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Perceptions and practices on e-waste management in selected institutions of Zimbabwe

Margaret Macherera^{1*}, Vusumuzi Maphosa² and David Zezai³

1. Environmental Science Section Department of Crop and Soil Sciences, Lupane State University, Box 179 Lupane, Zimbabwe

2. Information and Communication Services Department, National University of Science and Technology, Box AC 939, Ascot, Bulawayo, Zimbabwe

3. School of Nursing and Public Health, Centre for Rural Health, University of KwaZulu Natal, South Africa.

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***Corresponding Author:**

mmacherera@gmail.com;
mmacherera@lusu.ac.zw

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ABSTRACT

Rapid industrialisation has seen the integration of electronic devices for process automation to support increased consumer demand and remain competitive. The rapid adoption of these devices has raised the production of e-waste. E-waste poses environmental and public health hazards. Proper management of this waste by relevant institutions may reduce the problem. This paper aims to determine the implications of the practices of selected institutions on e-waste management. The study was conducted in four purposively selected provinces of Zimbabwe. Participants included: ICT producers (4), regulators (3), government ministries (private sector civil society organisations (3), and municipalities (4). An interview guide with thirteen questions addressing each stakeholder sector's roles, perceptions, and experiences was used to conduct the in-depth interviews. Data were reduced by transcription and coding of the various data sources. The findings of the study show that there was no legislation directly talking to e-waste management in the country. E-waste was disposed of together with general waste at landfill sites. The importation of e-waste is not monitored since no legislation controls this activity. Telecommunication companies auction obsolete electronic gadgets to the public and other companies. The regulatory institutions did not consider e-waste a major problem in the country. There is no control over the importation of e-waste at ports of entry, resulting in non-compliance with the Basil and Bamako Conventions. E-waste was not regarded as a major problem in the country. This misconception results in a lack of control over the management of e-waste in the country resulting in environmental and Public Health problems.



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Introduction

Electronic devices are now a significant part of every aspect of human life, including education, commerce and communication (Bosamia, 2013). Today's typical household is packed with several electronic devices that support modern life and brings comfort and convenience. These technological devices have enhanced

communication and security, transformed the entertainment industry, and pushed consumers to pursue a better life in the knowledge economy era. Rapid industrialisation has seen the integration of electronic devices for process automation to support increased consumer demand and remain competitive. The rapid adoption of these devices has spurred technological and economic

development but has also raised the production of electronic waste (e-waste). The increasing adoption of electronic devices results in rapid obsolescence leading to the rising production and the accumulation of e-waste (Kumar et al., 2017).

The production of electronic devices has been rising to meet the ever-demand for electronic products, and recycling efforts need to catch up, resulting in a massive accumulation of electronic waste. Product miniaturisation, shorter life cycle and rapid innovation to meet ever-increasing consumer demands are fueling the growth of e-waste (Baldé et al., 2015). Advancements in electronic device design and constant improvements driven by consumer demands have seen the lifespan of computer equipment and related devices reducing from 5-10 years to about 3-4 years. They further decrease as designs focus on replacement instead of repair (Agamuthu et al., 2015).

Technological advancements are fueling obsolescence through shortened product lifespan due to consumer demand for enhanced product features and ever-changing lifestyles (Gurung et al., 2013). Thus institutions and consumers are ever replacing their old electronic devices with new ones, even if they are still working. Electronic devices are composed of plastics, glass and precious metals, and scholars report that over 1000 materials are used to manufacture electronic devices (Transel, 2017). Maphosa and Maphosa (2020) highlight that the manufacture of electronic devices is a complex process where over a thousand substances, including rare earth metals such as palladium, gold, copper and platinum, are mixed with toxic substances such as arsenic, mercury, cadmium and lead and many more.

E-waste is one of the fastest-growing streams of solid waste with toxic elements such as lead, mercury, cadmium, brominated flame retardants and polychlorinated biphenyls (Islam and Huda, 2019). Over 50 tons of mercury and 71 kilotons of flame retardants were released into the environment through e-waste activities, which have catastrophic environmental effects (Sabra et al., 2017). For most developing countries with high unemployment rates and poverty levels, informal e-waste management is seen as a source of employment and reducing poverty. It is reported that e-waste management activities at the Agbogbloshie, with an estimated annual income of USD268 million, directly supported over 200 000 people (Oteng-Ababio et al., 2014).

Although developed countries have invested in infrastructure and appropriate management policies, e-waste recycling remains expensive. This has seen some of the e-waste being

illegally exported to developing countries (Jinhui et al., 2013). Developing countries lack proper management and infrastructure for recycling e-waste, leaving its administration to the informal sector, which uses rudimentary methods to reclaim the precious metals and rare earth minerals found in the e-waste (Grant and Oteng-Ababio, 2012). Due to poor economic performance, developing countries allow institutions and citizens to acquire second-hand computers for automation and office work. However, these quickly become obsolete, raising environmental and human health concerns (Maphosa and Maphosa, 2022). As developed countries export used electronics to developing countries, this extends their useful life and assists in bridging the digital divide as most citizens from developing countries cannot afford to buy new electronic equipment. Without policies and infrastructure, second-hand equipment quickly becomes e-waste. Developing countries lack recycling technology and use intensive manual recycling methods. This has resulted in Africa accounting for only 0.1% of its e-waste recycled formally, lower than a 30% global average set for 2023 (Forti et al., 2020).

Perkins et al. (2014) noted that heavy metals contaminate the soil and water bodies due to improper disposal, threatening the environment and public health; informal e-waste workers and nearby communities are directly exposed to toxins released during the burning to recover precious metals. Lack of appropriate recycling infrastructure and policies results in e-waste being disposed of together with municipal waste, thereby finding its way into dumpsites and landfills. The lack of e-waste management policies in developing countries affects the separation of e-waste from the source. Thus, institutions do not have dedicated collection points for e-waste.

E-waste management in developing countries is mainly informal, where primitive methods such as using stones, chisels, burning plastic casings, and acid leaching are used to recover precious minerals (Li et al., 2013). Thus low recycling levels result in the accumulation of e-waste, posing an environmental hazard through increased pollution. The economic value of e-waste is not realised and at the same time, improper management results in adverse effects on the environment and human health (Jinhui et al., 2013; Maphosa and Maphosa, 2022). Data on e-waste recycling is scarce. Only a few countries, such as South Africa, Egypt, and Rwanda, have invested in e-waste recycling infrastructure and enacted policies to support appropriate management (Grant and Oteng-Ababio, 2016).

The Zimbabwean government removed the import duty on information communication technology (ICT) devices (Techzim, 2015) and allowed institutions and citizens to import second-hand devices to automate and participate in the knowledge economy, thus increasing the consumption and obsolescence rate. The country's economy is largely informal, with few job opportunities from the formal sector, and this has seen many people engaging in e-waste management activities. Zimbabwe's economic challenges over the past two decades have forced individuals and institutions to buy cheap and second-hand electronics from developed countries, thereby fuelling e-waste accumulation (Chitotombe, 2013).

Zimbabwe has no policies that support the appropriate management of e-waste and has not invested in infrastructure to manage e-waste effectively (Mutsau et al., 2015). The lack of national policies has negatively impacted the establishment of institution-based policies, crippling the effective management of e-waste. This results in the indiscriminate disposal of e-waste by institutions and individuals. E-waste is collected with municipal waste and deposited in the country's landfills and dumpsites, threatening the environment and human health (Maphosa and Maphosa, 2020). E-waste is becoming a burden as there is evidence of e-waste burning in major cities in Zimbabwe, where toxic elements are released into the environment (Chitotombe, 2013).

Understanding the issues related to e-waste management in these areas is crucial to implement proper and sound management measures to reduce the risk of e-waste accumulation. Furthermore, the output of this study can be an essential framework for developing policies and practices sensitive to e-waste hazards. This study aimed to assess the implications of institutional practices on e-waste management in Zimbabwe. The remaining sections of the article are organised as follows: the next section discusses the method and the study setting. The data analysis and presentation of results follow this. A general discussion on the issues that affect e-waste management is presented. Finally, the study presents the conclusions and recommendations on how e-waste management can be improved, the research's theoretical implications, and its impact on practice.

Method

Study design

To investigate the continuum of institutional roles and practices on e-waste in Zimbabwe, a qualitative research design was

adopted since this has been shown appropriate when researching a social phenomenon, of which e-waste strategy is one, and shown to combine exploratory and explanatory elements, which our research questions sought to answer.

Study setting

The study was conducted in four purposively selected provinces of Zimbabwe, a landlocked country in Southern Africa, between the Zambezi and Limpopo rivers. South Africa, Botswana, Zambia, and Mozambique border it. Based on the Census of 2022, the country's total population was 15 178 979. Of the population, 7289558 males and 7889421 females, giving a sex ratio of 48% males and 52% females (Zimstat, 2022). The majority of the population has low socio-economic status and average education. Zimbabwe has a moderately growing ICT service sector due to its adoption of various digital technologies in many services. Sectors such as universities, colleges, government ministries, and municipalities are active producers of electronic waste as they actively participate in tech- processes.

Study population and data collection

Purposive sampling was conducted. This sampling technique was appropriate in this study since it is widely used when recruiting participants who can provide in-depth and detailed information about the phenomenon under investigation (Palinkas et al., 2015). With qualitative research, triangulation of data sources is recommended to strengthen research validity and reliability (Boyce and Neale, 2006). Therefore, critical informants from various sectors of the economy were recruited for the study, ranging from the public sector, private sector, civil society organisations and municipalities. An interview guide with thirteen questions addressing each stakeholder sector's roles, perceptions, and experiences was used to conduct the in-depth interviews.

In-depth interviews are a qualitative data collection method that allows for the collection of a broad range of information about the behaviour, attitude, and perception of the interviewees by giving researchers and participants the freedom to explore additional points and change the direction of the process when (Saunders and Thornhill, 2012). It is ideal for situations such as the current study where knowledge of the discussed matter is limited. The interview guide was pre-tested before administering the final version. The number of participants in the in-depth interviews was: ICT producers (4), regulators (3), government ministries and private sector civil society organisations(3), and municipalities(4). Each in-

depth interview lasted for an average of forty-five minutes.

Table 1. E-waste management Institutions

Institutions	Description
Regulators	Government departments, parastatals responsible for waste management, control of imports and post and regulation of post and telecommunications
Municipalities	Local authorities responsible for the management of e-waste.
Private sector	Telecommunication companies
Civil society organisations	Non-governmental organisations and private voluntary organisations dealing with e-waste

Ethical approval

Permission to conduct the study was sought from and granted by various institutional leadership. The Medical Research Council of Zimbabwe approved this study (MRCZ/A/2811). Written informed consent was obtained from all participants. Participation in the study was voluntary. Data were treated with maximum confidentiality by storing it in password-protected computers only accessed by the principal investigator and authorized research team members.

Results

Institutions studied were selected according to their involvement in ICT and environmental management. In-depth interviews were conducted with 40 representatives of the selected institutions from the four cities that were studied. Some institutions only had representatives in the capital city, while some could not participate due to failure to get clearance from their Head Offices. The institutions were divided into four categories: regulatory (Government Ministries and parastatals), municipal, private sector and non-governmental organisations.

Knowledge of E-waste and its dangers

Most of the representatives of the studied organization across the institutions defined e-waste as any device that has become obsolete and beyond repair. At the same time, some said it is waste generated from electronic gadgets, e. g.

Data analysis

The primary interpretation of interview data was fed back to interview respondents to check the validity of the interpretation with the source. In parallel, data were reduced by transcription and coding of the various data sources. In line with recommended practice, the codes were descriptive. They were iteratively developed from the foundation of the pre-formed, literature-derived categorizations of e-waste strategies, perceptions, and practices. Code validation was undertaken within the author group through scrutiny and discussion of the code categorization and interpretation of interview transcript samples. Data were displayed via a presentation on a spreadsheet matrix to enable cross-source triangulation. Data were then analysed through a qualitative classification system based on triangulated source frequency. NVivo software was used to gather and organize data appropriately as needed.

obsolete and old phones, computers, photocopiers etc.

When asked about the environmental and public health dangers of e-waste, most representatives in the regulatory category thought that dangers were there. However, they were unsure if the dangers of waste were significant in Zimbabwe because they considered the e-waste produced too little to pose harm. One response from a regulatory authority, a Government Ministry, had this to say:

There are no dangers from electronic waste because we have little e-waste in the country. Dangers may arise from toxic smoke as well as explosions.

Some estimated that dangers might be anticipated in 10 years if the waste is not handled correctly. The general feeling was that e-waste in Zimbabwe does not pose severe environmental and public health problems. However, there were also indications that most electronic devices contain chemicals that may harm people and animals. One representative of a regulatory authority had this to say:

Dangers are there, but I would like to know if there are significant in Zimbabwe with the e-waste we have; maybe as we go in the future, in the next ten years, if the waste is not handled correctly, it poses problems.

However, a representative of the same Regulatory authority from a different town was of a different opinion. He had this to say:

Most of these electronic devices contain chemicals that may harm people and animals. Let us take, for example, phone batteries with mercury

that can harm people and animals, especially if it enters water bodies. If people and animals drink this contaminated water, it can harm them. Batteries can also be dangerous, especially if they are exposed to heat. They can explode, and such explosions can cause injury or even death of people.

There was no uniformity in the information on the dangers of electronic waste within and across institutions. Municipality representatives and non-governmental organisations (NGOs) agreed that there were dangers that may arise from e-waste, but there were no specific responses. The responses on the hazards were general. For example, one respondent from an NGO said:

Yes, there are many health hazards. I believe so, just like any threat that is caused by not properly disposing of waste.

Views from respondents in the telecommunication sector on the environmental and public health dangers of e-waste showed that the representatives from this sector had some knowledge of the dangers of electronic waste to public health and the environment. One of the respondents from the telecommunications sector said:

Every waste product has some hazardous issues, primarily if not appropriately handled. These electronic waste products are hazardous because they contain toxic substances such as carcinogens. Such substances might affect the health side of individuals prone to such waste.

Yes, e-waste is hazardous to the environment if not handled properly because some organisations and individuals tend to burn and bury these solid materials. These products accumulate underground when buried, thereby causing environmental dangers.

Monitoring of the importation of electronic gadgets

According to the responses from the key informants, the importation of everything that comes into Zimbabwe is monitored. Monitoring was said to be mainly for revenue collection purposes. There was no monitoring for the control of the importation of e-waste. Before the importation, gadgets must be checked to determine whether they are functioning or obsolete. The main concern is tax and revenue generation. No regulations controlled the importation of electronic gadgets in terms of their condition. Available regulations were for tax purposes. The Zimbabwe Revenue Authority was said to be the custodian of the regulations on imports. The importation of ICT equipment was duty-free at the time of the study. One key informant from the NGO sector had this to say:

It is not being monitored because we do not have restrictions on the quality of the products, we do not have restriction durability of the product and other issues. According to ZIMRA, the Taxman's Corner, most gadgets are free of duty. They are only taxed after they have reached an amount of US\$1000. Hence such regulation is described as a quota. So that is the only regulation I know has been established.

Computers and other selected Information and Communication Technology (ICT) equipment can be imported customs duty-free. Customs Duty on the importation of products listed in the table below was removed to promote the development of the Information and Communication Technology Sector. There are no specific regulations controlling the condition of imported ICT equipment.

Another critical informant from one of the municipalities echoed similar sentiments on the lack of control over importing electronic gadgets into Zimbabwe.

Yes and no to monitoring electronic gadgets' importation. Yes, because anything that passes through the ports of entry pays tax. On the other hand, we hear of goods being smuggled into the country. This means that even electrical gadgets are being smuggled.

Management of E-waste and regulations controlling its management

Responses from the key informants revealed that telecommunication companies have obsolete electronic gadgets on their premises. They are, from time to time, auctioned to companies and the public, and some are sold for spare parts by repairers. Municipalities are responsible for the collection and disposal of all types of waste. Government departments look for takers like people who are in the recycling business. With waste generated in government offices, there are some procedures where they must declare it obsolete it goes through a tender process for you to dispose of it. Most of the departments keep obsolete electronic gadgets in storerooms on their premises.

Different organisations handle e-waste differently. Some keep the waste on their premises, while others dispose of it with general waste. One key informant from a government department said that Government departments keep and resell obsolete gadgets after the board of survey approves, and those that are not bought are burnt or incinerated. There is no waste segregation in most organisations. The waste is mixed during transportation and final disposal in organisations where segregation is done. Generally, e-waste is handled as general waste. A respondent from one

of the municipalities had this to say about e-waste management in their city:

As X city council, we have yet to have a standard handling of e-waste material. There is no specific or unique way of handling e-waste. It is just treated like any other waste. There is no separation during collection disposal. As X city council, we do not have the human and material resources capacity to separate e-waste from any other waste.

Some telecommunication companies said reusable waste was sent to Head offices (Harare). However, the obsolete ones were discarded in bins together with municipal waste. When asked about recycling e-waste, most organization representatives needed to be aware of recycling companies. One representative of the NGO sector had this to say:

E-waste is growing out of control if concrete action is not implemented. Most organisations are disposing of electronic gadgets, such as TVs which contain hazardous substances. In Zimbabwe, e-waste is handled informally by individuals or other private sectors, although they cannot recycle such waste. They can only collect the waste and sell it to other institutions from other countries, such as South Africa, that can recycle them. We only consider much at our organization as municipal waste, which is being separated conveniently. Unfortunately, we do not separate waste electronic waste from any other waste.

There was information about a company in Harare that collected e-waste and sent it outside the country for recycling. The key informants were not aware of the name of the company and the country to which the waste was exported; on the regulations governing the management of e-waste, two pieces of legislation were mentioned, which are the Environmental Management ACT Chapter 20:27 and Statutory Instrument 6 (SI 6) of 2007 under the same Act which is known as the waste disposal regulations. Pieces of legislation are not specific to e-waste, but they control all types of waste, pointing out appropriate waste disposal. The Environmental management authority, Ministry of Health and Child Care and Local authorities, through the Public Health Act and Municipal By-laws, respectively, regulate the storage, handling and disposal of all types of waste. Currently, there is no legislation specific to e-waste in Zimbabwe, as pointed out by all the respondents in the four categories.

One of the respondents from a regulatory authority had this to say about regulations that control the management of e-waste.

We have Statutory Instrument 6 of the EMA Act. These are waste disposal regulations and the Environmental management act; However, it is not specific to e-waste; it says waste is to be disposed of

appropriately, so appropriateness will be considered according to the type of waste. If it is biodegradable, it is composting; if it is plastic landfilling and recycling, whatever means necessary.

Some of the key informants in the telecommunications sector.

Roles of various institutions in the management of e-waste

Most telecom organisations did not realize that they had roles in the management of e-waste. The management of e-waste was seen as the duty of the municipalities, the Environmental Management Authority and the Ministry of Health and Child Care. The duties of these organisations were said to be carrying out awareness campaigns and other educative programmes about the dangers of waste as well as developing and implementing policies and regulations regarding the management of e-waste. The responses showed that the studied organisations did not consider the activities they carried out as part of the management of e-waste. All the key informants from the telecommunications sector shared the same sentiments. One of the respondents from the telecommunications category had this to say:

Here in the city of B, we have yet to participate in the management of e-waste. It is the duty of municipalities, EMA and the Ministry of Health.

The respondents were asked about the organisations and individuals they recognised as stakeholders. Most of the representatives of the studied organisations mentioned regulatory authorities as stakeholders, while representatives of regulatory authorities said all citizens as stakeholders. One representative of a regulatory authority had this to say about stakeholders in the management of e-waste:

Stakeholders include the users of e-waste; almost everyone in the country has a phone, refrigerator, or radio, and their role is to understand the risk and potential dangers of using electronic waste; we have heard of gadgets exploding while charging.

Local Authorities are responsible for managing waste in their areas of jurisdiction. They have to construct landfills. They should create conditions necessary for the safe handling of that e-waste. They also disseminate information on e-waste.

Availability of e-waste recycling Centers in Zimbabwe

All the categories of respondents concurred that there were no e-waste recycling centres in Zimbabwe. However, one of the

telecommunication company representatives noted that company Y collected electronic waste for recycling outside Zimbabwe. One of the regulators had this to say:

Zimbabwe has no e-waste recycling sectors that are formally registered. I am unaware of any recycling organisations operating in Zimbabwe, even from the private sector. A company in Harare asks organisations for obsolete computers, and then they break them up. They ship them to China, and some chips can last for a long time that piece that radioactive; if you take them back to the manufacturer, they can still use it.

Discussion

Institutions that deal with information and communication technology (ICT) and those that deal with environmental management are important in the management of e-waste. In the current study, these institutions were studied to deduce the implications of their practices to the management of e-waste. The study revealed that the representatives of the studied institutions perceived no legislation specific to the management of e-waste. However, the Environmental Management (effluent and Solid Waste Disposal) Regulations of 2007 (SI 6 of 2007) provide for the management of all types of waste in Zimbabwe, even though there is no mention of electronic waste specifically (Government of Zimbabwe, 2007). Representatives of the studied institutions did not relate this legislation to the management of e-waste. This piece of legislation is administered by the Minister of Environment and tourism, which houses one of the institutions that was studied. This may mean that this legislation needs to be effectively enforced to cater for electronic waste due to misinterpretation by the relevant authorities.

The regulatory authorities in the current study affirmed that no legislation controls the importation of electronic gadgets to prevent the importation of e-waste in Zimbabwe. The available pieces of legislation focused on customs and excise. This is even though Zimbabwe is a signatory to the Basel and Bamako Conventions that outline international regulations for the trade of hazardous wastes. The treaty of Basil convention has policies restricting the transboundary movement of hazardous substances except where it is apparent that the movement is according to the principles of good management (UNEP, 2011). A similar situation was reported in Ghana, where there is non-compliance with the Basel and Bamako Conventions (Daum et al., 2017).

The Basil Convention also requires Parties to adopt domestic legislation to prevent and punish

illegal traffic in hazardous wastes. This is not followed in Zimbabwe, especially in controlling the importation of obsolete electronic gadgets from Western countries (Khan, 2016). This is despite research indicating that e-waste quantities are increasing faster than any other form of municipal waste (Onac, 2020) and is estimated to increase to 78 million Mt by 2050 (Asefi et al., 2019). Our findings concur with a review by Shahabuddin et al. (2022), who identified the lack of e-waste legislation as one of the key challenges regarding e-waste and its management. They reported that most developing countries still need to get e-waste legislation. The lack of legislation results in the lack of control over the activities of the various stakeholders that deal with e-waste resulting in negative impacts on the environment and the health of the citizens.

Most of the representatives of the institutions that were studied did not regard e-waste as a significant problem. The implications are that these institutions will not advocate for legislation that controls the management of e-waste, and they may not manage this type of waste appropriately, resulting in environmental and public health problems. Knowledge of the dangers of e-waste may cause poor management of e-waste, such as the lack of separation of e-waste from general waste and the dumping of e-waste at landfills that the respondents reported. The other implication is the failure to provide appropriate protective clothing and equipment to the handlers of such waste. The fact that even some of the regulatory authorities viewed e-waste as a minor problem is a cause for concern, especially the Environmental Management Authority that is supposed to administer controls. Municipalities had a better understanding of the dangers of e-waste than other institutions; however, their management practices did not correspond to their knowledge, as it was noted that all the municipalities used landfills to dispose of e-waste. According to Osibanjo&Nnorom (2007), proper end-of-life management practices for electronic waste must include repair and remanufacturing, recycling, incineration and disposal using appropriate landfill technology must be a last resort. This hierarchy was not followed in the current study, as e-waste was reportedly dumped at dumpsites.

The representatives of the institutions that were studied reported that they separated their waste at source, but the waste was mixed during transportation and final disposal. There was no motivation for separating waste because all types of waste were disposed of at the landfills. This does not concur with what is required by Part IV of the

Environmental Management (Effluent and Solid Waste Disposal) Regulations of 2007, which states that every waste generator should provide and adhere to waste management plans. These plans should have an inventory of the waste management situation that specifies the quantity of waste and its components. Institutions must provide plans for environmentally sound waste management (Government of Zimbabwe, 2007). Even though there is legislation that is not very specific to e-waste, the regulatory authorities are expected to be able to interpret and enforce them or at least adhere to them. The failure to enforce this legislation may result in other generators of electronic waste also mixing their waste and indiscriminately disposing of it.

According to the Department for Environment, Food and Rural Affairs (DEFRA), there are hazards in e-waste management, including hazardous chemicals such as CFC fluids, polychlorinated biphenyls (PCBs), mercury, cuts and abrasion risk, fire and explosion risk, among others (DEFRA, 2006) On the positive side, e-waste contains precious metals that can be recovered using the urban mining of e-waste if adequately managed (Shahabuddin, 2022). Furthermore, adopting and implementing e-waste management strategies, policies, and legislation can improve health and provide a healthy environment (Abalansa et al., 2021).

Conclusion

All the municipalities that were studied managed e-waste as general waste. This discourages proper management of e-waste by other stakeholders since the waste is mixed at final disposal. The authorities supposed to control the importation of e-waste do not have any legislation to control the importation of such waste, resulting in a lack of control at the ports of entry into the country. This lack of legislation also results in non-compliance with the Basil and Bamako conventions. The representatives of the institutions studied did not regard e-waste as a major problem in the country. This misconception results in a lack of control over the management of e-waste in the country resulting in environmental and Public Health problems. The Statutory Instrument 6 (SI 6 of 2007) under the Zimbabwe Environmental Act, known as the waste disposal regulations, is silent on e-waste. This may result in the institutions overlooking the proper management of e-waste.

Recommendations

The Environmental Management Authority should initiate the promulgation of legislation that controls e-waste. Municipalities

should properly dispose of e-waste and conduct awareness campaigns to promote the proper management of e-waste. The government and corporates should work together to improve the management of e-waste.

Author Contributions

VM, MM and DZ participated in designing the study and Data collection; MM analysed the data and drafted the manuscript. VM and DZ read all the versions of the manuscripts and made the necessary changes.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Abbreviations

CFCs-Chlorofluorocarbons
DEFRA-Department for Environment, Food and Rural Affairs
EMA- Environmental Management Authority
ICT- Information and Communication Technology
NGO-Nongovernmental Organisation
PCBs- polychlorinated biphenyls
SI- Statutory Instrument
UNEP- The United Nations Environment Programme
ZIMRA- Zimbabwe Revenue Authority
Zimstat- Zimbabwe Statistics Authority

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