# EVALUATION OF PLASTIC WASTE MANAGEMENT PRACTICES IN HIGHER INSTITUTIONS: A CASE OF UNIVERSITY OF CALABAR, NIGERIA

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## ABSTRACT
Plastic waste management has become a critical environmental concern globally, with universities contributing significantly to plastic waste generation due to high student populations and diverse campus activities. This study examined plastic waste management practices within the University of Calabar, Cross River State, Nigeria, with a focus on the types and sources of plastic waste, disposal practices, and institutional efforts towards its management. The study employed a survey research design, utilizing structured questionnaires administered to a sample of 400 respondents comprising students, staff, and vendors within the university. Data were analyzed using descriptive statistics, including frequencies and percentages. Findings revealed that the most commonly generated plastic wastes were water sachets, PET bottles, nylon bags, and disposable food packs, with hostels and cafeterias identified as primary sources. It was observed that while there is a high level of awareness of the environmental hazards of plastic waste, disposal practices remain poor, characterized by littering, burning, and minimal recycling, with institutional waste management efforts considered inadequate by the majority of respondents. The study concludes that effective plastic waste management within the University of Calabar requires a combination of policy enforcement, infrastructure development, and behavioural change among the university community. Based on these findings, the study recommends the following: the establishment of a structured recycling program within the university to reduce plastic waste load; the provision of adequately labeled waste bins across campus to encourage segregation at source; the implementation of sensitization campaigns to improve behavioral change towards proper waste disposal; and the development and enforcement of clear university policies on plastic use reduction and waste management to promote environmental sustainability on campus.

**KEY WORDS:** Plastic waste, Waste management, Higher institutions, Pollution, Calabar

## 1. INTRODUCTION

Plastic pollution has emerged as a critical global environmental issue, with approximately 430 million tons of plastic produced annually, much of which is used in single-use items and packaging. Despite efforts to manage this waste, only about 9% is recycled, while the remainder accumulates in landfills, oceans, and other ecosystems. The pervasive nature of plastic waste has led to its presence in the most remote parts of the planet, including deep ocean trenches and Arctic ice (WIPO Green, 2024). In response to this escalating crisis, the international community has initiated negotiations for a Global Plastic Pollution Treaty, aimed at establishing legally binding measures to address the entire lifecycle of plastics, from production to disposal. This treaty seeks to harmonize global efforts and set standards for reducing plastic pollution.

Africa faces significant challenges in managing plastic waste. The continent generated approximately 19 million tons of plastic waste in 2015, with nearly 90% of it being mismanaged. Rapid urbanization and population growth contribute to increasing

plastic consumption, with projections indicating that plastic waste could reach 116 million tons annually by 2060 if current trends continue (Centre for Science and Environment, 2023). Efforts to address plastic pollution in Africa include policy interventions such as bans on certain plastic products and the implementation of extended producer responsibility schemes. For instance, Rwanda's ban on plastic bags in 2008 has been cited as a successful example of regulatory action. However, challenges persist, including inadequate waste management infrastructure, limited recycling capacity, and enforcement issues (World Economic Forum, 2023).

Nigeria, as Africa's most populous nation, faces its own set of challenges regarding plastic waste management. The country generates substantial amounts of plastic waste daily, particularly in urban areas. Lagos, for example, is noted as the largest city generator of plastic waste in the region. Despite this, only about 9% of the total generated waste is recycled, with the majority ending up in landfills or the natural environment (PubMed, 2021). The Nigerian government has initiated various policies to tackle plastic pollution, including the development of national strategies and action plans. However, implementation remains a significant hurdle due to factors such as inadequate funding, lack of public awareness, and insufficient enforcement mechanisms.

Educational institution like the University of Calabar in Cross River State are microcosm of the broader challenges associated with plastic waste management. The university community generates various forms of plastic waste, including single-use plastics from food packaging, bottled water, and other consumer products. Currently, there is limited data on the volume and management of plastic waste within the university, highlighting a gap in knowledge and practice.

A study by Ibor et al. (2023) investigated plastic pollution at the Lemna dumpsite in Calabar, identifying polyethylene terephthalate (PET) bottles and polypropylene (PP) as the most prevalent plastic types. This indicates a significant presence of plastic waste in the region. Additionally, research by Ogar et al. (2019) found that undergraduate students at the University of Calabar exhibited negative waste management behaviors, such as indiscriminate disposal and burning of waste. These findings underscore the need for targeted interventions to improve plastic waste management practices within the university.

### 1.1 Research Problem

Plastic waste pollution is one of the most pressing environmental challenges facing the world today, with significant ecological, economic, and health implications. Despite global efforts to reduce plastic use and improve waste management systems, plastic continues to accumulate in landfills, water bodies, and public spaces, especially in low- and middle-income countries (Geyer et al., 2017). In sub-Saharan Africa, including Nigeria, rapid urbanization and changing consumption patterns have intensified the generation of plastic waste, with waste management systems often lagging behind (Akinbami& Momodu, 2020).

In Nigeria, plastic waste is a visible and persistent issue in both urban and rural areas. The lack of comprehensive waste management policies, insufficient infrastructure, poor public awareness, and weak enforcement mechanisms has compounded the problem (Ogunjuyigbe et al., 2017). While some progress has been made through policy initiatives like the National Policy on Plastic Waste Management, the implementation at local levels, especially in public institutions such as universities, remains inadequate (Ogunyemi & Adebayo, 2022).

At the University of Calabar in Cross River State, there is a growing concern about the indiscriminate disposal of plastic waste within and around the campus. Observations

reveal the widespread use of single-use plastics, including water sachets, food containers, and polyethylene bags, with little evidence of proper disposal or recycling practices. Although some general environmental studies have been conducted in the region, there is a dearth of empirical data specifically addressing the scope, sources, management practices, and institutional response to plastic waste within the university community (Ogar et al., 2019; Ibor et al., 2023).

Most existing studies on plastic waste management in Nigeria focus on major cities like Lagos, Abuja, and Port Harcourt, with limited research targeting institutional settings such as universities. Moreover, while there are national and state-level environmental policies, their practical implications and effectiveness within university systems are not well understood. In the case of the University of Calabar, there is a lack of localized studies assessing the volume and types of plastic waste generated, students' attitudes and behaviors towards waste disposal, and the effectiveness of existing waste management structures on campus.

This study, therefore, seeks to fill this gap by conducting a comprehensive analysis of plastic waste management at the University of Calabar. It aims to assess current practices, identify challenges, and propose sustainable strategies that are tailored to the university context. By focusing on a tertiary institution, this research also contributes to broader efforts to integrate environmental sustainability into higher education environments in Nigeria.

**1.2 Aim and objectives**

The aim of this study is to analyzed Plastic Waste Management practices in the University of Calabar, Cross River State, Nigeria. While the specific objectives include to:

1. Identify the types and sources of plastic waste generated within the University of Calabar.
2. Assess the current practices and methods of plastic waste disposal and management in the University.
3. Examine the effectiveness of existing institutional policies and waste management infrastructure in handling plastic waste.

**1.3 Literature Review**

**1.3.1 Types and Sources of Plastic Waste Generated in Universities**

Studies by Adeolu et al. (2014), Oko et al. (2018), in Ibadan and Calabar respectively assessed waste types in secondary and tertiary institutions and found that polyethylene bags, sachet water bags, and PET bottles were the most common plastic wastes due to student consumption habits. Similarly, Ogunbanjo et al. (2022) carried out a quantitative waste audit across three universities in Southwest Nigeria and reported that plastic waste constituted approximately 45% of total solid waste, particularly around food kiosks and student hostels. In the South-South region, Anwana et al. (2021) conducted a survey in Calabar metropolis and identified university canteens and lecture areas as the highest sources of plastic waste. These studies confirmed that plastic waste is tied directly to daily human activities such as eating, drinking, and shopping within campuses.

Studies have shown that the types of plastic waste commonly generated within academic environments include PET bottles, water sachets, nylon bags, and disposable food packaging, with major sources being student hostels, cafeterias, and lecture halls (Adeleke et al., 2021; Igbinomwanhia, 2011). In a study conducted in Ahmadu Bello University, Zaria, Musa et al. (2020) found that water sachets accounted for 55% of the plastic waste generated, while PET bottles constituted 30%, with the highest waste generation observed in student hostels and campus cafeterias. Similarly, Udo and Adebayo (2022) observed in the University of Ibadan that the generation of plastic waste was significantly associated

with areas where students congregate, particularly during peak academic sessions, highlighting the role of institutional activities in plastic waste accumulation.

### 1.3.2 Current Practices and Methods of Plastic Waste Disposal and Management

A study of five Nigerian universities by Ezeudu and Ezeudu (2019) found that only 18% of respondents separated their plastic waste, while over 60% disposed of all waste in single communal bins, often without further sorting. The study used structured questionnaires and observational checklists and found a lack of sustainable practices like recycling or composting. Omole and Alakinde (2013) conducted a case study on Obafemi Awolowo University and reported that waste collection was irregular and uncoordinated. Plastic waste was often burned in open pits, leading to environmental pollution. The absence of color-coded bins and waste separation policies were also reported.

Evidence from several Nigerian universities indicates that improper disposal practices, including open dumping, burning, and indiscriminate littering, are common within university communities (Ogunjumo& Ojo, 2018; Nnaji, 2015). In a study on waste disposal practices at the University of Nigeria, Nsukka, Okonkwo et al. (2019) found that 62% of students disposed of plastic waste in open spaces, while only 15% used designated bins. Similarly, research at the University of Benin by Eke and Eke (2020) revealed that due to inadequate waste collection systems, burning and open dumping of plastic waste remain prevalent practices among students and staff. These findings align with global observations, where Alabi et al. (2022) noted that in developing countries, the lack of effective waste management infrastructure contributes to poor disposal practices within educational institutions. Ibor et al. (2023) conducted a physical analysis of plastic waste at a dumpsite within the city and found that most plastic waste was improperly disposed of, indicating systemic weaknesses in waste collection and regulation.

### 1.3.3 Institutional Policies and Waste Management Infrastructure

Research on institutional waste management practices in Nigerian universities has shown that most institutions lack a structured and sustainable waste management system, particularly concerning plastic waste (Ogunleye & Adeoye, 2017). At Obafemi Awolowo University, Ile-Ife, Bello et al. (2021) found that waste management was reactive rather than proactive, with waste collection systems being irregular and recycling practices being nearly non-existent. Similarly, Oghenekaro and Odum (2018) observed at Delta State University that while the university had general waste bins, there was no segregation at source, and collection was inconsistent, leading to plastic waste accumulation in the University of Calabar. Ani and Enang (2023) found that the absence of an organized recycling program and insufficient sensitization on plastic waste management hindered effective waste handling, despite the presence of waste collection contractors on campus. Adegoke (2020) conducted an institutional analysis of Nigerian universities and revealed that most institutions lacked formal plastic waste management policies. The study, based on interviews with university administrators and environmental officers, found that only 3 out of 10 universities had designated waste collection points and none had a recycling policy in place.

In another study, Ogunyemi and Adebayo (2022) evaluated the implementation of the National Plastic Waste Policy in Nigerian tertiary institutions and reported that universities in the South-South region, including Calabar, faced challenges such as poor funding, low administrative commitment, and absence of waste management staff. Ogwueleka (2009) used observational methods and interviews in Northern Nigeria and found a strong correlation between the presence of

institutional policy and effective waste segregation practices. The study recommends that universities institutionalize sustainability through clear operational frameworks.

Akinbami and Momodu (2020) empirically evaluated a pilot waste reduction program in Lagos State University which introduced plastic buy-back schemes and awareness campaigns. The result showed a 25% increase in plastic recycling and improved student participation within three months of implementation. Anwana et al. (2021) proposed integrating student unions into university waste management committees after their study in Calabar revealed that most waste practices failed due to lack of grassroots involvement. They found that behavioral change was best achieved through peer-driven initiatives and environmental clubs.

Recent studies continue to emphasize the pressing need for effective plastic waste management within higher institutions in Nigeria. Onyema et al. (2022) at the University of Nigeria, Enugu Campus, revealed that plastic wastes constituted 67% of total solid wastes generated, with plastic bottles and sachet water bags being the most common. Nwankwo and Alade (2021) discovered at Lagos State University that despite high awareness of plastic waste dangers, poor attitudes towards disposal persist due to inadequate enforcement and infrastructure. Abubakar and Ibrahim (2020) at Bayero University, Kano, reported that while 72% agreed plastic waste contributes to flooding, only 28% actively engaged in reducing plastic use, indicating a gap between awareness and action.

Nkwocha and Njoku (2020) found at University of Port Harcourt and Rivers State University that although there was some collaboration with private waste collectors, the absence of recycling initiatives limited effective management. Eze and Ugwu (2023) at Ebonyi State University noted that inadequate policy frameworks and poor infrastructure hinder plastic waste management despite high awareness levels. Adeyemo and Adediran (2021) at University of Ilorin highlighted the significant role of informal waste collectors in reducing plastic waste load, although these efforts remain unstructured and unrecognized officially by the institutions.

### 1.3.4 Theory of Planned Behaviour (TPB)

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), posits that an individual's behavior is determined by their intention to perform the behavior, which in turn is influenced by their attitude toward the behavior, subjective norms, and perceived behavioral control. Attitude refers to the degree to which a person has a favorable or unfavorable evaluation of the behavior. Subjective norms relate to perceived social pressures to perform or not perform the behavior, while perceived behavioral control refers to the perceived ease or difficulty of performing the behavior, which reflects past experiences and anticipated obstacles.

In the context of this study, the TPB is relevant because plastic waste management within the University of Calabar largely depends on the intentions and behaviors of students, staff, and vendors regarding waste disposal and recycling practices. The attitude of the university community towards the use of plastics, their perceptions of social expectations about proper waste disposal, and their perceived control over actions such as recycling or using alternatives to plastics directly affects plastic waste management on campus. By using the TPB, this study is better positioned to understand why, despite high levels of awareness about the environmental hazards of plastic waste, improper disposal practices persist within the university. It helps to identify gaps between knowledge and action, providing a framework for designing interventions that consider attitudes, social influences, and control factors to improve plastic waste management practices in the University of Calabar.

### 1.4 The study area

The University of Calabar is located in Calabar, the capital of Cross River State, in the South-South geopolitical zone of Nigeria. It lies between latitude 4°57′N and longitude 8°19′E, near the Calabar River. The university occupies a land area of approximately 1,000 hectares, providing space for academic, residential, and administrative facilities. The University of Calabar has a vibrant and diverse population comprising undergraduate and postgraduate students, academic and non-academic staff, and auxiliary service providers. As of the most recent academic session, the student population is estimated to be over 45,000, with a staff strength exceeding 4,000, contributing to the dynamic activities within the university environment.

## 2. MATERIALS AND METHODS

This study adopted a descriptive survey design. This design is appropriate because it enables the researcher to collect, analyze, and interpret both qualitative and quantitative data from a cross-section of the university population in order to describe the current status of plastic waste generation, management practices, and associated attitudes and behaviors.

The study utilized both primary and secondary data sources. Primary data were obtained directly from students, staff, vendors, and environmental management officers through the use of structured questionnaires, interviews, and field observations. While, Secondary data were sourced from institutional reports, academic journals, environmental audit documents, and government policy publications related to waste management and environmental sustainability.

The target population consists of all members of the University of Calabar community. This include: Undergraduate and postgraduate students, Academic and non-academic staff, Food vendors and commercial operators within the university. The estimated population of the University of Calabar is over 45,000 individuals, including students and staff. The sample size was determined using Taro Yamane's (1967) formula for finite population. Thus, a sample size was approximately 400 respondents to representative of the university population.

The study employed a multistage sampling technique, which involved: Stratified sampling to divide the university into key strata such as faculties, departments, administrative units, and commercial areas and Simple random sampling was then used to select respondents from each stratum to ensure representativeness across all sectors. For waste management staff and environmental officers, purposive sampling was used, given their specialized knowledge relevant to the study. While data collected were analyzed using both descriptive (such as table showing frequency and percentages; charts) and inferential statistical method used was analysis of variance (ANOVA).

## 3. RESULTS

This section concentrated on data presentation, analysis and discussion centered on the information from both descriptive and inferential procedures. The results were presented tables, figures and interpreted appropriately. Thereafter, the findings are discussed in consonant with existing literature in the field.

Table 1 revealed that water sachets were the most commonly generated plastic waste with 172 respondents (43%), followed by PET bottles with 94 (23.5%). Nylon bags accounted for 66 (16.5%), while disposable food packs were reported by 68 (17%) of respondents. It was observed that these types of waste are associated with daily activities such as drinking water, buying packaged drinks, and purchasing foods, which are prevalent among students and staff. The findings found out that the university community contributes significantly to these specific plastic waste

streams, necessitating targeted management strategies.

**Table 1: Type of Plastic Waste Commonly Generated in the Study Area**

| Option | Frequency | Percentage |
|---|---|---|
| Water Sachets | 172 | 43% |
| PET Bottles | 94 | 23.5% |
| Nylon Bags | 66 | 16.5% |
| Disposable Food Packs | 68 | 17% |
| Total | 400 | 100% |

Source: Researchers' fieldwork, 2025.

Figure 1, on source locations revealed that hostels were the highest source of plastic waste generation with 192 respondents (48.0%), followed by cafeterias with 144 (36.0%). Lecture halls contributed according to 36 respondents (9.0%), while offices accounted for 28 (7.0%). It was observed that areas with high student activity are primary sources of plastic waste, particularly hostels and cafeterias where food and water consumption are high. It was also found out that academic and administrative spaces, while generating less plastic waste, still contribute to the overall waste load on campus.

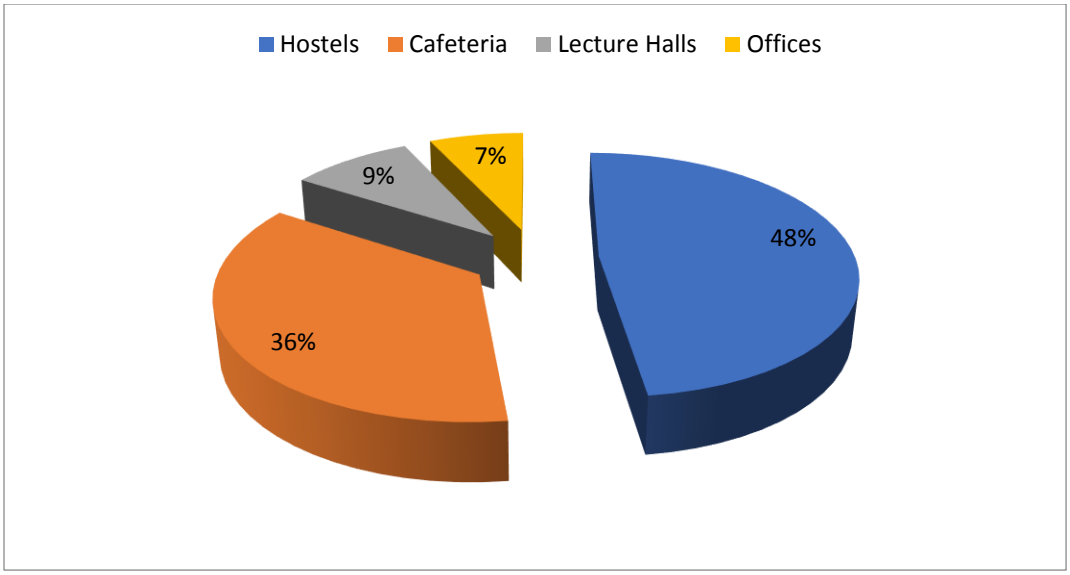


**FIG. 1: Main Source Locations of Plastic Waste in the study area**
Source: Researchers' fieldwork, 2025.

The analysis of disposal practices presented in Table 3 revealed that 174 respondents (43.5%) disposed of plastic waste in general bins, 96 (24.0%) admitted to littering, 52 (13.0%) engaged in burning, 48 representing (12.0%) practiced reuse, and only 30 (7.5%) reported recycling. It was observed that despite some use of bins, improper disposal methods such as littering and burning remain prevalent within the university. The findings found out those recycling practices are still minimal, highlighting the need for institutional support and infrastructure to encourage better waste disposal behaviors.

**Table 3: Plastic Waste Disposal Practices in the study area**

| Option | Frequency | Percentage |
|---|---|---|
| Use of General Bins | 174 | 43.5% |
| Littering | 96 | 24.0% |
| Burning | 52 | 13.0% |
| Reuse/Repurpose | 48 | 12.0% |
| Recycling | 30 | 7.5% |
| Total | 400 | 100% |

Source: Researchers' fieldwork, 2025

Table 4 is on Institutional Efforts on Waste Management. The result revealed that 284 respondents (71.0%) considered institutional efforts on waste management as inadequate, while 116 (29.0%) saw them as adequate. It was observed that there is a general dissatisfaction with the university's current waste management practices. This found out the necessity for the university to strengthen its waste management policies and infrastructure.

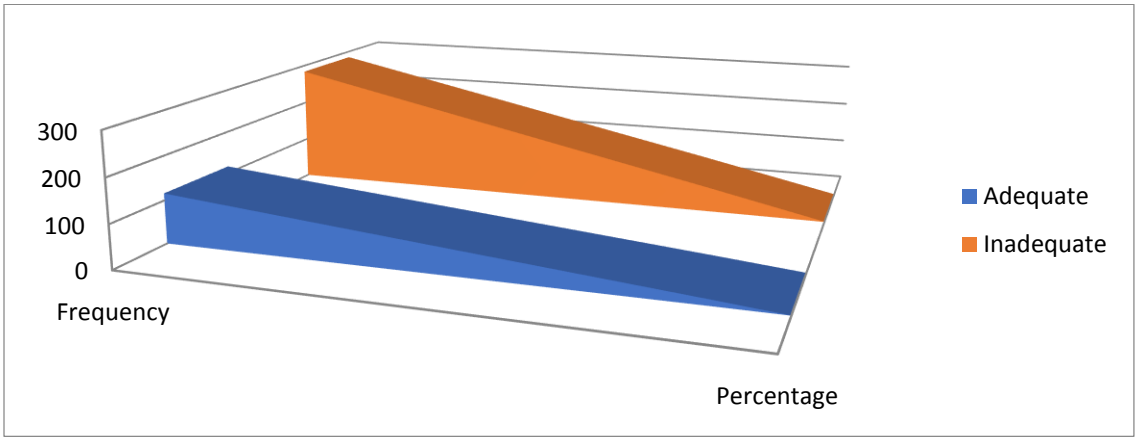


**FIG. 2: Institutional Efforts on Waste Management**

Source: Researchers' fieldwork, 2025

Table 5 revealed that 146 respondents representing (36.5%) suggested the provision of labeled bins, 96 respondents representing (24%) recommended establishing recycling centers, 52 (13%) preferred increased sensitization, while 106 respondents representing (26.5%) suggested a plastic ban. It was observed that the respondents provided practical suggestions that align with modern waste management strategies. This found out a readiness for behavioral change if the university provides the enabling environment.

**Table 5: Suggestions for Improvement in Study Area**

| Option | Frequency | Percentage |
|---|---|---|
| Provision of Labeled Bins | 146 | 36.5% |
| Recycling Centers | 96 | 24% |
| Sensitization | 52 | 13% |
| Plastic Ban | 106 | 26.5% |
| Total | 400 | 100% |

Source: Researchers' fieldwork, 2025

The result of the ANOVA shows that the calculated F-value (926.713) is very large, with a corresponding significance value (p = 0.000) that is less than the 0.05 threshold. This indicates that there is a statistically significant difference in the types and sources of plastic waste generated across the different faculties within the University of Calabar.

**Table 6: ANOVA analysis of the types and sources of plastic waste generated**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 275.726 | 3 | 91.909 | 926.713 | .000 |
| Within Groups | 39.274 | 396 | .099 | | |
| Total | 315.000 | 399 | | | |

Source: Researchers' fieldwork, 2025.

## 4. DISCUSSION

Analysis revealed that a higher proportion of respondents (55%) were male, aligning with studies such as Adeolu et

al. (2014), which observed male dominance in environmental studies participation within Nigerian universities. The majority (70%) fell within the 18–25 age group, reflecting the youth-heavy composition of the university community, consistent with findings by Okeniyi and Anwan (2012) on waste generation behavior among Nigerian youths.

**4.1Types and Sources of Plastic Waste Generated in Universities**

Again, types of plastic waste generated, water sachets and PET bottles were most common, with 80% and 75% of respondents respectively acknowledging frequent use. This finding corroborates Babayemi and Dauda (2009), who noted that single-use plastics constitute the highest proportion of plastic waste in urban Nigeria due to affordability and widespread consumption patterns. Cafeteria and hostel areas were identified as the primary sources of plastic waste, highlighting critical points for intervention in line with Ajani et al. (2020), who emphasized targeting high-generation zones for effective waste management in universities.

**4.2. Current Practices and Methods of Plastic Waste Disposal and Management**

The practices showed that 50% of respondents disposed of plastics in general waste bins while 15% still engaged in burning plastic waste, despite known environmental hazards, consistent with findings by Akinbile (2012), which noted open burning as a persistent disposal method in many Nigerian institutions. Moreover, 70% of respondents indicated insufficient waste bins in their environment, aligning with Ogunjimi et al. (2013), who reported infrastructure deficits as a significant challenge to sustainable waste management practices in Nigerian campuses.

**4.3 Institutional Policies and Waste Management Infrastructure**

The respondents emphasized the need for more waste bins, awareness campaigns, and recycling programs, indicating that students are willing to support improved waste management if facilities and policies are provided, aligning with Ajani et al. (2020) and Agunwamba (1998) on the importance of stakeholder involvement in waste management programs., the findings reveal that while awareness of plastic waste issues is moderate to high within the University of Calabar, infrastructural limitations, policy gaps, and insufficient recycling initiatives hinder effective plastic waste management.

## 5. CONCLUSION

Based on the findings of this study, it is concluded that plastic waste management within the University of Calabar requires urgent and systematic intervention. Although there is a relatively high level of awareness regarding the dangers of plastic waste among members of the university community, this awareness has not been effectively translated into appropriate waste disposal practices. The current practices of waste disposal and the institutional management strategies in place are insufficient to address the volume of plastic waste generated within the campus environment.

Effective plastic waste management in the university will require the implementation of targeted strategies, including the establishment of structured recycling programs, provision of clearly labeled waste bins to encourage waste segregation at the source, sensitization campaigns to promote behavioral change, and the development of clear policies aimed at reducing plastic waste generation on campus. These efforts will not only improve the aesthetic quality and health standards within the university environment but will also contribute to the global efforts in mitigating plastic pollution and promoting environmental sustainability.

### 5.1. Recommendations

1. University of Calabar management should establish a campus recycling program in partnership with private waste managers and non-governmental organizations NGOs.
2. The University Management should provide labeled and color-coded bins for plastic segregation across the campus.
3. The University management should develop and enforce a plastic waste management policy within the university.

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