

**CHALLENGES AND OPPORTUNITIES ASSOCIATED WITH  
COMMUNITY PARTICIPATION IN SOLID WASTE MANAGEMENT  
IN SAKUBVA, MUTARE**

**R135725H**



**A DISSERTATION SUBMITTED TO THE DEPARTMENT OF  
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# APPROVAL FORM

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The undersigned persons certify that they have read and therefore recommend Midlands State University to accept a dissertation entitled: **Challenges and opportunities associated with community participation in solid waste management in Sakubva, Mutare**. The dissertation is submitted by Chirema Esther Tariro (R135725H) in partial fulfilment of the requirements for the attainment of a Bachelor of Social Science Degree in Geography and Environmental Studies.

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## **DEDICATION**

This dissertation is dedicated to my amazing father and mother. Your boundless love overwhelms me.

## **ACKNOWLEDGEMENTS**

I wish to acknowledge God the Almighty, for carrying me through till the end. Words alone can never express how appreciative I am. Additionally, I acknowledge contributions made by academics, special mention to Mr Tinashe Mukunyadze and Mrs Zanele Furusa, as well as EMA Quality Officer, Mr Norman Chetsanga who assisted me in data collection. Support and inspiration from lecturers, friends and classmates of the department of Geography and Environmental Studies is enormously appreciated. Sincere gratitude goes to my supervisor and lecturer, Professor, Steven Jerie. This would not have been a success without your guidance and patience. May the gracious Lord continue to bless you abundantly.

I extend my profound appreciation to my mother, Margret and four siblings, Tait, Drew, Tammy, and Erasmus as well as to Mr and Mrs J. Gumbo for their support over the span of the degree program.

## ABSTRACT

*The aim of the study was to analyse the challenges and opportunities of community participation in solid waste management in Sakubva suburb of Mutare. The research was fundamental since it envisioned unravelling more information in relation to objectives which included interrogation of the level of Sakubva community participation in solid waste management in light of the challenges and opportunities for future waste management, establishing types and amounts of waste generated, determining approaches used to manage waste, exploring the role played by the community in solid waste management, as well as analysing ways in which the public could be engaged to ensure that the communities sustainably participate in solid waste management. Snowball and purposive sampling were used in determining the sample size which comprised of a target population of 1 600 residents. Ten percent was used as a benchmark to obtain the actual sample size of 160 respondents. A triangular technique was used in data collection which included interviews with key informants, self-administered questionnaires, photographs, field observations and secondary data from organisational records, e-journals, and reports. The findings revealed that the Sakubva community is practising solid waste management activities like waste separation, reduction, reuse and recycling. They are also engaging with other stakeholders like EMA, NGOs and pressure groups to manage waste in their suburb and these have paid off with various socio-economic prospects. However, these practices have been done ineffectively as the community is lacking full legislative support, financial resources as well as adequate awareness or education on sustainable solid waste management. Furthermore, the scale of population growth is overwhelming the capacity of the Mutare City Council to provide adequate waste collection services, hence a myriad of solid waste management challenges is being faced by the Sakubva community. In light of the above, the study therefore, recommends that the City Council of Mutare, together with other stakeholders like EMA and NGOs provide financial aid to community based organisations, formulate an integrated solid waste management plan that incorporates the community, as well as conducting more, effective trainings, educational tours and awareness campaigns that involve the community on solid waste management. Policy makers should also amend already existing policies and legislations and include community engagement and participation in environmental issues. This helps to create a sense of ownership in the community and to reduce the waste management problem in the suburb.*

## **ACRONYMS**

**EMA-** Environmental Management Agency

**CBD-** Central Business District

**HDPE-** High-Density Polyethylene

**LDPE-** Low-Density Polyethylene

**CBO-** Community Based Organisation

**NGOs-** Non-governmental Organisations

**QGIS-** Quantum Geographical Information Systems

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background to the study

Waste management is a global problem and Mutare City is not spared of the challenges associated with this problem. Every individual is a potential waste generator hence the community contributes to this problem as well. However, there is a growing consensus that public participation in waste management poses great opportunities in managing this problem (Saeed, 2016). Studies have pointed to the fact that the way solid waste is being generated globally, surpasses the way it is responsibly managed. At present, 3.4 to 4 billion tonnes of municipal and industrial solid waste and up to 300 million tonnes of hazardous waste is produced worldwide per year, (Chalmin and Gaillochet 2009). Waste generation in Africa is generally low with an approximation of 62 million tonnes per year per capita, (UNEP 2011). It spans a wide range from 0.09 to 3.0 kilograms per person per day, with an average of 0.65 kg per capita per day (UNEP, 2011). Zimbabwe produces on average, 2.5 million tonnes of solid waste (household and industrial) annually, (Practical Action, 2007).

Bhatia (2013) refers to waste as “useless, unwanted or discarded materials which are no longer considered of sufficient value and are thrown away by the possessor.” Waste is classified by way of source or premise of generation, the physical state of the waste material, material composition and level of risk. Solid waste is any solid or semi-solid, non-soluble material (including gases and liquids in containers) such as agricultural refuse, demolition waste, industrial waste, mining residues, municipal garbage and sewage sludge, (Environment Management Agency 2017).

Tchobanoglous et al (2003), define solid waste management as the discipline associated with the control of generation, storage, collection, transfer and transportation, processing and disposal of solid wastes in a manner that it is in accord with the best principles of public health, economics, aesthetics, engineering, conservation and other environmental considerations and that is also responsive to public attitudes. Solid waste management is a crucial aspect of sustainable development for any country and giving it top priority is highly supported by global initiatives like the Rio Declaration on Environment and Development

and Agenda 21, which explicitly affirmed that environmentally sound management of wastes was one of the topical environmental issues of major concern in maintaining quality of the Earth's environment and in achieving environmentally sound and sustainable development in all countries (UNDESA, 2005).

According to Zimstat (2016), the value for urban population growth (annual %) in Zimbabwe was 5.5 in 1990, 2.1 in 2000, 2.0 in 2010 and 1.85 in 2015. In particular, Mutare urban population has been increasing over the last decade hence waste volumes are also increasing resulting in a situation whereby the facilities to accommodate the problem are significantly going beyond the reach of Mutare City Council. However, immediate stakeholders in waste management are the people who should be taken as a priority in joining hands with the responsible authorities to fight the challenge that has far reaching health and environmental effects (Garity, 2015). Studies have revealed that the delivery of waste management services has been deteriorating in most urban areas of Zimbabwe over the last decade, despite the existence of local authority by laws and national laws that deal with waste management (Tevera et al, 2002).

Globally, solid waste is managed in several ways which include source reduction, collection of the waste, recycling, composting, incineration, landfilling, industry programs like voluntary plastic-type labelling and voluntary take-back programs, (Palczynski 2012). He further states that the recovery and reuse of materials from the waste stream also occurs at several levels in Africa. At the household level, items are reused before entering the waste stream, thereby extending their useful life. Scavengers also recover materials for personal and commercial purposes. Saeed (2016) denote that the extent of commercial recycling of paper, metals, glass and plastic depends on the presence of industrial or other end uses for these materials. In Zimbabwe, a waste collection system by the city municipalities and town councils has been put in place. Furthermore, practises such as waste reduction, recycling composting and industry programs are done. Recycling, landfilling and industry programs are done in Mutare, although at a much smaller scale. Solid waste collection by the City Council is done ineffectively.

Sources of solid waste in the city of Mutare include small to medium enterprises, supermarkets, illegal vendors, households, hospitals, clinics, surgeries, food industries, manufacturing industries, residential areas, motor industries and construction industries. Solid waste poses both environmental and public health threats if not properly managed. These

include land pollution, pollution of underground and surface water bodies, loss of livestock and wildlife from consumption of plastic, blockage of water and sewer drains by litter and non-biodegradable material, methane produced from decomposing material, water borne diseases and malaria resulting from mosquito bites (Chimhowu, 2012).

Waste management in Zimbabwe has been commercialised by the government, resulting in a decrease in the participation of sustainable solid waste management by the public (communities and individuals), which is also a waste generator (Tevera et al, 2002). This has resulted in the community having a neglecting attitude towards solid waste management, hence their dumping of waste in undesignated areas. The leaving out of the community in sustainable solid waste management has left the community assuming that this is a responsibility of the City Council. In light of this, this study therefore seeks to infer into how community participation is vital as far as waste management is concerned. The study also seeks to shed more light on challenges faced by local authorities in engaging people. According to Saeed (2016), studies have put much emphasis on the environmental effects as well as health threats with little done as yet concerning community participation in solid waste management. The current level of participation is meagre, not supported and also not regulated.

## **1.2 Statement of the problem**

Waste management is more than an environmental problem. The current waste management practices at Mutare City Council focus on disposal of waste management rather than looking at the waste generation sources and the opportunities associated with involving waste generators in waste management. The burgeoning population levels of the entire urban settings, let alone Sakubva, has resulted in a number of challenges of which solid waste disposal is one of the rampant problems. Sole efforts by Mutare City Council are not in unison with the increase in population hence the efforts are relatively lagging behind the waste being disposed. Public participation in solid waste management is not formal in Zimbabwe as in other countries like United States and United Kingdom (Katyal, 2011). Community participation in solid waste management has been spearheaded by civic organizations such as non-governmental organizations and other pressure groups. The Sakubva community does not own up any programs that are sustainable with regards to solid waste management. There seem to be challenges that stand in the way of public involvement

in solid waste management, however, there has been a growing recognition that if the public own up programs for solid waste management, there lies opportunities for great improvements in solid waste management. This study therefore, endeavours to interrogate the challenges impeding public participation and unlock opportunities that lie within the involvement of communities in solid waste management. According to Argawal (2016), there is need of a study on how planners should incorporate the public to play a more pro-active role in solid waste management. Moreover, the Sakubva community is not well educated or informed about the issue of solid waste management, benefits associated and what can be positively achieved through close cooperation in fighting the problem. With the growing population of Sakubva and its associated waste generation, effective waste management is a problem that can be best understood and fought through incorporating the Sakubva community in waste management programs.

### **1.3 Objectives of the study**

#### **1.3.1 General objective**

The main aim of this study is to interrogate the level of Sakubva community participation in solid waste management in light of the challenges and opportunities for future waste management. The present participatory levels will be examined as well as what can be done to improve such.

#### **1.3.2 Specific objectives**

1. To establish types and amounts of waste generated in Sakubva.
2. To determine approaches used to manage waste in Sakubva.
3. To explore the role played by the community in solid waste management in Sakubva suburb and the ways in which the community participation manifests.
4. To analyse ways in which the public could be engaged in solid waste management to ensure that the communities participate in solid waste management.

### **1.3 Justification of the study**

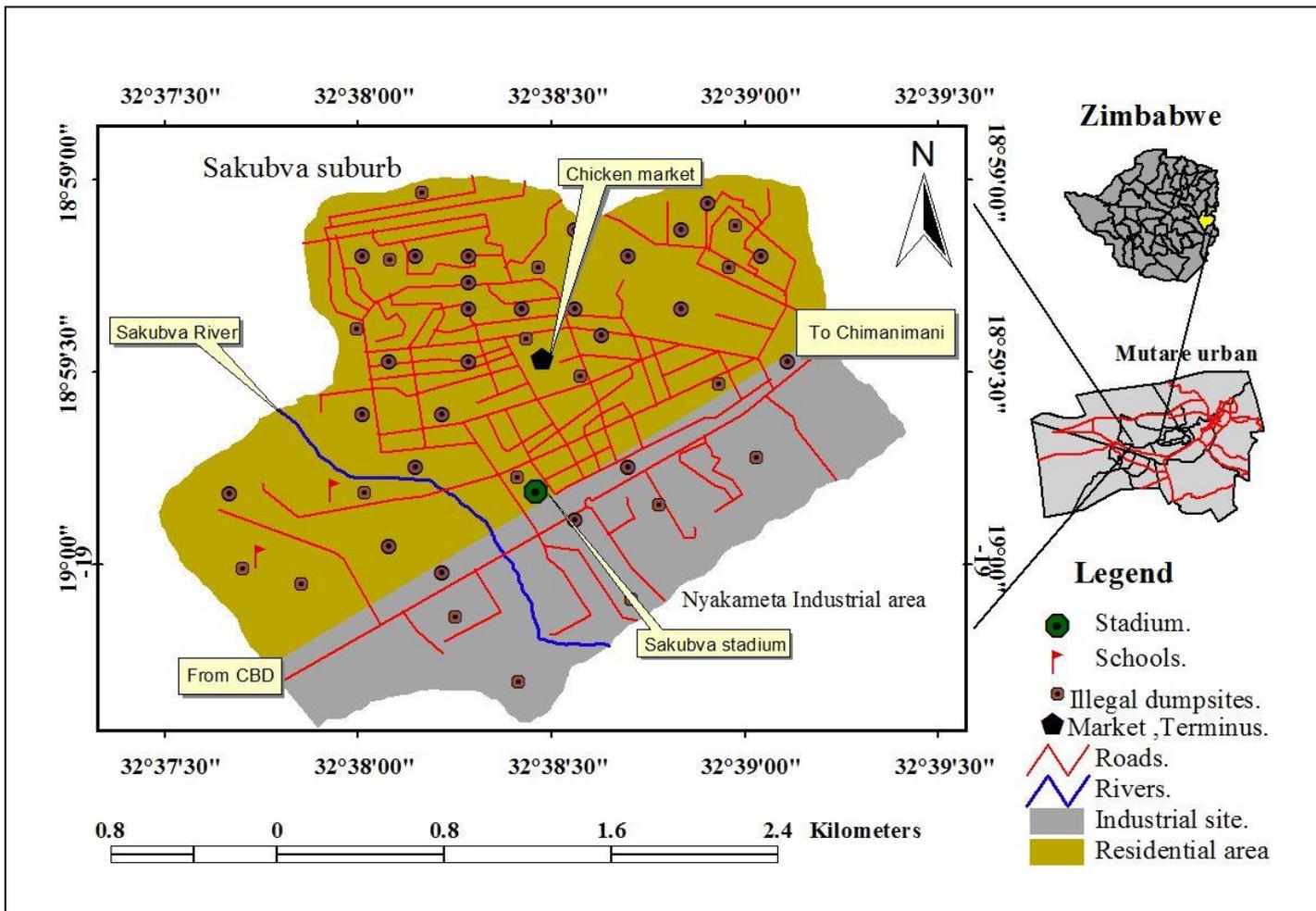
Solid waste management has been widely taken as an active research area by many scholars but little has been done in relation to public participation's role in sustainable solid waste management. The study develops a participatory model that capacitates local authorities' ability to expand waste management strategies through the involvement of communities. The study will unearth the challenges associated with civic engagement in solid waste management as well as opportunities that lie in the involvement of the people in solid waste management. There is growing recognition that the public who are the waste generators can play a bigger role in fighting the problem of solid waste management. There are also times when the public take part in solid waste management but this has not been institutionalised hence this study demonstrates the critical role that the community can play in solid waste management so as to minimise waste. Moreover, initiatives for public participation have been owned up by civic organisations (through clean up campaigns) but the local people have not been active enough to develop their own initiatives. There are currently no policies or regulation that regularise public participation or even to support community initiatives in solid waste management as in other developed countries hence this study also develops strategies and suggest possible areas for policy development that support public participation in solid waste management. The current solid waste management practice focuses on end of pipe solutions that have short term impacts and are inadequate in promoting sustainable urban waste management. The underlying fact is that, many potential opportunities for solid waste management exist in communities whose active role should be ignited by the council to minimise the negative impacts of waste on the environment and the societies they live in.

The study will benefit Mutare City council in the way they can possibly engage the communities in fighting waste management problems since the study will suggest best possible ways to involve these important stakeholders. The study will gather information surrounding the challenges the council and the communities face in relation to engaging each other in solid waste management hence solutions towards engagement platforms that can be best prioritised and sustainably taken are also developed. Furthermore, the study will help the researcher acquire skills, as well as have a better understanding of the subject to be researched. The study will also benefit the Sakubva community in ways they can take care of their environment through solid waste management, making use of the Waste Management Hierarchy, that is, the (Reduce, Re-use, Recycle concept), as well as the benefits and

economic opportunities that are associated with solid waste especially in these economic hard times the country is enduring through. The study will also benefit policy makers in developing policies that are waste management specific since the study discusses the opportunities for powers that can contribute to waste management programs that are community-specific and the precept of transforming waste management practices into urban planning agenda. Moreover, the study will ultimately help students in the department of Geography and Environmental Studies when carrying out their researches to addressing participatory issues in solid waste management world over. In this study also, lecturers of different departments will be provided with information about effective community participation in solid waste management, as well as a reference for the Midlands State University.

#### **1.4 Description of the study area**

The area under study is Sakubva suburb, a high-density suburb in Mutare City, located 5 kilometres South West of Mutare's Central Business District at geographic coordinates of 18.59 degrees South and 32.39 degrees East, with an elevation of 1 120 metres (Samake, 2015). Sakubva's climate falls under that of Mutare which has a temperate climate, with an average annual temperature of 19 degrees Celsius and average annual rainfall of 150 millimeters (Meteorological Services Zimbabwe, 2017). The suburb was the first black location of Mutare and it was established in 1925. It has an estimated population of 1 600 people (Zimbabwe National Census, 2012). It is divided into 23 sections including Chisamba, Mazhambe, Avenues and Macgregors. Sakubva's economy is centred on a large outdoor food and flea market and its most famous attraction is the Sakubva Market also referred to as 'Chicken Market' which is shown in **Figure 1.1**. The market has the largest food and vegetable markets, traditional artwork and a second-hand clothing market. More so, Sakubva has a number of schools and tertiary institutions which include Mutanda primary school and Saint Joseph's Catholic Mission. It is also endowed with three hospitals, a stadium, old people's homes and a public swimming pool for recreational activities. Due to the current economic hardships, increase in population and the lack of resources, the community of Sakubva is struggling to maintain a clean environment. The study area is diagrammatically illustrated on a map in **Figure 1.1**.



**Figure 1.1:** Map showing Sakubva suburb, Mutare (Residential and Industrial areas)

Source: Developed by Chirema E.T, extracted from Q.G.I.S

# CHAPTER TWO

## LITERATURE REVIEW

### 2.1 Introduction

The challenges and opportunities associated with integrating the community into active solid waste management have been the subject of a vast body of research. In line with this, this chapter is to unveil an analysis of the existing literature that relates to this study. The study will review other scholars' published studies along the solid waste management continuum. This section again details the conceptual and theoretical frameworks of the study.

#### 2.1.1 Waste

Waste has previously been defined by Bull (2013) as anything discarded by an individual, household or organization and as a result it is a complex mixture of different substances, only some of which are intrinsically hazardous to health. The United Kingdom Environment Agency classifies waste into 2 categories, controlled waste, that is, waste generated from households (municipal solid waste), commercial and industrial organizations and from construction and demolition and non-controlled waste which includes waste generated from agriculture, mines and quarries and dredging operations. Waste, as defined by Samake (2015), refers to rubbish, trash, junk or garbage, depending on the type of material or the regional terminology. It is an unwanted or undesired material or substance.

Wilson (2014) suggested that waste is any substance or an object that is disposed, is intended to be disposed or is required to be disposed of by the provisions of national laws. According to the United Nations Statistics Division UNSD (2016), waste may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products and other human activities. Research by the Eurostat (2016) depicts that municipal waste generated by a less economically developed country, range from 280 to 780 kilograms per capita.

#### 2.1.2 Solid waste

Solid waste has been defined by Gaillochot (2016), in his article of Solid Waste Management, as discarded materials other than fluids and gases and it includes municipal garbage, agricultural refuse, demolition and industrial waste as well as mining residues. Sources of

solid waste include illegal vendors, households and residential areas (EMA, 2017). As indicated by Chalmin (2016), solid waste is characterised by the presence of an abundance of degradable carbon and solid waste microbiology is influenced by the nature of this carbon. Chandler (2011) clearly states that solid waste, as generated from residential and commercial sources, is heterogeneous with respect to both physical and chemical composition. He asserts that although the composition of solid waste has changed throughout history, the most dramatic changes have occurred during the last 50 years, characterised by an accelerated proliferation of waste organic matter, paper and plastics. According to Christen (2016), Solid waste is defined to include refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments (including hospitals), market waste, yard waste and street sweepings. The International Panel on Climate Change (IPCC) includes food waste, garden waste, paper and cardboard, wood, textiles, nappies (disposable diapers), rubber and leather, plastics, metal, glass, ash, dirt, dust, soil and electronic waste in their definition of solid waste.

### **2.1.3 Solid waste management**

Bull (2013) views solid waste management as the generation of waste and the collection, processing, transportation and disposal of waste. Solid waste management refers to the collection, transportation, treatment, final disposal and recycling of solid wastes (Lankester, 2014). Booth (2014) concurs with the above definitions, denoting that solid waste management is the systematic control of generation, collection, storage, transportation, source separation, processing, treatment, recovery and disposal of solid waste. While levels, environmental impacts and costs vary dramatically, solid waste management is arguably the most important municipal service and serves as a prerequisite for other municipal actions (Martin, 2014). Goals and principles of solid waste management include protection of environmental health, promotion of quality of the environment, generation of employment and income, as well as supporting the efficiency and productivity of the economy. Schubeler (2016) concurs with the above scholars and states that the principles of sustainable solid waste management strategies are to minimise waste generation, to maximise waste recycling and reuse and to ensure the safe and environmentally sound disposal of waste. Solid waste management is a complex task which depends as much upon organisation and cooperation between households, communities, private enterprises and municipal authorities as it does upon the selection and application of appropriate technical solutions for waste collection, transfer, recycling and disposal (Wehrle, 2016).

Solid waste management typically consumes between 20% and 50% of municipal budgets in developing countries. Furthermore, solid waste management is an essential task which has important consequences for public health and well-being, the quality and sustainability of the urban environment and the efficiency and productivity of the urban economy (Schubeler, 2016).

#### **2.1.4 Community participation**

Garity (2015) discusses community participation as the process by which individuals and families assume responsibility for their own health and welfare and for those of community and develop the capacity to contribute to theirs and the community development. He eludes that they come to know their own situation better and are motivated to solve their common problems. This enables the community to become agents of their own development instead of positive beneficiaries of development aid. Subash (2016) recognizes community participation as the sociological process by which residents organise themselves and become involved at the level of a living area or a neighbourhood, to improve the conditions of daily life (water, sanitation, health and education). The concept community participation comprises of three pertinent aspects, that is, awareness, mobilisation and action. Awareness of the community raises a sense of ownership within the community, thus sustainable solid waste management is achieved (Chiwandamira, 2010). According to Chapman (2013), the term community participation, rather than consultation, indicates an active role for the community, leading to significant control over decisions. She further states that the two key rationales for community participation are that it is ethical and pragmatic.

According to Khan (2006), performance of effective and efficient solid waste management systems depends on the meaningful participation of individuals, communities and institutions, producers, non-governmental organisations and governments. In relation to the above statement, analysing the data, Chimhowu (2012) notes that the operational efficiency of solid waste management depends upon the active participation of both the municipal agency and the citizens. Linkages of the public and private sector operators may improve the efficiency of the solid waste management and create new opportunities for employment (Chimbetete, 2012).

## **2.2 An overview of solid waste management practices in Sub-Saharan Africa**

Solid waste collection systems have been erected in Sub-Saharan Africa. These systems, as stated by Gandure (2012), comprise household and neighbourhood (primary) waste containers, primary and secondary collection vehicles and equipment and the organisation and equipping of collection workers, including the provision of protective clothing. Christen (2016) asserts that in countries such as Zimbabwe, Zambia and Kenya, selection of collection equipment is based on area-specific data on waste composition and volumes, local waste handling patterns and local costs for equipment procurement and operation and maintenance (labour, fuel, lubricants, and tires). Regarding the design of local waste collection systems, the most effective results have been obtained through the participation of the concerned Sub-Saharan African communities. Where appropriate, the objectives of material recovery and source separation are considered and these activities are being done in a pragmatic and incremental manner (Matovu, 2012). He reinforces the notion that in order to extend service coverage in Sub-Saharan African cities, especially in low-income areas, the use of low-cost, community-managed primary collection systems have been put in place. Faccio et al (2011) have suggested that the sizes, numbers and distribution of transfer stations have been designed to facilitate local collections while achieving efficient transfer operations and minimum transport distances and costs.

In Mauritius, no household is provided with a regular daily waste collection service (Heeramun, 2013). In the past, very few storage receptacles were in use on domestic premises, the waste being simply heaped on the ground or in open concrete ash pits. Focus on waste collection by Theisen (2012), uncovers domestic waste collection at household level as slow and labour intensive because of inadequate storage and large amounts of leaves and garden waste. Studies show that in most parts of Namibia, a significant proportion of municipal waste in rural areas is burnt in back yards (Longwe, 2012). Solid wastes in Botswana have traditionally been collected by local authorities, but during the last three years, however, the Ministry of Local Government has entrusted some of the collection function to private contractors (Patel, 2012). It has been reported that in other parts of the cities in developing Sub-Saharan nations, waste collection and disposal are left to individuals or local communities or waste may be left to accumulate in the streets (Vigil, 2012).

In low-income Sub-Saharan countries, recovery of recyclable materials, mainly paper, glass, metals and plastics, is normally undertaken by informal private sector workers. This

economically useful activity has been facilitated by appropriate designs of equipment and facilities for each stage of the collection and disposal processes (Longwe, 2012). The effectiveness of waste recovery, in Sub-Saharan Africa has lately been enhanced through active support aimed at improving organisational capacity of informal workers, improving equipment and facilities for the collection and sorting of materials and co-ordination of municipal waste collections and disposal operations (Wehrle, 2016). In line with this, Heeramun (2013) outlines that formal public sector workers are often engaging in some form of scavenging activities on the side.

A study of solid waste management practices in Zimbabwe and Uganda concludes that the public sectors are involved in solid waste recovery and or leasing of waste recovery rights to formal private sector enterprises (Patel, 2012). Composting is an activity that has largely under practise in Sub-Saharan Africa for the recovery of organic materials. For some countries, the potential for financially viable composting has been significantly improved through the introduction of waste separation at source (Heeramun, 2013). Additionally, Mukosa (2007) depicts that Sub-Saharan municipalities have undertaken accompanying measures such as the promotion of appropriate household waste storage facilities and information campaigns to encourage waste separation. Alternatively, community-based composting has been promoted. Other solid waste management practices underplay are incineration and landfilling. Transformation processes have been seen in which dumping practices have progressively improved and existing sites gradually upgraded (Mayeya, 2007).

### **2.2.1 Sustainability of the waste management practices in Sub-Saharan Africa**

Current waste management practices have managed to get rid of waste in urban areas. Besides reducing the volume of waste which needs to be transferred and disposed, composting generates a valuable soil conditioner for agricultural and horticultural use. The location of composting operations adjacent to markets, for soil conditioners, for instance, near farms or nurseries, have been of great advantage and sustainable (Roberts, 2016). However, these practices have not sustainably cleared the municipal solid wastes (Khan, 2006). The increase in current waste management practices' weaknesses has resulted in proposals of public involvement in sustainable solid waste management practices. Awareness is gradually improving with non-governmental organisations and civil societies in Sub Saharan Africa assisting community-based organisations in educating their residents on sound household waste handling (Mol, 2011).

Overwhelmed with the magnitude of the solid waste problem, sub-Saharan African city authorities have sought out environmentally friendly but costly technologies via public-private partnerships with firms often from the North, yet these technologies are to a greater extent inappropriate for the local conditions (Gabbay, 2013). He further argues that while the authorities' intentions may be laudable, the approach is born out from an empirical vacuum. Solid waste collection by responsible authorities is particularly inadequate in poor urban communities, where residents cope with refuse heaps laying uncollected for up to weeks at a time by burning it or dumping it in streams and stagnant gutters, all of which attract disease-carrying pests and give rise to serious public and environmental health hazards (Nyenje, 2011).

Solid waste management in Africa is at present delivered in an unsustainable manner. Due to uncontrolled urbanisation, large quantities of waste are generated daily and this exerts much pressure on over strained solid waste management systems in the sub-Saharan African states (Boadi, 2013). Coupled with weak institutional capacity and lack of resources, both human and capital, the city authorities are facing difficulties in ensuring that all waste generated in the cities is collected for disposal, hence compromising the systems' sustainability (Kuitunen, 2013). Some researchers that have investigated the sustainability of solid waste management in sub-Saharan Africa have come to the conclusion that home collection of waste is limited to high and some middle income areas while the poor are left to contend with the problem on their own. This leads to indiscriminate disposal of waste in surface drains, canals and streams, creating unsanitary and unsightly environments in many parts of the countries, thereby resulting in unsustainability of the whole system (Garity, 2015).

Longwe (2012) indicated that large-scale sector composting operations are seldom financially viable. Roberts (2016), however, argues that the alternative of small scale, decentralised composting plants have hardly been considered in Africa and decisions to practise composting in Sub-Saharan Africa have not been market-oriented and they have not been based on careful economic and financial analysis. This has resulted in this practise becoming less sustainable from a macro-scale.

While the technology is fairly simple, landfills involve complex organic processes. Particular attention has not been given to ground water, soil and air through the control of leachate and gases, hence making this practise less sustainable in Sub-Saharan Africa (Sawell, 2014). Furthermore, according to Vehlow (2014), landfill siting has proven to be politically difficult

in Southern Africa and has required active public participation for negotiated solutions. This has also aggravated its unsustainability.

### **2.3 Current solid waste disposal practices in Zimbabwe and their impacts on the environment**

The waste generated by a population is primarily a function of the people's consumption patterns and thus their socio-economic characteristics. Waste generation in Zimbabwe has been conditioned to an important degree by people's attitudes towards waste, that is, their patterns of material use and waste handling, their interest in waste reduction and minimisation, the degree to which they separate wastes and the extent to which they refrain from indiscriminate dumping and littering (Patel, 2012). It is generally regarded that in Zimbabwe, people's attitudes influence not only the characteristics of waste generation but also the effective demand for waste collection services, that is, their interest in and willingness to pay for collection services (Muller, 2015). In provinces like Manicaland and Matabeleland, attitudes may have been positively influenced through awareness-building campaigns and educational measures on the negative impacts of inadequate waste collection with regard to public health and environmental conditions and the value of effective disposal. With such campaigns, most of the country's citizens have taken responsibility as waste generators and of their rights as citizens to waste management services and this, in some towns, has helped improve environmental performance (Faccio et al, 2011).

Whilst attitudes towards solid waste may be positively influenced by public information and educational measures, improved waste handling patterns is hardly being maintained in the absence of practical waste disposal options in Zimbabwe (Parrot, 2009). However, as analysed by Khonje (2012), awareness-building measures in the country's ten provinces are being co-ordinated with improvements in solid waste collection services, whether institutionally or community- managed. Similarly, people's waste generation and disposal patterns are influenced by those of their neighbours. Matete (2008) states that besides general awareness, improved local waste management has largely depended upon the availability of practical options for waste collection and a consensus among neighbours that improvement is both crucial and possible.

Observed by Mayeya (2007), the most common disposal practices by more than 80% of Zimbabwean urban households, is indiscriminate dumping of solid waste on open space, near road sides or in open pits or illegal dumpsites, see **Plate 2.1**. This is due to the fact that there

is inadequate collection of solid waste, hence residents fear diseases and bad smell if they keep increasing waste within their yards. This is in line with Khonje's (2012)'s observation, where it was concluded that solid waste in most Zimbabwe's cities and towns is often dumped at road junctions and any available open space and the waste is rarely collected on time, if at all. These unsustainable practices have resulted in poor environmental sanitation and ground and water pollution, as well as serious outbreaks of cholera and dysentery across the country (Khonje, 2012). Furthermore, 40% of households store their solid waste in rubbish pits and as noted by Heermun (2013), few households have proper storage receptacles, that is, dustbins, bags and sacks. Mukosa (2007) highlights that nearly 20% of citizens burn waste at illegal dumping sites, worsening ambient air pollution. He further denotes that about 10% of the communities bury the solid waste in rubbish pits when full. Studies carried out by Kyte (2012) on solid waste disposal practices in Zimbabwe reveal that most of the household solid waste is dumped in low-lying areas and land adjacent to slums. Lack of enforced regulations therefore, enables potentially hazardous waste to be mixed with municipal solid waste, which is harmful to the environment.



**Plate 2.1:** Solid waste disposed at an illegal dumpsite in Mazhambe, Sakubva

Source: Field survey (2017)

It has been observed that the institutions responsible for the collection and disposal of solid wastes in Zimbabwe are the city and town municipal councils through the department of

Public Health (Mukosa, 2007). These municipal councils collect and dispose municipal solid waste in designated areas at given timetables, sometimes under close supervision by the Environmental Management Agency (EMA), a regulatory body. Be that as it may, in cities and towns where waste is not collected frequently or improperly disposed, there have been huge detrimental environmental impacts. The environmental threats include contamination of groundwater and surface water by leachate, as well as air pollution from burning of waste that is poorly collected and disposed (Hoornweg and Kyte, 2012). Burning of polystyrene polymers (kaylite) such as foam cups or containers, meat trays and yoghurt containers that is currently being practised widely in Zimbabwe releases styrene, a dangerous pollutant (EMA, 2017).

## **2.4 The role of public in solid waste management**

### **2.4.1 Community based organisations (CBOs)**

According to Kurian (2016), the community and its representatives have a direct interest in solid waste management, as residents, service users and tax payers. Literature uncovers that communities in the low-income areas generally receive marginal or no services in terms of public transport, electricity, drinking water, sanitation, drainage and also of waste removal. These communities will sometimes take the initiative to organise themselves into community based organisations, with the direct goal of self-help and improving their living conditions. Such community based organisations may receive external assistance in the form of technical and or financial aid from different agencies. Sometimes these activities may also take the form of direct participation in (their own) waste management, such as feeding organic material directly to their stock (Ali, 2014). Usable materials like bottles are often reused by the members of the low-income community themselves.

Groups of citizens, including those from the middle and high-income areas, may start community based organisations aimed at improving the waste situation in their neighbourhood. They may hire (informal or formal) waste collectors. They make arrangements with local politicians for waste transfer points and they may also start waste separation experiments (Moghadam et al, 2009), see **Plate 2.2**. Kurian (2016) clearly states that middle and high-income communities produce the more valuable waste and hence are attractive to low-income waste pickers, where they are often assisted by watchmen and domestic servants. Solving service problems in poorer areas is more likely to require intervention, since the materials have less value. Community based organisations mainly

participate in primary waste collection systems, separation at source experiments and implementation.

According to Ahmed (2014), community based organisations may also take a role in the actual provision of services, including operations and maintenance and even in the construction of facilities. Thus community based organisations, speaking for the individuals or members involved, play an important role in solid waste management system development processes. Organised communities have a stronger voice than individuals and bring about improvements more easily. They can also be organised along lines of gender, age or religion (Moghadam et al, 2009).



**Plate 2.2:** Pet cans, cardboard, plastic and bottles extracted and separated by a local Sakubva CBO at a local dumpsite

Source: Field survey (2017)

#### **2.4.2 The informal private sector**

The term informal private sector, as suggested by Furedy (2010) refers to unregistered, unregulated or casual activities carried out by individuals and or family or community enterprises, that engage in value-adding activities on a small-scale with minimal capital input, using local materials and labour-intensive techniques. Informal activities, in contrast with the formal sector in solid waste collection and recycling, are often driven by poverty and are initiated personally and spontaneously (and sometimes haphazardly) in the struggle for survival (although some enterprises, especially the ones engaged in recycling activities,

manage to make considerable profits) (Kurian, 2016). Consequently, the choice of materials to collect is in the first place determined by the value of the waste materials and in the second place, by their ease of extraction, handling and transportation. Paper, metals and plastics, usually collected from more wealthy residential or industrial areas, tend to attract more attention than organic or biodegradable materials, even though these materials are present in much smaller percentages than organic waste or manures (Ekere et al, 2009).

In general, the informal sector consists of two types of activities, individuals and families, performing activities which provide them with subsistence and small businesses, operating in much the same way as their larger, registered counterparts, but without the benefit of official registration (Ali, 2014). The organisation and structure of these recovery activities is generally opaque to outsiders. According to Ahmed (2014), this is true not only for waste pickers and itinerant waste buyers, but also for other groups such as small enterprises recycling metals or plastics. In general, waste work is done by religious or ethnic minorities, low castes or rural immigrants who are looking for a way to generate subsistence income in an urban context. The importance of the role played by the informal private sector in solid waste management systems in general and as partners for municipalities in particular, is slowly achieving international recognition (Ahmed, 2014).

Muller (2015) highlights that while informal-sector activities vary according to socio-cultural, religious and economic circumstances, some generalisations about gender roles are possible. The least sophisticated forms of labour, including collection of solid waste from the streets and dumps and primary sorting of the material fall to the women and children, most of whom work from home and do any handling or sorting in their homes or yards (Furedy, 2010). Men are more likely to be involved in the processing or manufacturing of items, together with the selling of recovered items and materials.

### **2.4.3 Non-governmental organisations (NGOs)**

According to Wasman (2008), the term non-governmental organisation can refer to such diverse organisations as churches, universities, labour organisations, environmental organisations, lobbies and even donor organisations. Non-governmental organisations are generally intermediate organisations which are indirectly non-continuously involved in community projects. They do not only advocate, they can also be involved in awareness-raising, advocacy, and decision-making. Non-governmental organisations can act as intermediaries between grassroots initiatives (CBOs) and municipal governments, or serve

the ideological, political or altruistic interests of international organisations (Muller, 2015). They can advocate interests on a larger scale than the single community and provide support and advice to community based organisations, but also to marginal groups in the society, such as waste pickers at dump sites and street children. Related research carried out by Dauda (2009) outlines that the role of non-governmental organisations as partner organisations in waste management systems ranges from serving as the umbrella organisation under which community based organisations operate, to providing a channel for donor financing. He goes on to say that as partners, they can sometimes confer a degree of credibility and perspective on the informal sector in the eyes of the municipality. They bring outside resources to bear on the situation, as they are motivated by an altruistic wish to improve circumstances or a combination of personal and altruistic motivation to improve the community.

## **2.5 The role of institutions in solid waste management**

### **2.5.1 Municipal governments and environmental agencies**

Local municipal governments as well as environmental agencies, have a role in the set-up and operation of waste management systems. Trois (2008) noted that most urban authorities in both industrialized and developing countries receive their powers and obligations from a central government authority, with allocation of powers and responsibilities to protect the rights of the citizens, to provide services and to serve the common good (Gidman et al, 2015). Zmirou (2015) depicts that municipal governments have to implement environmental laws and regulations in order to fulfil their statutory obligations. Local municipal governments, almost by definition, are charged with controlling living conditions and public health. Within this framework, urban authorities around the world traditionally interpret their mandate to include the delivery of services, including sanitation, waste removal and disposal within their political and geographic jurisdiction. This gives them formal responsibility for solid waste management and this responsibility is generally assigned to the Health or Sanitation Department, but in certain cases also to the department of Public Works or Engineering. Ali (2016), clearly states that external help from facilitating agencies may enable the public and private sector to form partnership with people for better service delivery.

### **2.5.2 The formal private sector**

According to Furedy (2010), the formal private sector is understood to refer to private sector corporations, institutions, firms and individuals operating registered and or incorporated

businesses with official business licences, an organised labour force governed by labour laws, some degree of capital investment and generally modern technology. Formal private companies are involved in wide-ranging activities in waste management systems, varying from waste collection, resource recovery, incineration and landfill operation. They may participate in the waste management system in a number of ways including entering into contracts paid by the municipality to perform collection, processing, disposal or cleaning services for compensation (Ekere et al, 2009). Furthermore, these companies may purchase the right to perform services and keep (all or part of) the income generated, as well as entering into contracts with individuals or businesses for collection services. They also function as a purchaser of recovered materials from the municipality or the collector using their private resources.

## **2.6 Challenges in solid waste management**

### **2.6.1 Institutional Challenges**

Wilson (2014) in his book, *Role of informal sector recycling in waste management in less economically developed countries*, outlines that with the focus of the Millennium Development Goals on poverty reduction and of waste strategies on improving recycling rates, one of the major challenges in solid waste management in less economically developed countries is how best to work with this informal sector to improve their livelihoods, working conditions and efficiency in recycling. Related research by Ali (2016) reveals that poorly designed attempts for partnership may actually worsen the situation by opening new avenues of inefficiency and corruption. Ahmed (2016) argues also that there is need for a facilitating agency for designing and nurturing partnerships in solid waste management.

Management deficiencies are often observed in the municipalities. Some researchers that have investigated the institutional factors that affect the system have come to the conclusion that local waste management authorities have a lack of organizational capacities (leadership) and professional knowledge (Chung, 2008). However, Seng et al (2010) argue that solid waste information in municipalities is very scanty from the public domain. They move on to suggest that extremely limited information is scattered around various agencies concerned, therefore, it is extremely difficult to gain an insight into the complex problem of municipal solid waste management.

Literature suggests that technical factors influencing solid waste management negatively are related to lack of technical skills among personnel within municipalities and government authorities, deficient infrastructure, poor roads and vehicles, insufficient technologies and reliable data (Hazra and Goel, 2009). Poor servicing of solid waste collection vehicles, poor state of infrastructure and the lack of adequate funding, militate against optimization of solid waste disposal service (Rotich, 2016). It has been reported that collection, transfer and transport practices are affected by improper bin collection systems, poor route planning, lack of information about collection schedule, insufficient infrastructure, poor roads and number of vehicles for waste collection (Goel, 2009).

Moreover, poorly located and illegal dumps consume valuable land that could be better used for other purposes. Rotich (2016) places emphasis on the issue of these unsightly facilities, outlining that they consequently lower the value of land in the surrounding area. In addition, piles of uncollected garbage and fallen waste storage bins on city streets exacerbate already congested traffic conditions and impede necessary road improvements until the solid waste problem is resolved. Chung and Lo (2008) depict that lack of knowledge of treatment systems by authorities affect the treatment of waste.

Vulnerability of pollution of surface and groundwater is high because local authorities rarely consider environmental impact in siting solid waste disposal sites. Matete and Trois (2008) and Asase et al (2009) respectively suggested that the factors affecting the environmental aspect of solid waste management in developing countries are the lack of environmental control systems and evaluation of the real impacts. Improper solid waste management causes soil, air and water pollution.

Waste workers are associated to a low social status situation that gives as a result low motivation among the solid waste employees. Politicians give low priority to solid waste compared to other municipal activities with the end result of limited trained and skilled personnel in the municipalities (Moghadam et al, (2009). Poor economic growth has resulted in an increase in the poverty level which presently stands at 56%. Research has shown that migration from the rural areas to the urban areas has resulted in unplanned settlements in suburban areas accommodating about 60% of the urban population on only 5% urban land area (Rotich, 2016). He further states that political interference also hampers smooth running of local authorities and ultimately solid waste management (Rotich, 2016).

### **2.6.2 Legislative and Regulatory Challenges**

Quite a number of legislative barriers frustrate the achievement of sustainable solid waste management, particularly in sub-Saharan Africa. Mandates for public delivery of services like waste collection may make it difficult or impossible to contract the services to private sector actors (Hazra, 2009). Furthermore, lack of enabling legislation to allow contracting means that the appropriate procedures hardly exist. Goel (2009) notes that lack of legislative and regulatory infrastructure for the management of community involvement in solid waste management risks insufficient monitoring and or control by contractors and no recourse for the city if contractors fail to perform in the ways they have agreed. Health and sanitation regulations governing waste procedures may require procedures that conflict with informal solid waste recovery activities. Moreso, environmental laws may discriminate against apparently dirty businesses, even if the net effect of these businesses on the environment is positive. Worker health standards may effectively exclude waste pickers and informal-sector entrepreneurs from consideration, since their workplace would not initially pass these standards (Hazra, 2009).

### **2.6.3 Financial Challenges**

According to Wright (2014), municipal solid waste management is a costly service that consumes between 20 % and 50 % of available operational budgets for municipal services, yet serves no more than 70 % of the urban inhabitants. Municipalities have failed to manage solid waste due to financial factors. The huge expenditure needed to provide the service, the absence of financial support, limited resources, the unwillingness of the users to pay for the service and the lack of proper use of economic instruments have hampered the delivery of proper waste management services (Sharholly et al, 2007). According to Samake (2009), solid waste management will not be effective and sustainable unless proper incentives for both sectors (public and government) are built into the design. Ali (2016) has also come to the conclusion that caveats and barriers that result in ineffective and unsustainable solid waste management are improper incentives for both the public sector and institutions, being built into the design.

Khan (2016) states that solid waste management is a challenge for the cities' authorities in less economically developed countries mainly due to the increasing generation of waste. This is a burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different

stages of waste management and linkages necessary to enable the entire waste management system functioning (Hogland, 2013). Evans (2012) concurs with the above scholars, noting that due to inefficient collection of waste disposal fees from residents, municipalities are compelled to sometimes cut the collection service and reduce its labour force, especially in high density suburbs.

#### **2.6.4 Health Challenges**

Different methods of waste management emit a large number of substances, most in small quantities and at extremely low levels. Raised incidence of low birth weight births has been related to residence near landfill sites, as has the occurrence of various congenital malformations (Bull, 2013). Researchers have documented that cancer incidence and mortality in populations around landfill sites or incinerators have been equivocal, with varying results for different cancer sites (Wright, 2014). Hazra and Goel (2009), however argue that there is little evidence for an association with reproductive or developmental effects with proximity to incinerators. They highlight that many of these studies lack good individual exposure information and data on potential confounders, such as socio-economic aspects.

Waste management procedures in less economically developed countries are associated with occupational safety and health risks (Olexa, 2012). The literature uncovers that waste management workers have been shown to have increased incidence of accidents and musculoskeletal problem (Bull, 2013). Francis (2014) outlines that the health impacts of new waste management technologies and the increasing use of recycling and composting have also had their fair share in waste workers.

Literature suggests that unsafe solid waste collection and disposal practices in cities threaten public health as well as surface and ground water resources (Wright, 2014). In developing country cities, ineffective solid waste management systems cause health risks largely from direct and indirect contact with waste containing human faecal matter. It has been reported that waste incineration also produces a large number of pollutants from the combustion of sewage sludge, chemical, clinical and municipal waste. Quite a number of these pollutants are considered to have the greatest potential impact on human health based on environmental persistence, bioaccumulation and amount emitted (Bull, 2013). Solid waste that is not properly collected and disposed can be a breeding ground for insects, vermin and scavenging animals and can thus pass on air and water-borne diseases. Surveys conducted by UN-Habitat

show that in areas where waste is not collected frequently, the incidence of diarrhoea is twice as high and acute respiratory infections six times higher than in areas where collection is frequent (UN-Habitat, 2009). It has been documented that burning of polystyrene polymers such as foam cups and yoghurt containers releases styrene that can be absorbed through the skin and lungs (EMA, 2017). At high levels, styrene gas can damage the eyes and mucus membranes. Long term exposure can affect the central nervous system, causing headaches, fatigue, weakness and depression. Furthermore, air pollution from the burning of dumps or skip bins results in respiratory diseases.

## **2.7 Opportunities attached to solid waste management**

Solid waste management contributes immeasurably to the improvement in adult health and reduction in child mortality, improvement in ambient water quality, improvement in ambient air quality, increased urban productivity and economic development. According to Faccio et al (2011), some of the enabling factors that facilitate solid waste management are technical, environmental, financial, socio-cultural, institutional and legal. Below, are some of the most crucial opportunities or benefits of investing in solid waste management improvements.

Gang (2016) depicts that solid waste management offers opportunities to improve profits by conserving resources and improving environmental performance. Khan (2016) and Samake (2009) respectively suggested that linkages of the public and private sector in solid waste management may improve the efficiency of the entire sector and create new opportunities for employment. Furthermore, Saeed (2016) notes that new opportunities in waste management include co-processing in cement kilns or energy recovery, conversion to fuel, construction of asphalt road and conversion to basic chemical. The impacts of providing effective solid waste management services are largely associated with the elimination of health risks, environmental degradation and impediments to urban productivity (Wright, 2014).

In studies carried out by Wilson (2014), on benefits of sustainable solid waste management, it has been observed that despite the health and social problems associated with it, it provides significant economic benefits that need to be retained and that solid waste management is also highly counterproductive. It appears that there is an emerging trend in encouraging the community to enter into solid waste management operations. Such linkages may improve the efficiency of the entire sector and create new opportunities for employment (Ali, 2016). According to Singh (2016), solid waste management yields opportunities that include construction of asphalt roads, basic chemical and fuel production and energy recovery.

## **2.8 Environmental and health hazards associated with solid waste**

### **2.8.1 Environmental Hazards**

Waste is an eyesore and results in the loss of aesthetic value of land, taking away the beauty of cities and towns and this has a negative effect on the tourism industry (EMA, 2017). Uncontrolled disposal of urban waste into water bodies, open dumps and poorly designed landfills is a principal cause of surface and groundwater contamination. According to Rotich (2016), illegal dumping of municipal solid waste on river banks or on the roadside poses environmental and economic threats on nearby properties. In EMA (2017)'s waste management report, it is denoted that waste can be washed away into water bodies, thereby polluting the surface water bodies. Moreso, leachate can pollute underground water and contaminate the soil. In many developing country cities, where local authorities lack adequate controls over solid waste disposal, hazardous solid wastes can enter the municipal waste stream. Consequently, leachate from open dumps or uncontrolled landfills can cause large scale, long term pollution of essential surface and ground water resources, many of which are used for drinking or other economically important activities. Leckie (2014) concurs and states that inevitable consequences of the practice of solid waste disposal on the environment are gas and leachate generation due primarily to microbial decomposition, climatic conditions and refuse characteristics. The migration of gas and leachate away from the solid waste boundaries and their release into the surrounding environment present serious environmental concerns at both existing and new facilities. He places emphasis on the notion that vegetation damage, unpleasant odours, ground water pollution, ambient air pollution and global warming can all emerge as a result of improper solid waste management.

According to Hoornweg (2012), illegal dumping of solid waste on the river banks or on the roadside poses environmental and economic threats on nearby properties. Olexa (2012) suggests that solid waste in water bodies can have various negative effects on habitats and may cause visual pollution. Solid waste can cause damage to the marine biota by entangling animals, causing suffocation or digestive problems. Environmental Management Agency's 2015 annual solid waste report shows that many of Zimbabwe's landfills have been closed because the solid waste disposed therein was contaminating ground water. Masocha (2013) further eludes that solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons.

According to Zimrou (2015), air pollution occurs largely through inefficient local open air burning of solid wastes, incineration in plants that lack effective treatment facilities for gaseous emissions and through spontaneous combustion of refuse at dumps. When methane gas generated by the anaerobic decomposition of organic waste materials is ignited, fires can spread underground and continue to burn for years. Landfill gas also constitutes a serious explosion hazard for workers and nearby residents. In line with the above, Leckie (2014) identified other causes of air pollution to be the decomposition of urban waste, involving the vaporization and emission of chemical constituents into the atmosphere and the dispersion of air-borne particulates from open collection points and solid waste transport or transfer activities. Decomposing material produces methane which ultimately leads to global warming.

### **2.8.2 Health Hazards**

Landfilled radioactive waste and toxic wastes from non-recycled household waste constitute the major threats to human health and to a clean environment (Adeola, 2014). He further eludes that solid waste result in a greater probability of synergistic effects of persistent environmental toxicants on the human physiological system. Wright (2014)'s studies have revealed that higher risk of exposure to toxic substances from solid waste translates into poor health conditions which manifest as high mortality, morbidity and lower life expectancy. High levels of toxic wastes have been linked to various human health problems, for instance, lung cancer, respiratory problems, and miscarriages among pregnant women, deformed fetuses, childhood leukaemia, mental disorders and immune deficiency (Adeola, 2014). Atmospheric dispersion of compost organic dust that convey microorganisms and toxicants, Gram negative bacteria, actinomycetes and fungi expose human beings to lung damage and allergies. Several geographical comparison studies have investigated cancer mortality and incidence around waste illegal sites. Increased frequency of cancers in countries containing open dump sites has been observed, particularly for gastrointestinal, oesophageal, stomach, colon, rectal, liver, kidney, pancreas and non-Hodgkin's lymphomas cancer (Bull, 2013). Blockage of water and sewer drains by litter by litter and non-biodegradable material leads to the high spread of water-borne diseases such as typhoid (EMA, 2017).

Children, refuse collection workers and scavengers are directly exposed to excreta-related pathogens and intestinal parasites when they handle faecal contaminated refuse. It is generally regarded that children are particularly vulnerable. It has been documented that

excreta-related diseases are responsible for one quarter to one half of the deaths of children under the age of 5 (Asase et al, 2009). Important indirect health effects result from the breeding flies, rats and other disease vectors at dump sites and open garbage heaps and drain. According to EMA (2017), solid waste is a breeding ground for disease spreading vectors such as flies, mosquitoes and rats, hence it harbours pathogens and promotes the spread of diseases such as cholera, dysentery and malaria.

Additional risks to public health are associated with exposure to toxic substances or hazardous materials that may enter the municipal waste stream. In studies carried out by Jerie (2015) on occupational risks posed by solid waste, it has been observed that for municipal solid waste workers, potential health hazards include viruses, mycoplasmas, bacteria, fungi and cysts or eggs of intestinal parasites; secondary pathogens and their toxins, volatile and semi-volatile organic chemicals; persistent lipophilic organic chemicals; metals and other organic materials and organometallics. Other potential risks include allergens from corrosive, caustic, explosive and sharp materials.

There is a general consensus that the population residing in close proximity to toxic waste dumpsites, municipal solid waste incinerators and landfills is at higher risk of developing health problems related to toxic waste (Bullard, 2012). High rates of worker illness and absenteeism are due to poor hygienic conditions and the proliferation of disease-carrying pests at open dumps. Refuse thrown into the drainage system blocks the flow of water which eventually causes flooding and consequent water borne diseases like malaria and typhoid (Leckie, 2014).

## **2.9 Significance of community participation in solid waste management**

It is generally regarded that waste management is the sole duty and responsibility of local authorities and that the public is not expected to contribute. The operational efficiency of solid waste management depends upon the active participation of both the municipal agency and the citizens (Sharholly et al, 2008). In relation to this fact, Moghadam et al (2009) note that socio-cultural aspects that include the community participating in decision making, community awareness and societal apathy also contribute to efficient solid waste management. Ekere et al (2009) proposed that the involvement of the population in active solid waste generation activities, including households, is necessary to have better systems. Sharholly et al (2008) indicated that the involvement of the public sector in solid waste management is a factor that could improve the efficiency of the system. Khan (2016) and

Samake (2009) respectively suggested that linkages of the public and private sector in solid waste management may improve the efficiency of the entire sector and create new opportunities for employment. Muller (2015) highlights that the most successful initiatives occur where a mixture of public, private and community involvement has come into being, either through evolution or by deliberate design. Raman (2015) reinforces the notion that modern, efficient, economically, environmentally and socially sustainable waste management systems are frequently beyond the reach of developing country municipal governments acting alone. Garity (2015) opines that involvement of stakeholders is important to achieve any meaningful and sustainable solid waste management.

A preferred option is to integrate the public into waste management planning, building on their practices and experience, while working to improve efficiency and the living and working conditions of those involved (Wilson, 2016). Involvement of stakeholders is important to achieve any meaningful and sustainable municipal solid waste management. The role of the informal sector through community based organisations and the private sector is also pertinent towards improvement of municipal solid waste management (Khan, 2016). It has been reported that organising the informal sector and promoting micro-enterprises are effective ways of extending affordable waste collection services (Sharholly, 2007). Kurian (2017), highlights that the involvement and participation of all stakeholders such as waste generators and informal agencies, is a key factor for the sustainable waste management. Citizens can contribute significantly to service delivery. They can support the authorities with payment of service charges. Garity (2015), however, is of the notion that the community can play a crucial, active role in improving accountability and service quality of both public and private sector. Ali (2016) argues that this radical shift in people's role from passive service receivers to active service partners may not occur endogenously.

Samake (2009) notes that private and community sector participation in waste management is not, in itself, an *a priori* goal of solid waste policy. It is rather a means to achieve the general improvement of waste management systems operating or being planned in developing countries. Community participation in waste management systems, to a greater extent contributes to making those systems more responsive, more efficient, more economical, more equitable and more environmentally responsible (Muller, 2015). With the community participating in solid waste management, there is successful recovery and return to productive use of materials that would otherwise end up in the waste stream. Furthermore, the amount of waste materials requiring collection and transport is reduced and there is risk reduction by

transferring of marginal activities, unpredictable costs or unreliable revenues to the private operator (Khan, 2016). There is provision of waste removal and sanitary services to otherwise unserved (generally poor) sectors of the city. Ekere et al (2009) have observed that the handling of large volumes of waste is done at no or marginal cost to the municipal government, as well as provision of service at no-cost to the municipality. Moreso, there is extension of the lifetime of capital investments such as environmentally appropriate sanitary landfills or composting facilities, through reduction of throughput. With community based organisations and non-governmental organisations participating in solid waste management, there is a promotion of environmental awareness, provision of environmental health education and provision of waste removal services to underserved, marginalised areas. Sharholly et al (2008) clearly states that there is mobilisation of citizens and enhancement of their participation in solid waste management schemes. They further denote that community participation also contributes to problem-solving at the local level, for instance, by setting up and supporting primary waste collection schemes and experimentation with innovations at neighbourhood level and within the informal sector. Environmentally, there is conservation of resources when materials are recovered. There is also reduction in use of water in primary production and reduction in environmental damage from exploiting primary resources, including mining and deforestation (Samake, 2009).

Community participation in solid waste management is also of paramount importance socially to the community. With the active participation of the informal private sector in solid waste management, employment is created for a number of people who might otherwise not be able to survive (Kurian, 2016). Communities are supported and family and neighbourhood cohesion is provided. Furthermore, there is an improvement of health and safety conditions when informal activities are recognized and supported. With the participation of community based organisations, organisational capacities of communities and informal individuals and entrepreneurs are strengthened. Additionally, there is stimulation of income-generating activities among the urban poor and provision of countervailing power (Ahmed, 2014). Poorer groups in the society, the low-income communities as well as the waste pickers, with technical assistance and advocacy, are supported.

Moghadam et al (2009) propose that community participation in solid waste management is vital economically as it results in the supply of raw materials to the local manufacturing sector without recourse to foreign exchange or import. It also results in the maintenance of a large and available stock of secondary resources to stimulate industrial production. According

to Wright (2016), there is provision of income-generating activity for a large number of people, many of whom would otherwise be indigent or require financial support from the government. Additionally, there is availability of a tier of products for poor people, such as containers, harnesses and wheels made from recycled materials, which improve the living standard of poor people at a price that they can afford.

## **2.10 Empirical Evidence**

### **2.10.1 Case Study**

KARWS, Karachi, Pakistan

In 2015, residents were dissatisfied with the inadequate service delivered to their low income area (the KAECHS-housing project south of Karachi) took the initiative to arrange for a private garbage collection service in their area. They approached their local politician for support, started a public awareness campaign on public health and garbage among the residents and established the Karachi Administration Residents Welfare Society (KARWS) to deal with these and related issues. They consider all residents responsible for the creation of waste and thus for proper disposal, even though the dominant Muslim religion enjoins its followers to avoid all contact with waste. The residents arranged their own van to pick up their waste, despite the fact that taxes supposedly covering this service would have already been paid by all the residents. Plans for home-composting or a small composting enterprise in the nearby park, run by some of the waste pickers in the area, are under discussion. Karachi has a significant number of similar initiatives due to the inadequate, highly centralised administrative system of public services.

Cofesfa, Kabulonga, Zambia

In Lusaka, the municipal department which has the responsibility to collect and dispose of the urban waste of the whole town consistently fails to perform its function. In 2014, Cofesfa, a non-governmental organisation consisting of young, unemployed graduates, got a contract from the Governate of the district to handle the collection of garbage in a suburb called Kabulonga and also provide a health education service. The pilot project was a success in 2015. With the approval of the local authorities, Cofesfa collected fees directly from the residents of the service area. They started with sensitising the community, making clear what their task was and the fee they expected from each household. A respected, senior person from each group of households would then collect the fees and hand the money over to the

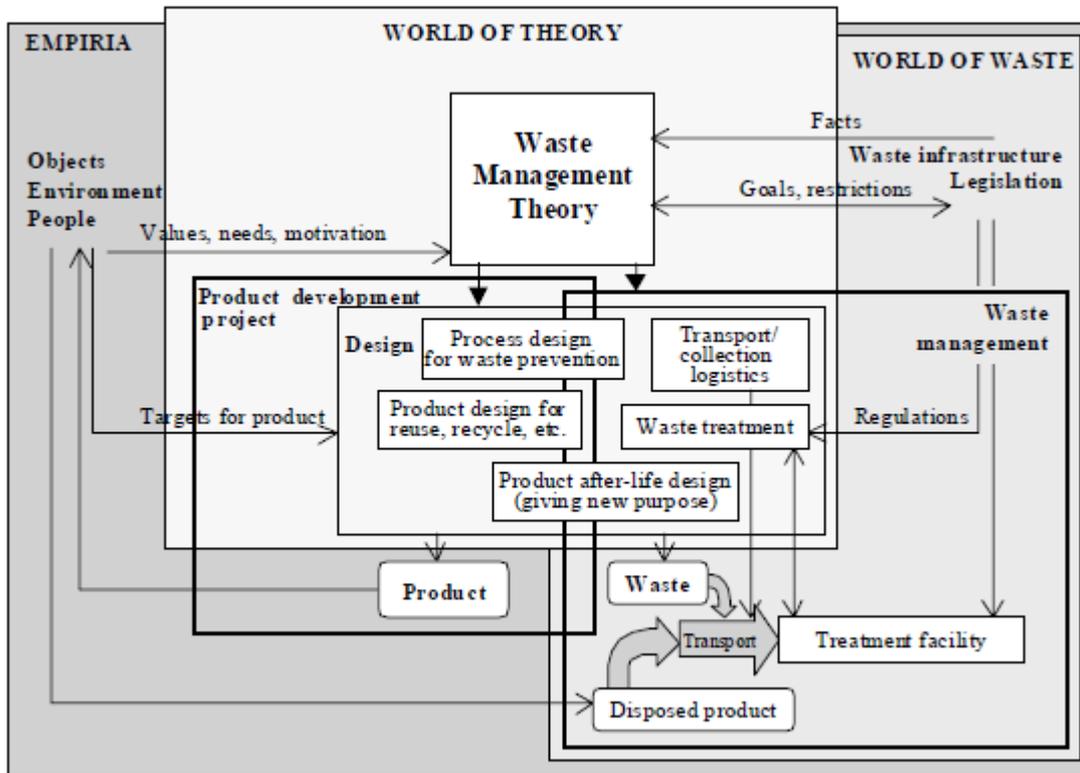
collection crew. Additional income would be generated by selling the compost made from the biodegradable fraction and by selling seedlings from the tree nursery.

## **2.11 Theoretical Framework**

### **2.11.1 Solid Waste Management Theory (Phillips, 2004)**

The Theory of Waste Management represents a more in-depth account of the domain and contains conceptual analyses of waste, the activity upon waste, and a holistic view of the goals of waste management. Waste Management Theory is founded on the expectation that waste management is to prevent waste causing harm to human health and the environment. The proper definition of waste is crucial to constructing a sustainable agenda of waste management. It is largely the case that current legislation attends to existing waste. Definitions emerging from this condition may, however, conflict with the goals of waste prevention, because something that already exists cannot be prevented from arising. When material is assigned the label of ‘waste’, it will be treated as such, consequently, despite its explicit wish of waste prevention, implicitly, legislation essentially amasses waste. The inherent philosophical implication of such definitions is that they are not able to facilitate a sustainable waste management system. Therefore, new, dynamic definitions for waste and waste management can be sought, which can explain why waste is created and can offer an intrinsic solution for the problem. A radically new approach, based on an object-oriented modelling language, is presented to define the key concepts of waste management.

One of the differences between Design Science and Waste Management Science is that while design of one particular product is specific, in waste management there are strategies that apply to a wide range of products. The designer of a Waste Management System has to abide by these rules and regulations. For instance, recycling quotas are valid for a material type, regardless of what the actual product to be recycled is. Strategies can be guidelines, or suggestions, for a potentially beneficial waste management action, but the actual strategy for one type of waste, product, or process should be designed individually. As with any new theory, one should start with defining the scope of the theory, and define the core of its concepts. Waste management has to be planned within restrictive limits, where the choice of options is generally pre-specified. **Figure 2.1** has been drawn by the author of this study to illustrate the scope and the influences of external factors on waste management.



**Figure 2.1:** The theory of waste management against the world of waste

Source: Phillips (2004)

The world of waste is emphasised from Empiria, to highlight the influencing factors on designing waste management. It draws facts from the existing waste management infrastructure, and is restricted by legislative constraints. However, it is hoped that there would be a communication between legislation and theory for best practical results. As proposed above, ideally, waste management design should be made for every individual product, be it for waste avoidance, treatment of process waste, or prescription/suggestion for treatments when the product turns to waste. Waste management and product development thus overlap where product/process design is concerned. As suggested by the diagram, process design should include design for waste avoidance. Initially, at the design phase of a product, consideration ought to be made of what will happen to the product after it ceases to be used for its primary purpose. Furthermore, waste management design includes design of the logistics of waste collection, transfer and treatment. There is one area of waste management, however, that cannot be designed: when humans dispose of unwanted things. One can model waste management, but it is not certain how the actions of individuals can be included in such a model. Given that waste is a human concept, and dependant on the needs

and values of humans, there should be a Waste Management Theory explaining those concepts. The design of a Waste Management System should draw its purpose, such as protection of environment and human health, from the Theory of Waste Management.

### Purpose and Causality

Needham (2007) asserted that all biological systems and all human behaviour could be explained in terms of cause and effect: a given cause produces a certain effect, and this again acts as a cause to other effects. In biology or psychology, the stimulus – response behavioural term can be used. Rignano (2006) claimed that machines could be explained entirely by cause and effect (e.g. input-output description), but biological systems require for their explanation a reference to purpose. Rosenbrock (2010) states that this debate goes back to classical antiquity, but he pointed out that from the 1950s onward, a highly developed theory of automatic control has since arisen, in which human purpose can be incorporated even into machines. However, he admits that machines embody subordinate purposes in a restricted way. Humans can adopt a purpose at a deep level, they care whether the purpose is fulfilled or not. Rosenbrock (2010) strongly suggests that the causal view of the world be replaced with a view that embodies purpose. It was also argued that, currently, waste management is a reactionary discipline, that is, a causal activity. Causality and purposiveness are merged in the PSSP approach (Pohjola 2001). In PSSP, human activity is modelled as causality, thus having cause, effect and preconditions. However, cause comes from goal, which is specified under Purpose. Hence the PSSP approach avoids the need to build any demarcation line between causality and purposiveness.

Every technological system starts from a human purpose, from the intention to satisfy some human need or desire. If so, then a policy that will implement the purpose is generated and the system is constructed so that it follows the causal laws implied by the policy. (Rosenbrock, 2010). As previously stated, the purpose of waste management is protection of the environment and conservation of resources. This goal is the basis of describing waste management as being “control of waste-related activities, with the purpose of resources conservation and environmental protection.” The argument presented in this thesis is that the causal view of waste management be replaced by a purported approach. The triplet of target, waste-related activity and management was argued to be a generic model of waste management. Design is characterised as a purposeful, human cognitive activity. It is thus clear that design is intentional. As referred to earlier, artefacts come into being through intent

Simon (2009) and can be defined as having been intentionally made or produced for a certain purpose (Hilpinen, 2009). Purpose only exists when related to human values of utility. Humans relate to artefacts through their purpose. A designer's navigation through the problem domain can be presented involving function, behaviour and structure. Clarification of the concepts of Purpose, Function, Behaviour and Structure leads to clearer understanding of design process.

## **2.12 Knowledge gap**

There are numerous studies, which have engrossed on solid waste management in Zimbabwe. However, most of them have focused on challenges and opportunities of solid waste management in Metropolitan cities, side-lining developing cities like Mutare and its fast growing suburbs. To date, information on challenges and opportunities in solid waste management with the incorporation of the community in Sakubva is constricted, hence this study sought to clarify on the subject matter.

# **CHAPTER THREE**

## **RESEARCH METHODOLOGY**

### **3.1 Introduction**

Every research is based on an underlying research methodology. Therefore, this chapter directs attention on the research methods that were employed, that is, the research design, population and sampling procedures and research instruments that were used to gather data in relation to this study. This chapter also provides a detailed explanation on how the data was analysed. The study engaged the use of primary data collection instruments in the realm of interviews and questionnaires as well as secondary data collection instruments in the form of review of related literature. Research methodology describes the research methods which were used to gather data for the purposes of research findings. The study employed a triangulation research paradigm which is premised on inferring into the natural phenomena without disturbing the natural environment.

### **3.2 Research design**

McNabb (2013) proffers that a research design necessitates paradigms used to incorporate study components into articulate and coherent way in ensuring that the problem under research is effectively addressed. Research design offers practical guidance to research procedures and specifically covers data collection techniques or procedure, population, sampling and data analysis procedures. In this study, the researcher made extensive use of both a descriptive and analytical research designs and these were adopted to acquire an in-depth analysis of the challenges and opportunities associated with community participation in solid waste management of Sakubva.

#### **3.2.1 Research paradigm**

A two pronged approach that triangulates the qualitative and quantitative designs was employed by the researcher. The researcher engaged qualitative methods such as questionnaires, interviews, photographs, field observations and secondary data sources, in order to obtain data. Ultimately, the quantitative methods employed included actual measurements of waste produced in Sakubva, use of both close and open ended

questionnaires (see **Appendix 1**) and hypothesis tests using inferential statistics. This was to scrutinize dependent and independent variables' relationships. A triangulation research paradigm was adopted in a way to study the experiences of people in waste disposal and management of the same, as well as to measure the amount of waste the Sakubva community produces. This design was adopted because it is flexible and effective in studying the natural environment in relation to human beings. This paradigm best suits this study because human behaviour that shapes the way waste is disposed or managed, perspectives and experiences towards waste management can be studied using both qualitative and quantitative means which focus on human experiences without disturbing their natural environment. This approach was appropriate to capture the actions of the Sakubva community as their lives unfold. Sakubva was used because it is a research strategy that is an empirical inquiry within its real life context. The researcher chose to use a triangulation design in order to justify the current practices in relation to solid waste disposal in Sakubva residential area in Mutare in an effort to make judgement and offer recommendations in an endeavor to improve the standard of waste management in the area, a point which can be adopted in Mutare suburbs.

### **3.3 Population and Sampling**

#### **3.3.1 Target population**

Bryman (2014) observed that a research population is generally a large collection of individuals or objects that is the main focus of a scientific query. Population in research has similar characteristics or something in common, specifically what researcher is trying to represent. The population under study must be clearly and fully defined stating what is included and excluded. In this study, the target population comprised of service providers, that is, Mutare City Council, EMA officials, Ministry of Environment Water and Climate officials and residents of Sakubva.

#### **3.3.2 Sample size**

Using the rule of the thumb, the sample population for this study was 160 respondents, that is, 10% of the total population, who were drawn from the above mentioned departments and communities. Sampling techniques used to determine respondents from the above institutions are detailed below.

## **Sampling**

According to The Royal Geographical Society (2014), a sample is a nominated portion of a large population exhibiting features that are representative of the parent population and be able to deliver statistically binding insinuations. Research on the entire population would have been too costly and time consuming hence the researcher used purposive and snow-ball sampling techniques. Furthermore, a 10 percent sample of the target population of Sakubva which comprises of 1 600 people in total was calculated to arrive at 160 people, that is, the actual sample size. These techniques were used to select respondents from Sakubva Community and its informal sector.

Due to cost implications, it was impossible to include the entire population of Sakubva suburb in the study. The triangulation nature of the study, especially in-depth interviews, which are time consuming in nature, required the selection of a small sample.

### **Purposive sampling**

According to Creswell (2016), purposive sampling technique is a non-probability sampling technique that doesn't leave room for any estimation. This technique was used on the basis that the researcher once interacted with these organizations and was better placed to purposefully select respondents whom she knew to be able to provide relevant information concerning this study.

### **Snow-ball sampling**

Bryman (2014) posits that snowball sampling is a convenient sampling technique that is used in a situation where a standard sampling technique is prohibitively economically expensive or impossible for the purposes of studying individual population characteristics. Snow-ball sampling was incorporated in this study to reach out to the residents whose entire population was hard to reach. The technique was used to select residents of Mazhambe, Mcgregors, Chisamba, Chitungo, Chisamba, Old Location, Maonde and Chinyausunzi, where the first household was randomly picked and then the third house was selected to select resident who would participate in the study.

### **3.4 Methods of data collection**

#### **3.4.1 Questionnaire Surveys**

According to McNabb (2016), a questionnaire is a tool for collecting and reading information about a particular issue of interest, mainly made up of a list questions. Subsequently, one of the methods used as a key primary data collection instrument was the questionnaire. The researcher distributed the questionnaires personally at Sakubva Market and bus terminus, particularly to market vendors. The questionnaires were also distributed in the light industry to the small to medium enterprise personnel, as well as to chosen households in Chisamba, Mcgregors, Mazhambe and Singles flats.

The questionnaires pleated data on types of waste generated in Sakubva, waste composition, current practices being undertaken to manage solid waste, by the City Council and community, as well as possible ways to enhance community participation in solid waste management in Sakubva. Moreso, a pilot survey was done before the questionnaires were administered to the community, so as to determine the type of residents that were to be given the questionnaires, that is, school children, women, men and youths.

Specific people that were given the questionnaires were selected using the random walk technique. The questionnaires were administered in a period of seven consecutive days, from 0900 hours to 1700 hours, starting on the 9<sup>th</sup> of January up until the 15<sup>th</sup> of January. Most informal sector individuals in Sakubva operate during weekends, for instance, those who work at the Green Market, hence necessitated the inclusion of Saturday and Sunday in the distribution process. 23 questionnaires were distributed on a day to day basis and these questionnaires were comprised of both boxed and open ended questions relating to community participation in sustainable solid waste management in Sakubva, with the guide of the researcher, (see **Appendix 1**).

With these questionnaires, respondents were able to complete postal questionnaires in their personal time and telephone call-backs were arranged. Moreover, the questionnaires made it feasible to reach people who were spread across a wide geographical area of Sakubva. The researcher also contacted a large number of people at a relatively low cost.

### **3.4.2 Interviews**

Bryman (2014) defines an interview as a neutral means of extracting information from the respondent by the interviewer. The interviews were specifically targeted at policy makers and planners in the organisations dealing with solid waste management, (see **Appendix 2**). The use of interviews assisted the researcher to obtain first-hand information on approaches used to manage solid waste in Sakubva suburb. Also during the course of the interviews, the researcher clarified ambiguous answers, thereby enhancing the validity and reliability of the research. Furthermore, making use of interviews abetted the researcher on acquiring more information on current participatory levels in solid waste management of the Sakubva community over a short space of time.

The researcher made great use of ‘face to face’ interviews of key informants selected through purposive sampling. With this, the researcher directly communicated with the respondents in accordance with the prepared questionnaire which was in relation to community participation in solid waste management. This method enabled the researcher to acquire factual information, evaluations, attitudes, preferences and other information that came out during the conversation with the respondent. The method also ensured the quality of the obtained solid waste management data and increased the response rate. The personnel interviewed and organisations they represented are shown in **Table 3.1**

**Table 3.1:** Organisations, key informants and reasons for selection

Organisation	Key Informant	Reason for Selection
Mutare City Council	Director Environmental Health Services	<p>To determine the role of the Sakubva community in solid waste management.</p> <p>To determine current solid waste management practices and frequencies of waste collection in Sakubva suburb, as well as problems being encountered in promoting sound environmental waste management plans.</p>
Environmental Management Agency	Environmental Planning and Monitoring Officer	<p>Since Environmental Management Agency has the mandate of ensuring environmental sustainability, this aids in reviewing legislation governing waste management and the progress that the responsible authorities have made.</p>
Environmental Management Agency	Environmental Education and Publicity Officer	<p>To solicit statistics on environmental awareness campaigns held in Sakubva monthly, quarterly, as well as annually and the results attained from these awareness campaigns.</p> <p>Also to determine the groups in the Sakubva community that are educated on proper solid waste management.</p>
Environmental Management Agency	Mutare District Environmental Officer	<p>To determine approaches the Agency is using to involve Sakubva community in sustainable solid waste management</p>
Ministry of Environment, Water and Climate	Senior Environmental Officer	<p>To determine ways in which the Sakubva community can have a pro-active approach on solid waste management.</p>

### **3.4.3 Field observations**

Cresswell (2016) articulates that an observation encompasses a logical recording and noting of relics, behaviours and processes in the social scenery elected for study. In order to determine types of waste produced, the prevailing disposal facilities, and the waste collection practices, as well as environmental and health hazards of solid waste in Sakubva, a field observation was carried out by the researcher. Field observations are of paramount importance as they give first-hand information of what is actually happening on the ground, in terms of solid waste and its respective management. Additionally, overlooked roles being played by the community of Sakubva in solid waste management were ultimately detected. The researcher also made use of an observation checklist, (see **Appendix 3**).

### **3.4.4 Measurements**

The researcher ultimately embarked on a mission to determine types of waste produced in Sakubva, and measured amounts produced per household, of both bio-degradable and non-biodegradable waste. The researcher selected at least seven bins in different areas of the suburb, that is, Zororo, Mundembe, Maonde, Mazhambe, Chitungo and Chinyausunzi, and separated the waste then calculated the mean waste amounts, in a bid to determine the types and amounts of solid waste generated. Moreover, the researcher selected 7 households to measure types and amounts of waste in households' smaller bins (see **Table 4.4**).

### **3.4.5 Secondary data sources**

Secondary data sources were engaged in this study extensively by the researcher in order to obtain relevant data to the research problem. These sources include publications (articles, books and journals) and electronic sources (relevant websites and e-journals). The information attained was essential in defining the knowledge gap in solid waste management. The researcher preferred this type of source as it provides readily obtainable information. In consonance with this, annual and monthly reports on waste management from Environmental Management Agency and city bylaws from Mutare City Council were used to acquire relevant data in this study. Moreover, literature was reviewed on a global, regional and national scale, as well the Sakubva context and this comprised of the Agenda 21, Zimbabwe National Environmental Policy, and the Environmental Management Act (Cap 20:27).

### **3.5 Data analysis and presentation**

By its nature, most of the data collected in this study were of a qualitative nature. The data set constituted mainly of people's voices or views on the phenomena of public involvement in solid waste management. Therefore, the researcher decided to use the thematic approach to make sense of the data. This entailed coding data according to themes and then scanning it for most prevalent views or opinions on a particular phenomenon. The researcher employed the Statistical Package for Social Sciences (SPSS) data analysis technique for analysis of quantitative data.

Furthermore, to provide an easy orientation of data, the researcher made use of diagrammatic presentations, that is, graphs, charts and tables developed to indicate waste collection frequencies by the Municipality of Mutare in Sakubva and percentage quantities of waste produced per household. The choice of graphical illustrations emanated from the researcher's ability to interpret them effortlessly. The presentations were also employed in comparing population increase against waste generated in the suburb. The tools were crucial for comparative analysis of varied solid waste management systems and role of the community. In consonance with these, Microsoft excel was also used in order to create other graphs. This selection of these tools was predominantly influenced by their aptitude to summarise outcomes, as well as to make assessments tranquil on visual basis.

#### **3.5.1 Inferential statistics**

The inferential statistics analysis method was engaged in order to determine the relationship between population increase and waste generation in Sakubva. Pearson's Product Moment Correlation hypothesis test was used in the study, with graphs being produced to reveal the relationship between population increase and waste generation, hence the question, the increase in population results in more waste being generated, was answered.

### **3.6 Validity and reliability**

Cresswell (2016) defines validity as the ability of an instrument to measure what it is supposed to measure. Gray (2014) states that validity and reliability of a scale is its accuracy and consistency respectively. If an instrument is not reliable it cannot be valid. The researcher therefore required instruments that permitted validation of conclusions of the individuals under study that is the Sakubva community. Consistency gave the researcher confidence that the results actually represented that which was intended for study. Reliable instruments

obtained similar responses when they were administered to different respondents in the area under study. Pretesting of the instruments was done to a small number of people in Sakubva before the final instrument was adopted.

### 3.7 Ethical considerations

The following ethical considerations as proffered by Gray (2014, p.235) were observed during the study.

**Table 3.2:** The researcher’s ethical considerations

Ethical Issue	Suggested Solution
Explain Purpose	Explained the purpose of the enquiry to the respondents (possible benefits and the actual purpose of the study as well as revealing academic correspondences).
Promises and reciprocity	Stated what the respondent would gain in the process of the study.
Risk assessment	Considered in what ways the interviews would put the interviewees at risk in terms of stress, legal liabilities, ostracism or political repercussion.
Confidentiality	Reflected on the extent to which promises of confidentiality will be met.
Inform consent	Created a consent form for the respondents so that they would sign before participating in the study.
Advice	Sought the advice of the academic supervisor.

# CHAPTER FOUR

## RESULTS AND DISCUSSION

### 4.1 Introduction

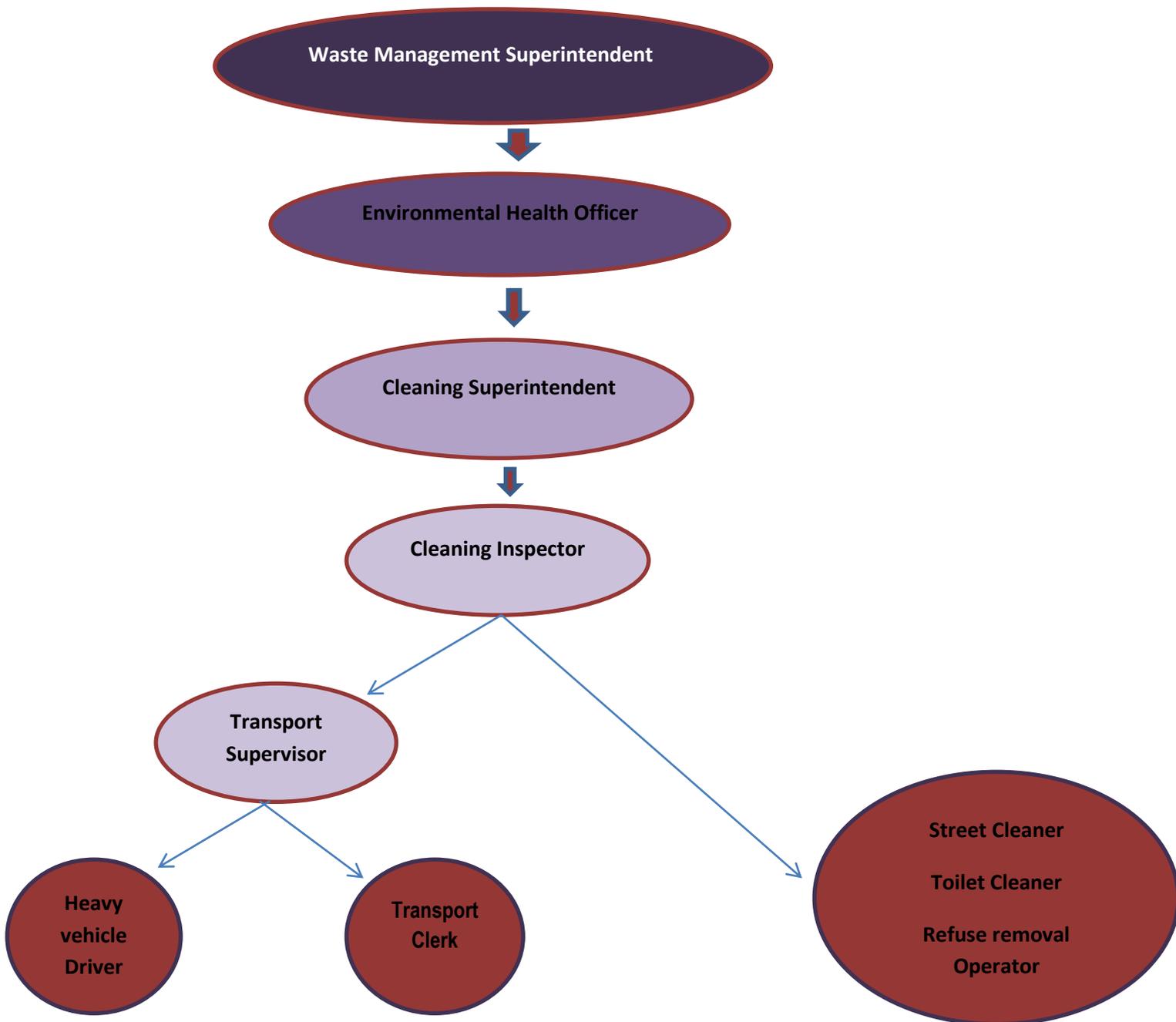
In this chapter, the data collected in the field is analysed, presented and interpreted. The research findings outlined in this chapter seek to answer the research objectives and questions of this study. Results are presented in the form of pie charts, graphs, tables, and photographs. Inferential statistics are also used to test for significance as well as statistical correlation in the analysis of the given data. Overall, this chapter is guided by the research objectives and related literature.

### 4.2 Organisational structure of waste management in Mutare

The Mutare City Council has various departments and amongst them are health, engineering, physical works and the amenities department. Waste management falls under the department of health and in charge of it is the Superintendent of waste management being followed by the Environmental Health Officer. The Cleaning Superintendent reports to the Environmental Health officer on issues pertaining the health and environmental upkeep of the city, as well as refuse collection databases. The two cleaning inspectors report directly to the cleaning superintendent on work progress and issues of day to day activities of the transport divisions. The transport supervisor consolidates reports from the 5 heavy vehicle drivers and the 2 transport clerks and forwards them to cleaning inspectors. Street cleaners (20), toilet cleaners (10) and refuse removal operators (20) fall under the cleaning division and they report directly to the cleaning inspectors. The organogram is illustrated in **Figure 4.1**. The clean face of the city is maintained through this hierarchy.

Due to the economic challenges being faced by the country, the Eastern Highlands city of Mutare is not able to maintain its status and the clean environment efficiently. Unfortunately, the efforts to maintain a sustainable approach to waste management are constrained by the shortage of finances to pay the waste collectors; fuel for the vehicles as large amounts of money meant for the progression of the council activities is being used up by the top

management of City Council in the country. These rampant corruption activities are blocking efforts to restore and adopt a sound integrated approach to waste management.



**Figure 4.1: Mutare waste management structure**

Source: Mutare City Council: Health Department (2017)

### **4.3 Demographic characterisation of respondents**

The socio-demographic data of the respondents obtained from Sakubva suburb include age, gender, marital status, education levels, residential location and duration of stay. These variables were examined in this study to come up with possible ways of engaging the Sakubva community in meaningful solid waste management.

#### **4.3.1 Gender of Respondents**

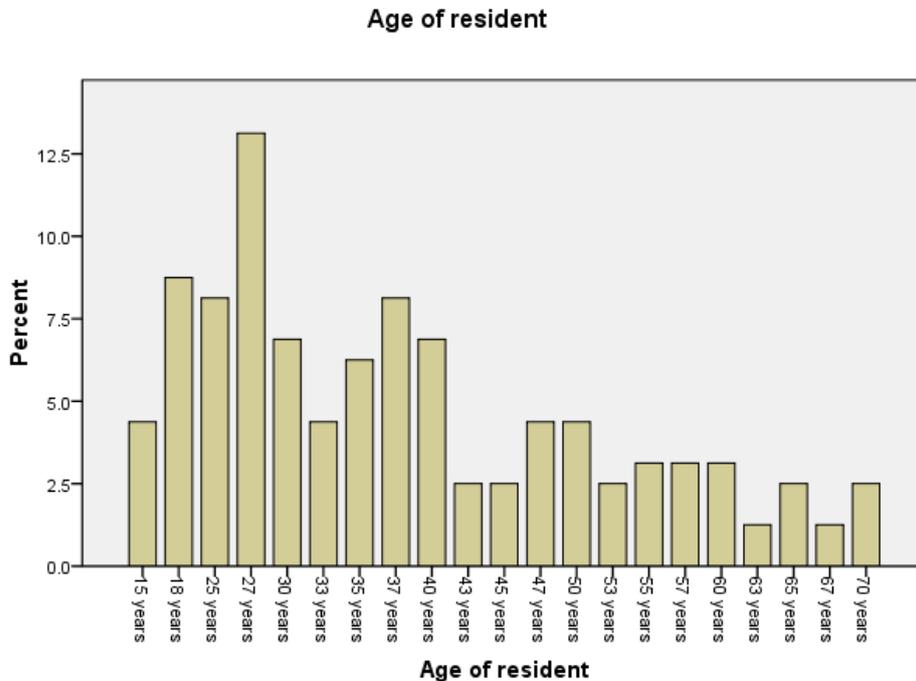
In this research, a total of 160 questionnaires were administered to Sakubva residents from the 5 sections in the suburb, which are Sakubva Central, East, West, North and South, with each section having a total of 32 questionnaires administered to them. The response of the target population was 100%. The questionnaires were meant to solicit data on waste generation, collection, disposal methods, community involvement as well as legislation and institutional aspects.

Of the 160 administered questionnaires, it was discovered that 52.5% of the total respondents were females and 46.3% were males. Basing on the results, it can be safely deduced that the suburb is female dominated and can be attributed to the fact that males out-migrate more in search of jobs hence, females remain behind at the family homes taking care of the children and the elderly. This goes hand in glove with Khan (2016)'s explanation of population distribution in less economically developed countries, where he postulates that men tend to migrate more leaving their family homes in search of better life and occupational opportunities hence resulting in an uneven population distribution.

#### **4.3.2 Age of respondents**

**Figure 4.2** presents the various age groups of respondents, of the 160 respondents, the lowest percentage constituted 12.9% that represented the group which fell in the age group of 20 years and below. The percentages indicate that the suburb is dominated by the population aged 20-30 years which constitutes 29.0%. In Zimbabwe, these are the most economically active group. The dominance of this age group can be attributed to high rural-urban migration which has resulted in the young adults moving from satellite rural areas like Nyanyadzi, Mutasa, Watsomba, Zimunya, Rowa and Honde Valley in search of employment hence they settle in Sakubva where there is affordable accommodation rentals. The group which fell

between 31-40 years was represented by a 25.3% and 13.6% were between 40-50 years and 19.2% were of the age 51 years and above.



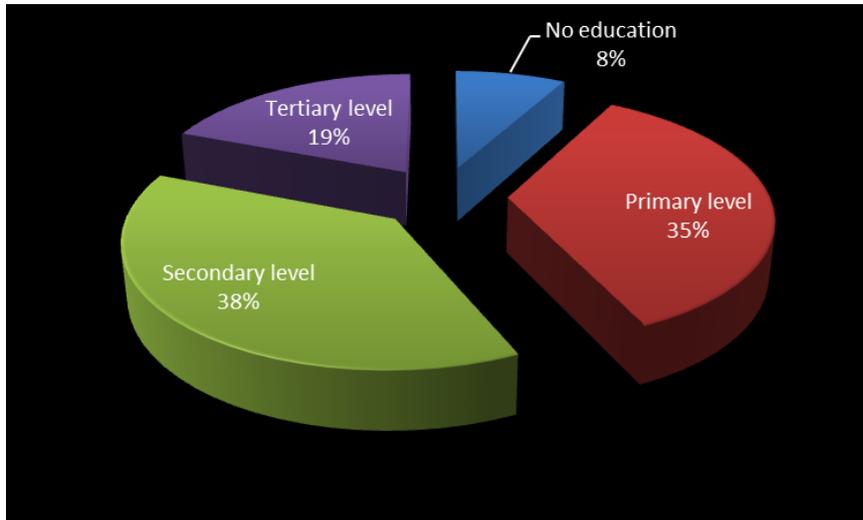
**Figure 4.2:** Age of respondents in Sakubva suburb by percentage

Source: Field Survey (2017)

### 4.3.3 Level of education of respondents

The educational attainment of respondents was also another crucial socio-demographic data solicited by the researcher in order to acquire information on their knowledge and understanding of the importance of their participation in solid waste management and to come to a conclusion on how best they appreciate the notion. Data on the educational attainments of the respondents is presented in the form of the pie chart (**Figure 4.3**). The chart reflects that 35.2% of the respondents had achieved primary level, whilst 37.7% had attained secondary level achievement, as their highest level of education, making it a large proportion of the total. This large proportion of the respondents with secondary education contributes significantly to the validity of the results. Respondents who had reached the tertiary level reached a total of 19.1%. This places the calibre of their opinions at a fairly educated level. Be that as it may, a substantial 8.0% had no education level attained. Education attainment of respondents determined the different levels of understanding as well as perceptions and attitudes of individuals on community involvement in solid waste

management. The highest proportion of 37.7% representing secondary education had a clear understanding on different aspects involved in solid waste management.



**Figure 4.3: Level of education of respondents by percentage**

Source: Field Survey (2017)

#### **4.4 Waste characterisation**

The UN-Habitat (2010) postulates that municipal solid waste is the solid waste generated by households, commercial and industrial premises by institutions such as schools, hospitals, care homes and prisons and from public spaces such as streets, markets, slaughter houses, public toilets, bus stops, parks and gardens. In respect of this study, solid waste generated in Sakubva suburb is divided into two groups which are bio-degradable and non-bio-degradable. Solid waste in Sakubva is generated by residents of different age groups, that is, young and old, as also observed by (Mangizvo, 2010). The waste categories and description are as shown in **Table 4.1**

**Table 4.1:** Classification of waste categories and description

Classification of waste categories	Description of the components of each category
Bio-degradable	Food waste, garden waste, vegetable waste, kitchen organic waste
Non-bio-degradable	Glass, plastic, metal, paper, synthetic (weaves)

Source: Field survey (2017)

In regard of this study, solid waste was separated through hand sorting of solid samples and visual characterisation of categories or waste types is shown in **Plate 4.1**



**Plate 4.1:** Types of waste generated in a Sakubva household (picture shows hand-sorted food and garden waste, plastic containers, glass bottles, kaylites, used motor spare parts, cloth, metal cans, plastics, papers, card boxes and tire)

Source: Field survey (2017)

#### 4.4.1 Types of solid waste generated at specific locations

In Sakubva, different types of solid waste is generated and disposed in different locations. Different waste categories were observed from non-organic waste to organic waste as shown in the **Table 4.2**. Waste types generated were hand-sorted and measured from households using a top-loading digital scale.

**Table 4.2:** Cross tabulation of type of solid waste generated in five locations by number of respondents

Location	Bio-degradable	Non bio-degradable	Total
Sakubva East	15	12	27
Sakubva West	13	16	29
Sakubva Central	19	20	39
Sakubva North	16	17	33
Sakubva South	18	14	32
Total	81	79	160

Source: Field survey (2017)

From **Table 4.2**, out of a total of 160 respondents, 81 people produce bio-degradable waste in the 5 selected locations of Sakubva. The bio-degradable waste comprises of food and garden wastes. Be that as it may, a total of 79 people, young and old generate non bio-degradable waste which includes glass, plastic, metal and paper. This reveals that bio-degradable waste is being generated more by the Sakubva residents. Organic waste however, exacerbates diseases especially if not properly disposed and managed, hence the need for the community to spearhead in its management. This goes hand in glove with Khan (2016)'s findings, who states that bio-degradable waste increases the prevalence of vector diseases such as malaria, as well as cholera, and bad odour. Sakubva West has the least number of respondents who produce organic waste (13) and Sakubva East also has the least number of respondents who generate non bio-degradable waste (12). This is due to small household sizes. Khonje (2012) concurs with the above stating that small household sizes and low income per household have a negative impact on the amount of waste generated in that particular household. Sakubva Central has more respondents who generate both bio-degradable waste (19) and non-bio-degradable waste (20). This comes as a result of the Green Market and Chicken Market being located in this section, as well as the bus terminus, (see **Figure 1.1**). Sakubva Central has a greater population size, hence more waste is generated. Parrot (2009) notes that different lifestyles of people either increases waste generation or reduces, and in the case of central

Sakubva, most respondents have medium to high paying jobs, therefore they have high purchasing power and ultimately generate more solid waste in their households.

#### 4.4.2 Chi-Square Test to analyse association between age and type of waste generated

It has been of great debate whether there is an association between age of a person and type of waste they generate. In most cases, people of different age groups in developing cities, produce the same types of waste as they use similar products per household. Khoen (2015), however, is of the view that different age groups generate different types and quantities of solid waste. He proposed this, stating that the economically active age groups, that is, 15 years to 64 years generate more waste as compared to the economically inactive, hence a test of significance was carried out to see if this notion was reliable or not.

#### Hypothesis

H<sub>0</sub> = There is no association between age and type of waste generated

H<sub>1</sub> = There is an association between age and type of waste generated

**Table 4.3:** Cross tabulation of age and waste type generated by number of respondents

		15 years	18 years	25 years	30 years	37 years	43 years	53 years	65 years	Total
Waste type	Organic	6	5	16	15	14	10	07	5	78
	Inorganic	3	8	18	13	9	12	14	5	82
Total		9	13	34	28	23	22	21	10	<b>160</b>

**Table 4.3.1:** Chi-Square results for analysis of age of respondents and waste type generated

	Value	Df	Asymp Significant (2 sided)	Significant	Lower Bound	Upper Bound
Pearson Chi-Square	50.747	40	.119	.142	.133	.151
Likelihood Ratio	36.756	40	.617	.363	.351	.376
Fisher's Exact Test	43.988	0	0	.405	.392	.418
N of Valid Cases	160	0	0	0	0	0

P<0.05 is significant at 95% confidence level.

Source: Field survey (2017)

**NB.** P<0.05 Accept H1 and Reject H0

The significant level for Pearson Chi-Square Test is 0.119 which is greater than 0.05 (**Table 4.3**), therefore, accept H<sub>0</sub> and reject Alternative hypothesis (H<sub>1</sub>), proving beyond doubt that there is no significant relationship between age and type of waste generated. Generally, there is no relationship between age of a person and the type of waste generated. This is because in a particular household, everyone, regardless of age, can eat the same type of food hence generated the same waste. This therefore results in the need to involve the whole community in solid waste management, despite age of the resident, as they are equally responsible for solid waste generation. However, Khoen (2015) is of the view that an economically active person, that is, 15-64 years, generate more waste as they acquire more money as compare to the economically inactive (0-14 and 65+ years). He further argues that between the ages 15 and 64 years, needs for goods and food increase, thereby generating more waste.

#### **4.4.3 Quantities of solid waste generated in Sakubva**

The amount of solid waste generated in Sakubva was at 2.857 kg per day per household on average during the 2017 Mutare City waste survey. The total amount of waste produced was at 49.9 kg per annum (EMA, 2017). Currently, solid waste generation rates are underway being acquired through various methods, researches and surveys by universities, EMA, municipalities and other stakeholders. Factors that affect waste generation rates in Sakubva include household size, income per capita, environmental awareness and management per

household, lifestyle, demographic characteristics as well as geographical location of houses, that is, proximity to major road networks. **Table 4.4** gives a summary of the survey conducted by the researcher in a bid to measure amounts of solid waste generated in Sakubva households. The findings were benchmarked against statistics provided by the Environmental Management Agency.

**Table 4.4:** Types and amounts in kilograms of solid waste generated daily in Sakubva per household

	House 1	House 2	House 3	House 4	House 5	House 6	House 7
<b>Sampling date</b>	9/01/17	10/01/17	11/01/17	12/01/17	13/01/17	14/01/17	15/01/17
<b>Sampling Time</b>	11:20	09:06	12:18	14:32	16:54	11:28	17:23
<b>GPS co-ordinates</b>	18.5964S 32.3849E	18.5967S 32.3848E	18.5954S 32.3860E	18.9947S 32.6435E	18.9941S 32.6439E	18.5961S 32.3848E	18.5956S 32.3862E
<b>Location</b>	Sakubva West	Sakubva Central	Sakubva Central	Sakubva Central	Sakubva East	Sakubva North	Sakubva South
<b>Ward</b>	5	3	3	3	6	2	4
<b>Physical address</b>	153 Mazhambe	39 Mudembe	158 Mudembe	183 Mudembe	207 McGregors	165 Chitungo	53 Chisamba
<b>Classification</b>	High density						
<b>Weight of waste before separation (kg)</b>	3.040 kg	2.443 kg	4.885 kg	3.350 kg	1.830 kg	2.810 kg	5.055 kg
<b>Receptacle weight (kg)</b>	2.10 kg	22.012 kg	7.36 kg	6.69 kg	5.27 kg	8.53 kg	1.95 kg
<b>Organic waste(kg)</b>	2.009 kg	1.920 kg	3.281 kg	2.132 kg	0.835 kg	1.461 kg	3.011 kg
<b>Inorganic waste(kg)</b>	1.031 kg	0.523 kg	1.604 kg	1.218 kg	0.995 kg	1.349 kg	2.044 kg

Source: Field Survey (2017)

Results in **Table 4.4** reveal that residents of Sakubva, from the given sample, generate 85.7% (2.435kg) of organic waste and 14.3% (0.739kg) of inorganic waste per household per day on average. This means that more organic waste is produced in the suburb as compared to inorganic waste by a margin of 71.4%. Of the 85.7% of organic waste, Sakubva Central had the greatest amount produced, with 46.7% (3.023kg). This could be attributed to the location of the Chicken Market, as well as the main bus terminus in this location. In agreement, Mukosa (2007) asserts that the bigger a market which trades in organic products such as

fruits and vegetables gets, the more organic waste is generated and disposed in that area, hence explaining the 46.7% of Sakubva Central organic waste. On the other hand, Hoornweg (2012) eludes that more organic waste produced could be due to a flamboyant lifestyle of the residents who value meeting their dietary needs thereby purchasing and generating more food and garden waste. Organic waste however comes with its reparations which include a rise in the prevalence of vector diseases such as malaria since organic waste becomes a convenient breeding ground. Kyte (2012) further alleges that organic waste results in an increase in bad odour especially at open dumpsites, hence the need to raise environmental awareness to the community at large, educating them as well as implementing the law in order for the waste to be managed affably.

Be that as it may, Sakubva West, at 14.3%, is the only location that produces more inorganic waste as compared to organic waste, that is, 2.01 kilograms as compared to 1.03 kilograms respectively. This can be explained by the prevalence of three quarters of the informal sector in that location, that is, The Green Market. From the researcher's field observations, the inorganic waste generated include saw dust, paper from printing enterprises, kaylites as well as oil containers from mechanics. However, inorganic waste poses physical hazards to the community and the informal workers if not properly handled, hence the need for these generators of waste to be involved in solid waste management. Adeola (2014) clearly states that sharp objects poses a huge risk of cuts to both human beings and domesticated animals hence should be properly disposed. Furthermore, used oil containers can be breeding grounds for insects like mosquitoes that cause diseases such as malaria.

It was therefore imperative to measure the separated solid waste in the selected 7 households. This was done in order to determine the actual amounts of waste generated separately. Results therefore are exhibited in **Table 4.4.1** from the given results,

**Table 4.4.1:** Separated waste type and amounts generated daily per household in kilograms

Waste Type	House	House 2	House 3	House 4	House 5	House 6	House 7	Average
	1							
Organic	0.085	1.245	4.450	1.862	3.132	2.065	4.528	2.481
Paper	0.015	0.069	0.085	0	0.272	0.021	0.015	0.058
Glass	0.08	0	0.355	0	0	0.315	0.245	0.143
LDPE plastic(thin)	0.13	0.431	0.172	0.165	0.135	0.275	1.075	0.218
HDPE (buckets)	0.155	0.28	0.05	0.12	0.025	0.025	0.295	0.025
Pet(cans)	0.315	0.245	0.095	0.165	0	0.346	0.391	0.135
Styrofoam	0.06	0.09	0	0.035	0	0.354	1.011	0.025
Textiles	0.015	0	0.028	0.212	1.354	1.185	0	0.172
Rubber	0	0	0	0	0.005	0	0.152	0.022
Leather	0	0	0	0	0	0	0.062	0.009
Metal containers	0.17	0	0.045	0.05	0.215	0.035	0	0.032
Electronic	0.03	0.015	0.03	0	0.045	0	0	0.006
Synthetic	0.02	0	0.01	0	0	0.115	0.952	0.201
Ceramic	0	1.02	0.253	0	0.385	0	0.355	0.002
Sanitary	1.045	0.583	1.354	0.156	0.215	0.047	0	0.480
Average	0.004	0.031	0.721	0.153	0.024	0.015	0.002	0.132

Source: Field Survey (2017)

#### 4.4.4 Relationship between household size and amount of solid waste generated

It is widely believed that the amount of solid waste generated per household is influenced by the number of people living in that particular household, that is, the bigger the household size, the greater the amount of solid waste generated. Therefore, a correlation test was done for Sakubva to prove this assumption. The results are shown in **Table 4.5**

**Table 4.5:** Correlation between household size and amount of waste generated

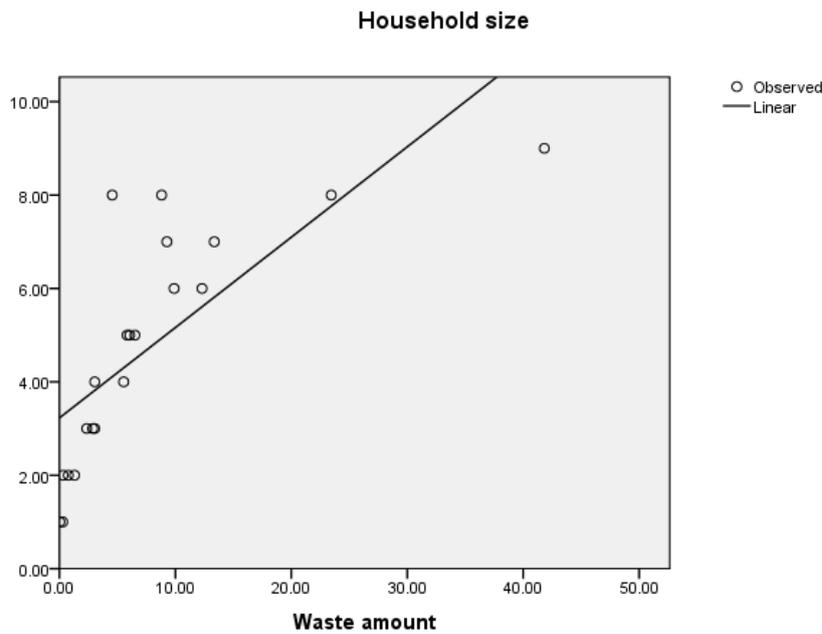
		Household Size	Waste Amount
<b>Household Size</b>	Correlation Coefficient	1.000	.912
	Sig. (2-tailed)	0	.000
	N	21	21
<b>Waste Amount</b>	Correlation Coefficient	.912	1.000
	Sig. (2-tailed)	.000	0
	N	21	21

Correlation is significant at the 0.01 level (2-tailed)

Source: Field survey (2017)

From the results displayed in **Table 4.5**, the correlation was significant at the level 0.912 which shows a strong positive correlation. This therefore means that solid waste generation per household is being strongly influenced by the household size. The greater the size, the more waste is generated and this concurs with Furedy (2010)'s postulation that population increase comes with high levels of waste generation.

The results were further analysed using Regression and they pointed out to the fact that solid waste generation increases with the increase in household size. With household size ranging from 5 and below, amounts of waste generated also ranged from 1.295 kg to 0.020kg. As the household sizes increase from 6 to 9 people per household, waste amounts also increase from 2.345 kg to 4.825 kg, before waste separation. This is illustrated in **Figure 4.4**



**Figure 4.4:** relationship between household size and waste generation rate

Source: Field Survey (2017)

#### 4.5 Variations in solid waste collection

According to the information provided by the Directorate of Waste Management Department of Mutare City Council, it is responsibility of the City Council to ensure sustainable solid waste management in the city of Mutare, as well as Sakubva suburb. In support of this, the Environmental Officer of Planning and Monitoring of Environmental Management Agency pointed out that it is mainly the duty of City Council to keep the city of Mutare clean and that Council collects solid waste as per need basis from all corners of the suburbs as illustrated in

**Table 4.6**

**Table 4.6:** Variations in the frequency and regularity of waste collection as provided by the City Council

<b>Location</b>	<b>Collection Days</b>	<b>Regularity</b>
Sakubva East	Monday	Regular
Sakubva West	Monday	Regular
Sakubva Central	Wednesday	Regular
Sakubva North	Thursday	Regular
Sakubva South	Thursday	Regular

Source: City Council (LEAP, 2017)

However, the researcher through observations and questionnaires found out that the City Council collects waste at least once a week in Sakubva. The findings of variations and irregularities of waste collection by the City Council were tabulated in **Table 4.6.1**. Sakubva West and Central are collected irregularly and these include the Chicken Market and Green Market. If it is collected, City Council collects only on Wednesday. In Sakubva North and South, waste is rarely collected hence the informal waste collectors and CBOs carry some of the waste away from the waste receptacles to the main dumpsite where they separate the waste for recycling purposes. More so, the residents of Sakubva East, due to the irregularity of waste collection by the City Council, burn most of their solid waste in open dumpsites and or backyards, hence the need to incorporate the community into sound and sustainable solid waste management, in order to keep their suburb clean. Additionally, the scale of urban growth has overwhelmed the capacity of the local Mutare authority to provide basic social services like refuse collection, hence a myriad of solid waste collection glitches in high density suburbs like Sakubva.

**Table 4.6.1:** Variations in the frequency and regularity of solid waste collection as observed from field survey

Location	Collection days	Regularity
Sakubva East	Monday	Irregular
Sakubva West	Monday and sometimes Friday	Irregular
Sakubva Central	Wednesday	Irregular
Sakubva North	Tuesday, Thursday	Irregular
Sakubva South	Thursday and sometimes Wednesday	Irregular

Source: Field survey (2017)

#### 4.6 Solid waste management practices

Mutare City Council has lost the confidence of the majority of the residents of general public when it comes to issues of waste management. The responsible authorities, that is, municipalities, are not reliable in collecting waste according to schedule and they do not provide sufficient waste storage equipment as supported by Chikobvu (2011) in his study of solid waste disposal in Harare. More so, the waste collection trucks can merely roam around the Sakubva streets without alerting the residents, for instance, through use of hooters, thereby leaving household waste uncollected. In some sections like Chisamba and Zororo, waste can go for several months uncollected. Therefore, in the majority of the cases the state of affairs forces the people to indiscriminately dump refuse. Jerie (2015) contends that the collapse of the rural economy and rapid urbanization of poor people have contributed to a breakdown of traditional methods of waste management in urban areas. Mutare is no exception of this notion, let alone Sakubva. There had been a marked increase in the number of people in Sakubva. This had not been accompanied by a concomitant increase in the number of waste receptacles and an update in the solid waste management practises (Tevera, 2003b).

##### 4.6.1 Community participation in resource recovery (waste minimisation)

The Sakubva community engages in quite a substantial number of solid waste management practices, that is, resource recovery. The European Union's Waste Framework Directive (2005) stipulates this as the waste management hierarchy. The practices therein include waste reduction, reuse, recycling and composting. According to **Figure 4.5**, 15.3% of the respondents practise waste minimization through waste reduction and reuse. The residents,

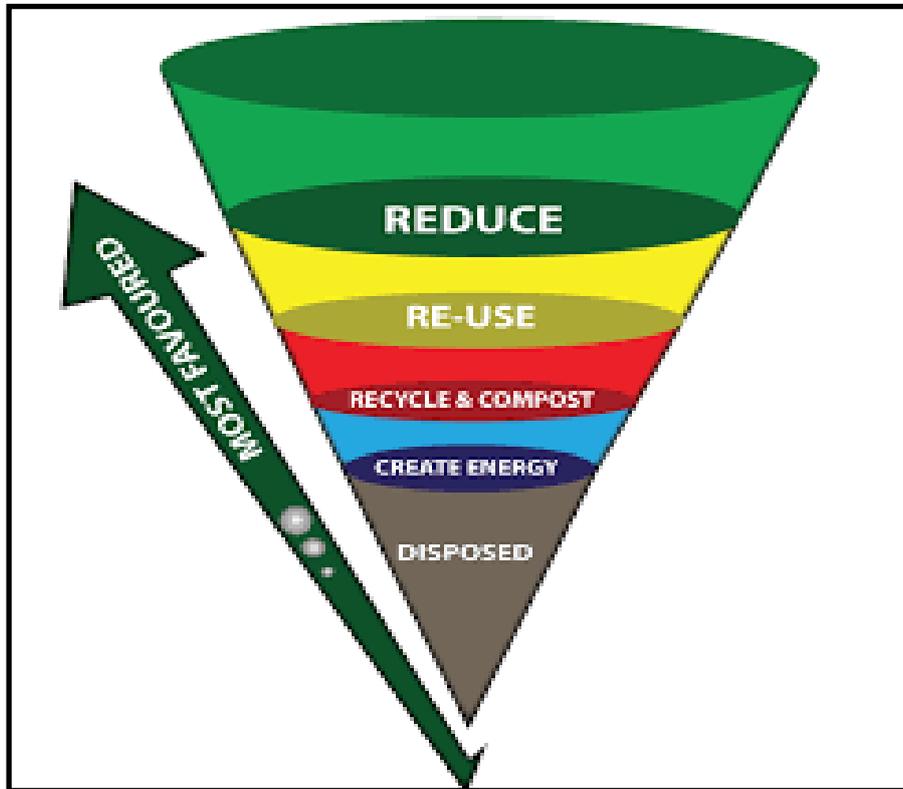
mostly women, make use of shopping bags and they reuse them. Subsequently, old textile rags are sewn together to make blankets for children, as well as door mats. A total of 13.5% of the respondents resort to composting of organic waste which includes food and garden waste. In sections like Chisamba, Mundembe, Old location and Mazhambe, the residents have formed community based organizations in a bid to minimize waste in their respective residential areas. The residents collect solid waste like Pfuko Udiwo and Coca Cola plastic bottles which they transport to the capital city of Harare for recycling once a month. This is shown in **Plate 4.2**. The private informal sector workers, who are into furniture making business, collect saw dust which they sell to recyclers who make saw dust firewood out of the waste saw dust. This practise however, has been successful to a lesser extent as the community based organizations lack adequate protective clothing and equipment for waste recycling. More so, a cost-benefit analysis reveals that if the waste material is transported to and from Harare, the scavengers yield a small profit, hence less venture into waste collection for recycling. Apart from the recycling, the residents of Sakubva have also successfully engaged in waste composting in their backyards in order to create manure for their fairly small gardens. Be that as it may, the Environmental Health Officer of Mutare City Council stipulated that, *“Compost sites require space, hence shortage of space has become a drawback to the zealous Sakubva residents.”*



**Plate 4.2:** LDPE thin plastic, empty plastic bottles and HDPE plastic collected and piled up for recycling by the Sakubva Momberume CBO

Source: Field Survey (2017)

The waste management hierarchy is illustrated in **Figure 4.6**. A significant portion of the respondents (38.3 %) practise solid waste management in line with the hierarchy. This shows the great need of conscientising the general public on sustainable solid waste management despite the presence of the local authorities responsible for waste collection.



**Plate 4.5:** Waste Management Hierarchy

Source (European Union, 2005)

#### **4.6.2 Community engagement in solid waste collection and separation**

Community participation in solid waste management has been derived from curtailed motives. According to the City Council's waste transport supervisor, members of the Sakubva community, if solid waste is not collected efficiently, collect solid waste in open dumpsites. They set up schemes as to who collects waste and when per ward. The CBOs and scavengers usually volunteer to collect and separate the waste even in some households as they derive financial benefits from the recycling of the valuable solid waste. The bio-degradable waste is here separated from the inorganic waste first then from the inorganic waste, valuable waste is extracted and cleaned. The women involved usually undertake the cleaning part. Mukosa (2007), however, argues that the community requires a driving force for them to initiate solid waste collection. In line with this, Khoen (2015) articulates that the

general public reluctantly participates in solid waste management in the absence of financial support.

#### **4.6.3 Community engagement with other stakeholders in solid waste management**

The Sakubva community engage with several stakeholders in solid waste management. These stakeholders include the Environmental Management Agency (EMA), Non-governmental Organisations, pressure groups and industrial companies. Khonje (2012) enunciates that the community sorely, can hardly manage waste sustainably, hence the need of various stakeholders to support them as well as to provide a financial muscle. The Environmental Management Agency undertakes environmental awareness campaigns three times per quarter, that is, once a month in all sections of Sakubva. These campaigns include road shows, indabas and environmental debates in schools. The community is highly engaged in these activities hence awareness on sound solid waste management is raised remarkably. Some of the activities are shown in **Plate 4.3**. Additionally, Non-Governmental Organisations (NGOs) provide financial aid to willing community members to pick up, separate and recycle solid waste. They also sponsor training workshops for selected key Sakubva residents, who will in turn educate their fellow residents on benefits of sustainable solid waste management. NGOs like CARITAS and Environmental Africa provide financial support to members of the community to make useful goods out of waste, temperature bags from waste Styrofoam. Large industrial holdings like Delta Beverages involve the Sakubva community in solid waste management as it commissions people from ages of 16 years to 50 years to collect Super Chibuku plastic bottles and re-sell to the company. On this exercise, first preference is offered to the Sakubva residents, as an endeavour to curb economic hiccups in the suburb. The Mutare District Environmental Officer agreed with this notion stating that commissions are given first to high density suburb residents so as to improve their livelihoods.



**Plate 4.3:** District Environmental Officers educating teachers and pupils of Dangare primary school and Mundembe youths respectively on waste separation as part of their awareness campaign

Source: EMA Manicaland (2017)

Pressure groups like churches, political unions and tertiary colleges conduct clean-up campaigns regularly in Sakubva in a bid to raise environmental awareness to the community, as well as to birth a sense of ownership in them. The Africa University's environmental club together with Forestry International Training College, secondary schools and the young adults from Sakubva, conduct clean up campaigns in major roads and market places of Sakubva once in two months as displayed in **Plate 4.4**. Moreover, the Seventh Day Adventist and Family of God churches carry out clean up campaigns in the Central and Eastern parts of Sakubva engaging the elderly people, both males and females. However, most of the residents tend to relax after the clean-ups are done with, thereby leaving the environment filthy with solid waste.



**Plate 4.4:** Clean-up campaign at Matida Market place in Sakubva, conducted by Africa University, Mutare Boys’ High school and Sakubva residents

Source: Field Survey (2017)

#### **4.6.4 Other solid waste management practices by the community**

**Figure 4.6** shows current solid waste management measures and strategies being employed in Sakubva. It reveals that illegal open space dumping and burning of waste are the most frequently used disposal methods with a percentage of 30.0 % and 22.5 % respectively. The findings show that 52.5% of respondents practise these disposal methods as they are easy and faster ways to eliminate waste from point of generation. Places targeted for illegal open dumping and burning include vacant land, stand waiting development, roadside, river banks, market places, especially those areas of high waste generation but have inadequate refuse bins or where the receptacles are never collected as shown in **Plate 4.5**. Using remote sensing and QGIS **2.18.3**, the researcher located a total of 43 open, illegal dumpsites. Of the 43, dumpsites, 34 were spread in the residential area, whilst the remaining 9 were found in the Nyakamete Industrial area. These open dumps are the breeding grounds of flies and mosquitoes. According to Prickford (2013), both houseflies and mosquitoes fly a distance of up to 5 kilometres. They can effective carriers of sanitation-related diseases such as cholera and malaria to vendors and general public. The Environmental Health Officer from City Council admitted that open spaces contained a lot of litter and solid waste dumped by the waste generators. She argued however, that, *“The situation is compounded by the fact that*

*some spaces are fenced and hidden thus the city council collectors cannot access and see these illegal dumps.”*

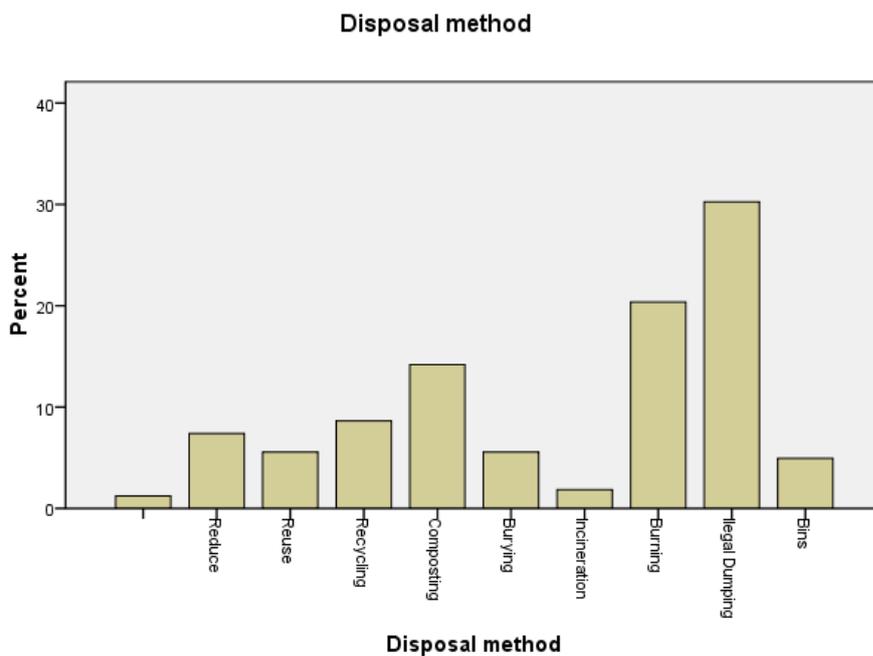
Those who use open space dumping which is deemed as legal by the City Council as they refer to them as transfer points accrue to 30.0%. The visit to the waste skips (transfer stations) at Bales Flee Market and Chicken Market revealed that organic waste, food containers and plastics constituted the greatest amount of waste. The skips were full and were over-spilling. Heaps of waste piled around the skips is the order of the day and collection was done only on Wednesdays which were inadequate to efficiently clear the sites. Street cleaners revealed that they burnt the waste that they swept from the markets and this was the only alternative way of controlling the waste, which was barely collected. They admitted that the process was environmentally unfriendly, but because of the problems faced by the City Council, burning was seen as one of the few helpful solutions. Shop owners and the informal sector also burn solid waste they generate and they argued that this was the only way they could deal with waste that was not being collected. Burning is the second leading disposal method practised in Sakubva by 22.5%. Vagrants were observed during the study period and were seen to be contributing to the burning on the open dumpsites to keep themselves warm in the evenings.



**Plate 4.5:** Solid waste illegally dumped in open spaces and burnt in Sakubva Central and Sakubva South respectively

Source: Field survey (2017)

Moreso, 5.1 % of the respondents dispose their solid waste in refuse receptacles supplied by the City Council. They provide litter bins in public places although the refuse bins are not evenly located and there are no separate bins for different materials. However, observations have revealed that these bins sometimes overflow and solid waste spills to the ground. Areas where most waste is generated by the public such as the Chicken Market, Bus Terminus and Pick n' Pay supermarket have small refuse bins which can carry only small quantities of solid waste compared to the large quantities generated by the public thus the public have no choice but to publicly throw away litter. Burying (2.9 %) therefore becomes an alternative to the Sakubva residents as most of them have little to no buying power. The Sakubva residents can bury the waste in their backyards and they also bury organic waste for composting. However, burying is not highly popular as it is more labour intensive and requires land and equipment to carry out. The least used disposal method is incineration with 1.2 % of respondents practising it as a way of managing their solid waste, especially sanitary. Of this portion, 1.0% was respondents from health care institutions, as well as the informal private sector and 0.2% was respondents from residents. Mayeya (2007) stipulates that incineration is not widely practised as it is expensive to set up, hence a mere low income, high density suburb can hardly afford incinerators for residents. Solid waste disposal methods practised are shown in **Figure 4.6**.



**Figure 4.6:** Solid waste disposal/ management methods (by percentage) practised by the respondents (Sakubva residents) Source: Field Survey (2017)

#### 4.6.1 Relationship between location of residence and disposal method applied

Medium to low density residents tend to use more sustainable methods of solid waste disposal and management that include the waste management hierarchy implementation. Longwe (2012) eludes that disposal of household solid waste varies with location of the people involved. However the residents from high density suburbs like Sakubva adopt unsustainable methods like open space dumping and burning of waste. However, other scholars argue that residents choose the most convenient methods of disposing solid waste given the socio-economic circumstances, despite place of residence, thus a test of hypothesis was undertaken in order to verify this notion. The results are shown in **Table 4.7**

#### Hypothesis

H<sub>0</sub> = There is no association between location and the disposal method used

H<sub>1</sub> = There is an association between location and the disposal method used

**Table 4.7:** Cross tabulation of location and disposal method used by number of respondents

Disposal method	Sakubva Central	Sakubva West	Sakubva East	Sakubva North	Sakubva South	Total
Reduce	4	2	2	1	3	12
Reuse	1	0	3	2	3	9
Recycle	3	4	0	4	3	14
Compost	2	3	5	6	7	23
Bury	2	3	0	1	3	9
Incinerate	0	0	2	0	1	3
Burn	7	4	9	8	5	33
Illegal dump	7	11	10	10	11	49
Bins	0	2	0	4	2	8
<b>Total</b>	26	29	31	36	38	160

**Table 4.7.1:** Chi-Square Tests for analysing association between the disposal method and location

	Value	Df	Asymp Sig (2 Sided)	Sig	Lower Bound	Upper Bound
Pearson Chi-Square	1.909E2	45	.112	.100	.000	.001
Likelihood ratio	52.775	45	.199	.188	.178	.198
Fisher's exact test	48.536	0	0	.254	.243	.266
Number of valid cases	162	0	0	0	0	0

Source: Field Survey (2017)

**NB.**  $P < 0.05$  Accept  $H_1$  and Reject  $H_0$

The significant level for Pearson Chi-Square Test is 0.112 which is greater than 0.05 (**Table 4.7.1**), therefore, accept  $H_0$  and reject Alternative hypothesis ( $H_1$ ) hence there is no significant relationship between location and the disposal method used. Generally, there is no relationship between location and disposal method. This is due to the fact that people normally practise a disposal method which is convenient and cheaper to them regardless of location. However, for this study, the disposal method employed was up to an individual and or household tolerance for the odour and visual blight caused by solid waste accrual at their household. The residents revealed that they dumped and burnt the waste from their households and these were the most convenient alternative ways of controlling the solid waste generated, which was barely collected by the responsible authorities. The informal private sector also burnt waste and they argued that this was the only way they could deal with waste that was not being collected and 80% of them claimed that they did could not afford practising proper waste management such as recycling. Furthermore, they noted that they burned waste to avoid being fined by the EMA if their waste products were found in the heaps of waste close to their production areas. As a result, a need has risen for the community, regardless of their various locations, to have their environmental awareness raised, especially concerning solid waste management. This is in line with the view of Sharholy et al (2007) who depict that community engagement in solid waste management is a requisite as anyone from any residential location generates almost the same types of solid waste.

#### 4.7 Perceptions and attitudes of respondents on community involvement in solid waste management in Sakubva

Views and attitudes must be considered as these can influence the solid waste management practises done in Sakubva. Perceptions can be changed by environmental awareness, clean-up campaigns and environmental education if these programs the waste generators and the general public. The vendors and consumers need to bear the cost of disposal through green taxation. Mangizvo (2010) explained the green taxes as economic instruments that are used worldwide and are often advocated as a better alternative to command and control approaches to regulating waste. Residents can be educated on and encouraged to practise recycling, composting and reuse in order to avoid open waste dumping and to avoid disappointment when the City Council does not collect the waste in their suburb. Findings of the respondents' perceptions and views on community involvement in solid waste management are shown in

**Table 4.8**

**Table 4.8:** The views of the respondents on community involvement in solid waste management by percentage

Perception	Frequency	Percent	Valid Percent	Cumulative Percent
Improves environmental aesthetic value and performance	85	53.1%	53.1%	54.3%
Costly	3	1.9%	1.9%	56.2%
Time consuming	4	2.5%	2.5%	58.6%
Non-favourable idea	9	5.6%	5.6%	64.2%
Way of income generation	57	35.8%	35.8%	57.3%
<b>Total</b>	160	100.0%	100.0%	290.6%

Source: Field Survey (2017)

As shown in **Table 4.8**, the highest percentage of 53.1% is of the view that community participation in solid waste management improves environmental performance and aesthetic value. Of the 53.1%, 32.5% was from Sakubva South. This could be because of a raised environmental awareness in that section, as a result of awareness campaigns carried out by EMA's Education and Publicity department. Khan (2006) asserts that once the community has been sensitised and have a sense of ownership of their environment, they can perceive their engagement in solid waste management as of paramount importance and a way to

improve on environmental management. The second hugely supported view was that of income generation with a 35.8% support. This is because quite a substantial number of Sakubva residents have engaged in the waste picking and recycling business and it has turned out to be productive for them as it improves their livelihoods. According to the Environmental Quality Officer of EMA Mutare, “Waste management in Sakubva is approximately manageable by 67%, with CBOs and waste pickers contributing a 40% of the 67%.”

However, 1.9% was of the view that community engagement in solid waste management is costly and 4 perceived the initiative to be time consuming as they considered the distances that would be travelled to and from the dumpsites and the amount of valuable waste gained eventually. The environmental officer from the Ministry of Environment, Water and Climate also explained this attitude bringing out the issue of cost-benefit analysis and he pointed out that most of the waste generated in Sakubva is of low value, for instance, plastic, hence the community perceived the suggestion to be time consuming for little or no value. Costs incurred in recycling and waste picking, as well as the distances one would have to travel from their place of residence to the dumpsites could have a negative impact on the community’s attitudes to the management of waste. Samake (2009) however, proposed that with little or no education attained, it can be near impossible to convince the community that they are responsible for their environment, thereby need to play a leading role in its protection.

In light of the above, a hypothesis was then done to test if there is an association between education level and the disposal method used. This was done on order to assess what influences an individual to practise a certain type of disposal method. The hypothesis was done to also assess the awareness and the extent of the environmental education to the general public or the community of Sakubva, as it plays a fundamental role in their perceptions and ultimate actions.

#### **4.7.1 Hypothesis Testing: Relationship between education level and disposal method employed**

It has been suggested that level of education affects disposal methods chosen by the general public. People who have attained a secondary and tertiary level of education opt for sustainable methods of waste disposal as compared to those who have merely attained primary level education or no education at all. Those who attain higher levels of education

have a better reasoning capacity as to the importance of maintain a clean environment and achieving sustainable development. In contrast, Matete (2008) states that people of Sub-Saharan Africa practise any disposal methods of waste as some are forced by circumstances, for instance, when the responsible authorities abandon the collection of waste, residents can desperately turn to burning. In line with this, a test of significance was then undertaken in order to see if there was a relationship between education level and disposal method used in Sakubva. The results are exhibited in **Table 4.9**

### Hypothesis

$H_0$  = There is no association between education level and the disposal method used

$H_1$  = There is an association between education level and the disposal method used

**NB.**  $P < 0.05$  Accept  $H_1$  and Reject  $H_0$

**Table 4.9:** Cross tabulation of education level and disposal methods used by number of respondents

Disposal method	No education	Primary level	Secondary level	Tertiary level	Total
Reduce	0	7	4	1	12
Reuse	1	2	5	1	9
Recycle	3	5	4	2	14
Compost	2	7	12	2	23
Bury	0	4	3	2	9
Incinerate	0	1	1	1	3
Burn	5	7	11	10	33
Illegal dump	1	22	16	10	49
Bins	1	2	3	2	8
<b>Total</b>	13	57	59	31	160

**Table 4.9.1:** Chi-Square Tests for education level and disposal method employed

	Value	Df	Asymp. Sig (2-sided)	Sig	Lower Bound	Upper Bound
Pearson Chi-Square	1.867E2	36	.081	.000	.000	.000
Likelihood Ratio	47.145	36	.101	.069	.063	.076
Fisher's Exact Test	44.946	0	0	.072	.066	.079
Number of Valid Cases	162	0	0	0	0	0

Source: Field Survey (2017)

The results (**Table 4.9.1**) show that there is no significant relationship between education levels and the disposal method used by the Sakubva residents as the significant level is 0.081 which is greater than 0.05. Even those who are highly educated and are aware of the consequences of unsustainable solid waste disposal still practise burning and open space dumping of waste. This might be because of the poor services offered by the City Council, hence the need to involve the community on self-initiated proper solid waste management practises. Questionnaires administered to the waste generators, as well as observations by the researcher revealed that the waste generators practise any type of solid waste disposal which guarantees the complete removal of accumulated waste close to where it is generated. Additionally, even those residents who are affluent and highly educated are ignorant of the sustainable ways of solid waste handling, storage and disposal. This could be due to the EMA awareness campaigns that target mostly school children ignoring the mothers who are responsible mainly for household solid waste handling at home.

#### **4.8 Legislation and governance issues on community participation in solid waste management**

The researcher delved into legislation and institutional aspects which affect solid waste management at community level so as to assess the knowledge of the general public as far as the legal and institutional aspects are concerned, as well as identifying possible ways to engage them through the legal instruments governing environmental management. Zimbabwe

has several pieces of legislation which deal with the issues of solid waste management either directly or indirectly. However, there is no waste management Act in Zimbabwe or even a waste management plan given the alarming rates at which solid waste is affecting the public and environmental health. Chenje (2014) argues that there are several legislations dealing with community participation in solid waste management. Waste management is guided by policies and regulations included in other Acts. These legal documents include Environmental Management Act CAP (20:27), Urban Councils Act (29:15), the Environmental Impact Assessment Policy of 1994 and Statutory Instrument 6 of 2007. The waste problem is blamed on the lack of specific policies on high density dwelling and on outdated policies, for instance, the Zimbabwean Environmental Management (Effluent and Solid Waste Disposal Regulations, 2007) are not only outdated but the fees charged are tantamount to encouraging littering. The figures are tremendously low and unlikely to have a deterrent effect. Be that as it may, despite the existence of these statutory instruments, it was evident during the time of the study that these were not effectively implemented.

#### **4.8.1 Environmental Management Act (CAP 20:27)**

The Environmental Management Act enacted in 2002 became the principle Act that governs the management of the environment in Zimbabwe. It asserts that every individual (including the communities) has to protect the environment for the benefit of present and future generations. It also addresses strategies that ensure the management and protection of the environment through community engagement. Its requirements discourse issues of waste management at various levels.

Jerie (2015) states that the Environmental Management Act with regards to waste management, provides for the formulation of waste standards in Section 69 (1), prohibiting against discharge of wastes (Section 70), prohibiting against littering in Section 83 (1-4), minimisation of waste through treatment, recycling and reclamation in Section 70 (3). Other pieces of legislation are silent on the issue of solid waste management standards. However, enforcement of the Environmental Management Act is a major problem. Section 70 (3) of the Act encourages sustainable waste management practices but leaves out the crucial role of other methods such as re-using, reduction and composting that are vital methods in sustainable.

Furthermore, the Act does not consider important aspects of waste minimisation and these include sorting of waste at source or point of generation. This is in line with Parrot (2009)'s

affirmation that separation of waste is vital in reducing the amount of waste that is disposed at landfills, thereby enabling the landfills to last longer. Income opportunities are also created through recovery and sale of paper and other non-bio-degradable materials like plastic and the sale of manure produced from composting of bio-degradable materials (Jerie, 2015).

#### **4.8.1.1 Role of EMA in fostering community participation in solid waste management**

The Environmental Management Agency through the Environmental Management Act (CAP 20:27) ensures proper solid waste management also with the involvement of the local communities. EMA encourages the local communities to adopt effective waste management practices such as the waste management hierarchy. The Environmental Management Agency has a decree that regulates refuse disposal as it is clearly declared in Section 83 of the Environmental Management Act [Chapter 20:27; Act 13 of 2002] that *“it is an offence to discard, dump or leave any litter on land, street or road except in a container provided for such purposes or at a place which has specifically been designated for such purpose”*. Therefore, in this study, this Section (sec 83) of the Act is central as it helps diminish unlawful discarding of litter and rules out illegal dumping which has been practised by the Sakubva community. This is done through the use of spot fines.

EMA is responsible for educating and raising awareness on environmentally sound solid waste management strategies (Wilson, 2014). Together with various stakeholders such as NGOs, City Council and the general public, EMA carries out clean up campaigns to inform the communities about the grave effects of poor solid waste management practices in relation to the alarming rate of climate change.

#### **4.8.2 Hypothesis testing: Relationship between disposal method and law awareness**

Awareness of the legislation governing solid waste management can influence the disposal methods opted for by residents in general. However, Gandure (2012) argues that people use various disposal methods despite their awareness of the law as implementation of the law by the responsible authorities is poorly done, hence a test of significance was done to verify if there was a relation or not. The results are subsequently displayed in **Table 4.10**

**Table 4.10:** Cross tabulation of disposal method used and awareness of environmental law by percentage of respondents

	Reduce	Reuse	Recycle	Compost	Bury	Incinerate	Burn	Bin	Dump	Total
<b>Solid waste management legislation awareness</b>	13 7.8% Aware	8 5.4% Aware	10 6.9% Aware	19 12.4% Aware	5 1.9% Aware	4 0.7% Aware	26 19.8% Aware	6 3.5% Aware	30 20.0% Aware	121 60.5% Aware
	0 0.0% Not aware	4 1.5% Not aware	5 2.0% Not aware	5 2.3% Not aware	2 1.0% Not aware	1 0.5% Not aware	10 2.7% Not aware	4 1.6% Not aware	10 10.0% Not aware	41 39.5% Not aware
<b>Total</b>	13 7.8%	12 6.9%	15 8.9%	24 14.7%	7 2.9%	5 1.2%	36 22.5%	10 5.1%	40 30.0%	162 100%

Source: Field Survey (2017)

The results displayed in **Table 4.10** shows that 60.5% of the respondents are aware of the environmental rules and regulations governing solid waste management. However, 55.4% of the population who are aware of the laws, still practise unsustainable disposal methods, illegal open space dumping (30.0%) being the most practised. Burning is the second most employed disposal method with a percentage of 22.5%, hence 38.0% of the people who are aware of the law practises this method. This shows that the authorities and EMA are merely educating the communities but they lack enforcement.

A total of 39.5% of the respondents are not aware of the environmental legislation hence they practise burning, illegal open dumping and unsustainable disposal methods unaware of the consequences. A smaller population (5.1%) however dispose waste in the refuse bins though 60.5% of the respondents are aware of the sustainable methods of treating solid waste. This is evident that EMA is not doing an effective and efficient job to reach and educate the total population of waste generators and instil in them an attitude of self-drive for proper solid waste management. Furthermore, the City Council is lacking in enforcing the city by-laws in order to maintain a clean environment in the city.

### **4.8.3 Public Health Act**

The Public Health Act CAP (15:09), whereby Section 83 of the Public Health Act of Zimbabwe of 1996 prohibits any accumulation of garbage or other matter whatsoever which is dangerous to health. It states that *“it shall be the duty of every local authority to take all lawful, necessary, and reasonably practical measures for maintaining its district, at all times, in a clean and sanitary condition by preventing the accumulation of waste, which may be injurious or dangerous to health”* (Government of Zimbabwe, 1996). However, this legislation is proven not to be functional as open waste dumps are seen in bushes, river banks, alleys and undesignated places. The Act does not effectively address the engagement of the community at large on issues pertaining to solid waste management. More so, Sakubva suburb has become an eyesore as garbage accumulates to large quantities on roadsides, evident that the local authority does not comply with its duties and responsibilities as decreed by the Act. Municipalities are expected to take responsibility for collection, transportation, storage and treatment of waste but the interviews and observations uncovered that other solid waste is sometimes collected by private companies, CBOs and the waste generators and the municipality barely provides adequate waste receptacles for solid waste storage to households.

### **4.8.4 Urban Councils Act (CAP 29:15)**

The Act regulates waste management in centres designated as urban. It makes provision of the urban council to charge for the removal of refuse where these services would have been provided. This ensures that the council provides waste management services in their area. The major weakness however, of this Act is that it is silent on key sustainable waste management practices such as waste prevention and minimisation, waste reuse and recycling. Furthermore, the Act overrides the contribution of the community in sustainable solid waste management, hence creating a myriad of solid waste problems as the general public assumes that they are exempted from proper management of waste.

### **4.8.5 Statutory Instrument 6 of 2007 CAP 20:27 Environmental Management (Effluent and Solid Waste Disposal)**

SI 6 of 2007 has a decree that regulates waste disposal as it clearly declared in Section 23 that *“any person found throwing litter on any land, street or site in any place except a container*

*provided for such purposes or at a place which has specifically been designated for such purpose shall be guilty of an offense and liable to a fine not exceeding level 3 or to imprisonment."* This section (sec 23) of the Act is indispensable as it helps to diminish the unlawful discarding of litter and rule out illegal dumping which has been practised in most areas of the Sakubva suburb by the community members. On the other hand, not much enforcement has been done in accordance to this section due to shortage of manpower to survey the city every day and also the public defends itself saying that there are no sufficient bins to throw litter in hence further shifting blame to the City Council. Garity (2015) states that, shortage of funds for purchasing refuse collection vehicles and spare parts contribute to inefficient and inadequate solid waste management systems, therefore resulting in illegal dumping of waste. Furthermore, due to high corruption levels, that is, diversion of revenue into private pockets and or bribes, the spot fines are not issued to the person who contravenes the regulations stipulated in Section 30. Rather, the offender merely pays a reasonable amount to the officer to avoid a ticket, hence proving inefficiency of the governance.

The SI 6 of 2007 properly discusses the issues of solid waste management in its sections. Section 12 of SI 6 of 2007 decree that every generator of waste shall prepare, implement and adhere to a waste management plan which shall consist of an inventory of waste management situation specifying the quantity of waste produced and components of such waste, as well as the goals for attaining an environmentally sound solid waste management (Government of Zimbabwe, 2007). However, this decree has not been implemented by waste generators (members of the community) and Environmental Management Agency has hardly enforced it. The waste quantities generated by Sakubva community are not known thus the researcher had to measure the solid waste and identify components of solid waste generated through field survey. Section 23 subsection (3) of Statutory Instrument 6 of 2007 authorizes the imposition of penalties and fines against offenders who dump litter in violation of its provisions. Imposing of fines and penalties to the offenders therefore assists to reduce illegal dumping of solid waste by the community at large.

#### **4.8.6 Mutare City By-Laws**

The Mutare City (Public Health) by-laws of 1982 governed the removal and disposal of waste in the city. The by-laws state that it is the responsibility of the owner to maintain a premise free from solid wastes such as debris, disused motor vehicles, filth, glass, paper, rags,

rubbish, rubble and anything regarded as a nuisance (Mutare City Public Health By-laws, 1982). The premises should be kept clean to prevent the breeding of bed bugs, cockroaches, flies, rodents or any other vermin. These by-laws and legislation require revision and updates to enhance and integrated solid waste management approach. A closer analysis of the by-laws shows that fines imposed by the City Council for environmental offences were insufficient punitive. The by-laws were set in 1982 and revised in 1987. Since then, no amendment was ever made and up to date, the fines are still documented as Zimbabwean dollars although our currency has altered.

However, despite the existence of these statutory instruments, it was evident during the time of the study that these were not being implemented. Both the government and municipality of Mutare were suffering from the effects of the economic melt-down that was gripping Zimbabwe. The issue of legislation is grim to deal with especially in municipal councils. However, the problem is the enforcement of the legislation. It has been observed that the informal private sector workers as well as the Sakubva residents tend to burn their sweepings and solid waste in the open dumps and alleys. This was in contravention of the city's by-laws. The informal sector workers from the Green Market supported this environmentally damaging act saying they did not have pushcarts to carry the waste to the transfer points or a station hence burning was convenient in dealing with the accumulated heaps of waste.

In a nutshell, the environmental legislation and governing solid waste management ineffectively addresses community involvement in sustainable solid waste management, as its main focus is thrust on the contribution of the municipalities in solid waste management, particularly, waste collection. Therefore, solid waste management problems in the greater Sakubva can hardly be pinned from all angles as the environmental law in Zimbabwe does not use a holistic approach. Lankester (2014) concurs with this argument as they stipulate that, *“Dependency on legislation and policies without particular mention and involvement of the communities who generate the waste, is a game of chasing shadows.”*

#### **4.9 Response rate**

The researcher managed to distribute a total of 160 questionnaires which were all answered fully, hence resulting in a 100% response rate from the Sakubva residents and members of the private informal sector. On the other hand, the researcher managed to interview 4 key informants from Mutare City Council, EMA and Ministry of Environment, Water and Climate, out of a planned number of 5 informants. Therefore, this projected an 80% response

rate from this particular section. Over and above, the general response rate was at 90% which was a satisfactory response rate, hence aggregating the findings' validity.

# CHAPTER FIVE

## CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

The findings of this research have revealed that community participation in solid waste management in Sakubva suburb of Mutare is associated with a plight of challenges and opportunities. The challenges include lack of financial resources, well- trained personnel and equipment for waste recycling. These challenges are exacerbated by lack of environmental law support. Lack of residents' cooperation and a sense of ownership, are also drawing back efforts by responsible authorities in solid waste management. Furthermore, solid waste management in Sakubva suburb is characterized by an erratic, unreliable collection system, hence resulting in waste generation rates exceeding the collection rates. Ultimately, environmentally unfriendly waste management practices by the community have therefore sprouted. These include illegal dumping and burning of the solid waste.

Additionally, the findings of this study also show that the Sakubva community, regardless of the challenges faced, has had a silver platter of opportunities related to solid waste management, which arise from solid waste recovery, waste recycling and other sustainable solid waste management practices.

In light of the objectives, the study revealed that the community of Sakubva has collaborated with other stakeholders in a bid to manage solid waste in their suburb. These stakeholders include EMA, pressure groups, industrial companies like Delta and Cairns, as well as NGOs. The results show that awareness campaigns, training workshops, educational tours, and clean up campaigns have been conducted in these collaborations and they have facilitated to reduce the problems of solid waste. However, from the study, it can be derived that sustainable management practices like waste minimisation, that is, reduction, reuse and recycling are not being effectively and efficiently practised, with only a significant proportion of the residents engaged in these practices, as well as in waste separation. This study therefore, has become a panacea in solid waste management as it sought to unravel the lucrative socio-economic, political and environmental opportunities associated with actively engaging the community in solid waste management.

## 5.2 Recommendations

Taking into consideration the findings of this research, in order to enhance Sakubva community participation in sustainable solid waste management, the following recommendations were brought forward:

Mutare City Council needs to formulate an Integrated Solid Waste Management System Plan. This would assist in reducing amounts of solid waste at source, thereby reducing the total amount of waste that would be illegally disposed and collected at the open dumpsites. Integrated solid waste management comprises of practices like waste reduction, reuse, recycling and separation. This plan therefore, requires inclusion of stakeholders like the Sakubva community.

The Council, in collaboration with ward councillors and environmental monitors, should also conduct public consultation meetings when making decisions associated with waste management that have a bearing on the greater community of Sakubva. This ultimately reduces resistance and improves on cooperation, as well as participation levels by the general public. For instance, in setting up their waste collection schedule, The City Council should consult the public on sites convenient to set up as communal collection points, dates and time of collection. This gives the community a sense of belonging, hence give them a zeal to keep their community clean.

The City Council should make efforts to provide waste receptacles in households and to the private informal sector, and place them strategically even at market places and business centres so as to reduce the problem of littering, burning, as well as indiscriminate dumping of solid waste.

The Council can also set up sites for waste recycling for CBOs. This helps reduce transportation costs for the CBOs. This is because, currently, the CBOs transport their collected waste for recycling in Harare, the capital city, hence their recompenses are reduced.

EMA should effectively engage the Sakubva community in environmental awareness campaigns such as educational tours, indabas, clean-up and anti-littering campaigns and environmental debate sessions so as to instil a sense of ownership in the community, thereby getting educated on the importance of sound solid waste management and eradicating the “throw away” attitude that has become rampant in

the suburb. This can also be done through mobilisation of the different residents in the suburb.

EMA, together with the City Council and willing NGOs like Environment Africa, can also carry out environmental education sessions in schools (Catch Them Young approach), market places and churches. This helps disseminate crucial information, to all age groups, on challenges brought about by solid waste, as well as opportunities associated with its proper management.

NGOs should carry out more training workshops that involve the community so as to equip them with valuable information on solid waste management and its perceived reimbursements.

NGOs can also provide solid waste management equipment such as recycling machinery and financial assistance to the Community Based Organisations. This helps lure more people from the community to voluntarily get involved, thereby reducing the unbearable upshots of improper solid waste management.

Industrial organisations like Delta and Cairns Holdings should buy back their empty products from scavengers and or waste pickers from the community. This reduces solid waste in the community.

Policy makers such as the Ministry of Environment, Water and Climate, should revisit the already established environmental legislations and amend in terms of community involvement, that is, formulate policies that involve the community to a greater extent. This assists the implementers of the law such as EMA when trying to engage the community. This also helps create a bottom-up approach in solid waste management as the community can pioneer waste management activities.

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# APPENDICES

## APPENDIX 1

### Questionnaire for Sakubva suburb residents

This questionnaire is premeditated to facilitate an assessment of the challenges and opportunities associated with community participation in solid waste management in Sakubva. Information attained shall subsequently be used to determine strategies of encompassing the community in sound solid waste management, to safeguard sustainability of the environment, as well as community development in and around Sakubva. The researcher, Chirema Esther Tariro, is a BSC Honours Geography and Environmental Studies student at Midlands State University. The information collected is strictly for academic purposes hence great discretion and confidentiality is guaranteed. Your voluntary input is highly appreciated.

Date: .....

Questionnaire No.: .....

Instruction: Please fill in the blanks or tick the appropriate box

### SECTION A: DEMOGRAPHIC CHARACTERISTICS

1. Gender :

Female

Male

2. Age (years) :

Below 20

20-30

31-40

41-50

51+

3. Marital status :

Single

Married

Divorced

Widowed

4. Level of education :

No education  Primary  Secondary  Tertiary

5. Section of residence (*for example Mazhambe, Mcgregors, Chisamba*) :

6. Duration of stay in Sakubva: .....

**SECTION B: WASTE MANAGEMENT PRACTICES AND THE COMMUNITY**

7. What types of waste do you generate in your household? :

Glass  Plastic  Metal  Paper

Sanitary waste  Food items  Garden waste

Other (*specify*): .....

8. What are the current measures and strategies being implemented to manage waste in your suburb? :

Reduce  Reuse  Recycling  Composting

Burying  Incineration  Burning

Other (*specify*): .....

9. How effective are these strategies in proper solid waste management? :

Excellent  Good  Satisfactory  Poor  Extremely ineffective

10. Who collects waste in your suburb?

Self  City council  Volunteers  None

11. What is the frequency of waste collection? :

Daily  Once a week  Twice a week

Once a month  No sequence

12. Where do you dispose waste if not collected? :

Name of site.....

Period when disposal began.....

How safe is the disposal site? .....

13. If there, who picks up the waste at these disposal sites? :

Community Based Organisations  Scavengers  Pressure groups

Other (*specify*): .....

14. Which are the visible health and environmental problems emanating from poor management of solid waste in Sakubva? :

.....

### SECTION C: INCOPORATING THE COMMUNITY INTO SOLID WASTE MANAGEMENT

15. a. Are you aware of legislation governing solid waste management? :

Yes  No

b. If yes, which ones are these? .....

c. If no, why? .....

16. What role does your community play in the management of solid waste in Sakubva? :

.....

17. What is your view pertaining community involvement in solid waste management? :

- a) Improves environmental aesthetic value and performance
- b) It is costly
- c) It is a time consuming
- d) Not a favourable idea
- e) Can be a way of income generation

**THANK YOU!!**

## **APPENDIX 2**

### **Interview guide for Mutare City Council: Director environmental health services and Supervisor waste management department**

1. What type of waste is generated by the Sakubva community?
2. What are the current solid waste management practices in Sakubva?
3. How often do you collect waste in Sakubva suburb?
4. Are there any problems being encountered by the waste management department in endorsing sound environmental waste management plans?
5. How are these problems being rectified?
6. How many functional vehicles are apparently available for waste collection and are they ample for the jurisdictions' amenity?
7. Which sections in Sakubva are you finding hitches in waste collection and why?
8. Where is the waste you collect disposed?
9. Are there any environmental problems emanating from poor solid waste management in the suburb? And if there, what are they?
10. What waste management plans have you established for Sakubva and how effective are these in refining solid waste management in the suburb?
11. In which ways can the public be engaged in solid waste management to ensure that the communities participate in solid waste management?

### **Interview guide for Environmental Management Agency staff: Planning and Monitoring officer; Education and Publicity officer And Mutare District officer**

1. What is the amount of solid waste(s) generated in Sakubva per annum and which type is dominant?
2. How sustainable is solid waste management in the suburb? If not, which areas require attention?
3. Which legal frameworks govern sustainable solid waste management?
4. Is the public aware of the legislation?
5. What perception do you have about the community? Any opportunities or challenges associated with community participation in solid waste management?

6. How many environmental awareness campaigns do you conduct in Sakubva monthly, quarterly, as well as annually?

7. Do you frequently embrace the community in these environmental awareness programmes and waste management campaigns? If yes, is awareness being disseminated to grass root levels? And is it of any assistance in the enhancement of solid waste management?

8. Are there any environmental problems emanating from poor solid waste management in the suburb? And if there, what are they?

9. What waste management plans have you established for Sakubva and how effective are these in refining solid waste management in the suburb?

10. What is the role played by the community in solid waste management in Sakubva?

11. In which other ways can the public be engaged in solid waste management to ensure that the communities participate in solid waste management?

**Interview guide for Ministry of Environment, Water and Climate: Senior Environmental Officer**

1. What is solid waste?

2. How sustainable are the solid waste management practices in Sakubva suburb?

3. What are the environmental hazards related to improper solid waste management?

4. What perception do you have about the community? Any opportunities or challenges associated with community participation in solid waste management?

5. What are the ways in which the Sakubva community can have a pro-active approach on solid waste management?

6. In which other ways can the public be endorsed in solid waste management to ensure that the communities participate in solid waste management?

## **APPENDIX 3**

### **Field observation guide**

1. Spatial distribution of households and small to medium enterprises in Sakubva suburb.
2. Types and amounts of waste produced in Sakubva.
3. Waste collection practices in the suburb.
4. Prevailing disposal facilities in the suburb.
5. Illegal dumps in the roads.
6. Environmental and health hazards of solid waste.
7. The role of community, city council and EMA in solid waste management.
8. Challenges and opportunities associated with community participation in the sound management of solid waste.