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**AN ASSESSMENT OF WASTE MANAGEMENT CHALLENGES AND PROSPECTS IN
HIGH DENSITY SURBURBS, ZIMBABWE: A CASE STUDY OF BUDIRIRO 1,
HARARE**

By

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Dedication

I dedicate this dissertation to my parents, who instilled a work ethic in me from a young age and never ceased to emphasise the value of education. I also hope that my younger siblings will be inspired by this work, which I dedicate to them with the utmost affection.

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Without the excellent guidance and tireless assistance of my most esteemed supervisor Mrs. Masona, to whom I am deeply indebted, my dissertation might not have been published or would have likely taken much longer to finish. She opened my eyes as she went alongside me along the rarely travelled path of inquiry and fed me the nutritious milk of academic wisdom, demonstrating her astounding knowledge and complete mastery of the subject. I would like to thank Mr. Dzingai and Mrs. Justinos for their essential help in compiling my dissertation, particularly with the research questionnaires and analysis. The assistance I received from EMA and Budiro Council and the Department of Waste Management throughout the gathering of my data was quite gratifying.

Abstract

This study's objective was to characterize waste produced in Budiriro 1, gauge community knowledge of waste management, and identify household waste management strategies and challenges in Zimbabwe's high-density suburb of Budiriro 1. Waste management in high-density areas poses unique challenges due to the complex interplay of factors such as population density, limited space for infrastructure, diverse waste composition, and socio-economic disparities.

The methodology employed a combination of approaches to gather data in both quantitative and qualitative formats. A survey questionnaire, an examination of the waste's composition, and interviews with major participants including residents, the Local Council, and the EMA were all used in the study. Analyses of the data showed that ablution, plastics and organic waste made up the majority of the waste produced in Budiriro 1. The practices used to manage waste were composting, burning, burying, dumping on open space, selling waste and recycling. determined to be insufficient, and the lack of proper infrastructure for waste collection and disposal resulted in widespread burning and dumping of waste.

One of the study's main conclusions was that there was a glaring lack of infrastructure for waste collection and disposal, inadequate waste segregation practices, and insufficient waste management strategies by local authorities and residents. The lack of public participation and understanding in handling waste was another important concern, the survey found. This was due to lack of education and awareness to the residents about waste management and consistent collection of waste in suburb.

The study concludes by emphasizing the pressing necessity for local authorities to enhance the waste management practices in Budiriro 1. The study urges the construction of sufficient facilities for waste collection and disposal. The study suggests that in order to accomplish sustainable waste management in Budiriro 1 and other high-density areas in Zimbabwe, there is a need for public education and involvement in waste management activities. The residents of

Budiriro 1 and the neighbouring areas will live in a cleaner, healthier, and more sustainable environment thanks to improved waste management actions.

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List of Abbreviations

EMA	Environmental Management Agency
ILO	International Labour Organization
UNEP Programme	United Nations Environmental
UNSD	United Nations Statistics Division
WHO	World Health Organization
ZIMSTAT	Zimbabwe National Statistics Agency

CHAPTER 1

INTRODUCTION

1.1 Background of the study

In densely populated urban areas, especially in underdeveloped countries, there are complex environmental problems that are becoming increasingly difficult to address. One major issue is the generation of waste, which is exceeding the capacity of municipalities to dispose of it properly, resulting in disposal problems (Srinivas, 2016). Developing countries suffer from high levels of pollution due in part to inadequate waste disposal facilities (Ana et al., 2016), putting approximately 5.5 million people at risk of fatal diseases related to poor waste management (Hardoy et al., 2015). The implementation of proper waste management strategies could prevent these diseases (Zerbock, 2013).

In many places, waste classification is required by law to guarantee that waste is properly managed and dealt with in a safe and environmentally friendly way. Depending on the type of waste, its potential impact on the surroundings and the well-being of people, and the manner of disposal, different statutory requirements for waste classification apply (European Commission, 2018). It is crucial to identify any substances that could be dangerous, including chemicals, heavy metals, and radioactive materials. If handled and disposed of improperly, these substances can present significant dangers to the environment and human health (US Environmental Protection Agency, 2020). By employing waste characterisation to find recyclable and recoverable parts, the amount of waste that ends up in landfills can be reduced. This can help preserve natural resources and decrease the negative effects of disposing of waste on the environment (US Environmental Protection Agency, 2020).

Waste management in Zimbabwe is becoming increasingly difficult due to various factors, including limited funding and technical expertise, lack of environmental education, and a growing population. This presents a significant challenge for the Harare City Council, as the high concentration of people generates a large amount of waste that must be managed with limited resources and space. As a result, domestic, industrial, and scrap waste is often dumped in open areas and along roadsides, leading to the spread of diseases such as cholera, typhoid, malaria, and dysentery. Poor waste management was identified as a contributing factor to cholera and typhoid outbreaks in Harare in 2008 and subsequent years (Saungweme, 2014; Chinobva & Makarati, 2014), prompting the attention of organizations such as EMA, city councils, and WHO.

The Department of Waste Management in Harare noted that between 2005 and mid-2009, the municipality was unable to collect waste due to economic difficulties. This prolonged period of waste accumulation likely resulted in a culture of littering and illegal dumping, as children growing up during that time may have never witnessed proper waste management practices (Harare Department of Waste Management, 2014). As a result, waste is often burned in public areas or deposited in unauthorized locations, leading to a growing pile of waste that is of concern to EMA. There is a strong association between city population size and the percentage of waste moved, as well as the frequency of regular waste collection in households, despite attempts by waste management authorities to establish collection systems and waste minimization strategies. This implies that managing waste will become a more difficult task as the city grows (Chirisa, 2014).

Solid waste management is a fundamental urban service that reflects the competencies and commitment of a municipality. In Harare, the collapsed solid waste management system is apparent, and one does not need to be an environmental manager to observe it. This collapse can be attributed to various limitations facing developing countries, such as financial, technical, and administrative constraints, which hinder effective waste management and disposal (Jerie, 2016). The waste generated in Harare comes from various sources, including domestic and industrial activities, necessitating environmentally, ecologically sound, economically feasible, and socially acceptable waste management methods that do not endanger human health (UNEP, 2016).

Therefore, the management of waste from homes, such as domestic waste, is concerning, particularly considering the increasing production of waste.

The purpose of this study is to examine the effectiveness of conventional waste minimization techniques, including reuse, recycling, decreasing, avoiding, and land filling. Given the significant challenges associated with waste management, it is crucial to emphasize the importance of having appropriate compactors, qualified personnel, environmental education, and adequate financial resources (WHO, 2015). Currently, waste management in most of Harare's residential areas involves collecting waste from high, medium, and low-density regions and disposing of it at designated locations, such as the Pomona dumpsite, without proper segregation and treatment (Mubaiwa, 2013). This research seeks to evaluate the difficulties and prospects of waste management techniques in Harare's high-density residential areas.

1.2 Statement problem

The dumping of waste in unauthorized areas, which has contributed to the spread of diseases like cholera and typhoid in Budiro, influenced this study. Harare's population is growing due to urbanization and industrialization, and the city council is struggling to keep up. As a result, citizens are adopting practical waste management strategies to assist their communities. This study focuses on Budiro to examine the challenges and prospects of waste management methods in high-density areas.

1.3 Main Research objective

To investigate the difficulties and potential for waste management techniques in densely populated places, with an emphasis on Harare.

1.4 Specific Objectives

The study seeks to achieve the following objectives:

- To characterise waste generated in Budiro
- To assess community knowledge on waste management
- To determine household waste management strategies and challenges in Budiro

1.5 Research questions

What kind of waste is being generated in Budiriro?

What is the community knowledge on waste management?

What are the challenges and strategies of waste management in Budiriro?

1.6 Justification of the study

Proper and supervised characterization of solid waste, along with information about its sources, is expected to significantly enhance waste management. The findings of this research will offer city officials and planners a factual basis for any suggested policies regarding domestic waste management.

This research attempts to close a knowledge gap created by previous studies that examined waste disposal methods in densely populated areas. While some of this data is compiled in day-to-day publications and reports, other data is not. The goal of this study is to draw attention to the fact that population is not constant and that it changes as a result of a variety of factors. As a result, authorities must be vigilant, encourage waste management practices to change over time, and make sure that the waste management strategies that are currently in use adhere to sustainable development standards. In order for responsible authorities to develop a strategy to reduce waste dumping, the study aims to discover how waste is managed and how residents use it in their daily lives.

This study is important for promoting the sharing of information among cities in Zimbabwe and the wider region. It aims to highlight the importance of waste management and encourage project-based learning on creating cleaner, greener environments through waste management awareness. This will help to develop people's intellectual, emotional, and social needs. The research findings will also serve as a valuable resource for other researchers and advocacy groups conducting similar studies.

This study is vital in identifying areas where waste management by the Harare City Council can be improved. It has the potential to provide valuable advice to both governmental and non-governmental organizations involved in waste management issues in the city. Additionally, conducting this research will enhance the researcher's practical analytical skills, while also

improving the reputation of the Bindura University of Science Education as a training institution and promoting its services. Other students, researchers, and university professors can use the study as a secondary data source. The study will also benefit the community by providing guidance on proper waste disposal methods and highlighting the potential risks associated with various waste management techniques that could harm the environment and human health..

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

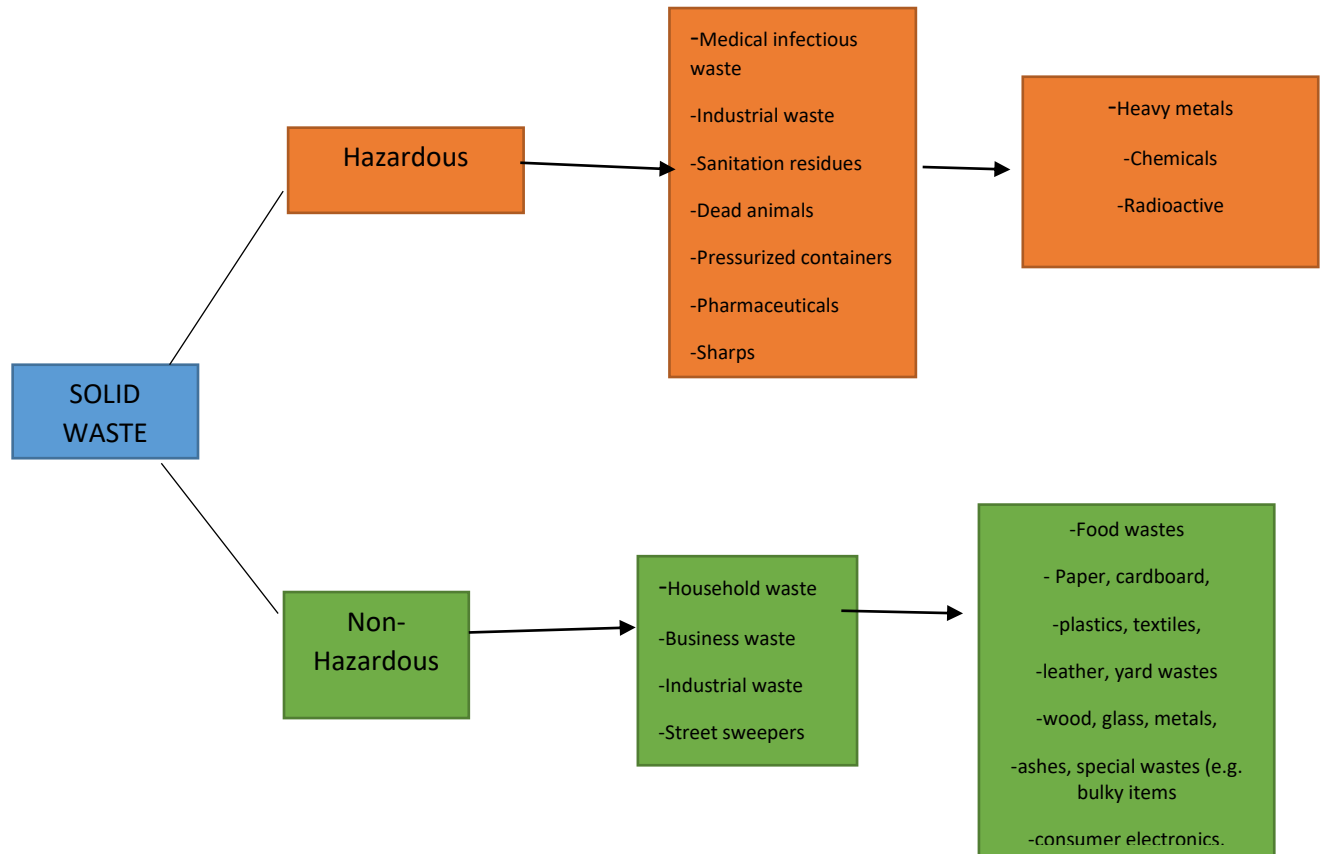
Waste management in high-density areas poses unique challenges due to the complex interplay of factors such as population density, limited space for infrastructure, diverse waste composition, and socio-economic disparities. Despite the significance of the issue, there is a lack of comprehensive understanding regarding waste management in high-density areas. This literature review aims to address this gap by examining existing research and providing a detailed analysis of the challenges and prospects associated with waste management in such areas.

2.2 Characterization of waste generated in high-density areas

Understanding the quantity and composition of waste generated in high-density areas is crucial for designing effective waste management systems. This objective aims to analyze previous studies and identify common patterns in waste generation rates, types of waste produced, and the factors influencing waste generation in these areas

Waste characterization involves categorizing waste into various groups, including organic waste, plastics, paper, metallic waste, hazardous waste, and non-hazardous waste. Numerous types of waste can be classed, including liquid, solid, organic, recyclable, and hazardous waste. A different approach to trash management divides waste into domestic and commercial waste (Links, 2016). According to Zimbabwe's Environmental Management Act (EMA), Chapter

20:27, Section 72(1), the five main categories of trash are hazardous waste, corrosive waste, flammable waste, toxic waste, and radioactive waste.



Source: ILO (2007)

Fig 2.1 Classification of waste

2.2.1 Quantitative Assessment of Waste Generation Rates

One of the key aims of comprehending waste management in high-density regions is to measure the amount of waste produced. In developing nations, various studies have been conducted to determine the volume of waste generated in high-density areas. These studies typically employ waste characterization surveys and waste generation rate calculations based on population density and consumption patterns. According to studies by Ojolo and Owoyemi (2014), Rahman et al. (2013), Alhassan et al. (2015), and Rahman et al. (2013), waste generation rates in high-density areas are significantly higher than in low-density or rural areas. The trend of increased

waste generation is attributed to rapid urbanization and population growth in developing nations (Rahman et al., 2013; Alhassan et al., 2015). Additionally, Ojolo and Owoyemi (2014) identify higher consumerism, evolving lifestyles, and the concentration of commercial activities in high-density areas as factors contributing to the trend.

2.2.2 Composition of Waste Generated

Understanding the composition of waste generated in high-density areas is crucial for designing effective waste management strategies. Studies have focused on waste characterization assessments, where waste samples are analyzed to determine the types and proportions of different waste streams.

According to a study by Islam et al. (2021), the composition of waste in high-density areas is influenced by cultural practices, economic activities, and levels of infrastructure development. The study found that organic waste, paper, and plastic are the most common waste streams in high-density areas. Plastic, paper, and organic waste were found to be the most common waste streams in high-density areas of Lagos, Nigeria, according to a recent study by Adekunle et al. (2022). According to a recent review paper by Purohit et al. (2021), the prevalence of hazardous trash, electronic waste, and medical waste in high-density areas presents unique problems to waste management. The article suggested implementing sustainable waste management practises, such as recycling and waste reduction, to solve the issues related to these waste streams.

2.2.3 Sources and Drivers of Waste Generation

To create focused waste management strategies, it is crucial to identify the sources and factors that contribute to waste formation. Studies have explored the primary sources of waste in high-density areas, including residential households, commercial establishments, and public spaces.

A study by Ullah et al. (2021) investigated waste generation in residential households in high-density areas of Peshawar, Pakistan. The study found that population density, consumer behaviour, and household practices significantly contribute to waste generation in these areas. Sheng et al. (2022) examined the waste creation and makeup of business facilities in Shanghai, China's high-density areas. The study found that restaurants, markets, and hotels generate substantial amounts of waste due to their scale of operations. Li et al. (2021) investigated waste generation in public spaces, including streets and parks, in high-density areas of Beijing, China.

The study found that improper waste disposal practices by individuals and insufficient infrastructure contribute to waste generation in these areas. In developing countries, rapid urbanization, inadequate waste management infrastructure, and limited awareness and education on waste management contribute to the increasing waste generation in high-density areas, as highlighted by recent studies (Ullah et al., 2021; Sheng et al., 2022).

By understanding the quantitative aspects of waste generation, the composition of waste, and the sources and drivers of waste, policymakers, urban planners, and waste management practitioners can develop targeted strategies to address the challenges associated with waste management in high-density areas, as suggested by a recent review article by Liet al. (2021). The article emphasized the need for the design of waste collection systems, recycling and resource recovery initiatives, and public awareness campaigns to promote sustainable waste management practices in high-density areas.

2.3 Assessing community knowledge on waste management

The knowledge, attitudes, and actions of the community have a huge impact on ways to handle waste. Examining the degree of awareness, knowledge, and perception of waste management among people living in high-density locations is the main goal of this study.

Waste management remains a major challenge in Zimbabwe, particularly in high-density areas where the population density is high, and waste generation is substantial. Assessing community knowledge on waste management is crucial for developing effective waste management strategies in these areas. For instance, a study conducted in Mutare, Zimbabwe, found that residents' knowledge of waste management was low, and waste disposal practices were inadequate (Munyoro et al., 2021). The study recommended community-based waste management programs that involve residents in waste segregation, recycling, and composting to improve community awareness and promote responsible waste disposal behaviour. This is supported in a study conducted in Kathmandu, Nepal, researchers found that the level of community awareness and knowledge of waste management was low in the city's high-density areas (Bhatta et al., 2019). A study conducted in Lagos, Nigeria, found that residents' knowledge of waste management significantly influenced their waste disposal behaviour (Adebola et al., 2020). The study recommended targeted waste management education programs to improve community awareness and promote positive waste disposal practices.

Overall, these studies demonstrate the importance of assessing community knowledge on waste management in high-density areas of developing countries. Effective waste management strategies must consider the needs and perspectives of local communities and promote community participation and awareness to achieve long-term sustainability

2.4 Determining waste management strategies and challenges in high-density areas

Waste management remains a major challenge in Zimbabwe, particularly in high-density areas where the population density is high, and waste generation is substantial. Several studies have examined household waste management strategies and challenges in Zimbabwe's high-density areas and have highlighted the need for community-based initiatives that promote community participation and awareness to improve waste management practices. For instance, a study conducted in Harare, Zimbabwe's capital city, revealed that inadequate waste management infrastructure and services, coupled with low community awareness and participation, were major challenges to effective household waste management in the city's high-density areas (Moyo et al., 2018). Similarly, a study conducted in Kathmandu, Nepal, revealed that inadequate waste management infrastructure and services were major challenges to effective household waste management in the city's high-density areas (Bhatta et al., 2019). A study conducted in Lagos, Nigeria, found that the majority of households in high-density areas disposed of their waste in open spaces, due to inadequate waste management infrastructure and services (Adebola et al., 2020). The study revealed that the lack of waste disposal facilities and limited access to waste collection services were major challenges to effective household waste management in the city's high-density areas.

Overall, these studies demonstrate that household waste management strategies and challenges in high-density areas of developing countries are complex and multifaceted. Effective waste management strategies must consider the needs and perspectives of local communities and address the underlying challenges of inadequate waste management infrastructure and services, low community awareness and participation, and insufficient waste disposal facilities.

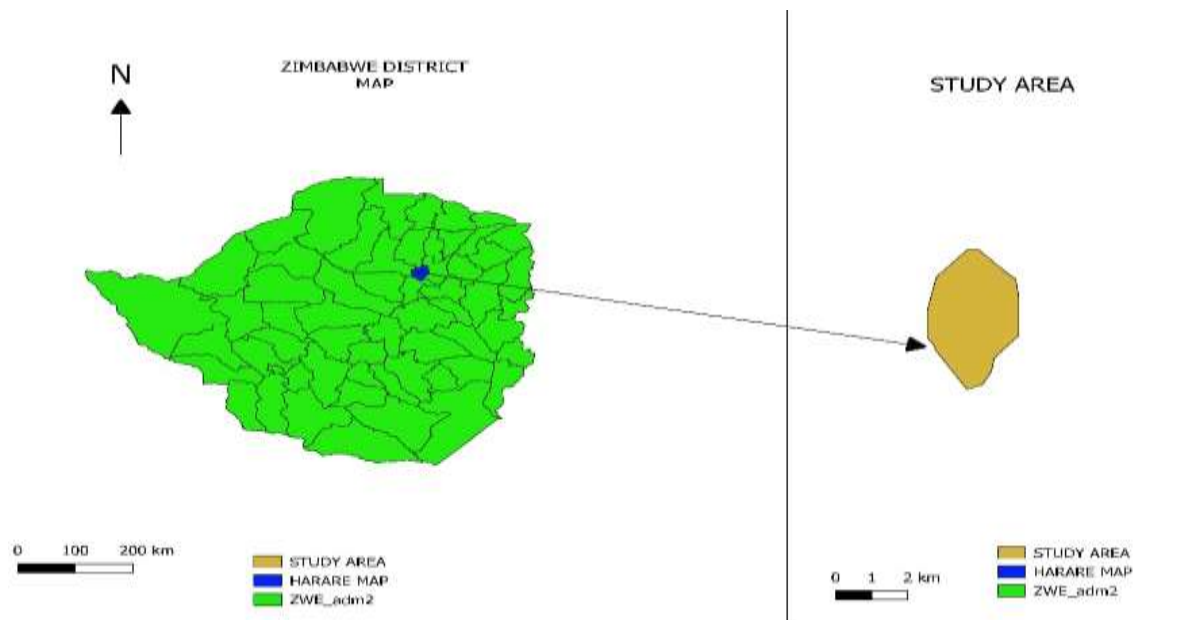
CHAPTER 3

RESEARCH METHODOLOGY

3.0 Background to the study

Budiriro is a suburb located in the southwestern part of Harare, the capital city of Zimbabwe. The geographic coordinates of Budiriro are approximately latitude -17.8969° S and longitude 30.9644° E. Budiriro is one of the densely populated suburbs in Harare. According to the 2022 Population Census preliminary results Budiriro has 89287 people. There are about 30000 houses but only two clinics and five elementary schools and a shopping centre, restaurants, retail shops and bars.

Fig 3.1 A map below showing Budiriro and where the study was carried out



Budiriro 1's population size could not be determined. However, data received from the local government indicates that Budiriro 1 has about 2000 residential homes. (ZIMSTAT, 2012) also

noted that Harare's metropolitan area had an average of two households per home. As a result, we can estimate that there are 4000 households in Budiriro 1.

3.0.1 Climatic conditions

From November to March, the area experiences a wet season, and from April to October, a dry season. With normal highs of around 25°C (77°F) in October and lows of about 13°C (55°F) in July, the annual average temperature is roughly 18°C (64°F).

3.0.2 Soil

The soil is predominantly of the Alfisol type, which is a type of fertile soil that is well-suited for agriculture. Alfisols are characterized by a clay-rich subsoil and a relatively high level of nutrients. However, like many areas in Zimbabwe, Budiriro 1 has experienced soil degradation due to factors such as deforestation, erosion, and overuse of fertilizers.

3.0.3 Vegetation

Harare is located in a region of savanna grassland, with scattered trees and shrubs. Some of the common tree species found in and around Budiriro include acacias, baobabs, eucalyptus and jacarandas

3.0.4 Rainfall

The area in question has a subtropical highland climate, which has two seasons: a wet one from November to March and a dry one from April to October. The amount of precipitation is roughly 825 mm (32 inches) on average per year, with January and February seeing the most. The weather is normally mild and sunny during the dry season, with cold evenings and warm midday temperatures.

3.1 Research Design

This study integrated qualitative and quantitative research approaches using a combination of methods approach. This approach is perfect for the study because it makes it possible to examine waste formation patterns, waste composition, waste management strategies, and waste segregation methods in highly populated areas in more detail. The main qualitative research instruments which were used included open and closed handed questionnaires, formal discussions with key informants (interviews) and field observations (ground truth). The study

focused on the 4000 residents and 2000 households in Budirio from which a population sample size of 333 residents and 364 households was drawn using the sample size formula below

$$\frac{N}{1+N(e^2)}$$

N representing Population size

A sample of residents (60) from Budiriro 1 was drawn randomly from the total population sample to answer questionnaires to determine the residents' perception on waste and the challenges and practices of waste management. At the temporary collection station, measurements were taken using a scale, waste containers, and sacks to quantify the quantity and types of waste produced by each residence. Additionally, the number of full bins collected each day was estimated. These measurements were undertaken for two weeks per month for three consecutive months for consistency. An arbitrary number of ten for sample size was selected for these measurement. The ten houses were randomly selected from the 364 residential homes from the population sample size for these measurements and no formula was used to determine this number. The house numbers collected from the local council were put in a hat and a draw was done to determine which houses were to be selected for the research. The waste was segregated into biodegradable and non-degradable and then further sorted into different units like food and vegetable waste, plastics and scrap metal. Interviews were used to solicit information from key informants on current generation, collection and disposal methods of waste as well as environmental health risks associated with poor waste management in Budiriro.

3.2 Targeted population and Sample

The targeted populace of this study comprised of women, men and children dwelling in Budiriro 1 reaching an estimate of about 4000 people and 2000 residential homes. This study however focused on population sample size of 333 residents and 364 households. From the population sample size, 60 respondents were chosen at random from Budiriro suburb to answer questionnaires and a sample of ten houses for the characterization of waste. Additionally, key informants were selected from EMA and Harare City Council.

3.3 Sampling Techniques utilized.

3.3.1 Random Sampling

A statistical technique called random sampling involves selecting a portion of people or things from a bigger population. This method entails choosing components from the population so that each component has an equal chance of getting chosen. In this study, residents who lived closer to the shopping centre we selected at random to answer the questionnaires.

3.3.2 Purposive Sampling

Purposive sampling, according to Teddlie and Fen (2017), is a technique where a researcher chooses particular members of a population for a given study. Individuals with particular traits that can give the researcher useful data for the study are the target of a purposeful sampling. In this study, important informants who were important to the investigation were chosen via purposive sampling. Since both organisations are directly involved in waste and its management, the researcher chose the EMA and the City Council as significant informants.

3.4 Methods of data gathering

Various methods were utilized in this research to collect data and information. The researcher consulted secondary sources, published and unpublished, and focused specifically on literature related to waste management. This segment covers literature audit and research instruments utilized. In gathering data, the researcher used field measurements for waste characterization, questionnaires (both open and closed questionnaires) and interview surveys.

3.4.1 Waste Characterization

At the temporary collection station, measurements were taken using a scale, waste containers, and sacks to quantify the quantity and types of waste produced by each residence. Additionally, the number of full bins collected each day was estimated. These measurements were undertaken for two weeks per month for three consecutive months which were February, March and April respectively for consistency. An arbitrary number of ten for sample size was selected for these measurement. The ten houses were randomly selected from the population sample size of 364 residential homes for these measurements. The waste was segregated into biodegradable and non-degradable and then further sorted into different units like food and vegetable waste, plastics and scrap metal. Quantities of waste generated by month calculated as average percentages in Kg/wk.

3.4.2 Questionnaires

Young (2019), characterizes a questionnaire as an apparatus for acquiring information from respondents and recording data about a specific issue of intrigue. The researcher managed to administer questionnaires in Budiriro 1. From the whole population, 60 respondents were randomly chosen as the sample size. The respondents, who ranged in age from 16 to 50, were made up of women, men, and kids from Budiriro 1. To minimise any inconvenience for the respondents, the questionnaires utilised in this study were created to be straightforward, brief, and simple to grasp. Face-to-face administration of the questionnaires provided the opportunity to chat with the respondents and clarify any areas of uncertainty regarding the subject matter of the study. Another benefit of employing questionnaires was that they were cost-free and contained questions that served as the foundation of the research. Information gathered from questionnaires was not difficult to compile. By remaining anonymous the respondents had a more noteworthy possibility of giving fair answers in answering questions.

3.4.3 Interviews

According to Adhabi (2017), an interview involves a conversation between two or more individuals, where questions are asked to obtain information relevant to a particular study. For this research, interviews were carried out with key informants from EMA and members of the Harare City Council, as well as with respondents. To get useful information, the researcher created questions that were in keeping with the study's objectives. The interviews lasted between 10-15 minutes and helped to gather information from both key informants and residents on the current waste generation, collection, and disposal methods, as well as the environmental health risks associated with poor waste management in Budiriro 1. The interviews with key informants were conducted to complement the data obtained from the questionnaires.

3.5 Data presentation and analysis

Bryman (2016) defines data presentation as the methods used to present and analyze collected data. Statistics were used for both descriptive analysis of the collected data. Descriptive statistics will be used to summarise the data. Using content analysis and SPSS, the qualitative data gathered through interviews and questionnaires will be analysed. The waste composition analysis results will be analyzed using the waste characterization index and EXCEL, this will give information about the different types and quantities of waste produced in the research area.

CHAPTER 4

DATA PRESENTATION AND ANALYSIS

4.1 WASTE CHARACTERIZATION

At the temporary collection station, measurements were taken using a scale, waste containers, and sacks to quantify the quantity and types of waste produced by each residence. Additionally, the number of full bins collected each day was estimated. These measurements were undertaken for two weeks per month for three consecutive months for consistency. An arbitrary number of ten for sample size was selected for these measurement. The ten houses were randomly selected

from the population sample size of 364 residential homes for these measurements. The waste was segregated into biodegradable and non-degradable and then further sorted into different units like food and vegetable waste, plastics and scrap metal. Quantities of waste generated by month calculated as average percentages in Kg/wk.

Table 4.1: Difference in Quantities of waste generated as average percentages in Kg/wk.

Types of waste	Percentage waste generated in Kg/wk.								
	10-13 Feb 2023	24-27 Feb 2023	Average	10-13 Mar 2023	24-27 Mar 2023	Average	7-10 Apr 2023	20-23 Apr 2023	Average
Organic waste ***	21.9	18.5	20.2	15	25.1	20.05	31.8	23.4	27.6
Paper**	3.8	7.1	5.45	4.8	2.3	3.55	5.3	6.8	6.05
Cardboard and egg trays	17.9	10.7	14.3	14.2	13.9	14.05	14.8	16.6	15.7
Plastics	14.8	22.9	18.85	17.1	22.8	19.95	16.3	14.7	15.5
Bones	10	12.4	11.2	14.3	19.5	16.9	9.3	13.6	11.45
Glass	4	9.2	6.6	4.9	8.4	6.65	3.7	8.5	6.1
Textiles	4.2	1.3	2.75	4.9	0.4	2.65	2.4	4.6	3.5
Ablution*	14.8	17.5	20.2	24.8	7.2	16	15.9	11.3	13.6

***including food scrap, vegetables, fruit and crop sheets **including tissue paper, newspaper, book sheets *diapers

The statistics showed that organic waste, which increased by 8% kg/wk, made up the biggest percentage of the total waste produced in Budiriro 1. In February and March, organic waste including food scrap, vegetables, fruit, and crop represented 20% of the total waste generated, and this percentage increased to 28% in April. Plastics and ablution waste were the two other major components of the waste generated in Budiriro 1. In February, plastics and ablution waste averaged 18.9% and 20%, respectively. In March, the waste averaged 19.9% and 16% for

plastics and ablution, respectively. In April, the percentages decreased to 15.5% and 13.6% for plastics and ablution, respectively. Cardboard and trays, bones, glass, and textiles were the other components of the waste generated in Budiriro 1. In February, cardboard and trays represented 14.3% of the waste, bones represented 11.2%, glass represented 7%, and textiles represented 3%. In March, the percentages were 14.05%, 17%, 7%, and 3%, respectively. Finally, in April, the percentages were 16%, 11.45%, 6%, and 3.5%, respectively.

4.2 Community knowledge on waste management

4.2.1 Demographic Data

A total of 60 questionnaires were distributed to the residents of Budiriro 1. The distribution of a sample population (n=60) based on several demographic variables. The age is divided into four categories: 18-24 years, 25-30 years, 31-40 years and 41-50 years. The largest age group in the sample was 18-24 years (23 individuals or 38.3% of the sample), followed by 25-30 years (19 individuals or 31.7% of the sample). The lowest age group in the sample was 41-50 (4 individuals or 8% of the sample). Secondly, 29 individuals (48.3% of the sample) identified as male, and 31 individuals (56% of the sample) identified as female. Thirdly, employment status, with 24 individuals (40% of the sample) being unemployed and 19 individuals (31.7% of the sample) being employed. 17 individuals (28.3% of the sample) were self-employed. The status of the people in Budiriro. The categories are Single, Married, Divorced and Widowed. The largest group in the sample were married (28 individuals or 46.7% of the sample) with lowest being those being widowed (6 individuals or 10% of the sample). Education level, with 12 individuals (20% of the sample) having a primary education, 31 individuals (51.7% of the sample) having a secondary education, and 17 individuals (28.3% of the sample) having a tertiary education.

4.2.3 Community knowledge on waste management

Residents were asked questions on their knowledge of waste management

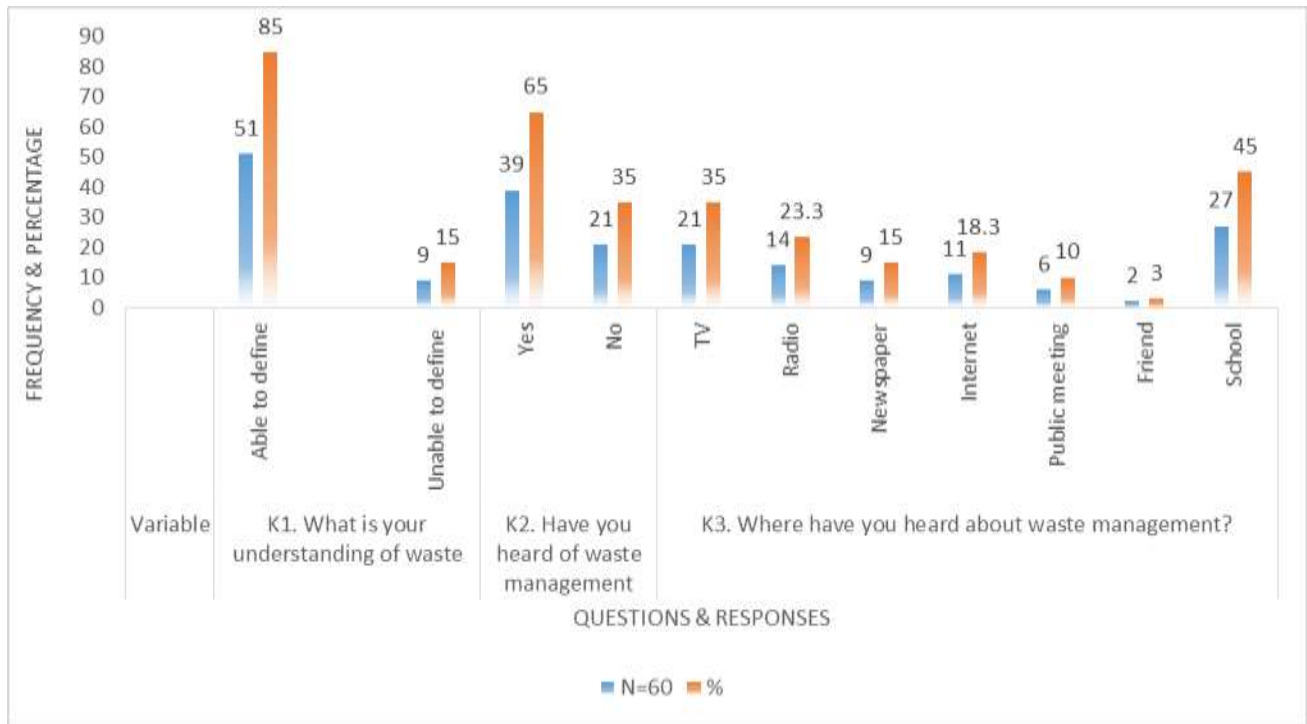


Fig 4.1 Knowledge on waste management

Most elevated number of the respondents 51 (85%) had knowledge on what is waste. The respondents gave satisfactory answers in this respect. However only a few could not give an answer. Most respondents 39 (65%) participants have heard of waste management. School is the most common source of information (45%), followed by TV (35%) and radio (23.3%).

4.2.4 Residents perceptions and attitudes towards waste management

Residents were asked about their opinions and impressions of waste management. This response indicates that a significant portion of the residents (73.3%) believes that the City Council has not been effective in managing waste. Approximately 33.3% of the residents perceive waste as merely a nuisance. A considerable portion of the respondents (51.7%) believes that waste management is solely the responsibility of the authorities, such as the City Council or the government. A percentage (37%) of the residents perceive the government as reluctant in addressing waste management issues. The 23.3 % of respondents who mentioned other reasons could have diverse perspectives or specific concerns about waste management.

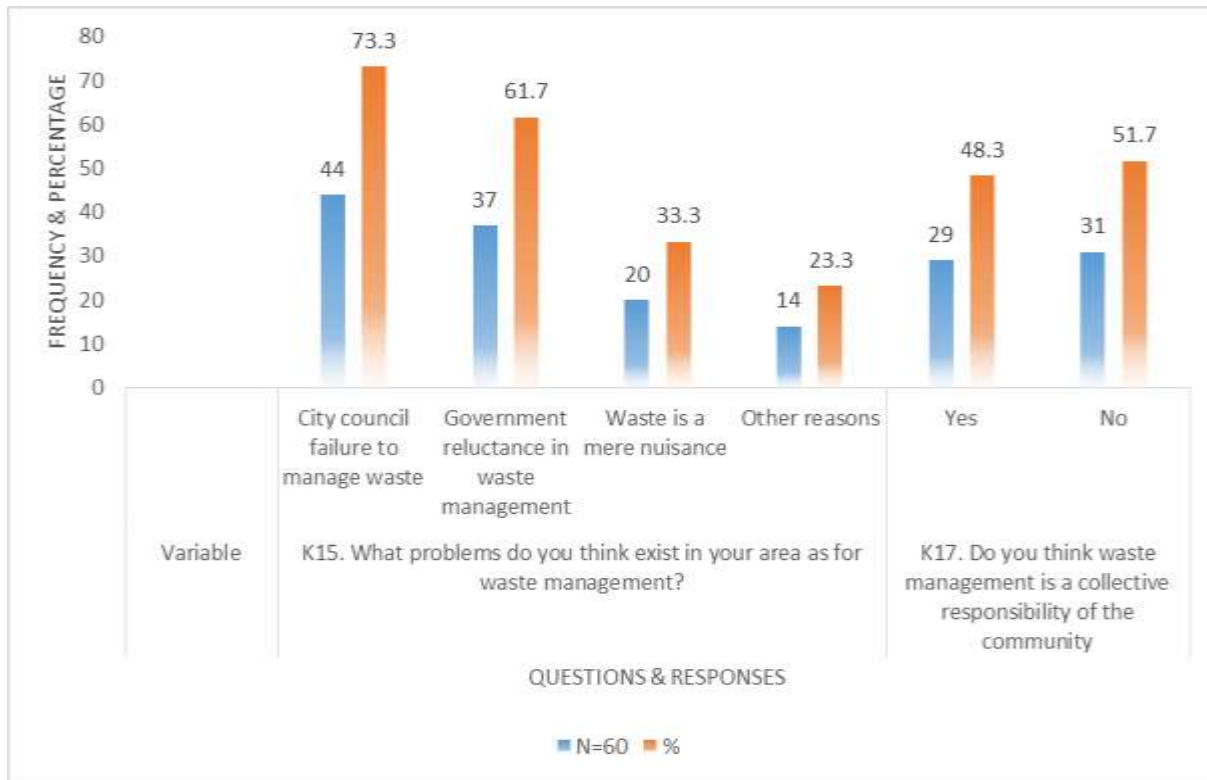


Fig 4.2 Perceptions and attitude towards waste management

4.2.5 Waste Management by Residents

Respondents were posed a question on how they manage waste and their waste management practices. The above Fig 4.3 shows that there were seven common ways to dispose of waste in Budiriro mentioned by the residents. The given data provides information about different methods of waste disposal and their respective proportions method. Dumping on open space 76.7%, burying underground 23.3%, sell 18.3%, recycling 15%, burning 71.7% and composting 43.3%.

The following are also different waste management practices mentioned by the residents. 45% of respondents are aware of composting as a waste management practice. 55% of respondents are aware of recycling as a waste management practice. 76.7% of respondents are aware of waste collection as a waste management practice. 11.7% of respondents are aware of selling waste as a waste management practice. 90% of respondents are aware of landfills as a waste management practice.

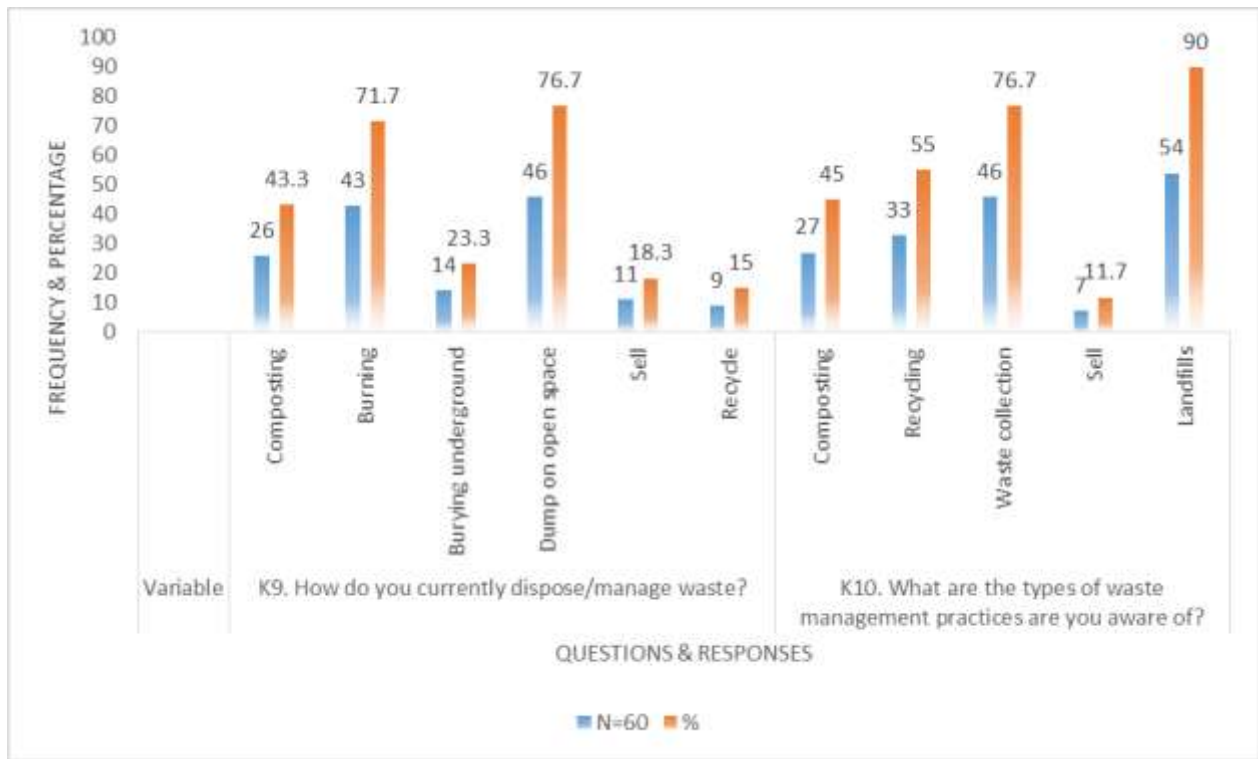


Fig 4.3 Waste Practices and Disposal

4.2.6 Types of receptacles

Respondents were posed a question on what kind of receptacle they use to store their waste. Fig 4.4 shows the use of different types of receptacles for waste collection and disposal in Budiriro and they can have significant implications for public health, the environment, and the aesthetic quality of the community. The breakdown of receptacles used in Budiriro, as given, is as follows: bin liners 55%, plastic bins 31%, cardboard boxes 11.7%, sacks 6.7, maize-meal bags 18.3%, and metal bins 5%.

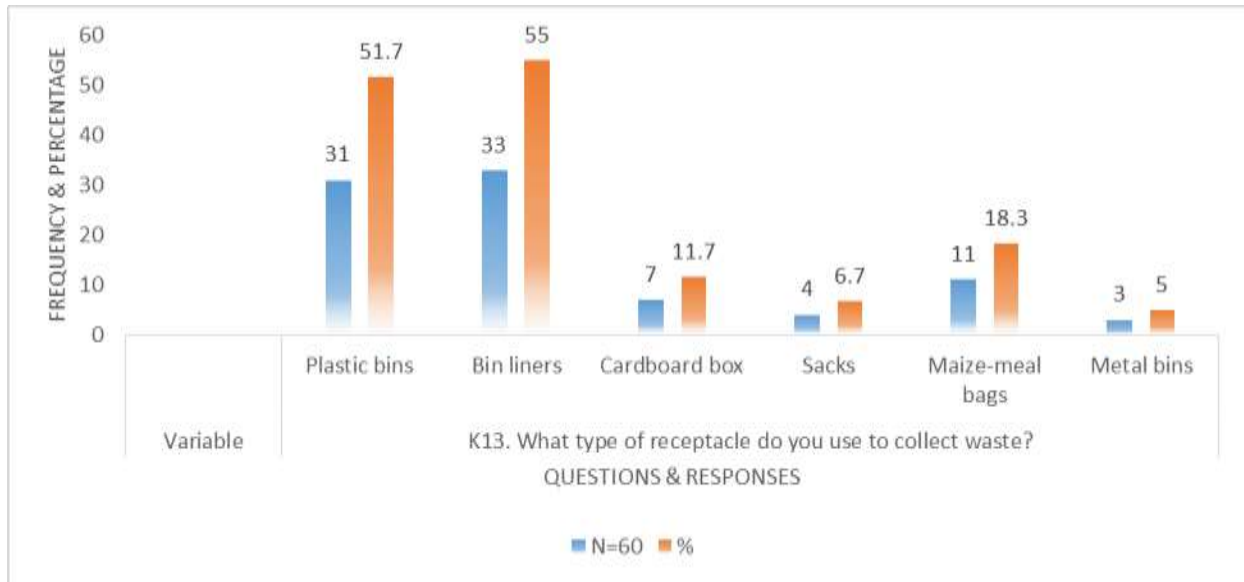


Fig 4.4 Types of receptacles

4.2.7 Waste Management Challenges

Residents were posed a question on the challenges they face in managing waste. 78.3% of respondents reported that there is a lack of adequate waste disposal infrastructure in their area, which makes it difficult to properly dispose of waste. 88.3% of respondents stated that littering and illegal dumping are common in their area, which leads to unsanitary conditions and further exacerbates the waste management problem. 33.3% of respondents stated that they do not have access to recycling facilities in their area, which makes it difficult to recycle and properly dispose of recyclable materials. 25% of respondents reported that the cost of waste disposal services is too high, which makes it difficult for them to afford proper waste management. 68.3% of respondents reported that they are not aware of proper waste management practices and are unsure of how to dispose of certain types of waste, such as hazardous materials or electronic waste.



Fig 4.5 Waste management challenges

4.2.8 Waste collection

Respondents were posed a question on the frequency of waste collection and how they rate the effectiveness of waste collection the area. The residents of Budiriro were asked about the frequency and standard of waste collection in the locality, the majority (65%) responded that they never witnessed waste being collected. This was followed by responses of once a month (25%) and once a week (8.3%). Some respondents acknowledged that they occasionally observed waste collection taking place, but not as frequently as it should. Regarding the effectiveness of the local waste collection, 75% of respondents deemed it to be "Not Good", while the other 25% stated that waste collection was not even available in the area.



Fig 4.6 Waste collection Frequency

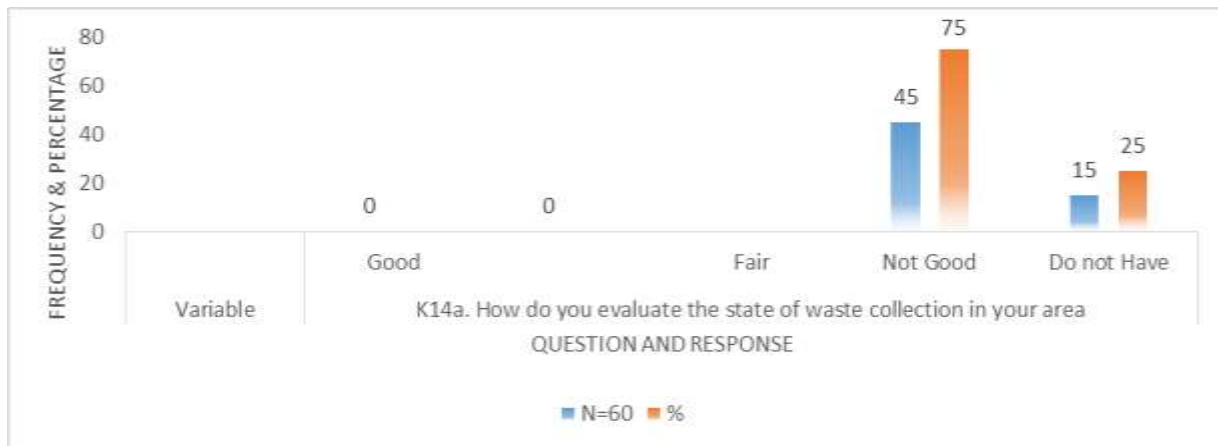


Fig 4.7 Effectiveness of Waste collection

4.3 Waste management challenges towards key informants

Key informants from the EMA and Local Council were asked in an interview of the challenges they faced in managing waste. All the participants who were present at the interview agreed that the primary difficulty they encountered was the shortage of refuse trucks and equipment (100%). Some of them also mentioned the presence of corruption (100%) as an additional challenge. Moreover, there was a shortage of personnel, which was a problem that affected the Council (100%).

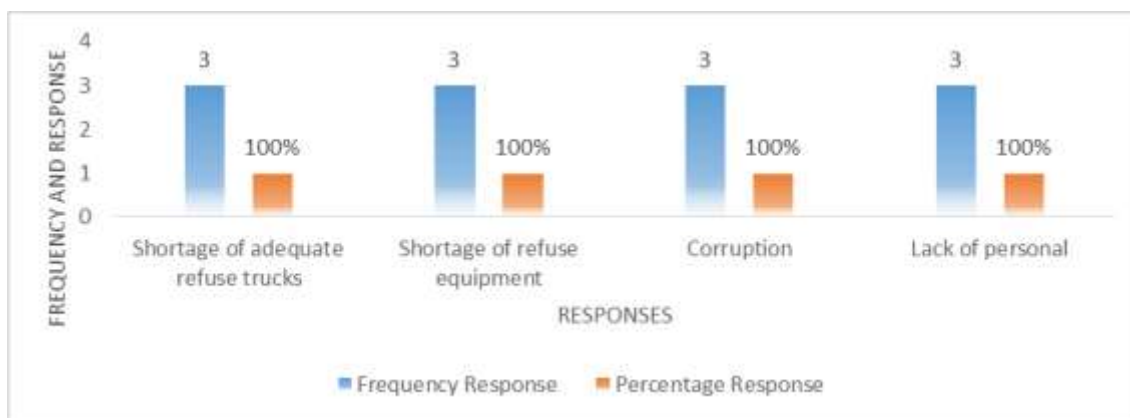


Fig 4.8 Challenges faced by EMA and Local Council

CHAPTER 5

DISCUSSION

5.1 Waste Characterization

Results in Table 4.2 show either a slight increase in waste quantities and this was attributed to changes in household size and maybe consumption pattern during holidays. Numerous researches have been carried out in developing nations to evaluate the amount of waste produced in high-density areas. These studies frequently use waste characterization surveys and waste generation rate calculations based on population density and consumption patterns. According to studies by Ojolo and Owoyemi (2014), Rahman et al. (2013), Alhassan et al. (2015), and Rahman et al. (2013), waste generation rates are significantly higher in high-density areas than they are in low-density or rural areas. The trend of increased waste generation is attributed to rapid urbanization and population growth in developing nations (Rahman et al., 2013; Alhassan et al., 2015). Additionally, Ojolo and Owoyemi (2014) identify higher consumerism, evolving lifestyles, and the concentration of commercial activities in high-density areas as factors contributing to the trend.

In February the general trend represents low quantities of waste as compared to high volumes in March and a decline again April. In April the majority of residents migrate in and out of town for holidays hence waste generated (paper, cardboard and egg trays, organic waste and textiles) are likely to be increased or decreased. In this case textiles, cardboard and egg trays, increased by almost 1%, paper by almost 2% and organic have also a percentage increase of 8%. Plastics and ablution wastes decrease by 4% bones almost 6% and glass 1%. Organic waste increases whilst inorganic waste decreases when results for the three months are compared. The reason attributed to this observed difference is that some people undertake indoor recycling of plastics, scrap metals and rags hence inorganic waste. Overall, the data shows that organic waste was the most significant component of waste generated in Budiro 1, followed by plastics and ablution waste. Although the average household size in Budiro 1 was 8 it was no impact on variations. However, significant variations would be expected when comparing high density and low density suburbs where there would be significant variations in terms of individual earnings.

5.2 Community knowledge on waste management

51 respondents, or 85%, had the highest level of understanding on waste. In this regard, the respondents provided good responses. Waste is defined as any material that is not a primary product, is no longer useful to the person who generated it for their intended purpose of production, transformation, or consumption, and which they wish to dispose of, and which is not intended to be disposed of through pipelines, according to The United Nations Statistics Division (UNSD, 2015). The participants' explanations were consistent with this definition. The respondents gave examples of household solid waste, such as food waste, plastics, and diapers. According to the International Labour Organization (ILO) (2017), household solid waste refers to materials that are generated from homes which are no longer useful and can be organic or inorganic. However, a small number of respondents (9 or 15%) were unable to provide an answer.

In this study, a large majority of participants (65%) reported having knowledge about waste management. Similar results were found in a study conducted in Lagos, Nigeria, where 65% of respondents had knowledge of what waste is and were able to provide satisfactory answers (Oluwande et al., 2021). This suggests that the residents of Lagos have a high level of awareness about waste management. The most common sources of information on waste management for participants in this study were schools (45%), followed by TV (35%) and radio (23.3%). This result is consistent with earlier studies, such as those by Ali et al. (2021) and Adeyefa et al. (2019) that highlighted the importance of education and the media in raising public awareness and knowledge about waste management practises in developing countries.

5.2.1 Perception and Attitudes of waste management

The findings from the survey show that there are varied perceptions among residents in the community regarding waste management. A considerable percentage of the participants (73.3%) expressed the view that the local City Council has not managed waste effectively. This perception is consistent with the findings of Chirisa (2014), who observed that City councils in most urban areas, particularly in developing countries, are not providing adequate waste management services. A similar conclusion was reached in a study conducted in Lagos, Nigeria, which found that the city's waste management system was inadequate and inefficient (Ojoawo et al., 2019).

Others view waste as a mere nuisance (33.3%) or consider waste management to be solely the responsibility of the authorities (51.7%). A study conducted in Nigeria found that while many people in the country recognize the importance of waste management, they view it as the sole responsibility of the government and do not consider their own actions as having an impact on waste management (Musa et al., 2020). Another study conducted in Dhaka, Bangladesh found that many residents view waste as a nuisance rather than recognizing the potential environmental and health hazards associated with improper waste management

Furthermore, a proportion of the participants (61.7%) believe that the government is reluctant to address waste management issues. This finding is consistent with the observation made by Chinobvu and Makarate (2015), who noted that many governments are perceived to be unenthusiastic about enforcing waste management practices. They also highlighted that the regulations are outdated, and the penalties imposed on offenders are not sufficient to deter littering. A study conducted in Ghana found that lack of political will and inadequate funding were major barriers to effective waste management in the country (Amoah et al., 2016).

A study conducted in Jakarta, Indonesia found that social and cultural factors influence waste management behaviors in high-density areas. These perceptions could stem from inadequate waste collection services, improper waste disposal methods, or inefficient management of waste treatment facilities.

5.3 Waste management by residents

5.3.1 Disposal

The results of the study conducted in Budiriro, a high-density area in Zimbabwe, reveal the various methods of waste disposal adopted by residents. The data shows that dumping waste on open space is the most popular way to dispose of waste, accounting for 76.7% of the total. Burning and composting are also common methods of waste disposal, with 71.7% and 43.3% of respondents using these methods, respectively. Burying waste underground and selling waste are less commonly used methods, with only 23.3% and 18.3% of respondents using these methods, respectively. Recycling is the least common method of waste disposal, with only 15% of respondents using this method.

Studies conducted in developing countries have shown that improper waste disposal practices, such as dumping waste on open space, burning waste, and burying waste underground, are

common in high-density areas (Moyo & Chikodzi, 2019; Rahman et al., 2018; Sharma et al., 2015). These actions can endanger the public's health and the environment, emphasising the necessity for sustainable waste management methods.

5.3.2 Waste management practices

The studies conducted in Budiriro indicate that waste management practices vary widely among residents. Although most residents recognize waste collection and landfills as waste management practices, less sustainable practices such as composting and recycling are not as well-known. Studies conducted in Lagos, Nigeria and Mumbai, India (Rahman et al., 2018; Ojoawo et al., 2019) found that residents are aware of waste collection as a waste management practice, but the effectiveness of these services is limited by inadequate infrastructure and funding.

Moreover, the studies conducted in Jakarta, Indonesia and Dhaka, Bangladesh found that many residents are not aware of more sustainable waste management practices, such as selling waste and composting (Sari et al., 2018; Rahman et al., 2018).

The research indicates that governments should allocate resources for public education and awareness campaigns to encourage sustainable waste management practices. The effectiveness of waste collection services is constrained by insufficient infrastructure and funding, which can lead to waste being dumped on the streets. To mitigate the amount of waste sent to landfills, governments should promote sustainable waste management practices like recycling and reuse. Community-based waste management initiatives can also be an effective way to promote responsible waste management behaviours in high-density areas of developing countries. Overall, a combination of government investment, public education, and community-based initiatives is necessary to promote responsible waste management practices in these areas.

5.3.3 Types of receptacles

The results of the study conducted in Budiriro show the various types of receptacles used for waste management. The most commonly used receptacle is bin liners, which account for 55% of the total. Plastic bins and cardboard boxes are the next most commonly used receptacles, accounting for 51.7% and 11.7% respectively. Sacks, maize-meal bags, and metal bins are used less frequently, with each accounting for 11% or less of the total. These findings suggest that there is a need for more effective waste management infrastructure and policies in Budiriro, as

the current waste receptacles being used may not be sufficient for proper waste disposal (Moyo & Chikodzi, 2019). The use of bin liners as the most common receptacle is concerning, as they are not durable and can easily break, leading to littering and unsanitary conditions.

5.4 Waste management Challenges

The findings of the study conducted in Budiriro reveal several challenges that residents face regarding waste management. According to the survey results, most participants (78.3%) reported insufficient waste disposal infrastructure in their locality, which causes difficulties in disposing of waste properly. Moreover, 88.3 % of the respondents mentioned that littering and illegal dumping are prevalent in their area, resulting in unhygienic conditions and worsening the waste management issue. Furthermore, 33.3% of respondents reported a lack of access to recycling facilities, which hinders their ability to recycle and properly dispose of recyclable materials. The cost of waste disposal services was also cited as a challenge by 25% of respondents, as it is too high for some residents to afford proper waste management. Finally, 68.3% of respondents reported a lack of awareness of proper waste management practices.

According to Rahman et al. (2018) and Ojoawo et al. (2019), developing countries face a number of problems with waste management, including inadequate infrastructure, a lack of money, and a lack of public awareness of good waste management practises. According to Sharma et al. (2015), improper disposal of waste is common in many of these nations and causes pollution of the environment and dangers to the public's health. To address these challenges, governments and local authorities should invest in waste management infrastructure and services customized to the specific requirements of their communities, as suggested by Sari et al. (2018). Public education and awareness campaigns are also vital to encourage responsible waste management behaviors, reduce littering and illegal dumping, according to Moyo and Chikodzi (2019). In general, developing countries should prioritize sustainable waste management methods to protect public health and the environment while promoting economic growth and development, as emphasized by Rahman et al. (2018).

Overall, the study conducted in Budiriro highlights the significant challenges that high-density areas in developing countries face in waste management. Addressing these challenges requires a multifaceted approach that includes investment in waste management infrastructure and services, public education and awareness campaigns, and community engagement and participation. Such

an approach can help to improve waste management practices, reduce environmental pollution and public health risks, and promote sustainable development in high-density areas of developing countries.

5.4.1 Collection

Studies have shown that inadequate waste management services are a common challenge in high-density areas of developing countries, such as Budiriro in Zimbabwe. The survey of residents in Budiriro found that a significant proportion of respondents reported infrequent waste collection services. For instance, 65% of respondents reported never witnessing waste being collected, and 25% and 8.3% reported waste being collected once a month and once a week, respectively. These results imply that the area's waste collection services fall short of what the locals require. The results given by respondents are in conformity with Chirisa (2014) who noted that in most urban areas especially in developing countries, City councils are failing to provide adequate waste management process.

The research further revealed that the residents of Budiriro generally held unfavourable opinions about the quality of waste collection services, with 75% describing it as "Not Good." Additionally, 25% of the respondents claimed that waste collection services were simply not available in the area, showing serious issues with the local area's approach to waste management. Similar issues were found in a research on solid waste management in high-density suburbs of Harare, Zimbabwe, according to Chirisa et al. (2020), with inadequate waste collection services being a major problem for the people.

The results of the survey of Budiriro residents highlight the serious problems in waste management services in high-density areas of developing countries. To address these issues, the public sector, the commercial sector, and the community must work together to develop and put into practise waste management strategies that are both effective and sustainable while also meeting the needs of the local population.

5.4.2 Information obtained from Informants

The challenges faced by the Local Council and EMA in waste management are not unique to this locality. The challenges include the shortage of refuse trucks and equipment, presence of corruption as an additional challenge and a shortage of personnel.

Similar difficulties have been identified by other research studies conducted in high-density regions of developing nations. For instance, Goswami and Bhattacharyya (2018) found that a lack of appropriate waste management infrastructure, including a shortage of refuse trucks and equipment, was a significant obstacle in a study conducted in Kolkata, India. Similarly, a study conducted in Lagos, Nigeria identified a shortage of personnel as a significant challenge in waste management (Oluwande et al., 2019). In addition to personnel shortages, the study also found that corruption was a challenge in waste management, with some officials engaging in corrupt practices to circumvent waste management regulations and procedures.

The shortage of refuse trucks and equipment was also identified as a significant challenge in a study conducted in Dar es Salaam, Tanzania (Kassenga & Mbuligwe, 2020). The study found that the inadequate waste management infrastructure in the city resulted in poor waste management practices, such as littering and illegal dumping.

Taken together, these studies suggest that the challenges faced by the Local Council and EMA in waste management are not unique to their locality. Similar challenges are prevalent in other high-density areas of developing countries and require a multifaceted approach to address them. This approach should involve investment in waste management infrastructure and services, addressing personnel shortages, and combating corruption in waste management practices. Such an approach can help to improve waste management practices, promote sustainable development, and protect public health and the environment in high-density areas of developing countries.

Chapter 6

Conclusion and Recommendations

The waste generated in Budiriro varies based on the population's behaviour, lifestyle, and religious practices. The analysis indicates that there is a higher generation of organic, cardboard, plastic, and ablution waste in Budiriro, while paper, glass, and textile waste have lower. This trend of increased waste generation is attributed to ignorance to the effects and impacts of improper waste disposal and commercail activites such as restaurants, bars and retail shops.

The findings of the survey indicate that while a majority of respondents have knowledge of what waste is and have heard of waste management, perceptions and attitudes towards waste management vary among residents in the community. While some view waste management as solely the responsibility of the authorities, others recognize the potential environmental and health hazards associated with improper waste management. Inadequate waste management infrastructure and inefficient management of waste treatment facilities, as well as lack of political will and inadequate funding, were identified as major barriers to effective waste management. Social and cultural factors were also found to influence waste management behaviours in high-density areas. These results highlight the necessity of a comprehensive strategy for waste management that tackles the social, economic, and environmental aspects that contribute to inadequate waste management practices in developing nations. Such an approach should involve investment in waste management infrastructure, public education and awareness campaigns, and community engagement and participation, as well as addressing corruption and political will in waste management practices.

In high-density areas of developing countries like Budiriro in Zimbabwe, waste management practises are typified by improper disposal methods, insufficient waste management infrastructure, and little public awareness of effective waste management practises. These practices can result in adverse environmental and public health consequences, including

pollution, disease outbreaks, and ecological disturbance. Addressing these challenges requires a multifaceted approach that includes investment in waste management infrastructure and services, public education and awareness campaigns, and community engagement and participation. The challenges faced by the City Council and EMA in waste management are not unique to Budiro, as other studies in high-density areas of developing countries have identified similar challenges. A concerted effort by authorities, the private sector, and the community is necessary to develop and implement sustainable and effective waste management strategies that meet the needs of residents.

Recommendations

- Investment in waste management infrastructure and services, including the development of proper waste disposal methods, recycling facilities, and waste treatment facilities.
- Launch campaigns to educate the public on good waste management methods, including the value of waste reduction, recycling, and proper disposal techniques.
- Promote community involvement and participation in waste management projects, such as by including local communities in the development and implementation of waste management plans.
- Develop and execute sustainable and effective waste management plans that cater to the needs of residents in high-density areas of developing countries.
- Collaboration between authorities, the private sector, and the community to address the challenges faced in waste management and to develop and implement effective waste management solutions.

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APPENDICES

APPENDIX 1: RESEARCH QUESTIONNAIRE

An assessment of waste management challenges and prospects in high density areas

QUESTIONNAIRE

My name is Tatenda Maposa registration number (B192669B) from Bindura University of Science Education, Faculty of Agriculture and Environmental Science. I would like to conduct a study survey to gather preliminary information to assess the challenges, people's perception towards waste and its management and waste management practices in Budiro 1 Harare, Zimbabwe. The indirect benefit of the study is to improve understanding of waste management and their related impacts and practices of managing waste in high density areas.

- Participation in the study is completely voluntary and written informed consent will be obtained
- Before answering the questions, please go through the instructions relevant to each question
- The questionnaire is to be answered by the owner of the residence or by their representatives

Name of Respondent:

Address :

Name of Interviewer:

Date :

The information requested is purely for academic purpose and will be treated confidentially.
Thank you for accepting the Questionnaire

General Information

Please put \surd in appropriate box/boxes for your answer

1. Sex

i. Male Female

2. Age group

i. 18-24 ii. 25-30 iii. 31-40 41-50

3. Status

i. Single ii. Married Widowed iv. Divorced

4. Qualification

i. Primary ii. Secondary iii. Tertiary

5. Employment Status

i. Employed ii. Self-Employed iii. Unemployed

KNOWLEDGE ON WASTE MANAGEMENT

6. What is your understanding of waste

.....
.....
.....

7. Have you heard of waste management

Yes No

If yes in what way

- I. Over radio
- II. Over TV
- III. In public meeting
- IV. In school
- V. On posters, pamphlets, newspapers
- VI. Other.....

8. What are the different types of waste generated in your area?

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.....
.....

9. How do you currently dispose/manage waste?

.....
.....
.....

i. Do you separate our waste (recyclables and non-recyclables)

Yes No

ii. Do you properly sort and dispose of your waste into designated bins

Yes No

iii. Are there specific designated places for waste disposal and collection

Yes No

iv. Do you actively engage in reducing, reusing and recycling waste

Yes No

10. What are the types of waste management practices are you aware of?

.....
.....

i. Do you actively educate yourself and others about waste management best practices

Yes No

11. What are the common waste disposal methods practiced in your area (e.g. landfill incineration, recycling, composting)

.....
.....
.....

Are you aware of the negative impacts of improper waste management on the environment and public health

Yes

No

ii. If yes, please specify

.....
.....
.....

12. What do you think are the effects of uncollected waste

.....
.....
.....

13. What type of receptacle do you use to collect waste

Plastic Bins	<input type="checkbox"/>	Cardboard Box	<input type="checkbox"/>
Bin liners	<input type="checkbox"/>	Sacks	<input type="checkbox"/>
Maize-meal bags	<input type="checkbox"/>	Metal Bins	<input type="checkbox"/>

14. How often is waste collected in your area by the Council

Once a week	<input type="checkbox"/>	Twice a week	<input type="checkbox"/>
Daily	<input type="checkbox"/>	Once a fortnight	<input type="checkbox"/>
Once a month	<input type="checkbox"/>	Never	<input type="checkbox"/>

i. How do you evaluate the state of waste collection in your area

Good	<input type="checkbox"/>	Not Good	<input type="checkbox"/>
Fair	<input type="checkbox"/>	Do Not Have	<input type="checkbox"/>

15. What problems do you think exist in your area as for waste management

.....
.....

16. What are some of the challenges you face in managing waste in your area?

.....
.....
.....

17. Do you think waste management is a collective responsibility of the community?

Yes No

i. If yes, what actions do you believe can be taken collectively to address waste management challenges in your area?

.....
.....
.....

18. How do you think waste management practices can be improved in high-density areas like yours?

.....
.....
.....

i. Do you have any recommendations or solutions?

.....
.....
.....

19. Is there anything else you would like to share or any additional comments about waste management in your community?

.....
.....
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