

Original Article

Awareness and Recycling Potential of Municipal Solid Waste in Bonny Island, Nigeria

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Received Date: 13 August 2025

Revised Date: 30 August 2025

Accepted Date: 10 September 2025

Published Date: 16 September 2025

Abstract: Municipal Solid Waste (MSW) generation in riverine communities in Rivers State, Nigeria, has attained alarming levels in recent years. This is easily attributable to the seeming geometric increase in the population of the communities. Bonny Island is one such community; it is surrounded by water and distant from the state capital, Port Harcourt, where waste management activities take place. So, despite the huge waste load generated, the bulk of the waste is largely unattended to, making some locations in the community untidy. The research, based on primary data, uncovered that the present residents (both permanent and temporary) on the Island have knowledge of recycling, which was also verified through statistical analysis. The educational centers, particularly schools, were the major source of information on recycling. There is no presence of billboards with any inscription on waste segregation; consequently, TikTok is the only social media platform not yet used for the dissemination of recycling information. Plastic is the most valuable source of income for the few recyclers. At the same time, a minimum of one hundred naira (\$0.109 at #920) to a maximum of half a million naira (\$543.48) has been earned engaging in the recycling business. 91.7% of respondents they will prefer a maximum of ten minutes' walk from their home to the nearest recycling centre, while 54% prefer the use of both door-to-door and recycling center for trading their recyclables. For the Kingdom to cope sufficiently with solid waste in the future, an aggressive campaign on recycling, especially through the use of the educational institutions, a legislative framework that will attract investors, and give support to the informal sector, is needed.

Keywords: Recycling Distance, Recycling Centre, Municipal Solid Waste Management, Recycling Awareness, Bonny LGA.

I. INTRODUCTION

According to Cristia, Leonel, Elvi, & Jermaine (2022), Municipal Solid Waste (MSW) is often burnt or buried in most of the world, with repercussions detrimental to neither humans nor the environment. The consequences of incinerating garbage contribute to global warming, the destruction of lakes, forests, and towns away from the source of pollution through the emission of harmful gases and dust (particulate matter). Contrarily, in most industrialized countries, these incinerating activities remove huge amounts of particulates and contaminants, leading to the release of cleaner air to the environment. Nonetheless, in Nigeria, the use of incinerators will be inefficient for municipal waste management because the waste generated has a lower calorific value, which is also the case in most low-income countries. However, it is much higher in high-income countries (UNEP, 2015). Consequently, most of the MSW collected is used for the reclamation of land or ends up in a pit. This process of burying garbage pollutes the underground water and air, while the transportation of the collected MSW results in greater pollution. Waste management should be concentrated at the local government level, wherein low technological methods can be adopted (e.g., anaerobic digesters); coordination can be easier, as well as supervision and data generation (Ajangaboka & Grace, 2021). By increasing the waste disposal charging fee, recycling behavior can be promoted, provided that the economic factor incentivizing strong positive relationships between disposal costs, collection, and sorting costs is identified (Mak et al., 2019). These constraints include costs associated with environmental impacts, such as those that disadvantage habitats, animals, and biodiversity. Hence, open trash disposal is an unsustainable waste management practice with the possibility of a long-term impact.

Trash management encompasses every aspect of the waste management process; however, it is primarily restricted to solid waste. There are various phases associated with an effective waste management process, from generation to final disposal. The practice includes collection, transportation, sorting, treatment, and disposal, including the monitoring and regulation, of both commercial and home waste (UN-HABITAT, 2010). Trash management includes MSW, industrial waste, including raw materials, and final goods. Whereas refuse containment involves restricting hazardous substances from entering the environment through the application of the "3 Rs" – Reduce, Reuse, and Recycle - which aims to sustainably mitigate waste generation at the source. There are several benefits in the adoption of the 3 Rs in the waste hierarchy when well communicated and enforced. Considering that items regarded as waste have multiple uses, wherein they utilize resources and will be discarded as single-use



waste, reduced packaging especially influences environmental destruction. Thus, rather than dumping waste indiscriminately, applying alternative means of exploring them through the 3Rs can help to conserve resources and money. Otherwise, simply passing them on to others is a more preferable sustainable option. Similarly, it can serve as a means for revenue generation as well as reducing budgetary expenses. Furthermore, source management strategy contributes to the conservation of the value of materials, components, and products within an ecosystem, thereby decelerating their degradation process through maintenance, repair, refurbishment, reduce, reuse, recycle, and remanufacturing (Pires & Martinho, 2019) as well as the individual (singular and corporate) ecological footprint of the generators.

To attain the Sustainable Development Goals SDGs, source waste management (SWM) strategies are encouraged to reduce greenhouse gases (GHGs). These measures are referred to as the model of circular economy (EMF, 2014). According to Obiora & Tochukwu (2019), the model proffers better alternatives in SWM with a track record of successful implementation in its full theoretical, practical, and policy forms in some developed countries globally. Odunze & Nwiko (2019) stated that recycling is a function of the waste materials generated, especially those that are unable to be reused directly through a transformative process that creates a new product or raw material.

The benefits of recycling are not exhaustive, particularly in terms of the reuse of materials and the generation of energy through combustion processes and from landfills (Wilson, Velis, & Rodic, 2013). Some examples of recycling processes include converting used paper into files, envelopes, art, craft, and cards, as well as energy recovery through pyrolysis, incineration, gasification, composting, and pelletization.

In Rivers State, recycling activities are spearheaded by resource harvesters (scavengers) from the northern part of Nigeria. They determine the value of the recycling items, some examples are - plastic (high and low density), paper (note/textbooks and magazines), cartons, metal (alloy and non-alloy), textiles (clothing, shoes, bags), electronics (watches, TVs, radios, phones, laptops), bottles, construction materials, etc. Although organizations with grant funding are creating the needed awareness, thereby reducing the quantity of resources harvested, including purchasing power. Through the use of geospatial technologies, the various recycling centers can be identified, thereby creating citizen participation in the waste management process (Robinson & Ian, 2022). The waste hierarchy framework has been adopted globally as a means for mitigating GHG emissions through the conservation of raw materials and fossil fuels (ISWA, 2009). Therefore, for the residents of Bonny Island to consciously and painstakingly implement recycling, there is a need for an investigation into the level of knowledge of the meaning and processes of waste recycling amongst the people, including any factor that will enhance it. This is most significant, particularly with the possible connection of the island to the other parts of the State by a tarred road. The major impact of this linkage is the migration of persons, destruction of pristine ecosystems, and pressure on existing resources, if a holistic environmental plan for waste management is not in place. Recyclables, for this study, are items that their primary user no longer needs and, hence, can be exchanged for money rather than being sent to the dumpsite. The research aims to advance knowledge in solid waste management, using the Bonny Kingdom as a reference, with a focus on waste recycling.

II. MATERIALS AND METHODS

A) Description of Study Area

Bonny Kingdom in Bonny Local Government Area of Rivers State, Nigeria, is the study area for this research. It is positioned on the shores of the Southern Atlantic Ocean, where its main river, the Bonny River, flows into. It is forty kilometers south of Port Harcourt, the capital city of Rivers State, Nigeria, located at latitude $4^{\circ} 28' 0''$ and longitude $7^{\circ} 10' 0''$ (Edward, 2020). The Bonny River is actually a major sea along the Atlantic coast of the Bonny area (fig. 1). In consideration of other neighboring communities, it is located in the southernmost portion of the eastern delta on the Atlantic coast, known as the Bight of Bonny. Its eastern boundaries are the Andoni (Obolo) Communities to the east, the Kalabari Kingdom (New Calabar) to the northwest, and the Okrika Kingdom to the northeast.



Fig. 1: Base map of Bonny Island, south-western corner. Source: (NLNG, 2019)

Bonny Kingdom is situated in a rainforest vegetative area, in terms of its natural geographic environmental feature, comprising brackish mangrove forest vegetation at the banks of the Bonny River and its tributaries. Bonny Island is the Kingdom's capital city as well as the headquarters of OLGA and lies slightly above sea level. Additionally, it serves as the seat of power, housing the King's palace and the LGA council headquarters, with a population of approximately 170,000 people (Rogers & Elenwa, 2021). Furthermore, the report stated that the Bonny community is subdivided into two main segments – the mainland and the hinterland. The mainland comprises Bonny Island and its segments, namely the Main Island (Township), Sandfield, Iwoama, Orosikiri, Aganya, Ayambo, Akima, Workers Camp, and some outlying fishing settlements lying along the Bonny River coastline. At the same time, the hinterland includes the village communities such as Kuruma, Ayama, Kalaibama, Oloma, Finima, Abalamabie, Oginiede, and many others.

Accordingly, Bonny Island can be found in the Beach ridges onshore geomorphic sub-environment of the Niger Delta region based on the Federal Ministry of Environment 2020 report. Comprising Pleistocene sediments deposited by fluvial and shelf hydrodynamic processes from waves, tides, and longshore currents, as the geologic materials are located. The quality of Air in Bonny Island is within an acceptable limit despite the massive industrialization activities, significantly, the Nigerian Natural Gas Liquefying plants, train seven project ongoing, alongside the bridging construction linking the island to the city capital, road and river traffic increasing in recent years (Lekwot, Balasom, Dyaji, & Yakubu, 2014). Conversely, Ede, Edokpa, & Ayodeji (2011) identified carbon monoxide, nitrogen oxide, sulphur oxide, hydrogen sulphide, methane, and non-methane volatile hydrocarbons due to the presence of the LNG plant to be above the limit. High humidity throughout the year, heavy annual rainfall of over 4000 mm, a mean annual maximum and minimum temperature of roughly 31.3 °C and 22.5 °C, respectively, are all connected with the seasonal climatic condition (dry and wet season). Additionally, Bonny Island has a flat topography with a series of shallow sand ridges due to previous seaward accretion. According to the hydrogeological research of Bonny, precipitation percolating through the sand profile formed a freshwater resource bulb that supplies residents with fresh water from their boreholes. Despite having the least amount of fresh water flow, the Bonny Island river system has the largest volume of any river system in the Niger Delta (Lekwot, Balasom, Dyaji, & Yakubu, 2014). Hence, tidal water frequently flows in a net fashion up the river and then splits off into different creeks and channels.

B) Sampling Technique

The data was gathered using a basic random sampling technique. The gathered data was collected at random using a standardized questionnaire. The population of the respondents is from temporary and permanent residents of the Bonny Kingdom. Statistical analyses will be administered to verify the level of awareness of recycling.

There is a need to verify statistically the level of awareness with the responses from the questionnaire. Hence, a confidence interval for the level of recycling awareness in Bonny for any population parameter, which is the sampling distribution of its point estimate, was determined. The point estimate of the population mean μ is the sample mean, $\bar{X}$, so to obtain a confidence interval for μ , the sampling distribution of the sample mean will be investigated.

The following conditions were made about the sampling distribution of sample means:

- If the parent population from which we select our samples of size 'n' is normal, then the sampling distribution of the waste recycling is exactly normal.
- When the distribution of the parent population is not normal, then by the central limit theorem, the distribution of sample means will be approximately normal if the sample size is large ($n \geq 30$).
- The mean of the sampling distribution of $\bar{X}$ is equal to the population mean that is

$$\mu_{\bar{x}} = \mu$$

Using the standard deviation of the sampling distribution of $\delta_{\bar{x}} = \frac{\delta}{\sqrt{n}}$ And a 95% confidence interval of the population distribution. The aim of the research will be determined using the data from the questionnaire.

To ascertain the standard deviation, the mean $\bar{x}$

$$\bar{x} = \frac{\sum fx}{n} = \frac{1255.5}{37} = 33.93$$

$$\delta = \sqrt{\frac{\sum (x-\bar{x})^2}{n}} = \sqrt{\frac{1197.33}{37}} = 5.69$$

The 95% confidence interval for μ becomes

$$\bar{x} - 1.96 \frac{\delta}{\sqrt{n}} < \mu < \bar{x} + 1.96 \frac{\delta}{\sqrt{n}}$$

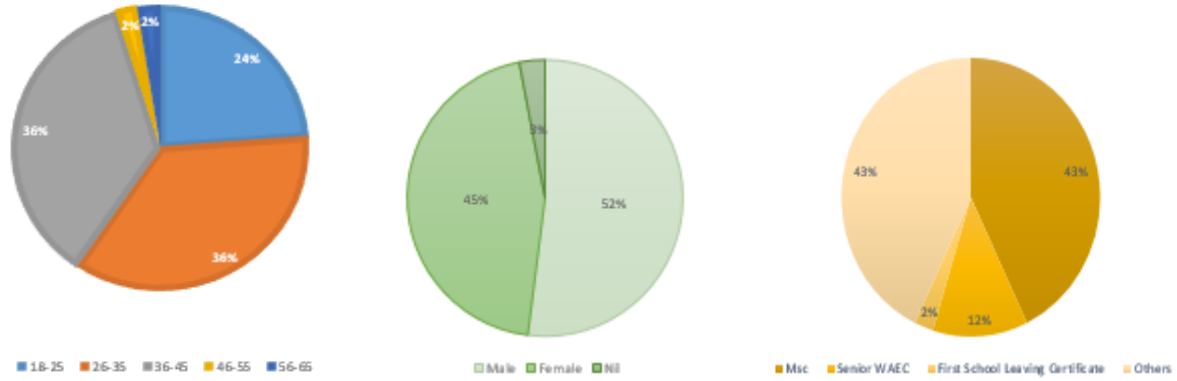
$$33.93 - 1.83 < \mu < 33.93 + 1.83$$

$$32.1 < \mu < 35.76 \dots\dots\dots (1)$$

N/B: x is for item in the same space of population distribution, f represents the number of occurrences, i.e., frequency of occurrence of the sample space, while $\bar{x}$ is the sample mean of the population distribution

III. RESULTS AND DISCUSSION

A) Demographics



The figures above denote the age range, gender, and highest educational qualifications, respectively. The male gender was the most willing to respond to the questionnaire (52%), and the 26-45 years age range was the highest age range (72%). In comparison, master's degree and other certificate holders are the highest (43%) of the respondents.

Table 1: Location of respondents

Abalamabie	Federal polytechnic of oil and gas, Bonny
Nil	Akiama before the naval base
Finima	Bonny
Sandfield	Bonny
Macualey Street	Nil
Bonny	King Williams dappa people
Water well 4	Bonny
Wilbros pipeline	FINIMA
Macaulay street	Ezekiel Hart compound
Bonny main town	Macaulay
Finima	Court Road
Abalamabie	Iwoama
Akiama Road	Orosikiri, Mile 2.
I stay in Port Harcourt	Finima
Hospital road	Bonny Town
Port Harcourt	Wilbros pipeline
Damascus road bonny	.BOGT
Perekule Iwoama community	Behind F.S.P
Orsikiri bonny round about	Maculey
Oguede Road Bonny	Oguede community
Eagle Forest off Wilbros pipeline	Sandfield Bonny Island

The research was strictly confined to Bonny indigenes and or residents. Table 1 shows the location of most of the respondents.

B) Recycling Awareness

Table 2: Statistical analyses to ascertain the recycling awareness

Class interval	x	f	fx	$x - \bar{x}$	$(x - \bar{x})^2$
18 – 25	21.50	7	150.50	-12.43	154.50
26 – 35	30.50	14	427.00	-3.43	11.76
36 – 45	40.50	14	567.00	7.11	50.55

46 – 55	50.50	1	50.50	16.57	274.56
56 – 65	60.50	1	60.50	56.57	705.96
>65	-	-	-	-	-
		n = 37	$\sum fx = 1255.50$		1197.33

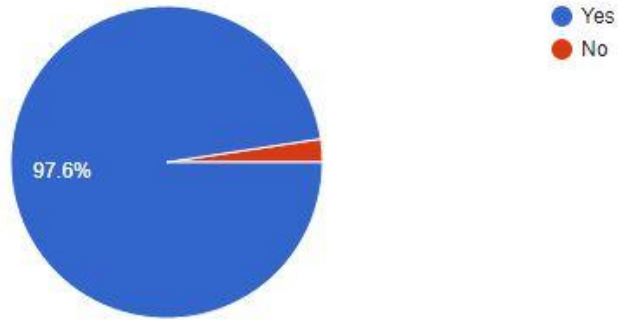


Fig. 2: The level of awareness of respondents on recycling

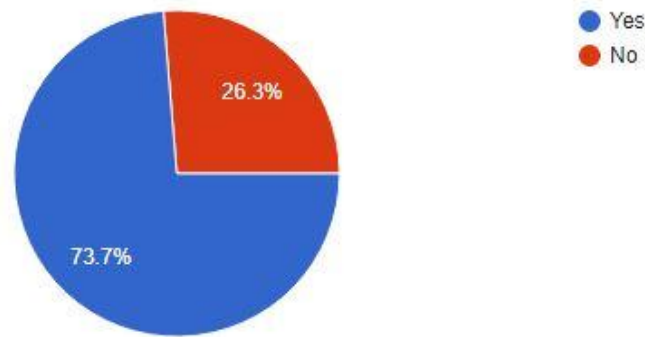


Fig. 3: Respondents' engagement in any form of recycling

The information obtained regarding the recycling awareness is presented in Table 2. The level of awareness from the statistical analyses shows the sample size is large ($n > 30$) with a 95% confidence interval of population distribution, as in (1) above. Thus, there is a wide acknowledgment of the benefits of Bonny residence to waste recycling statistically. This is also further substantiated by the data from the questionnaire, wherein the respondents' knowledge of what recycling means is 97.6%, with 73.7% having engaged in some form of recycling. In contrast, only 26.3% have taken part in it (fig. 2 and fig. 3). This corroborates the plastic value-chain report of Nigeria 2021 that Nigerians are aware of the benefits of recycling (UNIDO, 2021).

Table 3: Respondents' Feedback on Measures to Enhance Recycling by Individuals, Schools, and Communities.

What factors hamper individuals from segregating and recycling?	What means of communication will you suggest to enhance segregation of waste in religious centers?	How can individuals enhance segregation and recycling activities in schools?	How can individuals remind themselves to recycle every day?	What are the communication means to enhance segregation and recycling activities in communities or places of residence?
Laziness	Graphics/signage	Use of an automatically open Waste Bucket	Alarms	By the local town crier and periodic sensitization using dialect.

Lack of knowledge on recycling	Social Media	Drop more waste bins (both for combustible and non-combustible)	To make it a family habit. Everyone responsibility	Advertising and enlightenment programmes
No Dump site, and inefficient Government regulation/participation	Announcement through the media unit and the head, or whoever is in charge of the worship center	Regular teachings provide materials for both segregation and recycling, and allow pupils to participate in them	By keeping different kinds of recycling buckets.	Door-to-door verbal communication
Inadequate provisions of Trash Cans within their environments.	Both written and verbal means of communication	By telling them the effects on our environment	By keeping the recycling bins closer	Talks by community leaders, particularly during environmental sanitation exercises each month
Hazards associated with recycling	Placement of different bins with an inscription indicating the type of waste to go into them at strategic places	By keeping a labelled waste bin close to each class	Setting a reminder on the phone	Moving around with a vehicle, announcing it
Busy work schedule	A drama play that highlights the benefits and negative effects of recycling and not recycling.	Regular waste management education	By the bills posted around the house.	Town hall meetings inform people about the importance and rewards of doing so.
Low funds accrued from sales of recyclables	Employment of individuals to direct and manage waste disposal within the worship center	Through proper enlightenment. Then, occasionally, carry out a waste demonstration exercise	Use of Roaster.	Through billboards
Distance to recycling center.	Adequate disciplinary measures for defaulters, to serve as a deterrent to others	Training and retraining of students & teachers on waste management	Set a timed reminder on intervals with locations.	Seminars
A proper regulatory system to encourage segregation	Adequate education of members on environmental hygiene.	Announcement during devotion and corrective measures.	By having more than one waste bin in my house, and ensuring they are properly labelled.	Radio and television advert
Poor environmental sanitation exercises awareness by various relevant government and non-governmental agencies	Use of animated stickers and notices at strategic points	Provide a recycling point	Asking someone to do a reminder.	Advocacy and Social Media
Distance of Waste Collection Point	Regular announcements by the leadership	Talk to the students about recycling and its benefits and importance, then provide three big bags labeled bottles, plastic, and metal.	Use of a timetable	Hand flier
No designated bin for the segregation of different materials segregation	Sub-unit leaders emphasizing	Should be part of a topic in one of the subjects in schools, like PHE, Home Economics	Social media	Sensitization/ interactions

Unavailability of people who can offer money for recycled items.	Live chats after every worship service	Videos were played about the importance of recycling and what it is.	By creating a storage place for recyclable items in a garage or kitchen	Through a forum where the benefits and advantages will be shared
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Subsequently, acknowledging the knowledge level of the respondents. Table 3 further describes the various ways in which individuals, religious centers, schools, and the community can contribute to the harvesting of municipal solid waste resources for the benefit of themselves and society. Additionally, to determine the level of information available to the respondents regarding recycling.

C) Distance From Receptacle/The Burden of Distance/The Convenience Factor

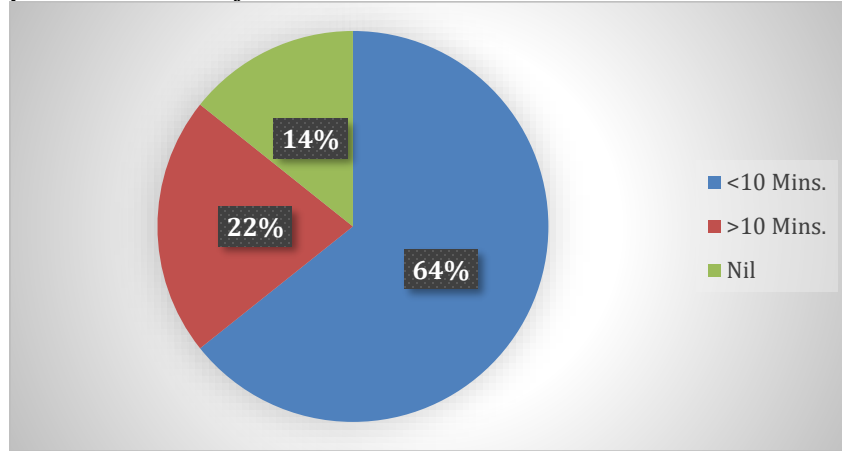


Fig. 4: Walk to the nearest Recycling center

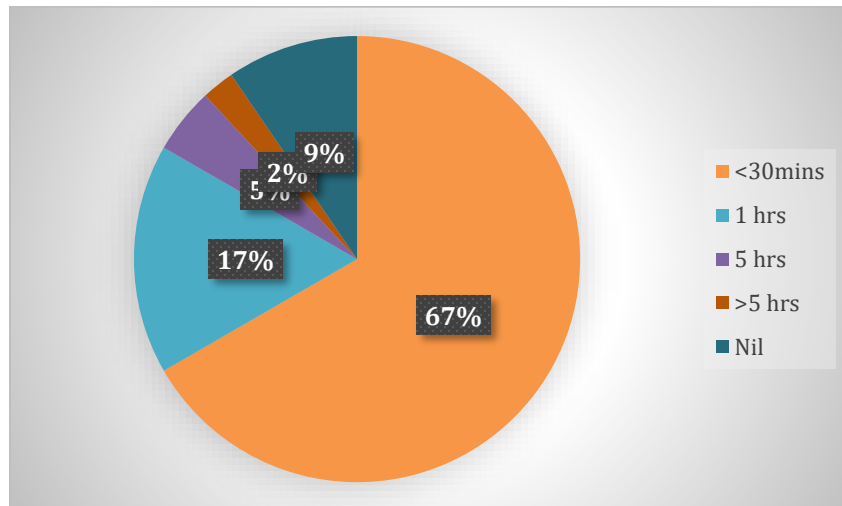


Fig. 5: What is the farthest time you can sacrifice to a recycling center?

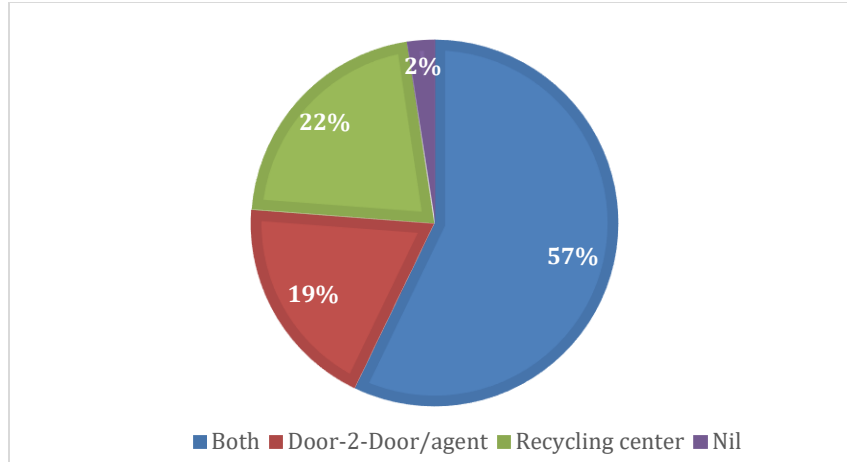


Fig. 6: Preferred means of trading recyclables by respondents

A significant factor that inhibits recycling is the reluctance of residents to use the nearest recycling centers. The research uncovered three major points within the Island where recycling activities take place: they are the NLNG roundabout, Amawusa junction, and Agaja market. They are being operated by informal sector players (resource harvesters), and they were also noticed going door-to-door to buy recyclables and waste. Yet, 64% of the respondents preferred a recycling center that is less than 10 minutes' walk from their residence (fig. 4) and with a maximum time of 30 minutes (fig.5) as the farthest distance. While 57% of the respondents preferred the use of both the recycling center and the door-to-door/agent system over either system (fig.6). L.González-Torre & B.Adenso-Díaz (2005) stated that most of the time, the number of fractions that residents separate and collect at home grows as the distance to the recycling bins reduces. This means that people who regularly use the bins to dispose of general garbage are more likely to recycle some items at home. Hence, distance only influences those who do not segregate waste from source and are not used to dumping waste at the receptacle. Reiterating the findings, Changjun et al. (2020) reported that the frequency of recycling is not influenced by variation in distance. Their research recommended that "recyclers acknowledge and do not overvalue the tiny contribution of distance to their recycling performance".

Furthermore, people who are really motivated to recycle need to find themselves in situations where they can act on their objective without any form of prejudice (Klöckner & Oppedal, 2011). Thus, it is demonstrated that the perceived capacity to act is a critical factor that is strongly associated with the features of the system. Therefore, as long as the willingness to recycle is there, distance will not be a barrier.

D) Recycling Enterprise

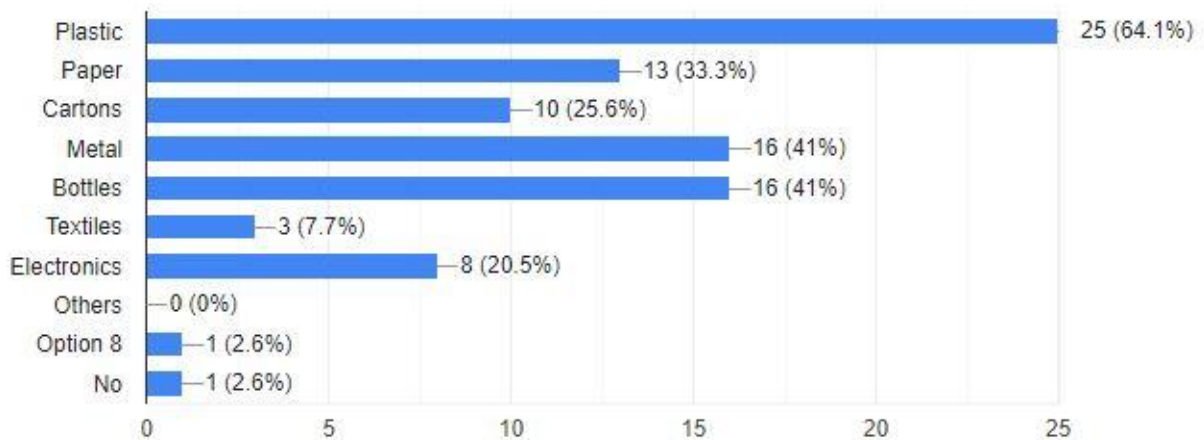


Fig. 7: Recyclables traded in Bonny Island

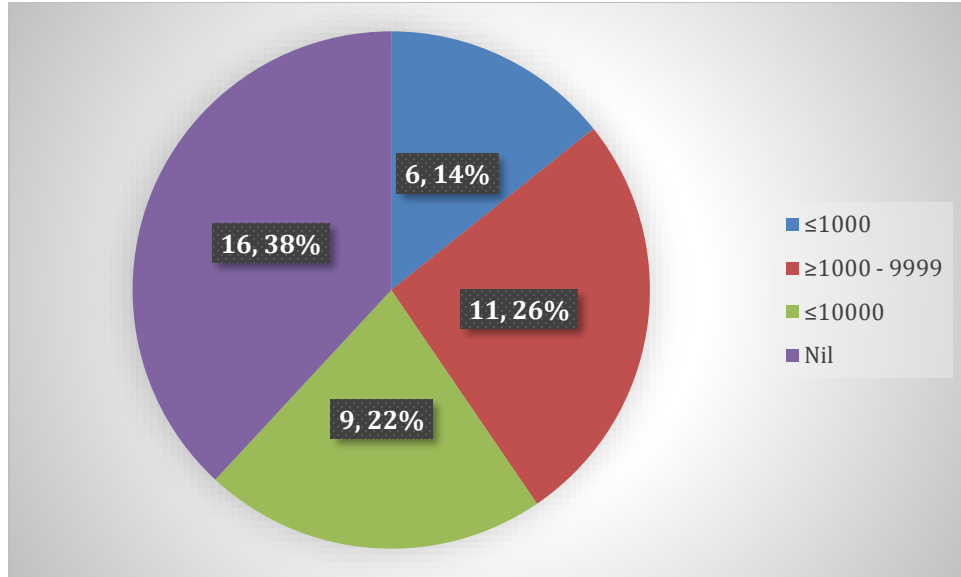


Fig. 8: Amount of money made from recycling

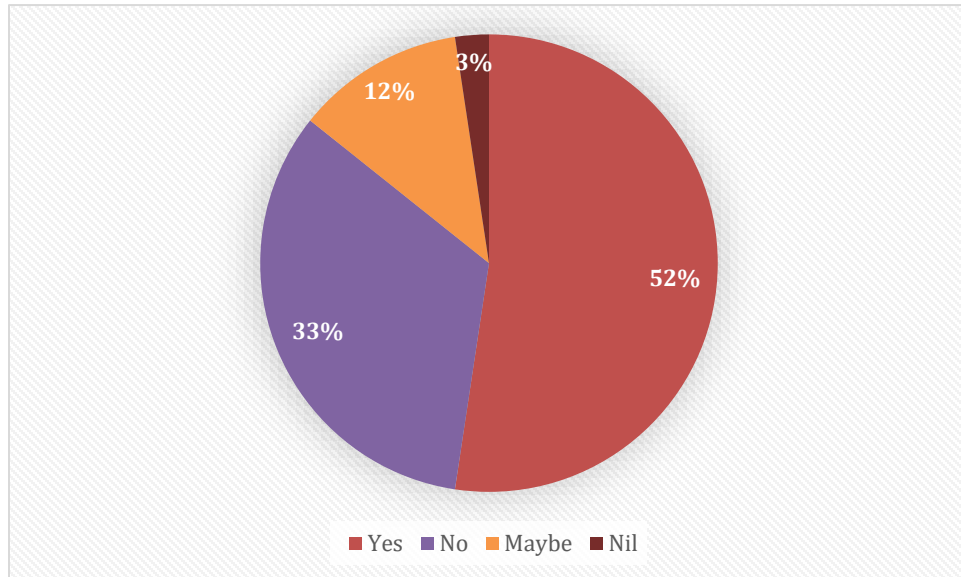


Fig. 9: Willingness to recycle for the minimum amount

Waste plastics are a major material that is readily available for recycling. It is the most valuable item to be traded in the recycling sector according to the findings in Fig 7, with 64.1%. This outcome is most significant because 2.5 million tonnes of plastic are generated in a year in Nigeria, which is estimated to be more than 200,000 metric tonnes of plastic trash released into the Atlantic Ocean each year from land-based sources (UNIDO, 2021). This is significant because it will increase the likelihood of a future in which plastic waste no longer hampers the flow of transportation into the island. Considering that wastes are only segregated at work sites, while waste collection trucks mix all the various categories of waste (Mba & Evelyn, 2022).

Furthermore, the report stated that an estimated 13% of plastic is a component of total solid waste, including an estimated 50-60 million plastic bags used for water sachets, which are regularly dumped in Nigeria's streets. Despite the volume of plastics traded, a significant amount of sachet plastics was discovered during the physical assessment of the study area. According to another estimate, more than one million square kilometers of plastic wrappers are wasted every day in Nigeria, exceeding the total area of the country. Hence, there is a need for more residents of Bonny to engage in plastic waste recycling, which promotes circular economy practices and provides sustainable alternatives. There are various types of plastics, including Polyethylene Terephthalate (PET), High-Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low-Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), and bioplastics. They are used in the following industries: Packaging (55%), Construction

(16%), Automotive (6%), Electrical/Electronics/Telecommunications (3%), and others (20%). Therefore, there are viable commercial opportunities for individuals or groups to engage in plastic waste recycling in Bonny Kingdom. In addition, the local government can attract investment into the sector by using the multinationals in the Kingdom. Ajoku & Okoro's (2020) studies on plastic waste indicated that homes, commercial establishments (markets and businesses), and institutional sources (religious, social, health, and educational institutions) are the main producers of plastic garbage.

According to the UNEP's 2015 report, there are two major problems associated with plastic recycling: the presence of numerous foreign items and contaminants, such as organic waste, and the mixing of different plastic types. However, with massive awareness, these problems can be resolved, considering that the level of cleanliness and separation of high and low densities determine the value of the recycling item. The respondents stated that, they have made a minimum of one hundred naira (\$0.109 at #920) to a maximum of half a million naira (\$543.48) engaging in the recycling business (fig. 8). Although, 33% of the respondents will prefer not to recycle than accept the minimum recycling amount of one hundred naira ((\$0.109), yet, 52% reported that it is worth the effort (fig. 9). Nevertheless, when the appropriate knowledge is applied in sorting waste into the various valuable items as in fig. 7, it will generate wealth for the citizens, the Kingdom as well as enhance hygiene and the transformation of the recycling industry.

E) Mode Of Awareness Creation

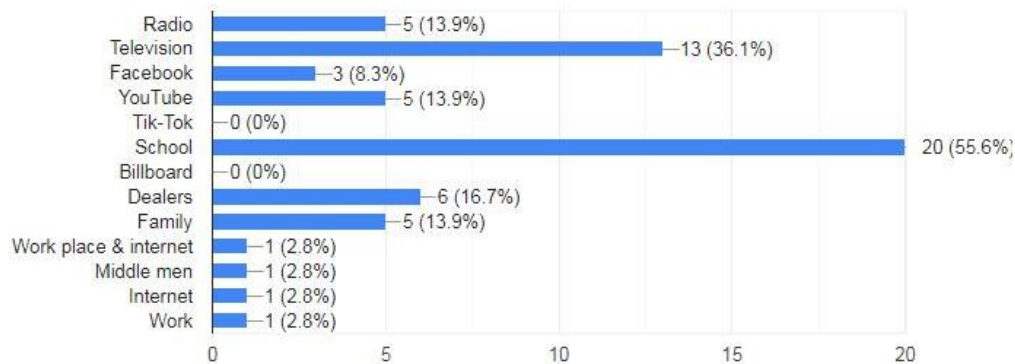


Fig. 10: Mode of obtaining information on recycling.

The effects of the mode of creating awareness about waste recycling in the residents of Bonny Kingdom are presented in fig. 10. For recycling to be an effective means for waste management, there ought to be regular communication. It should not be a one-off activity, but an all-encompassing media advocacy, adopting various broadcasting spaces available to sensitize, conscientise, and illuminate Bonny residents. The figure showed that billboards and TikToks are the communication media yet to be used in disseminating information about waste recycling in Bonny Kingdom. The fact that schools were chosen as the most common means of communication emphasizes the need for teachers and proprietors in the educational sector to be part of any stakeholder engagement to enhance recycling. This arrangement should include incentives and encourage homegrown strategies that promote recycling. The entire educational sector – crèche, nursery, primary, secondary, and tertiary institutions within the territory should be part of such a programme. Evidently, the schooling system remains the best means for sustainable enlightenment and the only guarantee of a clean, healthy, and hygienic Bonny Kingdom for generations to come.

Notwithstanding the various approaches identified in Fig. 10, every medium has its target audience or subscribers, which should be explored, as no one should be left behind in the drive to advance recycling as an effective waste management system for the Kingdom. Although currently, there seems to be no mass communication channel dedicated to information only from the Bonny Kingdom yet, there are paid advertisements for such purposes (E.g., Wazobia PH FM 94.1, Wednesday 5-6 pm Ibani hour). The Ibani hour could be used as a forum for disseminating such information, with specific sections reserved for recycling purposes. The programme will also be impactful with the participation of other radio and television stations in the awareness creation. The role of intermediaries or resource harvesters in the informal sector in creating awareness about recycling is also important. They should be granted legal protection to function as recycling practitioners since they are essential, especially with regard to the right to recycle materials and the assurance of access to solid waste disposal sites. They can be grouped into cooperatives or business enterprises to streamline their activities, empower them, and encourage more residents and investments in the sector. It will also enhance the communication of members of the Association on regulatory policies, including tax collection and other statutory levies. UN-HABITAT (2010) reported that in Pune, India, specifically, data revealed that when the unorganized sector converted to a cooperative, the amount of waste reaching the landfill decreased by more than 55%, or 320 tons every day. Regardless of their position in the chain - waste pickers, scrap buyers, retailers, stockists, and wholesalers, etc.,

these informal sector players ensure they harvest resources, generate income for themselves, and reduce waste in or heading to the dumpsite.

IV. CONCLUSION

The responsibility of enhancing our environmental quality ought to be strengthened with every means available. This enormous task is a legacy every stakeholder should appreciate as their contribution to a healthy and wealthier Earth. Recycling alongside other means of waste minimization in the hierarchy is a veritable means for such accomplishment, if it is well communicated and implemented by a wider range of residents in such a secluded place as Bonny Kingdom. The challenges of waste management in Island communities, towns, and villages will be significantly addressed when the majority of the populace can segregate waste at the source and subsequently engage in recycling activities. The burden attached to the government in all spheres will be channeled into infrastructural facilities needed for sustainability in the sector, rather than being collected and dumped at a site. The research has shown that Bonny LGA will be pristinely cleaned (now and in the future) if the council designs policies and programmes that will take advantage of the citizens' awareness of recycling, especially as they prepare to be integrated into the state capital through the road.

RECOMMENDATIONS

1. There should be billboards with inscriptions on waste segregation/recycling placed at strategic positions all over the Kingdom, say at the jetty, LGA secretariat, polytechnic, NLNG roundabout, Amanyanabo Palace, etc., in both the mainland and hinterland.
2. The existing waste management system, which has ensured the cleanliness of the Kingdom, should be enhanced through the involvement of the Bonny Kingdom Development Committee (BKDC), women leaders, youth leaders, and Chiefs of each compound/war canoe House, using the template in Ajangaboka & Grace (2021).
3. Dumpsites should be upgraded to engineered landfills. A properly designed landfill will be suitable for the Kingdom's growing population without issues of skyrocketing land prices, industrialization, or population explosion disrupting the process in the future.
4. Deliberate propagation of waste management education in schools, churches, communities, and other settings, utilizing the Ibani language, Igbo, English, Pidgin English, and cultural artifacts.
5. Enactment of appropriate legislation to encourage private participation in municipal waste management and enforcement of necessary discipline.
6. There should be a concerted effort to build the capacity of personnel involved in waste management, and to ensure that only professionals are at the helm of the regulatory arm/unit.
7. Consequently, the research recommended that LGAs designate collection points for plastic waste collection to enhance recycling activities within the LGA.

V. REFERENCES

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