

Electronic Waste Disposal Practices and Determinants of Sustainable E-Waste Management Among Educational Institutions in Aba Metropolis, Nigeria

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Abstract: The rapid growth in electronic waste (e-waste) has become a major environmental and public health concern, particularly in developing countries where effective waste management systems are often lacking. Educational institutions, as significant users of electronic devices, contribute substantially to e-waste generation; however, limited research has examined their disposal practices. This study investigated e-waste disposal methods and the factors influencing sustainable e-waste management among educational institutions in Aba Metropolis. A descriptive cross-sectional survey design was employed, involving 40 purposively selected personnel responsible for managing electronic equipment across three tertiary institutions. Data were collected using a structured questionnaire and analyzed using descriptive statistics. The results indicated that the most common disposal practice was the prolonged storage of obsolete electronic equipment (42.5%), whereas only 10.0% of the institutions utilized authorized e-waste collection services. Although 67.5% of respondents reported separating e-waste from general waste and 70.0% expressed willingness to participate in recycling initiatives, effective e-waste management was hindered by the absence of institutional recycling policies (32.5%), inadequate staff training (52.5%), weak collaboration with regulatory agencies, and infrequent visits by certified e-waste collectors (52.5%). Existing institutional efforts were primarily limited to awareness campaigns (40.0%) and inventory management of obsolete equipment (32.5%), with only a few institutions having formal structures for e-waste management. The findings suggest that the primary barriers to sustainable e-waste management are institutional, governance, and infrastructural shortcomings rather than a lack of commitment to environmentally responsible practices. The study recommends strengthening institutional policies, enhancing staff capacity through regular training, establishing dedicated e-waste collection systems, and promoting partnerships with certified recycling organizations. These measures will improve sustainable e-waste management in educational institutions and contribute to the broader transition toward a circular economy.

Keywords: *Electronic Waste, Sustainable Waste Management, Educational Institutions, Disposal Practices, Nigeria.*

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I. INTRODUCTION

The rapid growth in the use and replacement of electronic devices has intensified concerns over electronic waste (e-waste) management in Nigeria, where increasing e-waste generation and unsafe disposal practices continue to threaten human health and environmental quality (Miner et al., 2020; Nnorom & Odeyingbo, 2019; Agu, 2023). These concerns are particularly significant in Aba Metropolis, which is associated with informal e-waste processing activities such as open burning, dismantling, and acid leaching that contribute to environmental contamination and

public health risks (Lebbie et al., 2021; Andeobu et al., 2023). As major consumers of information and communication technology (ICT) equipment, educational institutions generate considerable quantities of obsolete computers, mobile phones, printers, projectors, and related devices (Maphosa, 2022; Fathima & S, 2025; Mejabi, 2014). However, evidence indicates that these institutions commonly rely on prolonged storage of obsolete equipment, disposal through municipal waste streams, or informal recycling channels, largely due to the absence of institutional policies and standardized management systems (Maphosa, 2022; Fathima & S, 2025). Furthermore, limited

awareness of e-waste hazards and inadequate disposal practices remain prevalent among Nigerian students (Olabisi et al., 2024). Previous studies have identified awareness, environmental education, collection infrastructure, government support, financial incentives, perceived behavioural control, and social norms as key determinants of sustainable e-waste management (Osagwu & Nkamnebe, 2025; Garg et al., 2023; Michael et al., 2024). Despite these advances, empirical evidence at the institutional level remains limited, particularly for city-specific educational clusters in Nigeria. Existing studies have largely focused on national assessments, households, legal frameworks, or a small number of tertiary institutions, providing little insight into disposal practices across educational institutions within a single metropolitan area (Mejabi, 2014; Miner et al., 2020; Agu, 2023). This study addresses this gap by examining e-waste disposal practices and the determinants of sustainable e-waste management among educational institutions in Aba Metropolis. By linking institutional disposal behaviours with organizational and behavioural drivers, it provides context-specific evidence to support targeted interventions and strengthen the implementation of sustainable e-waste management policies in educational settings.

II. MATERIALS AND METHODS

➤ Study Area

The study was conducted in Aba Metropolis, Abia State, and southeastern Nigeria. Aba comprises Aba North and Aba South Local Government Areas, with adjoining parts of Obingwa Local Government Area, and is one of Nigeria's largest commercial and industrial centres. The metropolis is characterized by rapid urbanization, intense commercial activities, numerous educational institutions, and increasing consumption of electrical and electronic equipment, resulting in growing electronic waste (e-waste) generation. The area experiences a tropical monsoon climate with high annual rainfall and average temperatures of approximately 29°C (Oforde *et al.*, 2022), conditions that may facilitate the mobilization of contaminants from improperly disposed electronic waste. The high concentration of educational institutions and commercial establishments makes Aba an appropriate location for assessing institutional e-waste disposal practices. Major markets include Ariaria International Market, Ekeoha Market, and Cemetery Road Market, attracting traders across West Africa. Agriculture, focused on cassava, maize, and yams, is significant, with farmers involved in cassava and maize farming and uses urban farming to supplement their income (Okoro *et al.*, 2017).

➤ Research Design

A descriptive cross-sectional survey design was adopted to evaluate e-waste disposal practices and determinants of sustainable e-waste management among educational institutions in Aba Metropolis. The design enabled the collection of quantitative information on institutional disposal methods, management structures, awareness, existing practices, challenges, and willingness to participate in sustainable e-waste management programmes.

➤ Study Population

The study population consisted of staff responsible for electronic equipment management, maintenance, procurement, environmental management, stores, and administration within selected tertiary educational institutions in Aba Metropolis. The institutions included: Abia State Polytechnic, Temple Gate Polytechnic, and College of Health Sciences, Aba. These institutions were selected because of their substantial use of electrical and electronic equipment and their continuous generation of obsolete electronic devices requiring appropriate disposal.

➤ Sampling Procedure and Sample Size

A purposive sampling technique was employed to select the three institutions based on the volume of electronic equipment utilized and accessibility of personnel directly involved in equipment management. Within each institution, respondents were selected using purposive sampling because they possessed relevant knowledge regarding institutional e-waste generation and disposal practices. A total of forty (40) respondents participated in the study, comprising: Abia State Polytechnic (n = 20), Temple Gate Polytechnic (n = 10), and College of Health Sciences (n = 10).

➤ Data Collection

Primary data were collected using a structured questionnaire developed to assess institutional e-waste management practices. The instrument comprised mainly closed-ended questions with a few multiple-response items and covered institutional e-waste disposal methods, responsible departments, waste segregation practices, partnerships with authorized recyclers and regulatory agencies, willingness to participate in recycling programmes, awareness and training, challenges to sustainable e-waste management, frequency of electronic equipment servicing, and institutional initiatives promoting sustainable e-waste management. Before data collection, the questionnaire was reviewed by environmental management experts to ensure its clarity, content validity, and alignment with the study objectives.

➤ Variables Measured

The dependent variable was sustainable institutional e-waste management, while the independent variables comprised institutional disposal methods, organizational responsibility for e-waste management, availability of recycling policies, awareness of improper e-waste disposal, staff training and sensitization, institutional partnerships, waste segregation practices, maintenance culture, availability of authorized disposal agents, and institutional willingness to participate in e-waste recycling programmes.

➤ Data Analysis

Completed questionnaires were screened for completeness before coding and entry into the Statistical Package for the Social Sciences (SPSS), Version 25. Descriptive statistics including frequencies, percentages, means, and ranking were used to summarize respondents' responses. The results were presented using tables and descriptive narratives. Institutional comparisons were made

among the three educational institutions to identify similarities and differences in e-waste disposal practices and management systems. The findings were interpreted in relation to sustainable e-waste management principles and existing environmental management frameworks.

➤ Ethical Considerations

Permission to conduct the study was obtained from the management of the participating institutions. Respondents were informed about the purpose of the research, and participation was entirely voluntary. Confidentiality and anonymity were maintained throughout the study, and information obtained was used solely for academic and research purposes.

III. RESULTS

Table 1 Institutional E-Waste Disposal and Segregation Practices among Educational Institutions in Aba Metropolis (N = 40)

Variable	Abia State Polytechnic (n=20)	Temple Gate (n=10)	College of Health (n=10)	Total	%
Disposal methods					
Donate to other institutions	1	0	1	2	5.0
Sell to scrap dealers	4	3	2	9	22.5
Store indefinitely	9	4	4	17	42.5
Dump in waste bins	4	2	2	8	20.0
Handover to authorized collectors	2	1	1	4	10.0
E-waste segregation practice					
Always separated	13	6	8	27	67.5
Sometimes separated	5	2	1	8	20.0
Never separated	2	2	1	5	12.5

The results show that storing obsolete electronic equipment was the predominant disposal practice (42.5%), followed by selling to scrap dealers (22.5%) and disposal with municipal waste (20.0%). Only 10.0% of respondents reported using authorized e-waste collectors, while 5.0% donated functional equipment to other institutions. Regarding segregation, 67.5% of respondents consistently

separated e-waste from general waste, 20.0% did so occasionally, and 12.5% never practiced segregation. These findings suggest that although waste segregation is relatively common, reliance on storage and limited use of formal disposal channels hinder sustainable institutional e-waste management.

Table 2 Institutional Governance and External Collaboration for Sustainable E-Waste Management (N = 40)

Variable	Abia State Polytechnic	Temple Gate	College of Health	Total	%
Department responsible					
Specific department exists	9	5	6	20	50.0
No department	7	3	2	12	30.0
Not clear	4	2	2	8	20.0
Partnership with agencies					
Yes	4	2	2	8	20.0
No	4	3	2	9	22.5
Not sure	12	5	6	23	57.5

Half of the respondents (50.0%) indicated that their institutions had a designated department responsible for e-waste management, while 30.0% reported the absence of such a unit and 20.0% were uncertain, suggesting inconsistencies in institutional governance. External collaboration was similarly limited, with only 20.0% confirming partnerships with relevant agencies, whereas 22.5% reported no partnerships and 57.5% were unaware of

any existing collaborations. These findings indicate weak institutional coordination and limited stakeholder engagement, which may impede the implementation of sustainable e-waste management practices. Strengthening institutional governance and fostering formal partnerships with certified recycling agencies and environmental regulators are essential for improving e-waste management efficiency.

Table 3 Institutional Readiness for Sustainable E-Waste Management (N = 40)

Variable	Abia State Polytechnic	Temple Gate	College of Health	Total	%
Willing to participate in recycling					
Yes	13	7	8	28	70.0
Maybe	5	2	1	8	20.0

No	2	1	1	4	10.0
Training programmes					
Regular	4	2	2	8	20.0
Occasional	6	3	2	11	27.5
None	10	5	6	21	52.5
Awareness level					
Very low	5	4	4	13	32.5
Low	4	2	3	9	22.5
Moderate	5	2	1	8	20.0
High	3	1	1	5	12.5
Very high	3	1	1	5	12.5

Table 3 indicates a generally positive institutional disposition toward sustainable e-waste management despite notable deficiencies in capacity building. Most respondents (70.0%) expressed willingness to participate in e-waste recycling programmes, while 20.0% were undecided and only 10.0% were unwilling. However, structured training on e-waste management was limited, with 52.5% reporting that no training programmes had been conducted compared with 27.5% indicating occasional training and only 20.0% reporting regular training. Awareness levels were similarly

low, as 55.0% of respondents rated awareness of improper e-waste disposal as either very low (32.5%) or low (22.5%), whereas only 25.0% reported high or very high awareness. The coexistence of strong willingness to participate and inadequate training and awareness suggests that educational institutions possess substantial potential for adopting sustainable e-waste management practices, provided that institutional capacity-building initiatives, continuous sensitization programmes, and environmental education are strengthened.

Table 4 Institutional Barriers Affecting Sustainable E-Waste Management (N = 40)

Challenge	Abia State Polytechnic	Temple Gate	College of Health	Total	%
No recycling policy	7	3	3	13	32.5
No designated collection system	4	2	2	8	20.0
Health and safety concerns	3	2	3	8	20.0
Lack of awareness	3	2	1	6	15.0
Poor access to authorized disposal agents	3	1	1	5	12.5

Table 4 highlighted several institutional barriers limiting sustainable e-waste management in the surveyed educational institutions. The most frequently reported challenge was the absence of a recycling policy (32.5%), indicating inadequate institutional frameworks to guide environmentally sound e-waste management. This was followed by the lack of a designated collection system (20.0%) and health and safety concerns (20.0%), both of which constrain effective handling and disposal of obsolete electronic equipment. Additionally, 15.0% of respondents

identified limited awareness as a barrier, while 12.5% cited poor access to authorized disposal agents. Collectively, these findings suggest that policy deficiencies, inadequate infrastructure, and limited institutional capacity remain significant obstacles to implementing sustainable e-waste management practices. Addressing these barriers through comprehensive institutional policies, dedicated collection systems, staff awareness programmes, and strengthened collaboration with certified e-waste handlers is essential for improving environmental sustainability.

Table 5 Institutional Support Systems for Sustainable Electronic Equipment Management (N = 40)

Variable	Frequency	%
Frequency of visits by disposal agents		
Regular	16	40.0
Very irregular	21	52.5
Never	3	7.5
Repair responsibility		
Certified professionals	33	82.5
Internal staff	7	17.5
Maintenance frequency		
Regular servicing	23	57.5
Case-by-case servicing	17	42.5

Table 5 shows that institutional support systems for sustainable electronic equipment management are characterized by both strengths and operational gaps. More than half of the respondents (52.5%) reported that visits by

authorized e-waste disposal agents were very irregular, while only 40.0% indicated regular visits and 7.5% reported no visits. This irregularity may limit timely collection and environmentally sound disposal of obsolete electronic

equipment. Encouragingly, 82.5% of institutions relied on certified professionals for equipment repairs, reflecting adherence to appropriate maintenance practices. Furthermore, 57.5% reported conducting regular servicing of electronic equipment, compared with 42.5% adopting a

case-by-case approach. These findings suggest that while maintenance practices are relatively well established, inadequate engagement with authorized disposal agents remains a significant constraint to sustainable institutional e-waste management.

Table 6 Existing Institutional Initiatives Supporting Sustainable E-Waste Management (N = 40)

Institutional Activity	Frequency	%	Rank
Training and awareness creation	16	40.0	1
E-waste inventory	13	32.5	2
Conducting projects	8	20.0	3
Organizational structure	2	5.0	4
Missing responses	1	2.5	-
Total	40	100.0	

Table 6 presents the existing initiatives undertaken by educational institutions to promote sustainable e-waste management. Training and awareness creation emerged as the most common initiative, reported by 40.0% of respondents, indicating that institutions primarily emphasize sensitization to encourage responsible e-waste management practices. This was followed by the maintenance of an e-waste inventory (32.5%), reflecting growing recognition of the need to monitor electronic assets and waste generation. However, only 20.0% reported implementing e-waste-related projects, while a mere 5.0% indicated the existence of a formal organizational structure dedicated to e-waste management. These findings suggest that although awareness initiatives are increasingly adopted, institutional commitment remains largely at the preliminary stage, with limited investment in formal governance structures and operational programmes necessary for effective and sustainable e-waste management.

IV. DISCUSSION

The findings indicate that educational institutions in Aba Metropolis rely predominantly on storing obsolete electronic equipment, while formal disposal through authorized collectors remains limited. Although most institutions reported separating e-waste from general waste, the continued use of scrap dealers and municipal waste streams suggests gaps in environmentally sound disposal. Similar trends have been reported in Nigerian tertiary institutions, where inadequate infrastructure and weak formal recycling systems encourage temporary storage and informal disposal pathways (Agu, 2023; United Nations Institute for Training and Research, 2024). Institutional governance was also inadequate, with only half of the institutions having dedicated e-waste management units and few maintaining partnerships with relevant agencies. This agrees with findings by United Nations Environment Programme (2024), which emphasized that weak institutional coordination constrains sustainable e-waste management in developing countries.

Despite these challenges, the high willingness to participate in recycling programmes demonstrates substantial institutional readiness for improved e-waste management. However, this willingness contrasts with the

low frequency of training programmes and poor awareness levels, corroborating earlier studies that identified insufficient environmental education as a major barrier to sustainable e-waste practices (Forti et al., 2024; World Health Organization, 2021). The absence of recycling policies, designated collection systems, and regular disposal services further reinforces evidence that policy and infrastructural deficiencies remain critical impediments to effective e-waste management in low- and middle-income countries. Collectively, these findings suggest that strengthening institutional policies, expanding awareness programmes, establishing dedicated collection systems, and fostering partnerships with certified recyclers are essential for improving sustainable e-waste management within educational institutions.

V. CONCLUSION

This study assessed electronic waste disposal practices and the determinants of sustainable e-waste management among educational institutions in Aba Metropolis, Nigeria. The findings revealed that although most institutions practiced e-waste segregation and expressed willingness to participate in recycling programmes, sustainable management was constrained by prolonged storage of obsolete equipment, inadequate institutional policies, limited training and awareness, weak collaboration with authorized recyclers, and irregular collection services. These findings highlight that institutional commitment alone is insufficient without supportive governance structures, regulatory enforcement, and operational infrastructure. Strengthening institutional e-waste policies, establishing dedicated collection systems, promoting continuous environmental education, and fostering partnerships with certified recyclers are essential for improving sustainable e-waste management. Future research should examine the effectiveness of institutional e-waste policies, quantify e-waste generation across educational institutions, and evaluate the environmental and health impacts of current disposal practices. There is an urgent need for policymakers, educational institutions, and environmental agencies to collaborate in developing comprehensive e-waste management frameworks that support a circular economy and protect public health and the environment.

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