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Recovery and Recycling of Municipal Solid Waste in Kaduna Metropolis: Realities and Challenges

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Abstract: This study examined challenges faced during resource recovery and recycling; and highlights factors promoting the usage of recycled products in Kaduna State, Nigeria. Questionnaires were administered to 131 respondents made up of waste pickers, retailers of recyclables and recyclers. Of the three groups involved in the study, waste pickers were the most likely to seek change in livelihood while retailers of recyclables and recyclers largely wanted to continue in their work. The challenges in resource recovery for waste pickers were numerous but the greatest was social stigma. The major challenges for recyclers were the lack of capital and the high cost of acquiring tools and equipment. Positive attitudes to products made from recyclables, the durability of the products, and their cheap prices are factors that promote increased usage of products made from recyclables. To tackle some of the challenges experienced by waste pickers, inhabitants should separate their waste appropriately before disposal. Subsidized means of transportation, increased access to capital and acquisition of modern tools and equipment would further increase resource recovery and recycling.

Keywords: Resource Recovery, Recycling, Waste Pickers, Recyclers, Retailers of Recyclables

Récupération et Recyclage des déchets solides municipaux dans la métropole de Kaduna : Réalités et défis

Sommaire : Cette étude a examiné les défis liés à la récupération et au recyclage de matières, et a souligné les facteurs promouvant l'usage des produits recyclés dans l'État de Kaduna au Nigéria. Les questionnaires furent administrés à 131 enquêtés qui comprenaient les ramasseurs de déchets, les recycleurs, et détaillants de produits recyclables. De ces trois catégories d'enquêtés consultés pour cette étude, les ramasseurs de déchets furent les plus inclinés à la quête du changement de moyens de subsistance, pendant que les détaillants de produits recyclables et les recycleurs furent disposés de continuer avec leurs moyens de subsistance. Les défis concernant la recouverte de produits pour les collecteurs de déchets étaient multiples, mais le plus énorme de tous était la stigmatisation sociale. Les

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défis majeurs pour les recycleurs de déchets comprenaient le manque du capital ainsi que le coût élevé pour acquérir les outils et l'équipement. Les facteurs qui favorisent l'utilisation accrue de produits fabriqués à partir de matières recyclables comprennent les attitudes positives à l'égard des produits fabriqués à partir de matières recyclables, la durabilité des produits recyclés ainsi que et leur prix avantageux. Pour résoudre certains des défis rencontrés par les ramasseurs de déchets, les habitants devraient trier leurs déchets de manière appropriée avant de les jeter. Des moyens de transport subventionnés, un accès accru au capital et l'acquisition d'outils et d'équipements modernes permettraient d'accroître encore la récupération et le recyclage des matières.
Mots clé : Récupération des matières, recyclage, ramasseurs de déchets, recycleurs, détaillants de produits recyclables

Introduction

Globally, solid waste generation is on the increase. Cities around the world in the year 2012 generated 1.3 billion tons of solid waste, amounting to 1.2 kg/capita/day of solid waste (Hoornweg & Bhada-Tata 2012). With the rapid increase in population and urbanization, and other factors such as improved standard of living with its attendant effects on consumption patterns, municipal waste generation is expected to increase by about seventy percent to 2.2 billion tons by 2025 (Da costa 2011; Hoornweg & Bhada-Tata 2012; World Bank 2018).

Management of municipal solid waste in developing countries has come under much criticism, as most cities and municipalities cannot cope with the accelerated level of waste generated (Ezeah 2010; Yakubu 2017). According to United Nations (2011), the rate of waste collection is not matching the generation, as more often than not, less than 70 percent of the waste generated is collected in most low-income countries; and more than 50 percent of the collected waste is usually disposed of through uncontrolled landfilling.

According to Abila & Kantola (2013), about 25 million tons of municipal solid waste is generated annually in Nigeria and the waste generation rates range from 0.66 kg/capita/day in urban areas to 0.44 kg/capita/day in rural areas. While states in Nigeria have state-owned environmental protection agencies, with one of its primary tasks being the management of municipal waste; various studies (see Bako 2008; Ezeah 2010) have shown that they largely collect and transport waste from dumpsites and street sides to landfills. And as is prevalent in most low-income countries, Bakare (2016) and Kofoworola (2007) observed that in Nigeria less than half of the solid waste generated is collected, because of the inefficient waste management system. The increase in urban waste generation, coupled with the decrease in available landfill space, necessitates the implementation of comprehensive and cost-effective waste diversion programs like reducing, reusing, and recycling (Robinson & Read 2005; Lakhan 2015).

Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products. According to the United States Environmental Protection Agency (2016, p. 3), recycling could be defined as

> the recovery of useful materials (such as paper, glass, plastic, metals, construction and demolition material) and organics from the waste stream (e.g. municipal solid waste), along with the transformation of the materials to make new products to reduce the amount of virgin raw materials needed to meet consumer demands.

Recycling, in addition to being one of the strategies for managing solid waste, has other benefits. It promotes the conservation of natural resources such as timber, water, and mineral resources; and saves energy, which would otherwise have been used in the production of new goods from scratch. It creates jobs and also reduces greenhouse gas emissions, which harms the climate (Kofoworola 2007; Beazley 2009). While there is growing global awareness of recycling practices (Anyasia & Atagana 2017; Igoli 2018), comparatively, recycling activities are higher in developed nations than in developing nations. For instance, in the United States, over 30% of the solid waste generated is recycled while very low rates have been reported for developing nations, as only 15 percent of solid waste generated is recycled (Botkin & Keller 2011; Wright & Boorse 2017; United Nations 2011).

The common solid waste management strategy used by the various state environmental agencies in Nigeria, which is waste collection, transportation and disposal, pay little or no attention to resource recovery. And reports in most studies show that the waste management system being practised in the country is inefficient (see Asibor & Edjere 2017; Alade 2018; Igwe et al. 2018). Studies have shown that resource recovery and recycling in Nigeria is largely dominated by the informal sector; with government's involvement at best, imperceptible (Kofoworola 2007; Ezeah 2010; Agbesola 2013; Ndubuisi-Okolo et al. 2016; Emelumadu et al. 2016). Kofoworola (2007) for instance opines that recycling in Lagos, as in other urban areas of Nigeria, is in its infancy.

While it is apparent from studies conducted in Nigeria, that resource recovery and recycling have many economic and environmental benefits, it is on record that advancement in the sector is hampered by the inattention to recycling by the three tiers of government – federal, state and local levels (Kofoworola 2007; Ezeah 2010). Also, weak and unsustainable waste management legislative instruments have perpetuated resource recovery and recycling to the infancy stage in the country. While it is not in doubt that these factors militate against meaningful advancement, some other factors also contribute to the slow pace made in resource recovery and recycling. One of such are the challenges faced by important persons involved in resource recovery and recycling. Challenges faced by people who work in resource recovery and recycling, particularly in the northern region of Nigeria, have not been given much attention in existing literature. To obtain maximum benefits, derivable from resource recovery and recycling in Nigeria, the challenges that hamper it need to be examined and tackled effectively. Therefore, this study focuses on the challenges faced by waste pickers, retailers of recyclables and recyclers in resource recovery and recycling in Kaduna State, a northern region in Nigeria. The objectives of the study are one, to examine the years persons involved in recycling and resource recovery engage in that activity; two, to examine the challenges of resource recovery and recycling; and three, to identify factors that promote the usage of products made from recyclables.

Methodology

Kaduna State is situated in the North-Western region of Nigeria. It is a fast-growing state, with a population of over 6 million as at the last census in 2006, and its population was the third-largest in the nation. Only surpassed by Kano and Lagos States (National Population Commission 2008). It is subdivided into twenty-three local government areas. The two Local Government Areas purposively selected for the study are Kaduna South and Kaduna North, the third and fifth largest local government areas in the state, with a population of 402, 731 and 364,575 respectively (National Population Commission 2008).

A descriptive research design was adopted in this study. To gather the primary data from waste pickers and retailers of recyclables, multi-stage sampling technique was used. The selection of two local government areas (which are sub-states in Nigeria) from the existing twenty-three local government areas within Kaduna State, at the first stage of the multi-stage sampling technique, was conducted using purposive sampling. The two selected local government areas form Kaduna Metropolis, which serves as the commercial and administrative hub of Kaduna State, hence they were selected for the study. The second stage of the sampling process was the selection of wards from the existing 27 wards in the study area. Kaduna North has 14 wards while Kaduna South has 13 wards. Six wards were randomly selected, three each from the selected local government areas (Kaduna North – Kawo, Hanyi Banki and Ungwan Dosa; Kaduna South – Barnawa, Kakuri and Tundun Wada).

The third and final stage of the sampling was the selection of waste pickers and retailers of the recyclables. Waste pickers and retailers of recyclables work in the informal private sector, and there are no official records of the number of persons who make their livelihoods from this enterprise, hence, the actual population of waste pickers and retailers of recyclables is unknown. Some studies on waste picking practices in other regions of Nigeria (see Bako 2008; Agbesola 2013; Asibor & Edjere 2017), with similar characteristics where the target population size is unknown and scattered population, largely used two sampling techniques, namely, snowball sampling technique and cluster sampling technique. Cluster

sampling was adopted in this study, because it is the most adaptive probability sampling technique in a target population that is scattered. The third group of respondents in this study are the recyclers. Unlike the other groups of respondents (waste pickers and retailers of recyclables), recycling activities in the study area are mainly concentrated in Panteka, a neighbourhood situated in Tudun Wada, a ward in Kaduna South. The administration of questionnaire to this group of respondents was carried out using convenience sampling method.

Three separate questionnaire surveys were used in the study (for waste pickers, retailers of recyclables and recyclers). These were administered from October to November 2021. The questionnaire was administered to 102 waste pickers, 23 retailers of recyclables and 6 recyclers (Table 1). The questionnaires were semi-structured. A direct one-to-one stepping questionnaire administration method advocated by Read (1999) was adopted in the administration of the questionnaire. This ensured a high rate of return since the questionnaires were hand delivered to the respondents and taken back immediately on completion. A retrieval rate of 100% was obtained in this study, as incentives (in form of detergents and recyclables) were also provided for the pickers who showed some reluctance in answering the questionnaire.

The data collected was analyzed using Statistical Package for Social Scientists (SPSS). While responses to the closed-ended questions were computed directly, the open-ended were first coded into categories after careful examination of the responses before entry. The descriptive analysis used in this study summarized and simplified the data collected. Frequencies, totals, range, and percentages were the measures of descriptive analysis used in the discussion of the results and interpretations.

Table 1: Distribution of Respondents in the Study Area

Local Government Area	Group	Frequency	Percentage (%)
Kaduna North	Waste Pickers	49	48.0
Kaduna South	Waste Pickers	53	52.0
	Total	102	100.0
Kaduna North	Retailers of Recyclables	10	43.5
Kaduna South	Retailers of Recyclables	13	56.5
	Total	23	100.0
Kaduna South	Recyclers	6	100
	Total	6	100

Source: Fieldwork, 2021

Results and Discussion

Years in Recovery, Retailing, and Recycling

Table 2: Years in Recovery, Retailing and Recycling

Group	Years Engaged	Frequency	Percent
Waste Pickers	Less than 1 year	31	30.4
	1 - 5 years	49	48.0
	6-10 years	13	12.7
	over 10 years	9	8.8
	Total	**102**	**100.0**

Retailers of Recyclables	Less than 1 year	3	13.0
	1-5 years	3	13.0
	6-10 years	4	17.4
	more than 10 years	13	56.5
	Total	**23**	**100.0**
Recyclers	6-10 years	1	16.7
	More than 10 years	5	83.3
	Total	**6**	**100.0**

Source: Field work, 2021

Table 3: Respondents' Willingness to Continue in their Jobs

Group	Responses	Frequency	Percentage (%)
Waste Pickers	No	39	38.2
	Yes	63	61.8
	Total	102	100.0
Retailers of Recyclables	No	1	4.3
	Yes	22	95.7
	Total	23	100.0
Recyclers	No	0	0
	Yes	6	100.0
	Total	**6**	**100.0**

Source: Field work, 2021

Table 2 shows that persons who are engaged in the recovery of recyclables for more than 10 years form a relatively small proportion (8.8%) of the respondents. Close to half of the respondents (48%) have engaged in waste picking activity for 1-5 years, and closely following in proportion (30.4%) is the group that has been at the activity for less than a year. The percentage of waste pickers rose from 30.4%, for those who have been in the work less than a year, to 48% for those who have been in the work for 1-5years. However, the increase, 17.6%, was not sustained as the working years increased further. A decline of 39.2% was observed as the working years increased to more than 10 years from the percentage of those who have been in the work for 1-5years (48%). The huge decline in figures implies that waste picking as a life-long job is not being considered as a good option, and the number of people in waste picking may not increase significantly. The results also indicate that while it is easy and non-restrictive to take up the activity, people turn to other forms of livelihoods and do not prolong their years of work in this activity. The results in Table 2 corroborate this inference, as about 38.8% (more than one-third) of the waste pickers desire changes from this form of livelihood.

The observation among the retailers and recyclers in terms of years engaged in the activity is dissimilar to what was obtained among the waste pickers, as more of them stay with this activity and a large percentage has continued in retailing (56.6%) and recycling (83.3%) (see Table 1). The recyclers and retailers of recyclables also form the groups where almost all the respondents' desire to continue in their occupation as 95.7% of retailers of recyclables and 100% of recyclers want to continue in their jobs (see Table 3).

Challenges of Resource Recovery and Recycling

Table 4: Challenges Associated with Waste Picking

Type of Challenge	Responses	Frequency	Percent
Problem of transportation	No	67	65.7
	Yes	35	34.3
	Total	102	100.0

Problem sorting waste	No	78	76.5
	Yes	24	23.5
	Total	102	100.0
Social stigma	No	61	59.8
	Yes	41	40.2
	Total	102	100.0
Lack of money to use as incentives	No	88	86.3
	Yes	14	13.7
	Total	102	100.0
Non Cooperation of households	No	89	87.3
	Yes	13	12.7
	Total	102	100.0
Health problems	No	75	73.5
	Yes	27	26.5
	Total	**102**	**100.0**

Source: Field work, 2021

Table 5: Retailers of Recyclables and Recyclers' Challenges

Group	Type of Challenge	Responses	Frequency	Percent
Retailers of Recyclables	Capital	No	0	0
		Yes	23	100
		Total	23	100
	Trade-Based Association	No	2	8.7
		Yes	21	91.3
		Total	23	100
Recyclers	Tools and equipment	No	2	33.3
		Yes	4	66.7
		Total	6	100.0
	Capital	No	1	16.7
		Yes	5	83.3
		Total	6	100.0
	Electricity	No	5	83.3
		Yes	1	16.7
		Total	**6**	**100.0**

Source: Field work, 2021

There are diverse kinds of challenges as shown in the responses in Table 4. These range from challenges of transportation, the problem of sorting mixed waste, the social stigma attached to the activity, lack of money to use as incentives, non-cooperation of households, and health problems. Social stigma is a major challenge for those who pick waste in the study area and 40.2% of the respondents considered it a huge challenge. Among all the challenges identified as impediments to the work of waste pickers, social stigma ranks highest. This is not surprising, as the work is looked down upon in society and many people do not regard waste pickers favourably. There is very little difference (1.4%) in the figures of those who identified social stigma (40.2%) as a challenge and those (38.8%) who are not willing to continue in the work of waste picking (see Table 3). This result could imply that there is a close association between the social stigma that waste pickers feel and their unwillingness to continue in the job.

Transportation, health, and other problems associated with sorting waste are also big challenges in the study area. For instance, more than a fifth of the respondents considered them as factors that were militating against resource recovery. Transportation is an essential part of the resource recovery process. It is needed by waste pickers to move recyclables for example, from dumpsites, households, and streets-

sides to points of sale. Thus, to get the recyclables from these sources to the retailers involves transportation which could be the direct usage of public transport or the use of hand carts or wheelbarrows. The inability of the pickers to afford hand carts or wheelbarrows results in many of them physically carrying the recovered recyclables on their backs. This is not only burdensome but affects the quantity they could carry at a single time. The use of public transport is not cheap in the study area, as the sector frequently experiences price hikes. More than a third of the respondents (34.3%) indicated that transportation was a challenge in their work (see Table 4). The 65.7% of waste pickers who did not see transportation as a challenge in their work could be among those whose point out that resource recovery is very close to the point where they sell recyclables to retailers of recyclables; or they are the ones who already have their means of transportation, such as hand carts or wheelbarrows.

More than a quarter (26.5%) of the respondents revealed that they had work-related health problems. It is a common occurrence to see waste pickers scavenging for recyclables without any form of personal protective dressing or equipment. Thus, they are exposed to things like sharp objects, obnoxious smells, hazardous materials, mosquito bites, bites from venomous reptiles, inhalation and ingestion of harmful chemicals; and many other health hazards. Their work also requires that they are on their feet for a large part of the day, lifting and inspecting recyclables from waste streams. All these are known to affect the normal healthy functioning of their bodies. The number of those with health problems could be higher, as many poor persons in developing countries do not have access to health facilities for regular check-ups and therefore may not know their actual health status. Furthermore, there is no regulation requiring people to separate their waste before disposal in the study area. It is therefore a common thing to see biodegradable and non-biodegradable waste being put together. Close to a fourth (23.5%) of the waste pickers in this survey considered the mixing up of all types of waste together as a challenge in their daily work.

Inadequate funds for incentives and non-cooperation of households did not rank as highly as the other challenges identified in the area. These two had less than 15% of the respondents identifying them as factors that impeded their work of waste picking. The use of incentives has been known to increase the willingness of households to engage in barter, where they exchange their recyclables for gift items like plastic products, and matches. At other times, they may buy the recyclables at what they considered to be a reasonable price for some profit when they finally sell them to recyclable retailers. However, some households do not like to interact with waste pickers and hence, any solicitation for recyclables by waste pickers is not encouraged. The result therefore, indicates that more than 85% of the waste pickers do not consider inadequate funds and non-cooperation of households as an challenge in resource recovery, probably because their sources are dumpsites and street-sides, where such are not needed.

Table 5 shows that capital is a huge challenge to retailers of recyclables with 100% of the respondents considering it as such. In their work, they require money to purchase recyclables from waste pickers. Insufficient capital sometimes led to deferment of payment for purchases and demotivated waste pickers. In some cases, it resulted in conflicts between the retailers and waste pickers as the recyclables were priced downward and the continuous fluctuation of market values for recyclables is a disincentive for the waste pickers. In addition, their desire to expand their business to take in more recyclables have been hampered because of insufficient capital. Mobilization of retailers of recyclables to form formal trade-based association that would promote their activities and help them lobby government for loans and welfare benefits was also considered as a challenge. For example, 91.3% of the respondents felt that although the existing associations had promoted some form of network where crucial information was passed among members, they had not sufficiently and collectively been able to get the needed assistance from government that would further promote their economic activities and lobby for other welfare benefits.

Most of the recyclers (66.7%) considered inadequate tools and equipment as a huge challenge in recycling (see Table 5). This could hamper the expansion of recycling activities, and lower the demand for recyclables that are recovered from waste streams. Erratic and unreliable electricity supply in the study is typical of what occurs in many other parts of Nigeria, and this hampers aspects of the recycling activity dependent on electricity supply. However, because the recyclers in the study area were majorly

artisanal recyclers, who had devised ways to do some processes of recycling without using much electricity, less than a fifth (16.7%) of the respondents considered electricity as a challenge (see Table 4). The 83.3% of the respondents that did not consider electricity as a challenge in their work could be recyclers whose businesses have a very minimal requirement for electricity or have become dependent on alternative energy sources (e.g diesel and petrol). Recycling requires capital, and 83.3% of the respondents considered capital as a challenge.The start-up capital in small recycling businesses is provided by personal savings and family support; as the informal sector have limited access to loans from financial institutions. The two major challenges, inadequate tools and equipment and lack of capital, are intertwined as access to capital could increase the recyclers' ability to acquire tools and equipment for recycling.

Factors Promoting the Usage of Recycled Products

Table 6: Factors promoting the usage of recycled products

Factors	Responses	Frequency	Percent
Durability of products	No	0	0.0
	Yes	6	100.0
	Total	6	100.0
Cheap	Not Indicated	2	33.3
	Yes	4	66.7
	Total	6	100.0
Positive Attitudes to products made from recyclables	No	0	0.0
	Yes	6	100.0
	Total	**6**	**100.0**

Source: Field work, 2021

Many products are made from recyclables, such as pans, pots, trays, local ovens, local ice block makers, and shopping bags. Since some of the products are essential household goods and are used for everyday purposes, the demand for the products has resulted in increased patronage of products made from recyclables. In addition, all the respondents (recyclers) opined that the increased patronage of products made from recyclables could be connected to the high quality of their products and their durability. The price of products was also seen as an important factor that influenced the purchase of goods. Some recyclers (66.7%) claimed that their goods were cheap, hence attractive to buyers. This result shows that the market for the products was very encouraging and increased production would get the needed patronage, thus making the businesses viable. Attitude is a major factor that affects whether a particular product would be well-received by buyers or not. In the case of products made from recyclables, 100% of the recyclers attest to the buyers having positive attitudes to the products made from recyclables.

Conclusion and Recommendations

Waste pickers' desire to seek other job opportunities would lead to many recyclables being left unrecovered from waste streams. This would increase the waste that gets disposed at landfills, thus, leading to more land being converted to landfills in the area. It also implies that the production of new products would increasingly depend on the extraction of raw materials, which would invariably increase energy consumption. The resultant effects of unrecovered resource from waste streams brought on by waste pickers seeking other jobs - more lanfills, greater raw material extraction and upsurge in energy consumption – would impoverish the environment and reduce its resilience. Furthermore, Social stigma, which is the biggest challenge faced by waste pickers could deter many people from taking up the activity as a livelihood, leading to high levels of unemployment and an increase in social vices such as robbery and prostitution.

Challenges faced by retailers of recyclables, insufficient capital for business expansion and the inability of trade-based association to get assistance from the government, means the number of recyclables bought from waste pickers may not increase. This has a direct negative impact on recyclers' production, as they would be unable to increase their scale of production to meet increased demand for products made from recyclables. Among recyclers, poor electricity supply, lack of capital and high cost of acquiring tools and equipment were identified as their challenges. These challenges would continue to confine recycling activities to only a rudimentary level, as advancement in the sector is dependent on regular electricity supply, access to capital and adequacy of tools and equipment. If the challenges associated with resource recovery and recycling are effectively tackled, greater recycling production could be expected. Improvement in electricity supply could help recyclers increase their production. The creation of industrial zones with a favourable supply of electricity and fewer rationing of power supply, where recycling activities are situated, could attract people into starting large scale recycling businesses and promote increased production of products from recyclables. The provision of low-interest loans for owners of recycling businesses from financial institutions could promote greater production of products from recyclables. To encourage waste pickers to continue in their jobs, better prices for the recyclables could be placed using favourable price control mechanisms put in place by the government.

Some of the challenges faced by waste pickers could be addressed with legislation, for instance, households should be made to separate their waste before disposal. While waste picking does not offer the same attraction as white and blue-collar jobs, public enlightenment on their roles in promoting a healthier environment could help to reduce the social stigma associated with their job. The provision of special health schemes for waste pickers, which would promote a healthy workforce, could act as a factor that could increase their working hours and general productivity. The subsidized price of hand carts and wheelbarrows would help to ease transportation of recyclables and increase the number of recyclables recovered from waste streams.

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