

Repurposing Electronic Waste Disposal and Management in the Bauchi Built Environment

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Abstract

Electronic waste (e-waste) has become a significant environmental challenge globally, particularly in developing regions like Bauchi, Nigeria. This paper examines the current state of e-waste disposal and management practices in the Bauchi built environment, highlighting the implications for public health and environmental sustainability. Through field surveys, interviews, and analysis of existing waste management policies, this study aims to identify gaps in e-waste management and propose actionable strategies for improvement. The results indicated that only 30% of respondents were aware of the environmental impacts associated with improper e-waste disposal. The findings from this study underscore the urgent need for enhanced public awareness campaigns focused on e-waste management in Bauchi Metropolis. It is crucial for local authorities to implement educational programs that inform residents about the environmental impacts of improper e-waste disposal and promote responsible waste management practices. It was recommended that establishing more accessible recycling facilities and improving existing waste collection services will be essential steps toward mitigating the negative effects associated with e-waste in the region.

Keywords: E-waste, Disposal, Management, Bauchi, Built Environment, Sustainability.

Introduction

Electronic waste (E-waste) management is a growing concern in Nigeria, particularly in urban areas like Bauchi. The city generates significant amounts of solid waste, including E-waste, but lacks proper disposal and recycling infrastructure (Gani *et al.*, 2013). This leads to indiscriminate dumping and environmental pollution. E-waste contains valuable metals and hazardous substances, posing risks to human health and ecosystems (Askari *et al.*, 2014). The rapid advancement of technology has led to an increase in electronic devices' usage, resulting in a corresponding rise in electronic waste (e-waste) generation. E-waste includes discarded electrical or electronic devices such as computers, televisions, and mobile phones. According to the United Nations (2020), global e-waste generation is expected to reach 74 million metric tons by 2030. In Nigeria, the situation is exacerbated by inadequate disposal methods and a lack of awareness regarding the environmental impacts of improper e-waste management (Audu & Osunkunle, 2014). In Bauchi State, the challenges associated with e-waste disposal are compounded by existing solid waste management issues. The local government struggles with inefficient waste collection

systems and limited resources for proper waste treatment (Kabir *et al.*, 2003). This paper aims to explore the current practices of e-waste disposal in Bauchi's built environment and assess their effectiveness in promoting sustainable development.

Statement of the Problem

The problem of electronic waste (e-waste) disposal and management in Bauchi is critical due to the rapid increase in discarded electronic devices. Improper disposal practices lead to severe environmental pollution and health risks, as toxic substances from e-waste contaminate air, soil, and water. Awareness and compliance with existing regulations are alarmingly low among stakeholders, exacerbating the issue.

Literature Review

Nigeria has become a major destination for used electronic equipment from developed countries, exacerbating the problem (Nnorom & Odeyingbo, 2020). To address these issues, experts recommend implementing stricter regulations, improving waste collection systems, and raising public awareness about proper disposal methods (Michael & Babaji, 2014; Nnorom & Odeyingbo, 2020). Additionally, developing recycling facilities and promoting community involvement in waste management could help mitigate the environmental impact of E-waste and potentially generate revenue through resource recovery (Michael & Babaji, 2014; Askari *et al.*, 2014).

Electronic waste (e-waste) refers to discarded electronic devices that have reached the end of their useful life. The proliferation of technology has led to a significant increase in e-waste generation, which poses substantial environmental and health risks if not managed properly. This paper categorizes e-waste into several distinct types, each with its own implications for disposal and management as follows:

1. Consumer Electronics

Consumer electronics are among the most common types of e-waste. This category includes items such as televisions, radios, computers, and gaming consoles. As technology advances rapidly, consumers frequently upgrade their devices, resulting in a high turnover rate for these products. According to the Global E-Waste Monitor (2020), approximately 53.6 million metric tons of e-waste were generated worldwide in 2019, with consumer electronics accounting for a significant portion of this total. The improper disposal of these devices can lead to the release of hazardous substances such as lead and mercury into the environment (Baldé *et al.*, 2015).

2. Home Appliances

Home appliances represent another major category of e-waste, encompassing refrigerators, microwaves, washing machines, and air conditioners. These appliances often

contain harmful chemicals and heavy metals that can leach into soil and water sources when disposed of improperly (Kumar & Singh, 2019). For instance, refrigerators may contain refrigerants that contribute to ozone depletion if not handled according to environmental regulations. The increasing demand for energy-efficient appliances further complicates disposal efforts, as older models are often discarded without adequate recycling options available (Zeng *et al.*, 2018).

3. Telecommunication Equipment

Telecommunication equipment includes devices such as mobile phones, routers, and other communication tools that facilitate connectivity. The rapid advancement in mobile technology leads to frequent upgrades and disposals of older models. In Nigeria alone, it is estimated that over 1 million mobile phones are discarded annually (Nwafor *et al.*, 2020). The improper disposal of telecommunication equipment can result in significant environmental hazards due to the presence of toxic materials like cadmium and brominated flame retardants (Audu & Osunkunle, 2014).

4. Industrial Electronics

Industrial electronics comprise equipment used in manufacturing processes, including computers used for automation, control systems, and machinery components. As industries modernize and adopt new technologies, older equipment is often replaced and discarded without proper recycling measures in place (Ogawa *et al.*, 1996). This category of e-waste can be particularly challenging to manage due to the complexity of the devices involved and the potential presence of hazardous materials such as heavy metals and chemical solvents (Igbinomwanhia *et al.*, 2009).

Environmental Impacts of E-Waste is as a result of improper disposal of e-waste poses significant risks to human health and the environment. Toxic substances such as lead, mercury, and cadmium can leach into soil and groundwater, leading to contamination (Ogawa, 1996). Studies have shown that exposure to these hazardous materials can result in severe health issues, including neurological damage and respiratory problems (Igbinomwanhia *et al.*, 2009).

Current E-Waste Management Practices in Nigeria faces considerable challenges in managing e-waste due to insufficient infrastructure and public awareness (UNEP, 2019). Many urban areas rely on informal recycling methods that often involve unsafe practices such as open burning and acid leaching (Audu & Osunkunle, 2014). The lack of formalized recycling facilities further exacerbates these issues.

Methodology

This study employs a mixed-methods approach, integrating quantitative data collection techniques to assess the awareness and practices related to electronic waste (e-waste)

disposal among residents in Bauchi Metropolis. The quantitative component of the research primarily involves surveys designed to gather statistical insights into residents' knowledge, attitudes, and behaviors regarding e-waste management. The survey design and implementation instrument consisted of a structured questionnaire comprising closed-ended questions aimed at quantifying respondents' awareness of e-waste issues and their disposal practices. The questionnaire was distributed to a sample of residents across three selected neighborhoods: Tambari Housing Estate, New GRA, and Igbo Quarters in Muda-Lawal Areas. A total of 60 questionnaires were printed, with 40 completed forms returned, yielding a response rate of approximately 66.67%. The demographic distribution of respondents is illustrated in Table 1, which shows the percentage of respondents from each neighborhood:

Table 1: Percentage of respondents from each neighborhood in Bauchi Metropolis

Neighborhood	Number of Respondents	Percentage (%)
Tambari Housing Estate	18	45
New GRA	14	35
Igbo Quarters, Muda-Lawal	8	20
Total	40	100

Source: Researchers’ Fieldwork (2024)

The results indicated that 45% of respondents from Tambari Housing Estate exhibited a high level of awareness regarding waste management issues compared to 35% from New GRA and only 20% from Igbo Quarters. This disparity suggests that education and socio-economic status significantly influence awareness levels, with residents in more planned areas demonstrating greater concern for proper e-waste disposal. The quantitative data collected through the surveys were analyzed using descriptive statistics to summarize the findings. Key metrics included frequency distributions and percentages to represent the level of awareness and common disposal practices among residents. For instance, when asked about their knowledge of e-waste hazards, only 30% of respondents acknowledged the environmental impacts associated with improper disposal methods, while 70% either lacked knowledge or did not perceive any significant risks. Additionally, field observations complemented the survey data by providing context to residents' disposal practices. It was noted that 60% of respondents disposed of their e-waste alongside regular household waste, often resulting in improper disposal methods such as open burning or dumping in vacant lots. This practice contributes significantly to environmental degradation within the metropolis.

Results and Findings

The statistical analysis highlighted several critical findings regarding e-waste disposal practices:

- 30% of respondents were aware of the environmental impacts associated with improper e-waste disposal.
- 60% reported that they dispose of electronic devices improperly.
- Only 25% utilized designated collection points for e-waste.

These findings underscore a significant gap in both awareness and practical application of proper e-waste management strategies among residents. The implications for policy and practice of the quantitative results reveal a pressing need for targeted public awareness campaigns focused on e-waste management in Bauchi Metropolis. The low levels of awareness about the environmental impacts associated with improper disposal highlight an urgent need for educational initiatives that inform residents about safe disposal methods and recycling options. Additionally, improving access to designated e-waste collection points is crucial for encouraging responsible disposal practices.

The survey's findings highlight a critical issue: the majority of residents in Bauchi do not recognize the environmental hazards posed by e-waste. Only 30% of participants acknowledged that improper disposal could lead to soil and water contamination, while 70% either did not know or believed that it had no significant impact. This lack of awareness is compounded by insufficient educational campaigns on waste management and environmental protection. For instance, in Tambari Housing Estate, where 45% of respondents demonstrated a higher level of awareness, residents still struggled with proper disposal practices, indicating that even informed individuals may lack access to appropriate disposal facilities.

Current disposal practices based on field observations revealed that most e-waste was discarded improperly—either dumped in open spaces or burned without any pollution control measures. A staggering 60% of respondents admitted to disposing of their old electronics by throwing them in nearby vacant lots or burning them openly. This practice contributes significantly to environmental degradation in the region, as toxic substances from e-waste can leach into the soil and waterways, posing health risks to the community. The survey also indicated that only 25% of respondents utilized designated collection points for e-waste, which are often inadequate or poorly maintained. The remaining 75% resorted to informal disposal methods, further exacerbating the e-waste crisis in Bauchi. Observations showed that many residents were unaware of local regulations regarding e-waste disposal and recycling, leading to a culture of neglect towards proper waste management practices.

Implications for environmental health as a result of the improper disposal of e-waste have serious implications for public health and environmental sustainability. Toxic materials such as lead, cadmium, and mercury found in electronic devices can contaminate local

ecosystems when disposed of improperly (Nwafor *et al.*, 2020). The accumulation of these hazardous materials poses risks not only to the environment but also to human health, potentially leading to respiratory issues and other long-term health problems with key challenges of lack of public awareness about proper e-waste disposal methods, insufficient infrastructure for collecting and recycling e-waste and limited government policies addressing electronic waste management.

Conclusion

Effective management of electronic waste (e-waste) is crucial for achieving sustainable development in Bauchi's built environment. The findings indicate a significant lack of awareness among residents regarding the environmental impacts of improper e-waste disposal, with only 30% acknowledging these risks. Current disposal practices are alarming, as 60% of respondents improperly dispose of their e-waste, often through open burning or dumping in vacant lots. To address these challenges, it is essential to implement comprehensive public awareness campaigns and establish accessible recycling facilities. By adopting these strategies, Bauchi can mitigate the adverse effects of e-waste on public health and the environment, fostering a more sustainable urban future.

Recommendations for Improved E-Waste Management

1. **Public Awareness Campaigns:** Implement educational programs to inform residents about the dangers of improper e-waste disposal.
2. **Establishment of Recycling Facilities:** Develop formal recycling centers equipped with safe processing technologies.
3. **Policy Development:** Encourage local government agencies to create policies that promote responsible e-waste management practices.

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