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Analysis of the Knowledge of E-Waste Generation and Management Strategies in the Urban West Region, Zanzibar

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Abstract: The rise in electronic waste (e-waste) generation in Zanzibar has become a serious issue because of the increasing use of electronic devices in recent years. Approximately 2,300 tones of e- waste are produced each year in Zanzibar, highlighting the urgent need for effective management strategies to address the issue. This research focuses on analyzing the level of knowledge regarding e-waste generation and management strategies in the urban west region of Zanzibar. A case study research design was employed enabling the collection of both qualitative and quantitative data from traders and consumers in selected areas. This study was carried out in Zanzibar, specifically in locations with strong presence of electronic related business to ensure diverse representation. Participants in the study included electronics technicians, consumers' environmental experts, traders and urban municipal officers. A stratified random sampling was used to select a set of number of respondents from each group. Data were gathered through field observations, interviews with key informant and questionnaire. These findings reveal a sharp increase in e-waste production in Zanzibar. However, the awareness among consumers on proper disposal methods is low. Most participants were unfamiliar with safe disposal practices, and currently, there are no effective strategies in place for handling the e-waste. This highlights the critical need for structured management practices due to the harmful environmental impacts of improper disposal. The e-waste from the urban and other nearby areas is often burned along with other wastes in the main damp located at Kibele area in the region of Southern – Unguja, in Zanzibar, which poses serious health and environmental threats. This study concludes by emphasizing the urgent need to implement preventive strategies to protect consumers, traders, electronics technicians in Zanzibar from the health risks associated with unsafe e-waste handling.

Keywords: *Electronic Waste, Electronic Technicians, Harmful, Risks, Consumers, Health, Environment, Damp.*

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I. INTRODUCTION

In the last 20 years, the global demand for electrical and electronic equipment (EEE) has rapidly increased, while the lifespan of these devices has significantly decreased (Nnorom, 2008). As technology advances and more people use electronic devices, the need to develop methods for estimating and managing e-waste becomes increasingly urgent (UNEP, 2019). The global use of electrical devices is expected to keep rising, which leads to more imports and use of electronic products. This trend presents serious environmental challenges, highlighting the importance of monitoring e-waste generate and associated risks (DEAT).

By other hand, Namias (2013) notes that, Tanzania fast economic growth has led to greater movement of used electronics like TV, phones, laptops, oven and the likes. These imports demand effective implementation of the 3Rs (reduce, reuse and recycle). The proper management of electronic waste (e-waste) is crucial for conserving the environment and optimizing resources use (JEITA, 2005). However, many e-products release toxic substance like heavy metals that when it is burning can emit poison which can harm to general human life.

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Alternatively, in Zanzibar, managing e-waste remains difficult due to worsened by increased importation of used electronics due to economic growth and weak regulation. Therefore, this electronic importation poses serious health and environmental risks when not properly disposed in the urban region of Zanzibar (Kumar, 2019). Although, there are international guidelines promoting reuse, reduction and recycling, but Zanzibar remains weak in implementation of these guidelines.

II. METHODOLOGY

This research utilized both qualitative and quantitative methods and was carried out on Unguja island, part of Zanzibar. As well, Zanzibar is situated in the tropical Western Indian Ocean and bordering mainland Tanzania. It is the part of the United Republic of Tanzania. In like manner, it comprises of two major islands that are Unguja and Pemba. What's more, the combined area of Zanzibar is approximately 2,656 km^2, with Unguja covering 1,666 km^2 and Pemba 988 km^2 (Kombo and Kitwana, 1997). To add to that, the islands are located between latitudes 4^0 and 6.5^0 south of the equator, in the Indian Ocean.

As of 2022, the population of Zanzibar was about 1.8 million, with 68.7% living in Unguja Island (URT, 2022). The study sites were selected based on areas where there is a high concentration of electronics businesses and active engagement in buying and using electronics devices. Besides, these sites were not chosen for comparative purposes, but rather to reflect typical areas involved in electronic issue within Urban West Region of Zanzibar.

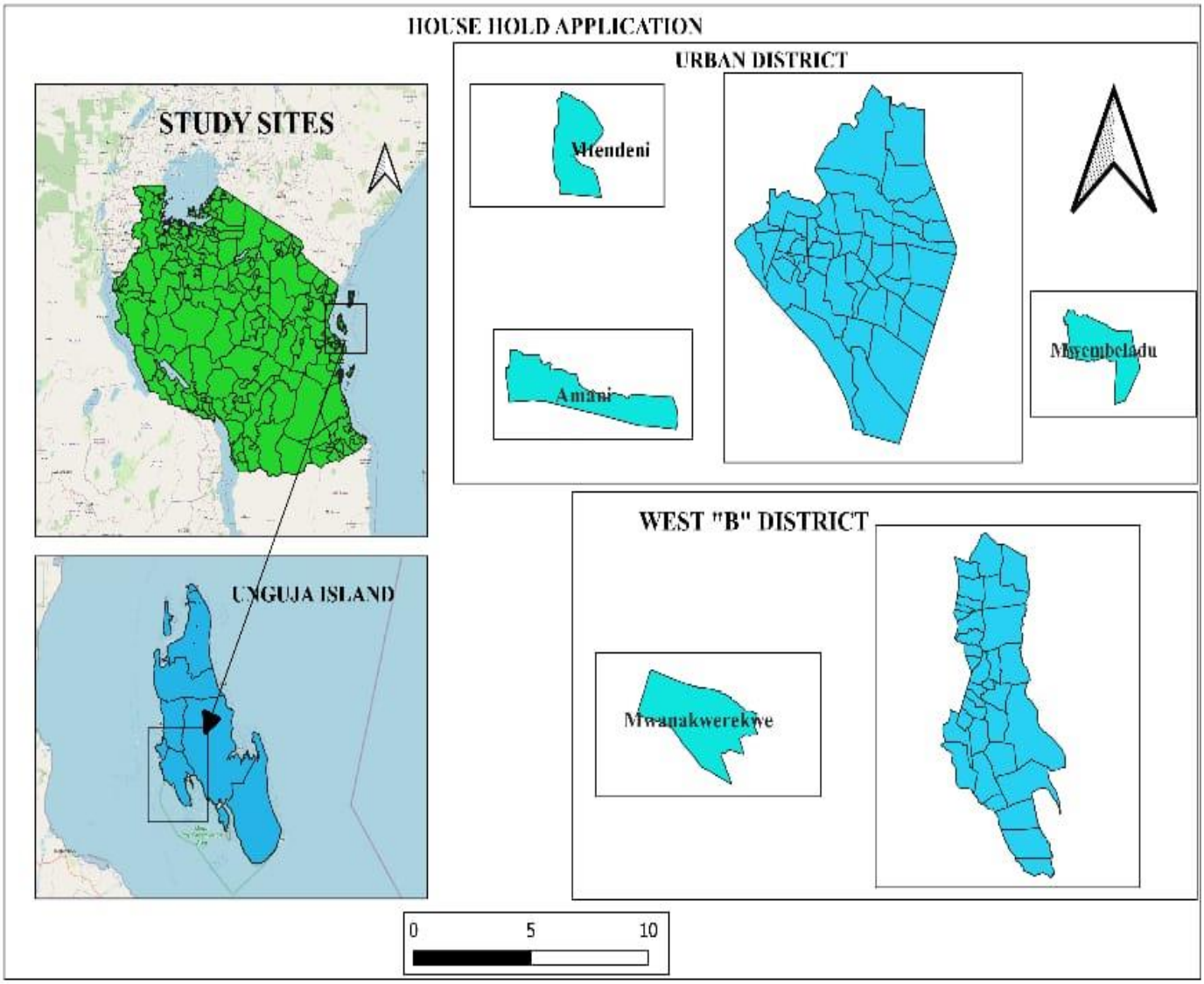

Fig 1 Population of Zanzibar

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III. RESULT AND DISCUSSION

A. *Stakeholders' Efforts Towards Sustainable E-Waste Management Strategies*

This study explored the initiatives taken by various stakeholders to support sustainable e-waste management in Zanzibar. The analysis involved gathering insights from electronics technicians, dealers, users, environmentalists and municipal officers. These different groups offered diverse understandings of e-waste management approaches. The focus areas included the methods used by stakeholders to manage e-waste and improve strategies for handling e-waste in the Urban West Region of Zanzibar.

B. *Techniques Used by Stakeholders to Support E-Waste Management*

This study aimed to identify stakeholder perspectives on how e-waste is collected and managed. According to the results, 65% of participants stated that establishing designated dumping sites for e-waste was the primary approach. About 20 % mentioned the enforcement of both formal and informal e-waste collectors. Additionally, 9.1% highlighted the separation of e-waste from other types of waste, while 5.8% indicated that recycling was being practiced. These finding are summarized in Table 1 below,

Table 1: Techniques Used by Stakeholders in Sustaining E-Waste Management Strategies in the Urban West Region

Responses	Frequency	Percent %
Established specific damps for e-wastes	78	65
Imposed formal and informal of e-wastes collectors	24	20
Enhanced separation between e-wastes and other solid wastes	11	9.1
Recycling of e-wastes	7	5.8
Total	**120**	**100**

Source: field data, 2023.

The results confirmed that stakeholders play a key role in maintaining e-waste management systems in Zanzibar. Their efforts –such as setting up designated e-waste dumping sites, involving both formal collectors and informal waste collectors, and promoting recycling, highlight their responsibility and commitment to sustainable waste practices.

Despite their effects, challenges still exist, including ineffective environmental practices, weak enforcement of laws lack of awareness and poorly managed collection and recycling systems. These problems worsen the impact of e-waste. This aligns with the 2007 national health policy, which promotes the safe disposal of hazardous waste, especially from health care sources, to protect public health particularly vulnerable groups.

The findings also support a study by Luoga et al. (2020). Which revealed that the lack of awareness and improper skills among e-waste consumers contributes to poor e-waste handling. Many consumers dismantle electronics unsafely for income, exposing themselves to health risks. This highlights the urgent need for training in safe and modern e-waste management practices, including recycling particularly in Zanzibar Urban West Region.

Additionally, the study agrees with Agarwal and Sarkar (2023), who emphasized that effective e-waste systems require improved collection and recycling processes. Stakeholder actions are essential to make e-waste systems more sustainable and reducing exposure to harmful substances like lead, flame-retardants.

These insights link to the National Energy Policy (2003), which promotes reliable and affordable energy use. It is also encourages the adoption of energy efficient equipment, contributing to better use of electrical and electronic equipment (EEE) and reducing e-waste generation.

C. *Strategies to Enhance E-Waste Management in Urban West Zanzibar*

This study intended to gather views from respondents about effective strategies for improving e-waste management in urban west Zanzibar. According to the findings:

- 51.6% of respondents emphasized the importance of raising awareness and encouraging responsible behavior
- 13.3% suggested enhancing the capacity of formal collectors and recyclers
- 31.7 % recommended strengthening legal and regulatory frameworks
- 3.3% supported the adoption of modern and advanced technologies

These results are outlined in Table 2 below

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Table 2: Strategies to Enhance E-Waste Management in Urban West

Responses	Frequency	Percent %
Increased awareness and responsible act	62	51.6
Strengthened formal collectors and recyclers	16	13.3
Improved legal and regulatory regime	38	31.7
The use of novel/advanced technologies	4	3.3
Total	**120**	**100**

Source: field data, 2023.

IV. CONCLUSION

In the urban west of Zanzibar, both consumers and informal collectors demonstrated limited knowledge on the improper handling of electronic wastes (e-wastes). Many view e –waste as a threat to human and environment. The growing amount of e-waste in this region is largely due to a lack of awareness and the absence of essential skills for its proper disposal. A significant number of individuals involved in dismantling electronics do so using unsafe methods, such as burning, burying, which pose serious health risks. Moreover, given these dangers it is critical to implement preventive strategies aimed at protecting these through education on safe e-waste handling and the use of protective tools. Meanwhile, technical solutions for managing e-waste exist, their success depends on supportive policies, effective collection systems, logistics and trained personnel. Since, most consumers and traders are lack of proper knowledge, all key stakeholders must increase awareness efforts. This campaigns should highlight safe e-waste practices like reuse, repair, recycling and correct disposal methods. Public education on the harmful effects of e-waste should also target traders and technicians through various platforms, including local leaders (shehas) and media outlets.

Furthermore, the use of outdated or unused electronics should be minimized, such items should be disposed in designated sites rather than with general waste. Legal frameworks must be enforced widely communicated to support proper e-waste management. To ensure proper handling and disposal, Zanzibar must prioritize the development of e-waste management system. This will guide users, facilitate collection and disposal and reduce the volume of e-waste accumulating in homes and the streets. Ultimately, this will lower the health and environmental risks associated with prolonged e-waste exposure.

➢ *Author Contributions*

- Asha O. Hamad: Responsible for conceptualizing the study, designing the methodology, conducting investigations and writing the first draft.

- Abdalla R. Mkumbukwa: Oversaw the research, helped with methodology, conducted formal analysis and contributed to reviewing and editing the writing.

➢ *Declaration of Interest*

Asha O. Hamad declares that there is no conflict of interest regarding this publication. The authors jointly agreed on and approved the publication of the article.

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