small-capacity vehicles/containers to bigger ones, and transporting them from collection stations, to processing stations or disposal sites (Rousta 2008).
- vi. Waste disposal- this usually involves disposing of waste in landfills, or disposing of ashes from waste in the landfill after burning (Everett 2012).

**2.1.2.1. EXISTING WASTE MANAGEMENT PROCESSES AND PRACTICES IN NIGERIA**

In Nigeria, wastes are usually dumped on roadsides, open pits, flowing gully water and drainage channels. The indiscriminate disposal of municipal waste is a prominent habit in most urban cities of Nigeria. The processes involved in the management of waste are; storage, collection, transportation and disposal at dumpsites. There are different techniques of MSW disposal which include landfill, incineration, composting, anaerobic digestion and recycling. The prominently practiced municipal waste management technique is open dumping, land fill, open burning and incineration. Recycling is an environmentally friendly option that is not fully adopted in Nigeria, as there are no formal recycling sectors in Nigeria. Wastes are recycled informally by scavengers who buy recyclables from people or collect from dumpsites (Abila and Kantola, 2013).

**Figure 2.1: Municipal Solid Waste Management Flowchart for Nigeria**



Source: Abila and Kantola, 2013

**2.1.3. STEPS TO RECYCLING MATERIALS**

According to EPA (2020), recycling includes 3 steps that make up a closed-up loop, and they are;

- **Collection and Processing:** This is done through collection points, such as curbside collection (where clean recyclables and garbage are put in different containers, both placed at the curb for collection), drop-off facilities (a designated recycling drop-off site, in accessible locations), and buy back centres (meant for purchase of recyclable waste materials).
- **Manufacturing:** More and more of present-day merchandise are synthesized with recycled content material. Family gadgets that incorporate recycled substances consist of Newspapers and paper towels, Aluminium, plastic, glass, soft drink containers, steel cans, laundry detergent bottles etc. (EPA 2020).
- **Purchasing New Products Made from Recycled Materials:** To close up the recycling loop, shopping for and using new merchandise crafted from recycled substances, is the final step. There are hundreds of merchandises that comprise recycled content material. When you go shopping, search for merchandise that may be recycled easily and those that incorporate recycled content (EPA 2020).

**2.2. Categorization of Solid Wastes**

In order to design waste management systems, accurate data on the composition as well as the chemical and physical properties of waste materials are required (Ferronato and Toretta 2019).

- **i. Biodegradable Waste:** These are waste that decompose into

their constituent elements by reaction of microorganisms or bacteria i.e waste that can be broken down e.g., animal wastes, human, paper, agricultural, and food wastes (Adeoye *et al.*, 2011).

- **ii. Non-biodegradable Waste:** These are wastes that cannot be broken down or decomposed into constituent elements by microorganisms and bacteria, so they remain unchanged over a long period, for instance; glass, metals, plastics, batteries and tyres (Adeoye *et al.*, 2011).

### 2.3. Challenges of Recycling in Nigeria

Factors affecting solid waste management in Nigeria include; lack of advanced technology facilities for separation at its source, enforcement procedures, environmental education and awareness (Olukanni *et al.*, 2018), lack of proper regulatory framework, inadequate infrastructures due to lack of sufficient funding, and inadequate capacity of waste managers and regulators (Bokani 2019).

### 2.4. Challenges of Recycling in Minna

Inadequacy in numbers of vehicles for collection of waste, due to insufficient funding and maintenance is a waste control problem in Minna (Adeoye *et al.*, 2011). There is dispersal of refuse from the assemblage vehicles during conveyance, as a result of unsuitable covers throughout the trip (Sarwoko, *et al.* 2007). A compost plant was built by the UNDP in 2006 in Minna and this was the only attempt at recycling in the town. Access roads, water supply and electricity were supplied by the Niger state government, to boost the process of converting waste to wealth in the town. The plant was tested, certified to be functional, and was open for tender for private individuals to use and pay, so as to generate revenue for the state. Due to negligence on the part of the government however, this plant is not operational currently (NISEPA 2021).

## 2.5. Potentials of Recyclable Solid Wastes

Recycling 10,000 tonnes of waste materials, would create 36 jobs compared to landfilling 10,000 tonnes of waste that would provide only 6 jobs (EPA 2020). Waste reduction can provide monetary and environmental benefits. It gives social advantages including contributing to an excessive pleasant life (Diaz 2011). According to Olukanni *et al* (2018), plastic recycling industries shred plastics into pellets to manufacture other plastics and allied products, waste paper and cardboard is used to make tissue paper, newsprint, and packaging materials. Waste glass is processed by glass or terrazzo companies, aluminum smelters process nonferrous metals. Agunwamba (2003) observed that recycling in Nigeria could save up to 78% in waste management costs and 79.5% in landfill avoidance costs. Recycling leads to reduction of greenhouse gas emissions, air, and water pollution, associated with production from virgin raw materials. Recycling reduces the demand for raw materials and decreases the level of damage to the habitat (Hristovski *et al.*, 2007) and provides of a cleaner environment, by improving aesthetic pleasantness that will attract tourism and foreign investments (Bokani 2019).

## 3. METHODOLOGY

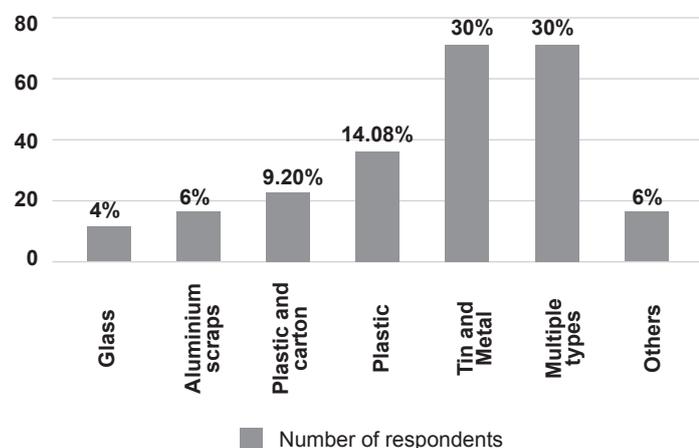
Purposive sampling technique was used to collect data through field survey, questionnaire administration to 250 scavengers, and interviews with 25 waste dealers and 25 waste fabricators. This was due to the crucial information that only they can provide, because other stakeholders in solid waste management, do not participate in any form of recycling activities. Questionnaires were administered randomly, to understand the types, sources and destinations of generated recyclable solid waste. Oral interviews were conducted, to understand potentials of recyclable solid wastes. Pictures were taken from field observation/survey to corroborate findings. Descriptive statistics was used to analyse obtained data and results were presented using tables and charts.

## 4. RESULTS AND DISCUSSIONS

### 4.1. Types of Recyclable Solid Waste Generated in Minna

The results obtained show different types of recyclable solid wastes collected by scavengers which include tin and metal scraps, plastic, bottles, paper, carton, aluminium and zinc scraps, glass bottles as well as others (tyres, tubes, batteries, charcoal, wood shavings, saw dust, leather and shoe soles).

Figure 3: Types of Recyclable Solid Waste Generated in Minna



Source: Author's Analysis, 2022

Figure 3 shows that 30% of scavengers collect Tin and metal scraps, because it generates more money at the point of sale to waste dealers. This is because recycling companies that buy waste in large volumes from Minna, desire tin and metal scraps in large quantities due to its potentials. Japan has a high metal recycling rate and even the medals for the Tokyo Olympic games are a good example of this, as they are made of recycled metals (BBVA OpenMind 2020).

Another 30% of scavengers collect multiple types of recyclable solid waste, then sell those that are still in good condition to different waste dealers. Only 6% of scavengers collect Aluminium scraps due to the difficult means of transporting them to waste dealers. Therefore, only a few scavengers have the capacity to transport Aluminium scraps using tricycles and big push carts. As explained by Everett (2012), transfer of waste from collection to processing stations, from smaller vehicles or containers to bigger ones, is an important function waste recycling. Solid waste must be collected from points of generation and transported to disposal sites, or even recycling facilities.

Using multiple sources by the scavengers, artisanal recyclers, plastic and scrap metal collectors, provide a variety and large quantity of recyclable materials which improve their income. It is important to note that, especially in institutions or households, scavengers purchase valuable waste from the owners, this is however based on weighing the recyclables to know the value and amount worthy of the waste. But in the words of some of the respondents “negotiations at times exist depending on the quantity seen with the eye and not on measurement using a weighing scale”. However, it is pertinent to have segregation bins in all areas, to enable acquisition of various recyclables in good condition and with no risk to the environment. Wittmaier *et al.* (2009) explained that recyclables in Germany, are picked up from the front of each home for a fee. In addition, there are recycling bins virtually everywhere and this enables recycling of about 57% of all generated waste.



Source: Author's Survey, 2022

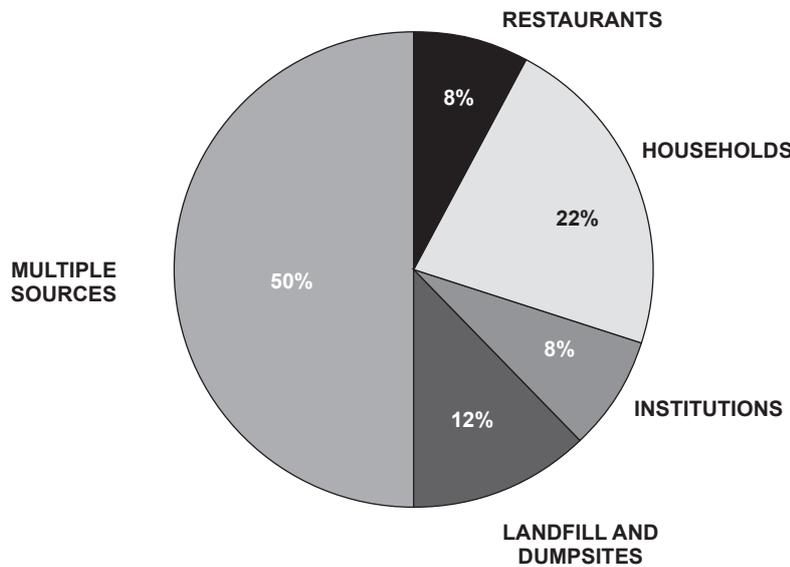


Source: Author's Survey, 2022

**4.2. Sources of Recyclable Solid Waste Generated in Minna**

The study shows that scavengers collect waste from households, institutions (schools, markets and offices), landfill/dumpsites, restaurants, and multiple sources (including factories and mechanic workshops). This collection happens either through purchase or waste picking from waste bins or the surroundings around these sources.

**Figure 4: Sources of Recyclable Solid Waste**



Source: Author's Analysis, 2022

**4.3. Destinations of Retrieved Waste Materials**

Findings reveal that all scavengers dispose of their materials at different Minna destinations, including junk shops, Scrap Dealers Association (Old Gwadabe), and others (blacksmiths/welders/artisans' shops, cobblers, bottling companies, poultry farms/owners and hotels). Middle men/Junk shop owners, sell to either waste dealers/fabricators in Minna or companies outside Niger state. All waste dealers sell recyclables to companies outside Niger state, including those in Lagos, Aba, Kano, Abuja, Nasarawa, Kaduna and Kwara states.

Niger State Environmental protection Agency, under the Ministry of Environment is solely responsible for management of solid waste in Minna. However, management of solid waste in Minna does not entail any form of recycling, due to lack of government policies or interventions and necessary facilities for recycling. They only collect solid waste and dump in landfills

and dumpsites, from which scavengers pick recyclables of interest. García-Rubio (2020) reported that various countries have succeeded to increase their levels of recycling in recent years through investment in technology, and awareness campaigns, as well as introducing policies intended to encourage citizens and businesses to recycle more and better.

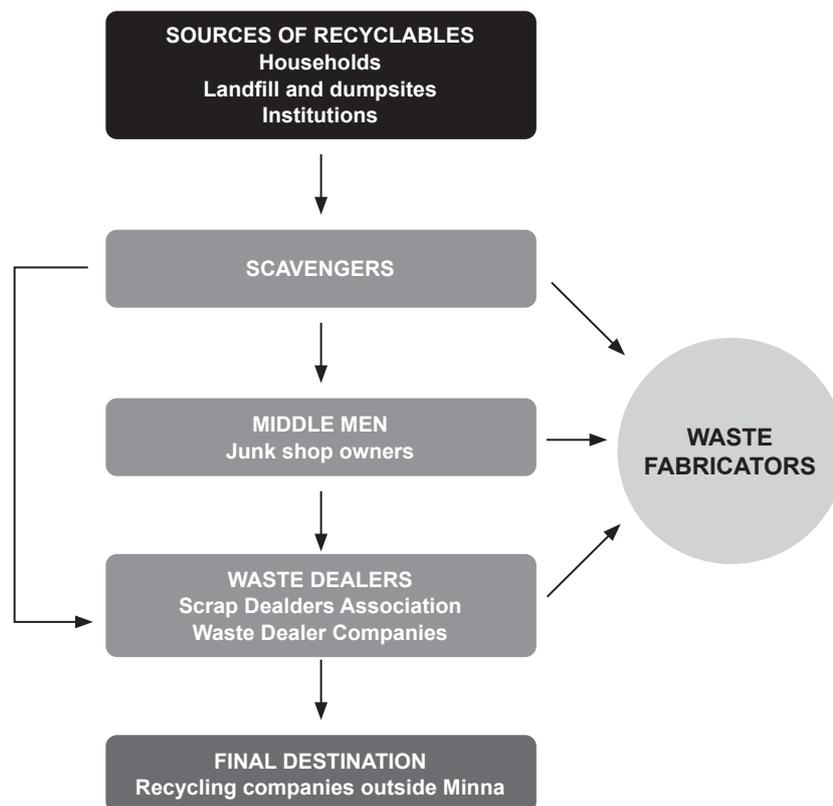
**Table 1 Destinations of Recyclable Solid Waste**

Destination of Collected Waste	Number of Respondents	Percentage
Junk Shops	93	37.2%
Scrap Dealers Association (Old Gwadabe)	144	57.6%
Others	13	5.2%
<b>Total</b>	<b>250</b>	<b>100%</b>

Source: Author's Analysis, 2022

In order to understand the level of waste recycling in Minna, an appreciation of the interconnectedness and flows within the system, is necessary. Although the quantity of materials that move from one point to the other differ based on seasonal reasons, there is an average observable pattern.

**Figure 5: Recyclable Solid Waste Management Flowchart for Minna Metropolis**



Source: Author's Analysis, 2022

Figure 5 shows that recyclables are collected from various sources within the metropolis by scavengers and sold to middle men, waste dealers or waste fabricators based on demand. Waste Fabricators also purchase from middle men or waste dealers, when they require certain recyclables in larger quantities than scavengers can provide at the point of demand. All waste dealers however sell majority of collected recyclables to recycling companies outside of Minna, due to an unavailability of recycling plants within the metropolis.

#### 4.4. Potentials of Recyclable Waste Generated

Interviews conducted with waste fabricators, reveals the potential uses of recyclables within Minna. This is as a result of their experience based on small scale recycling and fabrication that takes place within the metropolis, as well as interactions with recyclers outside the metropolis.

**Table 2 Potential Uses of Recyclables**

S/N	Recyclable Materials	Markets	Uses
1	<b>Metal Scraps</b>	Balcksmiths, Artisans, Welders	For making Cutlass, hoes
2	<b>Plastic</b>	Plastic Companies	Rubber slippers, cups, plates, chairs, buckets
3	<b>Wood Shavings and Saw Dust</b>	Hotels, Homes and Poultry farms	Cooking, heating, beddings for birds and pets
4	<b>Batteries</b>	Battery companies	Lead for Batteries
5	<b>Glass Bottles</b>	Bottling companies, cosmetic companies, Market women	For softdrink bottling, peanut bottling, mirrors
6	<b>Aluminium Scraps</b>	Artisans, craftsmen and Aluminium Companies	For making of pots, plates, cooking utensils, soldering, jewelleryes, nets
7	<b>Carton</b>	Paper mills and construction companies	Books, Wall boards, roof cover boards, floor underlays

Source: Author's Survey, 2022

**Plate III:**

**Stoves and pots made from recyclables at Kasuwan Gwari**



Source: Author's Survey, 2022

**Plate IV:**

**Stoves and pots made from recyclables at Kasuwan Gwari**



Source: Author's Survey, 2022

As seen from the plates above, recyclables in Minna are being used by waste fabricators to make various kitchen ware amongst other recycled equipment, that are usually sold to residents within the metropolis.

#### 4.4.1. JOB CREATION AND EMPLOYMENT OPPORTUNITIES

Investigation carried out shows that all parties involved in recycling processes in Minna amount to about 1810. These include 500 waste fabricators, 950 members of Scrap Dealers Association, 110 workers from the only two waste dealing companies (Gidan Bola waste dealers and Berger Junction waste Dealers) in Minna, as well as 250 scavengers that were interviewed. This therefore proves that recycling in Minna, even at an elementary level has provided at least 1810 jobs for the residents, and expansion and improvement in recycling has the potential to provide even more jobs for the residents. Recycling provides jobs and 10,000 tons of materials would create 36 jobs compared to landfilling 10,000 tons of waste that would provide only 6 jobs (EPA, 2020).

#### 4.4.2. SOURCE OF INCOME FOR ACTORS IN SOLID WASTE RECYCLING

##### Source of Income for Scavengers

From the study conducted, the scavenger makes an average of about N1050 daily. Over a 7day work week, a scavenger earns about N7350 a week, which translates to about N31,500 a month. A middle man makes an average of N2000 a daily and about N60,000 a month.

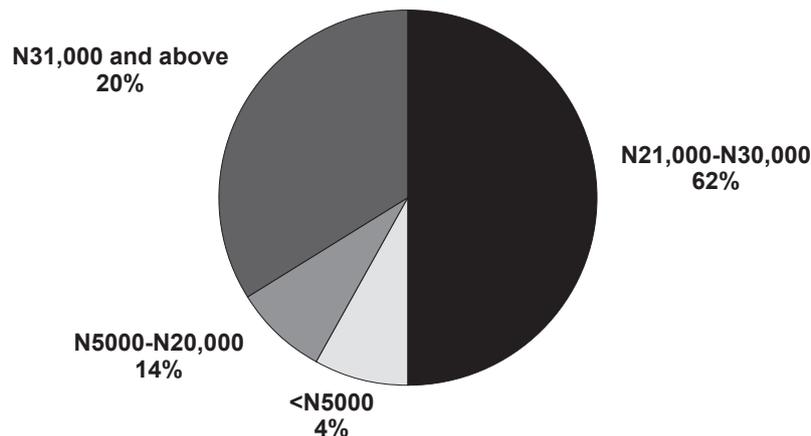
**Table 3 Average Income of Scavengers per kg/dozen of Waste Sold**

Scavengers Income	Number of Respondents	Percentage
Above N1000	205	82%
N100-N300	10	4%
N700-N1000	35	14%
<b>Total</b>	<b>250</b>	<b>100%</b>

Source: Author's Survey, 2022

As seen from the figure below, 64% of the respondents earn N21000-N30000, 12% earn between N5000-N20000, while 24% earn N31000 and above, which is above the stipulated minimum wage for the state (N30, 047). This implies that actors in solid waste recycling within Minna have a steady source of income from waste collection within the metropolis.

**Figure 6: Income Level of Scavengers on a Monthly Basis**



Source: Author's Analysis, 2022

##### Source of Income for Waste dealers

Waste dealers from scrap Dealers association earn between N15000-N65,000 as salaries, based on rank, those from Gidan Bola waste dealers earn between N40,000-N60,000 on a monthly basis, while those from Berger Junction company earn N20,000-N28,000. This translates to an average income N40,500 as shown on the table 4.

This implies that a waste dealer in Minna earns a stable income from the purchase, sorting, repackaging and transportation of solid waste recyclables from the metropolis and an improvement in recycling will translate to an increased level of income for waste dealers.

**Table 4 Average Income of Waste Dealers on a Monthly basis**

S/N	Waste Dealers	Income of Waste Dealers	Average Income
1	Scrap Dealers Association	N15,000-N65,000	N47,500
2	Gidan Bola Waste Dealers	N40,000-N60,000	N50,000
3	Berger Junction Dealers	N20,000-N28,000	N24,000
	<b>Total</b>		<b>N121,500</b>
	Average		N40,500

Source: Author's Analysis

▪ **Source of Income for Waste Fabricators**

Results from the investigation show that there is a waste fabricators association located in kasuwan Gwari with about 500 workers that earn a monthly income of 50, 000- N60,000, which translates to an average of N55, 000 a month. This implies that fabrication of recyclable solid waste provides a source of financial stability and income for waste fabricators through sale of various equipment and products, recycled from solid waste generated within the metropolis.

From the discussions above, this study may serve as a guide and framework for the State government, stakeholders, individuals, and developers, in an effort to device and drive government strategies on sustainable waste handling. Information on the characteristics of solid waste will aid in evaluating systems, management programs, and planning for reuse, reduction, recycling, and final disposal activities for solid waste management.

## **5. CONCLUSION AND RECOMMENDATIONS**

### **5.1. Conclusion**

Recyclable solid wastes are managed solely by informal recycling companies and individuals without the involvement of Government agencies such as NISEPA and Ministry of Environment. The types of recyclable solid wastes that are desirable to recyclers are, tin and metal scraps, plastic containers, plastic bottles, paper, carton, aluminium scraps, zinc scraps, glass bottles, glass jars, tyres, tubes, batteries, charcoal, wood shavings, saw dust, leather and shoe soles.

Scavengers acquire recyclable solid wastes from various households, schools, markets, offices, restaurants and landfills/dumpsites. After collection, recyclables are sold to middle men and fabricators within Minna. Middle men sell a small quantity to fabricators and larger volumes to major waste dealers

within the town, who sell large volumes to recycling companies outside the metropolis. These include companies in Lagos, Aba, Kano, Abuja, Nasarawa, Kaduna and Kwara states. However, recycling has the potential to reduce the volume of waste in circulation and curb the depletion of the environment and natural resources in Minna, through solid waste reuse and fabrication. Solid waste also has the potential to provide financial stability, income and employment for the populace.

### **5.2. Recommendations**

Therefore, the study recommends that enlightenment and public awareness on good recycling practices should be incorporated in the Solid Waste Management Program of Minna. An inclusive Municipal Solid Waste Management Policy, in which the scavengers are recognised as stakeholders and included in the expansion of recycling industries and activities in Minna, should be formed.

Government participation and Intervention should be done through; drafting policies, public private partnership, provision of separation bins for segregation of waste, introduction of curb side collection, drop-off centers, and buy-back centers, provision of loans and support for informal recyclers, and organized workshops and training for stakeholders on current trends, with regards to best practices for recycling activities. Effective implementation and provision of these, will promote growth and expansion of recycling within Minna. Taxation on purchase of new products and imposition of fines and penalties on defaulters dumping waste indiscriminately, will discourage generation of waste, thereby encouraging recycling through re-use of waste materials.

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