



Exploring the opportunities and barriers in implementing Makhado Municipal Integrated Waste Management Plan

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PREFACE AND ACKNOWLEDGMENTS

“If you fail to plan, you are planning to fail!” is a quote by Benjamin Franklin. “Give me six hours to chop down a tree, and I will spend the first four sharpening the axe is”, a quote by Abraham Lincoln.

Planning is the central management function, which involves decision-making in advance, what needs to be done, when to do it, how to do it, who will do it and what resources are required. It is an intellectual process which lays down an organisation’s objectives and develops various courses of action by which the organisation can achieve those objectives. It draws out exactly how to attain a specific goal.

In completing this study, I would like to express appreciation and gratitude to my family, especially my wife and children, friends and everyone who supported me throughout this academic journey.

I would also like to express my heartfelt gratitude to Dr Phathutshedzo Mukwevho, whom I am certain that without his excellent guidance, supervision, and support, this academic journey could have been equivalent to a trip from heaven to hell.

Finally, I would like to dedicate the fulfilment of this academic journey to my late parents, who had my educational dream even though I had none based on my childhood background. They have invested everything they had to make my “academic Mount Kilimanjaro” feel easier. I want to dedicate this life progress to a friend and a Pastor, Mr Takalani Phillip Ndou, for his role in my academic life. To my late son, Vhutali Prince Radzuma, it was my wish and will to witness your dad's success as your role model, hoping that you will strive to surpass it in your life; however, God had other plans. May their souls continue to rest in power and perfect peace. I love you all.

ABSTRACT

Solid waste management is challenging in developing countries such as South Africa. Integrated waste management planning (IWMP) is essential for designing or improving a waste management system to address these challenges. Increasing population levels, economic development, and rapid urbanisation have significantly accelerated the municipal solid waste generation rate in developing countries like South Africa. Municipalities in developing countries are responsible for city waste management and are challenged to provide an effective and efficient waste management system to their communities. Most often, municipalities fail to provide efficient waste management systems due to problems at times beyond their ability associated with a lack of organisation and financial resources, including corruption. Increasing solid waste generation is a major concern worldwide, with least developed countries particularly affected due to ineffective waste management systems.

Developing and implementing IWMP in South Africa is a legislative requirement in section 12 of the National Environmental Management: Waste Act 59 of 2008 (Waste Act). An IWMP is one of the key instruments in the Waste Act for local government to manage their waste better. The primary aim of this study is to explore the opportunities and barriers to implementing the Makhado Local Municipality (MLM) IWMP. The specific objectives are to determine the extent to which the MLM has implemented its IWMP and identify the opportunities and barriers towards implementation of MLM's IWMP. The approach used to conduct this research was qualitative, where the researcher collected data through open-ended interviews, document review, and ground truth observations.

The researcher interviewed officials from the MLM, Vhembe District Municipality, Limpopo Department of Economic Development and Tourism, and the Department of Forestry, Fisheries and the Environment. The researcher also extended interviews to stakeholders identified by the MLM IWMP as implementing partners. The content data analysis method was applied.

Given the overall 22% conformity and 30% partial conformity, one can conclude that the overall findings were that MLM partially conforms with implementing its IWMP. Barriers were identified, such as lack of capacity, insufficient waste management budget, and unreliable waste service and collection frequency. Some of the opportunities identified in implementing the IWMP were compliance with the law, especially section 24 of the Constitution of the Republic of South Africa 1996 in general. Some of the recommendations made included the MLM to start reporting on the implementation of its IWMP annually as per the provision of the Waste Act. This will help the municipality identify obstacles to implementing its IWMP and develop an intervention programme.

Keywords: integrated waste management plan, solid waste management, development and implementation, opportunities and barriers, Makhado Local Municipality, opportunities and barriers

ABBREVIATIONS AND ACRONYMS

CE	circular economy
Constitution	Constitution of the Republic of South Africa 1996
DEA	Department of Environmental Affairs
DEFF	Department of Forestry, Fisheries and the Environment
ECA	Environment Conservation Act 73 of 1989
EIA	Environmental impact assessment
EPR	Extended producer responsibility
e-waste	electronic waste
FNASREC	Faculty of Natural and Agricultural Sciences Research Ethics Committee
GGD	Good-green-deeds
IDPs	Integrated Development Plans
IWM	Integrated waste management
IWMP	Integrated Waste Management Plan
IWMPlanning	integrated waste management planning
LEDET	Limpopo Department of Economic Development and Tourism
MEC	Member of the Executive Council
MLM	Makhado Local Municipality
Municipal Systems Act	Local Government: Municipal Systems Act 32 of 2000
NEMA	National Environmental Management Act 107 of 1998
NWMS	National Waste Management Strategy
Ros	Research objectives
SAWIS	South African Waste Information System
SDBIP	Service Delivery and Budget Implementation Plan
SDZ	Musina-MLM Special Development Zone
SMMEs	Msmall, medium and micro enterprises
Waste Act	National Environmental Management: Waste Act 59 of 2008
WMP	Waste Management Plan

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Solid waste management has been on the public agenda and, globally, has moved to the forefront of policymakers' agendas. This is because, for decades, the waste generation in many countries has been increasing and has become more reliant on landfilling and, to some degree, the burning of waste as a management strategy. These poor waste management measures have existed for too long and are no longer acceptable and viable worldwide. Again, inadequate waste management measures have further inflated the socio-ecological negative impacts, such as increased human diseases and climate change (Clarke *et al.*, 1998).

The world faces unprecedented production and resource demand due to never-ending population growth (Debrah *et al.*, 2022). Production and resource demand, population growth coupled with urbanisation, industrialisation, and other factors influence the increase in the volume of solid waste generated globally (Mautla, 2022).

Global waste generation in large cities has reached over 2 billion tons annually and is expected to reach 3.4 billion tons by 2050. Africa and South Africa contribute significantly to this figure (Nyika *et al.*, 2019).

Due to the same factors indicated by Mautla, 2022, the global waste generation trajectory is expected to outpace population growth by more than double by 2050 (Dlamini *et al.*, 2019; El-Fadel and Maalouf, 2019). Similarly, the increase in waste generation in Africa will likely overshadow the global decrease in waste generation (Debrah *et al.*, 2022).

Due to global waste generation and its challenges, like poor waste management and outdated measures, many solid waste management policymakers are adopting new strategies and sustainable practices. The most recent commonly adopted strategies include zero-waste, circular economy (CE), sustainable materials management, and extended producer responsibility schemes. Although some countries like the United States, China and South Africa have embraced these strategies, challenges with integrating these strategies into solid waste policy and planning still exist (Anshassi *et al.*, 2019).

Countries have adopted integrated waste management planning (IWMPlanning) into their management system - the concept of solid waste management planning dates back in history. Internationally, waste management planning provides mechanisms for changing and improving waste management and related behaviour (Anshassi *et al.*, 2019). IWM Planning is essential for designing and enhancing a waste management system in the organisation. South Africa is a signatory party to some international protocols and conventions and must adhere to international commitments by promoting an integrated waste management (IWM) approach

(Mautla, 2022). Like in South Africa, policymakers and planners in other countries have invested millions of dollars and years of studies in establishing and improving the IWMPlanning system and its implementation (Hostovsky, 2005).

1.2 Overview of the municipalities' service delivery failures in South Africa

Globally including in South Africa, the term service delivery is defined as the distribution of basic communal needs and services by local government to the local communities, mainly housing, water, sanitation, land, waste management, electricity and infrastructure. However, in South Africa, the continuous and uninterrupted delivery of these basic services has become unreliable, and inconveniencing and as a result characterised by increasing service delivery protests by local communities demanding improved service delivery (Reddy, 2016).

The country shortage of skills, corruption, nepotism, interference in the daily operations and administration of departments by political principals must also be considered. These issues must be urgently addressed to improve public service delivery (Nengwekhulu, 2009). Similarly, Reddy, 2016, further emphasised that the political infighting and related clashes between the political and management components in local government in South Africa have also adversely affected municipal service delivery (Reddy, 2016).

The end of apartheid and the dawn of new democratic South Africa without segregation necessitated the re-incorporation of previously excluded communities into the mainstream of the civil service and the need to urgently provide rapid delivery of services to rectify the results of apartheid. However, decades into the democratic South Africa, poor service delivery is still endemic in many municipalities, partly due to corruption, patronage and skills deficits (Ntliziywana, 2017).

The South African Constitution, Act No. 108 of 1996 (Schedule 5, Part B) provides powers and mandates for waste management service delivery to municipalities in both residential areas and industrial sites. Waste management services by municipalities include waste collection, waste transportation and waste disposal. While it can be argued that, while municipalities are striving to provide reasonable service in high and middle income areas of South Africa, the reality on the ground shows that waste management service delivery, especially in cities and urban centres is still inadequate and very low in low income and rural areas (Fakoya, 2014).

In 2009, Nengwekhulu recorded that:

“Decades after the dawn of a new and democratic South Africa, the excitement marking the beginning of a new South Africa has been replaced by growing signs of despair regarding

the inability of government to provide the services that the majority of the people waited for”
(Nengwekhulu, 2009).

Municipalities in the country have identified a number of stubborn service delivery and governance factors which includes among others, huge service delivery and backlog challenges, poor communication and accountability relationships with communities, political interference with administration process including corruption & fraud, poor financial management, weak civil society formations, lack of skills and serious poor leadership (Ntliziywana, 2017). The poor performance on delivering basic services by municipalities has further led to their failures to achieve Auditor-General's clean audits in many most of South African municipalities (Motubatse et al., 2017).

1.3 Problem statement and rationale for the study

Municipal solid waste (MSW) generation in high volumes is a serious problem in South Africa, mainly due to poor waste management (Muzenda, 2014). According to Hoornweg and Bhada-Tata, 2012, waste has a huge impact on health, the local and global environment, and the economy. Inappropriate waste management often leads to greenhouse gas emissions, littering and illegal dumping (Hoornweg and Bhada-Tata, 2012). Landfill remains a common and cheap method for managing MSW in most parts of the world. Unfortunately, like many other developing countries, South Africa has generally non-engineered landfill sites posing serious threats to groundwater from biological, chemical, or physiochemical processes. Competing of different land use practices often leads to the unavailability of land for new landfill establishment (Idowu *et al.*, 2019). While this can be a problem, it is also an opportunity for countries to plan for new sustainable waste management options (Idowu *et al.*, 2019).

The increasing standard of living and economic growth in South Africa result in the same waste generation problem and associated impact (Godfrey and Dambuza, 2006). In 2011, South Africa generated approximately 108 million tons of waste, and it generated 121 million tons of waste in 2017 (Nyika *et al.*, 2019). The Limpopo Province has a population of over 6 million households, and most households dispose of their waste. Illegal dumping is a big concern to the authorities (DEA, 2018). The Limpopo Province generated approximately 623,678 tons of waste in 2011 and is now yielding over 1.1 million tons per year (LEDET, 2020).

Developing and implementing a municipal IWMP within the IWM system is a legal requirement in South Africa under section 12 of the National Environmental Management: Waste Act 59 of 2008 (Waste Act). Monitoring adequate IWMP implementation is critical in exploring the opportunities and challenges for constant improvement (Al-Fayez, and Jubran., 2012).

South Africa waste management is based on the principles of the White Paper on Integrated Pollution and Waste Management (IP and WM), the National Waste Management Strategy

(NWMS) of 1999 (Muzenda et al., 2012). The development of IWMPs in South Africa was introduced through the NWMS of 1999. This was called the first generation and was not mandatory requirement as there was no legislation to enforce it. Consequently, the first generation of IWMPs was voluntary and had little to no success with implementation. Of 2012 IWMP is now a legal requirement in terms of the Waste Act, 59 of 2008 (Muzenda et al., 2012 and DEA, 2012). The Department of Environmental Affairs (DEA) 2012 viewed IWMPs as a legal instrument to integrate and optimise waste management planning to maximise efficiency and minimise the associated environmental impact. IWMPs are implemented for five years and monitored annually by providing progress reports in municipal annual performance reports (NWMS, 2020).

Goal 5 of the NWMS of 2011 was to achieve IWMP planning by having all municipalities integrate IWMPs in their Integrated Development Plans (IDPs) and meet all the IWMP targets by 2016 - similarly, pillar 2 of the NWMS of 2020 highlights IWMP planning as one of the focus areas. The focus area aims to support the local government in implementing IWMPs and services that better address the constraints and varying circumstances the local government faces (NWMS, 2020). Though it was not an objective of the study, MLM IWMP of 2018 was chosen as it seeks to achieve the goal 5 of and expected to be aligned with NWMS of 2011.

IWMP is now a legal requirement and one of the key instruments in the Waste Act, 59 of 2008 for local government to manage their waste better. Previous studies have stressed the importance of developing an IWMP, including an implementation plan. Furthermore, such studies emphasise the need to explore further the extent of IWMP implementation within municipalities (Muswema, 2012; Molaba, 2019; Mautla, 2022).

Whilst Godfrey and Dambuza in 2006 recorded that 81.7% of the completed municipal IWMPs have been prepared by consultants resulting in the lack of internalisation and successful implementation (Godfrey and Dambuza, 2006), however Muswema, 2012, Polasi et al., 2020 and Kolaventi, 2021 concurs that the implementation remains a concern due to several challenges (Muswema, 2012 and Polasi et al., 2020). Additional challenges against implementing IWMPs include a lack of supporting data, the relevance of the IWMP, financial and human resources, and public participation (Kolaventi, 2021). Although these are the findings in literature for other municipalities in RSA, nothing is known regarding the MLM and hence the importance of this study.

Molaba, 2019, found that implementing IWMPs in local municipalities within the Fezile Dabi District was below 20%, with no evidence of IWMP implementation progress being reported and monitored. Viljoen *et al.*, 2021 recommended further research to focus on analysing the obstacles faced by municipalities in rural/remote areas and how they can be overcome (Viljoen

et al., 2021). Several studies and research have been conducted on IWMPs, but there is still a gap in opportunities and barriers to IWMPs' implementation, specifically in Makhado Local Municipality (MLM) (Muswema, 2012; Molaba, 2019; Mautla, 2022). This study seeks to close this identified knowledge gap using MLM's IWMP.

1.4 Research aim and objectives

Given the problem statement, this research study's primary aim is to explore the opportunities and barriers to implementing MLM's Integrated Waste Management Plan (IWMP).

The specific research objectives (ROs) are to:

RO 1: Determine the extent to which MLM has implemented its IWMP.

RO 2: Identify the opportunities and barriers to implementing MLM's IWMP.

1.5 Research scope and Limitation

Developing and implementing an integrated waste management plan (IWMP) in South Africa is a legislative requirement in section 12 of the National Environmental Management: Waste Act 59 of 2008 (Waste Act). An IWMP is one of the key instruments in the Waste Act for local government to manage their waste better.

This study explored the opportunities and barriers to implementing the Makhado Local Municipality (MLM) IWMP. The specific objectives are to determine the extent to which the MLM has implemented its IWMP and identify the opportunities and barriers towards implementation of MLM's IWMP.

The approach used to conduct this research was qualitative, where the researcher collected data through open-ended interviews, document review, and ground truth observations. The researcher interviewed officials from the MLM, Vhembe District Municipality, Limpopo Department of Economic Development and Tourism, and the Department of Forestry, Fisheries and the Environment. The researcher also extended interviews to stakeholders identified by the MLM IWMP as implementing partners. The content data analysis method was applied.

This research was only limited to the 2018 MLM IWMP and the supporting documents reviewed were the MLM IWMP with a focus on the Implementation Plan of 2018, MLM invitation to comment on the development of its IWMP stamped 23 October 2017, Municipal Waste Management By-laws of 2014, MLM community services waste management policy of 2014, MLM IDP of 2021/22 and Member of the Executive Council (MEC) IWMP endorsement letter of 2018 in terms of section 11(4)(a)(i) of the Waste Act were reviewed. The study did not

include other related documents such as SDBIP and annual reports due to unavailability at the time of the study.

Interviews were only limited to the officials from local, district, provincial, and national departments, including the MLM IWMP implementing partners, as identified in the IWMP and municipal database. The sample size of 15 participants was determined out of 23 identified participants. This is 65% of the total implementing partners and it is therefore deemed as enough representative sample size. 7 identified participants did not pass selection criteria while 1 refused to be interviewed. Criteria is described in sections 3.3.3 of this dissertation.

The interview data is based on self-reported data from individuals and that their responses may be influenced by their own perceptions and experiences – and it may not be an accurate reflection of reality.

1.6 Structure and outline of the dissertation

Chapter 1: Introduction and problem statement

This chapter introduces the research study to explore the opportunities and barriers to implementing MLM's IWMP. The first chapter provides background on the term waste management and generation in South Africa and some waste management practices and measures adopted. The problem statement, research aim, and ROs are defined.

Chapter 2: Literature review

This chapter presents the literature review and prior research on waste management and pollution in a global, regional, and South African context. It further describes global, regional, and South African waste management practices. It identifies the research gaps and designs the framework for the analysis of the results of the research. The chapter also focuses on the literature related to the research aim and objectives by focusing on global and African perspectives and district and local perspectives.

Chapter 3: Methodology

Chapter 3 comprehensively discusses the research methods, design, and data collection approaches. It further identifies data collection techniques to determine the extent of MLM's IWMP implementation and identifies potential barriers and opportunities. This chapter also takes note of the ethical considerations and academic issues relevant to the study.

Chapter 4: Results and discussion

This chapter explains data collection results, interpretations, and analysis of MLM's IWMP implementation, documents reviewed, how the data was analysed, and its key findings.

Chapter 5: Conclusions and recommendations

Chapter 5 presents the conclusions and recommendations based on the results discussed in Chapter 4. The conclusions provide an overview of the study by examining the research aim and the extent to which the research aim and objectives have been addressed. Finally, the chapter puts forward key conclusions and proposes rational recommendations for implementing MLM's IWMP, which can also be adopted by other municipalities experiencing the same challenges.

1.7 Conclusion

This chapter demonstrated that waste generation as a global problem has existed for decades mainly due to population growth, urbanisation, industrialisation, and production and demand of resources. It has further proved that previous management options of landfilling and burning have become impracticable. Many countries, including South Africa, have shifted to an efficient international IWM approach. This approach necessitated South Africa to introduce regulation for IWM in government. The following chapter will summarise existing literature on IWM worldwide.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Waste is defined differently across the globe. The European Union, in its legislation, defines 'waste' as 'discard' (Oelofse and Godfrey, 2008) and further defines 'municipal waste' in its legislation as waste from households and 'other waste' as household waste according to nature and composition. This broader definition, therefore, considers waste from commercial or business premises to be municipal, where it is similar in composition to household waste (Amasuomo and Baird, 2016).

In South Africa, waste is defined in terms of the Waste Act as:

- (a) any substance, material or object that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or
- (b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste -

- (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;
- (ii) where approval is not required once the waste is or has been re-used, recycled or recovered;
- (iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or
- (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste (DFFE, 2022).

Waste management is a global challenge due to high waste generation from industrialisation and urbanisation and the failure to implement waste management policies and standards effectively (Al-Fayez, and Jubran., 2012). Similarly, according to Radzilani, 2019, waste management is a concern in both developed and developing countries due to rapid industrialisation, population growth and urbanisation, which leads to an increase in waste generation and volumes with poor waste management leading to a detrimental impact on the environment and public health (Radzilani, 2019).

To regulate MSW and related impacts, other countries including South Africa's government has instituted IWMP instruments in its environmental management regime as a policy instruments for better waste management (de Souza et al., 2021). The concept of solid waste management planning dates back in history (Anshassi et al., 2019). Countries such as USA, Hong Kong, and Brazil among others have adopted integrated waste management planning (IWM Planning) into their management systems (Clarke et al., 1999; Tam, 2007; de Souza et al., 2021).

Developing and implementing a municipal IWMP within the IWM system is a legal requirement in South Africa under section 12 of the National Environmental Management: Waste Act 59 of 2008 (Waste Act). Monitoring adequate IWMP implementation is critical in exploring the opportunities and challenges for constant improvement (Fayez, 2012; Muswema, 2012; Molaba, 2019; Mautla, 2022).

2.2 Waste pollution internationally and in the African region

Global waste practices and their related impacts have been persistent for over four millennia and have been recognised as a worldwide concern (Seadon, 2006; Singh *et al.*, 2014). Every year, a huge amount of waste is generated, and, for example, about 10 million tons of oil products reach rivers and oceans, carrying more than 500 billion tons of industrial waste. Industrial facilities and transportation release approximately approximately one billion tons of aerosols and ash into the atmosphere annually (Skenderovic *et al.*, 2015).

In 2010, 161 countries representing almost three billion people generated about 1.3 billion tonnes of waste (El-Fadel and Maalouf, 2019). Globally, over 2 billion tons of waste is generated annually in large cities, and this is expected to reach 2.2 billion tonnes by 2025 (Ross and Rogoff, 2012:755; El-Fadel and Maalouf, 2019).), 3.4 billion tons by 2050 and a threefold increase in developing economies by 3050 (El-Fadel and Maalouf, 2019).

Except for the United States of America, which generates 258 million metric tons annually, it has been recorded by Nanda and Berruti, 2020:1436 that China and India are among the three MSW-generating countries with an annual generation of 220 million metric tons (Nanda and Berruti, 2020:1436). China, India, Brazil, Indonesia, and Mexico are the five developing countries among the world's top ten MSW-generating nations (Nanda and Berruti, 2020:1436). According to Zhang *et al.*, 2019, China's increasing quantity of waste generation is the main concern in many of its cities. This situation is further worsened by ineffective and inefficient waste collection and management operations and exacerbated by population growth (Mohan *et al.*, 2016; Zhang *et al.*, 2019; Berruti, 2020:1436).

The general trend of MSW generation in China has significantly increased in the past 20 years, leading to the total MSW generation in China rising from 44.7 million tons in 1985 to 148.4 million tons in 2006 (Liu and Wu, 2010). China is expected to become the highest MSW generator at 1,397,755 tonnes/day by 2025, followed by India, 376,639 tonnes/day, and Brazil, 330,960 tonnes/day (Hoornweg and Bhada-Tata, 2012).

While Brazil brags about its developing informal waste sector that plays an important role in its waste management, it generally still generated a worrying significant amount of MSW, reaching 62 730 096 tonnes in 2012, which is an increase of 1.3% from 2011 MSW generation (Poletto *et al.*, 2016). Similarly, Indonesia faces its share of waste generation challenges and generated approximately 38.5 million tons of waste in 2006 (Meidiana and Gamse, 2010).

Mexico, for many years, has faced not only serious environmental challenges but also challenges with recording its waste generation data. Significant differences in waste volume generation have existed between official government data and non-governmental sources for many years. In 1998, official statistics reported a higher MSW generation rate than non-official sources reported (Buenrostro and Bocco, 2003). While many studies have been conducted on waste management, very few have reported the quantification and characterisation of MSW (Virgen *et al.*, 2010). However, de Vega *et al.*, 2006, have recorded Mexico's waste generation estimation at an annual rate of 54 million tons of MSW (de Vega *et al.*, 2006).

Generally, the relationship between MSW generation and factors varies concerning the developmental stage of a nation (Liu and Wu, 2010). The fast global increase in the pace of MSW generation is caused by factors like urbanisation, changes in the population's

consumption patterns, investment in economic development or industrialisation, and increased demand for natural resources. However, population growth is the primary driver strongly linked to increased waste generation and demand for virgin resources (Sharma and Jain, 2019).

Mexico is experiencing fast-paced population growth, from 102 million in 2003 to 133 million in 2023 (Buenrostro and Bocco, 2003). Indonesia's population grew from 220 million in 2010 to about 242 million in 2019 (Andriani and Atmaja, 2019). The population in India has increased from 109 million in 1971 to 419 million in 2014 and is expected to rise to almost 600 million before 2030 (Kolaventi *et al.*, 2021). It grew from 1,027 million in 2011 to over 1.3 billion in 2017 and is expected to reach 1.4 billion in 2021 (Sharma and Jain, 2018). The consequences of all these factors and drivers are increased waste generation and ecological degradation, littering, illegal dumping, and pollution (Sharma and Jain, 2019).

Equally, the African region has experienced high waste generation for many years due to urbanisation, industrialisation, and socio-economic improvement (Dlamini *et al.*, 2019). In 2012, Africa generated approximately 125 million tonnes of MSW, which is anticipated to double by 2025. Waste generation progression in Africa is expected to soon overshadow the global decrease in waste generation (Debrah *et al.*, 2022).

Nigeria is known to be one of the biggest MSW producers in Africa. The rate and amount of MSW generation in Nigeria continue to increase faster than the ability of the authorities to improve the financial and technical resources required for its waste management. Twenty-five million tonnes of MSW have been generated annually since 2009 in Nigeria (Ogwueleka, 2009). The estimation for the year 2020 showed that the MSW generated by Nigeria's urban population alone ranges from 16.8 to 25.3 million tons (Olukanni *et al.*, 2020).

North African countries like Egypt, Algeria, and Tunisia are not immune to the increasing waste generation challenge. Egypt's annual MSW generation has increased by more than 36% since 2000 (Abdallah *et al.*, 2020) and has risen to 13.5 million tons in 2022. In the same year, Morocco generated 68.6 to 90.04 million tons of organic waste and 7.4 million tons of MSW (Hemidat *et al.*, 2022). While Botswana generates 10,000 tons of waste daily, equivalent to approximately 2.6 million tonnes a year, Mozambique's annual waste generation estimation is between 770,125 and 1,732,450 tonnes (Kgosiesele and Zhaohui, 2010:6; Radzilani, 2019).

Consistently, population growth, among others, is a dominant driver behind the ever-increasing waste generation in the region as it further pressures other resources. Population growth and income highly influence the rate of waste generation. Countries like Nigeria, Egypt, Tunisia, Botswana, and Mozambique, among others, have been experiencing steady population growth for over a decade (Orhorhoro and Oghoghorie, 2019).

Similarly, MSW is one of the environmental challenges facing countries in the Middle East and North Africa and is attributed to the rapid population growth, economic growth, rapid urbanisation, and high standards of living, which have significantly increased the rate of MSW generation (Hemidat *et al.*, 2022). Nigeria experienced a population growth of over 180 million in 2019. It rose to over 214 million by 2020 and is expected to increase to 392 million by 2050 (Okafor *et al.*, 2022).

In Egypt, waste management is generally worrying as there are no clearly defined strategies for efficient management of MSW, leading to serious environmental risks to Egyptian communities and draining a portion of the local economy. The government has failed to provide the minimum required services effectively due to limited and inadequate existing regulations. MSW has been prioritised poorly in Egypt (Ibrahim and Mohamed, 2016:336).

The consequences of the vast amount of waste generation coupled with poor management and inadequate facilities, among others, have caused socio-ecological and economic impacts like blocked stormwater drains, air and water pollution, health problems, unesthetic dump sites and loss of community pride and contribution to climate change (Agwu, 2012, Skenderovic *et al.*, 2012x; Yukalang *et al.*, 2017:2). Littering, illegal and open dumping, and uncontrolled burning of MSW in Egypt and Nigeria along the riverbanks and canals are common practice especially in most rural areas (El-Messery *et al.*, 2009).

2.3 Waste pollution in South Africa

South Africa is experiencing increased levels of waste volume generation. It should, therefore, prepare its systems for increased solid waste volumes to reduce its vulnerability to waste-related environmental hazards (Tsheleza *et al.*, 2019). In 2011, an estimated 108 million tonnes of waste was generated in South Africa, with 90% of all waste generated disposed of to landfills. An increase of 121 million tons of waste in 2017 was further recorded (Godfrey and Oelofse, 2017; Nyika *et al.*, 2019).

Like in many other countries, several factors influence MSW management in South Africa. The factors that directly or indirectly influence MSW generation in South Africa may be regarded as economic and social. This is further complicated by South Africa's vast and varied historical and political background of segregation and education levels, eventually affecting all facets of daily living and lifestyles. Solid waste management at all levels of society is likely to mirror this complex structure of attitudes and behaviour (Karaniand Jewasikewitz, 2009).

With a population of over 60 million, the increasing waste generation is owing to its population growth, urbanisation, and industrialisation (Tsheleza *et al.*, 2019; Adeleke *et al.*, 2022). Until the 20th century, waste management has been a national priority as it has negatively impacted

the South African environment and human health (Ogola *et al.*, 2011; Oelofse and Nahman, 2013:81; Muzenda, 2014).

Modern technological, industrial and economic development and urbanisation have uplifted human life and dignity. The same development led to unwanted industrial, air, water, and land pollution, ozone layer destruction and global warming with great consequences of climatic change. The consequences of climate change, such as floods, storms and drought, are being felt especially in low-lying areas and coastal provinces of South Africa (Skenderovic *et al.*, 2015).

Poor institutional practice is a major challenge to municipal waste management in developing South Africa; therefore, households' increasing practices of littering, dumping, and burning solid waste, especially in un-serviced areas, have become a norm (Fakoya, 2014).

2.4 Waste management in the local context (district and local municipal level)

The Limpopo Province conservatively estimates domestic waste generated to be about 1,286,269,88 tons annually. The Limpopo Green Economy Plan of 2013 highlights that while landfilling in the Limpopo Province is the most common waste disposal method, waste management presents an opportunity to address climate change through waste diversion programmes (LEDET, 2020).

Municipalities in South Africa face many waste management challenges, including escalating volumes of waste generation and management costs and decreasing landfill airspace (Sango *et al.*, 2014; DEA, 2011). The Vhembe District generates over 900,000 tons of waste annually (LEDET, 2020).

Consistently, MLM is facing the same challenge of rapid waste generation. In 2017, MLM recorded over 91,000 tons of waste generation. Waste generation is anticipated to increase significantly in 10 years due to an envisaged development within the municipality, like the Musina-MLM Special Development Zone (SDZ) (MLM, 2018).

The Constitution of the Republic of South Africa 1996 provides for everyone's right to live in an environment that is not harmful to their health. Poor MWM has been a major problem for this human right, especially in provinces like Limpopo, where it is recorded that less than half of the solid waste produced is collected. In contrast, waste is thrown away at various dumping sites (Tshivhase and Mashau, 2020).

The Vhembe District is one of the poorest areas in Limpopo, with growing informal settlements in the rural and urban areas, leading to overcrowding. Street vendors are all over in towns like Thohoyandou and MLM, leading to MSW being scattered all over the environment. There is a common practice of littering, dumping, and burning household waste. This further increases

the risk of health problems such as respiratory ailments and diarrhoea (Tshivhase and Mashau, 2020).

2.5 Waste management practices internationally

Most available literature agrees that waste governance in most developing countries, particularly Sub-Saharan Africa, is nearly in a crisis. Africa generates relatively small quantities of waste compared to developed regions; however, the waste mismanagement compounded with other ecological challenges worsened the environmental degradation. This is because developed states have resources like finances to invest in waste management measures (Ezeah and Roberts, 2014).

2.5.1 Circular economy

According to Ekins *et al.*, 2019 the CE is an industrial system that is restorative or regenerative by intention and design, which replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models (Ekins *et al.*, 2019).

According to Kirchherr *et al.*, 2017, the circular economy concept is trending and is of great interest to both scholars and practitioners because it is viewed as an operationalization for businesses to implement the much-discussed concept of sustainable development (Kirchherr *et al.*, 2017). CE is also operationalize sustainable development for businesses through the green economy and green growth is further argued to be the one with most traction these days (Ellen MacArthur Foundation, 2014).

A circular economy redefines economic growth by moving away from a take-make-waste industrial model to one that decouples economic activity from the environment and supports a just transition to renewable energy sources. The three key principles of a circular economy are: design out waste and pollution, keep products and materials in use and regenerate natural systems. The Ellen MacArthur Foundation states that transitioning to a circular economy requires moving beyond making adjustments to reduce the negative impacts of a linear economy to making adjustments that build long-term resilience, generates business and economic opportunities and provides environmental and societal benefits (Ellen MacArthur Foundation, 2014).

According Ellen MacArthur Foundation, 2019, circular economy consists of “closing the loop” between resource extraction and waste disposal by the application of waste avoidance, reuse, repair, recycling, and recovery throughout the economic cycle to minimise waste generated and reduce demand for virgin materials as production inputs, as illustrated in the following Figure 2-1.

Figure 2-1: Butterfly Diagram on Circular Economy sourced from Ellen MacArthur Foundation

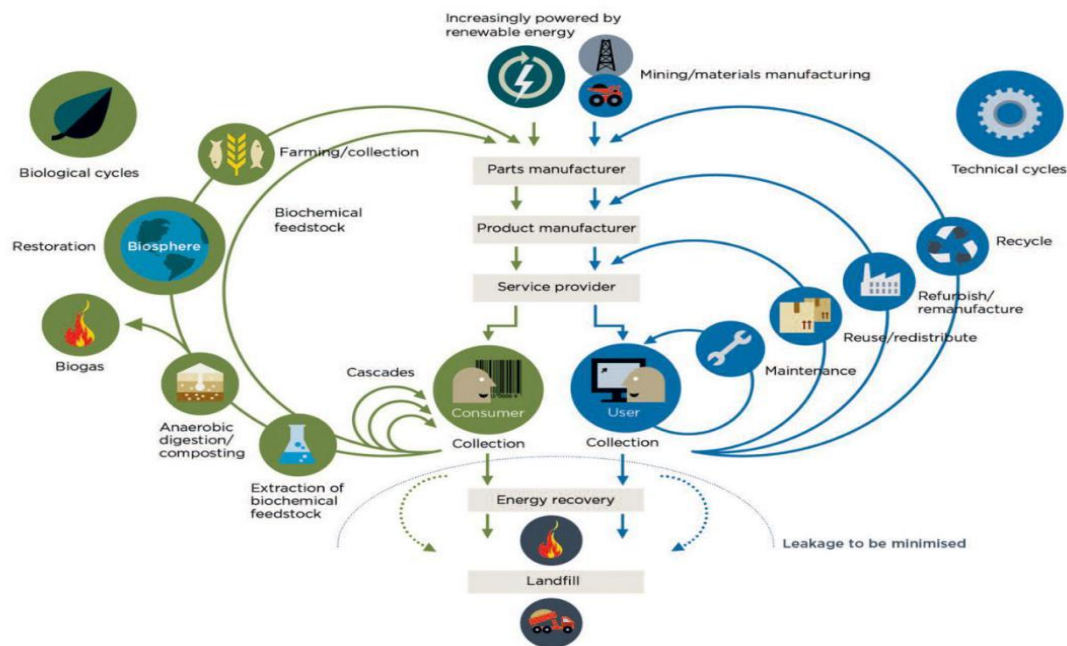


Figure 2-1: Butterfly Diagram on Circular Economy sourced from Ellen MacArthur Foundation

Solid waste management is directly or indirectly influenced by government policies and the development of the economy and technology in developing countries such as China (Guo et al., 2021). Over the past 15 years, China has been formulating policies and standards for solid waste management. The policies and standards adapted to local conditions promote solid waste reduction, recycling, and harmlessness (Guo et al., 2021). China's environmental governance system is rapidly changing, with state institutions governing waste through laws, policymaking, and implementation. The Cleaner Production Law of 2002, the Environmental Information Disclosure Decree of 2008, and the Law on Promoting a Circular Economy of 2009 harmonise China's environmental laws (Mol, 2009).

The Chinese government has been at the forefront of promoting CE and has legislated CE as part of its national development policy in 2008 (Zhang et al., 2019). The increasing quantity of waste and its management are major concerns to developing and developed regions, posing a serious challenge to environmental sustainability. Communities are faced with ineffective and inefficient operations of waste collection and management. This demands a new focus and drastic improvements to transition from a dominant linear waste management approach to a zero waste and CE. CE is now widely recognized as a sustainable alternative (Zhang et al., 2019).

The Chinese Government and many enterprises have already implemented the CE in 27 provinces, covering metallurgy, transportation, pharmaceuticals, and textiles. In addition,

China has accelerated CE implementation, leading to the development of ecocities and industrial parks in the last two decades by working with international partners. Furthermore, the Chinese State Council has identified waste management as a strategy for circulating resources. It has since launched a new programme to develop ten zero-waste cities to minimise solid waste generation and maximize recycling in urban areas (Zhang *et al.*, 2019).

In Europe, the implementation of the CE primarily emerged through waste policies such as the Waste Disposal Act in Germany in 1976 and the European Union Waste Directive, which promotes the waste management hierarchy, mainly the recycling principle of a CE. However, the focus of the CE has shifted from waste recycling to the closed-loop flow of materials at all stages of the supply chain. In December 2015, the European Commission adopted a new CE package, which involves actions to contribute to "closing the loop" of products through greater recycling, reuse, and repair (European Commission, 2015).

Since the 1990s, Germany has experienced an emergence of a highly differentiated landscape of metropolitan governance arrangements concerning the content of policies. This resulted in a mismatch of factual interdependencies between municipalities and existing institutional arrangements for coordinating policies such as waste management and land use planning (Zimmermann, 2014). In recent years, many other public and private initiatives and organisations on various scales entered the scene and changed this situation (Zimmermann, 2014).

In 2015, a German waste management company called 'Renova' and a Swedish car manufacturing company realised that waste management has evolved from pure logistics to a manufacturing industry due to increasing volume and the trend towards recycling. Together, they developed a self-propelled, mobile robot that can find garbage cans in the area and transport them to a collection vehicle. Containers are emptied through a drone, which searches for waste bins in the area and sends the corresponding coordinates to the robot. The robot is attached to the collection vehicle. With the help of coordinates, sensors, and cameras, it can find the bin, pick it up, transport it to the collection vehicle and return the empty container (Sarc *et al.*, 2019).

The Republic of Korea is moving toward a sustainable resource-circulating society to fight climate change and resource scarcity. The Framework Act on Resource Circulation was enacted in 2016 and came into effect in 2018 to achieve this goal (Lee and Cha, 2018).

2.5.2 Waste collection and disposal

Brazil's MSW management in cities is fast improving due to the role of the informal waste sector (waste pickers) and its curbside collection mechanisms. Some cities have adopted a two-bag collection system, one for recyclables and the other for organic waste collection. After

a compactor collects organic waste, it is transported to landfill sites, whilst the recyclable waste collected by non-compactor trucks is delivered by a local authority to scavenger associations without any cost to the scavengers for recycling purposes (Poletto *et al.*, 2016:52).

The quantity of solid waste is fast increasing in China due to its investment in economic development, with MSW being landfilled in large quantities. China is the home of 651 disposal facilities, and landfill is the main disposal method for MSW in China. With an annual generation of 220 million metric tons in 2002, the quantity of MSW disposed of to landfill was 74.04 million tons (Zhang *et al.*, 2019). Zhou *et al.*, 2015 reported that China has landfilled over three billion tonnes of MSW in the last three decades and is currently disposing of about 73% of its waste in its operational urban landfills (Zhou *et al.*, 2015).

According to Andriani and Atmaja, 2019, 69% of MSW generated in Indonesia is poorly managed through an open dumping landfill, while landfills in Mexico are used for adequate final MSW disposal as the best approach (Buenrostro and Bocco, 2003).

Like many developing countries, Ethiopia's collection and disposal of waste is poorly organised (Kassahun and Birara, 2018). Dump sites and trucks for solid waste collection and disposal are inadequate and in poor condition (Regassa *et al.*, 2011). It is reported that about 20 to 30% of the waste generated in Addis Ababa, the capital city, remains uncollected (Lema *et al.*, 2019; Hirpe and Yeom, 2021). In Egypt, due to a lack of waste collection services in the residential area by the government, the residents from their home premises do the collection or practice onsite disposal (Kassahun and Birara, 2018).

In 2008, Egypt's annual waste generation total reached nearly 75 million tons, while MSW reached about 20 million tons. Illegal disposal of domestic and industrial waste remains a common practice, and solid waste management has been given a low priority in Egypt. The annual MSW generation in Egypt has increased by more than 36% since 2000, with less than 60% being managed by the public and private sectors. The rest accumulates on streets and illegal dumping sites, which indicates that the management system is mostly inefficient. More than 80% of the generated MSW in Egypt is illegally dumped or landfilled, and the overall recovery rate has not exceeded 11.5% (Ibrahim and Mohamed, 2016). The available land for landfills is not enough in Egypt. Landfills are despicably designed, defectively constructed and unreliably operated (Azmy and Gohary, 2017).

2.5.3 Recycling and recovery

Traditionally, MSW was regarded as things that were unwanted in Botswana. In recent years, there has been an increasing recognition that MSW has an economic value, for example, the use of waste as energy and the recycling of beverage cans (Kgathi and Bolaane, 2001).

The implementation of waste recycling has not been realised in most parts of Botswana, although some waste recovery activities are being established in urban areas such as Gaborone City. Like in Brazil and South Africa, the collection of recyclables is predominantly done by informal waste reclaimers. Botswana's recycling sector has not gained priority but remains promising, with waste processing only covering waste streams such as cans used for beverages, paper, plastic bottles, and metals (Mmereki, 2018).

In recent years, informal waste reclaimers have gained momentum and identified an opportunity. They are now one of the important role players in the waste diversion value chain while also creating new jobs and business opportunities in Botswana and Egypt. Brazil is seen as leading in implementing this model (Regassa *et al.*, 2011; Godfrey *et al.*, 2019).

Solid waste generation prevention and reduction, reuse, and recycling activities are poorly implemented in Ethiopia. In the 20th century, the dump in Addis Ababa, Ethiopia, marked a significant transition in Africa's waste management by establishing a large-scale MSW thermal treatment plant (Godfrey *et al.*, 2019).

Despite Ethiopia's waste-to-energy conversion strategies, more effort is still lacking in implementation. Although some recycling initiatives by private companies are already underway in some cities, such as Addis Ababa, there is a need to scale up these activities by introducing new recycling companies and strengthening end-product markets. Ethiopia's urban solid waste recycling activities are inadequate, with only approximately five per cent of the solid waste generated in Addis Ababa being recycled (Hirpe and Yeom, 2021).

While composting is popular in Egypt, it is not implemented effectively. On the other hand, recycling activities are only undertaken in some cities under risky and dirty conditions (Azmy and Gohary, 2017).

2.6 Waste management practices and governance in South Africa

As an emerging nation, South Africa has been facing the challenge of meeting high standards in service delivery with limited resources. The disparity in service coverage between different communities is a characteristic of waste management practices in South Africa. Environmentally and socially unacceptable practices characterise many aspects of waste management in many urban areas with poor delivery; those services collapsed because of poor financial planning (Matete and Trois, 2007).

MSW is a serious environmental problem in South Africa (Muzenda, 2014). As of 1998, waste generation in South Africa amounted to approximately 533 million tonnes per annum (Oelofse and Godfrey, 2008). In 2011, South Africa generated about 108 million tons of waste, and it generated 121 million tons of waste in 2017 (Nyika *et al.*, 2019). Population growth,

urbanisation, and socio-economic development are major contributors to this rapid waste generation. However, there are mechanisms in South Africa to address waste issues: the Constitution of the Republic of South Africa 1996 and the Waste Act provide the local government with the full mandate and direct responsibility for solid waste management (King *et al.*, 2018).

The Waste Act and its implementation plan in the form of the National Waste Management Strategy (NWMS) of 2011, revised in 2022, have robustly adopted an international waste management hierarchy to shift from cradle-to-grave to cradle-to-cradle and circularity waste management approach. The waste management strategies in South Africa range from legislative to fiscal approaches, among others (Sango *et al.*, 2016; DFFE, 2022).

2.6.1 Waste management practices

Waste management practices in South Africa before 1994 until the mid-20th century focused mainly on waste disposal; hence, the focus was establishing landfill sites. Landfilling is generally considered the most practical and cheapest waste management method in South Africa (Ogola *et al.*, 2011; Oelofse and Nahman, 2013:81; Muzenda, 2014).

Landfilling of both general and hazardous waste remains largely practised in South Africa. Studies have demonstrated that 65% to 90% of total waste generated in South Africa is disposed of in landfills. This is typical of waste management practices in developing countries. Historically, South Africa has operated many landfill sites, including unlicensed ones. The national government once embarked on a process to get *all* landfill sites permitted by assisting municipalities and funding the authorisation of unlicensed landfill sites between 2013 and 2016. This process is assumed to cost the government an estimated US\$2.44 million. This has resulted in a significant turnaround in the licence status of landfills in South Africa, although compliance with licence conditions remains unclear (Godfrey and Oelofse, 2017:4).

Economic instruments are tools using monetary incentives and disincentives to influence waste management behaviour for control of waste generation, disposal, and pollution in general. There are some compelling reasons for a global shift to economic instruments in waste management, ranging from tackling high waste generation sustainable financing of the waste sector to waste being an economic commodity. With a value of at least R25.2 billion annually, these secondary resources are mostly lost to the South African economy (Nahman *et al.*, 2021).

Apart from the mainstream taxation system in South Africa, the Waste Act further provides certain additional legislative measures for using such economic instruments. In line with the requirements of the Waste Amendment Act 26 of 2014, South Africa developed The National Pricing Strategy for Waste Management of 2016 (NPSWM) with guiding methodologies for the

setting of waste management charges aimed at funding the reuse, recycling or recovery of waste and implementation of industry waste management plans for those activities that generate specific waste streams. The NPSWM provides different economic instruments and a course in selecting an appropriate economic instrument, setting waste management charges, and guidance on implementation (Nahman *et al.*, 2021).

2.6.2 Waste management governance

Waste management in South Africa is regulated by legislation such as the Medicines and Related Substances Act 101 of 1965, section 27, Hazardous Substances Act 15 of 1973, Environment Conservation Act 73 of 1989, section 20, Occupational Health and Safety Act 85 of 1993, National Water Act 36 of 1998, National Environmental Management Act 107 of 1998, Nuclear Energy Act 46 of 1999, sections 45 and 46, National Health Act 61 of 2003, and the National Environmental Management: Air Quality Act 39 of 2004 (Muzenda, 2014).

2.6.3 Constitution of the Republic of South Africa 1996

Section 24 of the Constitution of the Republic of South Africa 1996 (Constitution) provides that everyone has a right to an environment that is not harmful to their health and wellbeing. The government is responsible for protecting the environment from pollution and ecological degradation through reasonable legislative and other measures for current and future generations. Mautla (2022) states that the provision of the environmental right in the Constitution strengthened environmental law in South Africa, as it provides the foundation for the promulgation of the National Environmental Management Act 107 of 1998 (NEMA) (Mautla, 2022).

The Constitution further assigns exclusive competence of waste management to local government for cleansing and refuse removal, refuse dumps and general waste disposal in terms of sections 151(3) and 152, which both give a municipality a right to govern local government affairs guided by national and provincial legislation, and local government objectives to deliver services in a maintainable custom and encourage a harmless and healthy environment (Afrika, 2010 and Etengeneng, 2012).

2.6.4 National Environmental Management Act 107 of 1998

The NEMA did not per se regulate waste management as part of the act but regulated waste management-related aspects as part of the environmental impact assessment (EIA) listed activities promulgated in terms of the NEMA. The NEMA, therefore, did not only regulate waste disposal but also other waste management-related aspects, such as recycling and recovery. The NEMA does not provide a separate definition of waste. As a result, reference was still made to the definition of waste as envisaged in terms of the Environment Conservation Act

73 of 1989 (ECA). Therefore, many recycling and recovery activities were not regulated. The previously listed EIA activities, in terms of GNR 1182 and 1183, were ultimately repealed on 2 July 2006 by the listed activities and the EIA process promulgated in terms of the NEMA as contained in GNR 385, 386 and 387 of 21 April 2006, which came into operation on 3 July 2006 (Taljaard, 2011).

The NEMA advocated for the various government departments to support and collaborate on environmental issues. The NEMA includes open information, cradle-to-grave management, polluter pays principle, waste minimisation, sustainable development, and environmental protection. The NEMA also compelled state departments in charge of environmental management to develop and implement a plan for environmental management and ensure that local government follows the plan (Etengeneng, 2011).

The NEMA was promulgated in 1998 and provides a statutory framework for environmental management, pollution and waste (Papu-Zamxaka, 2006). It gives general duties and responsibilities, especially in terms of section 2. Principles such as precautionary, sustainability, best practices, environmental justice, and polluter pays are critical for waste and pollution (de Plessis, 2015).

It further identifies activities that require environmental authorisation, pre-commences, compliance, and monitoring on issues like pollution. Sections 28, 29, 30 and 31 of the NEMA make provisions to enhance the duty of care and rehabilitation of environmental dilapidation (DEA, 2019).

It provides cooperative environmental governance by launching decision-making principles and promoting cooperative governance on environmental matters as exercised by state organs (Beech *et al.*, 2017).

2.6.5 National Waste Management Act 59 of 2008

The Waste Act provides the legal mandate for successfully implementing the waste management hierarchy through additional measures for the remediation of contaminated land to protect human health and secure the environment's well-being. Implementing the waste management hierarchy promotes extended producer responsibility (EPR) concerning product design, composition, production, and packaging (Muzenda, 2014).

EPR is a regulatory intervention that holds producers responsible for their product at its lifecycle's post-consumer use (waste disposal) stage. EPR further enforces the polluter pays principle by imposing responsibility upon producers for their products, from design to disposal, thus compelling producers to internalise the product's end-of-life costs and incentivising product design that includes waste minimisation measures to facilitate final disposal. EPR can

potentially reduce the burden typically placed on municipalities and taxpayers to manage end-of-life product costs, reduce the amount of waste disposed of and increase recycling rates (Climate Legal, 2020).

Section 11 of the Waste Act re-introduces the concept of IWMPs and IWMP policy implementation instruments following the command-and-control approach (Roos, 2020). It was first introduced in South Africa through the 1999 NWMS before the promulgation of the Waste Act. IWMPs are now a legal requirement through section 11 of the Waste Act, which requires certain state organs to prepare IWMPs. Therefore, provincial departments and municipalities are legally required to develop IWMPs. IWMPs aim to transform the historical way of waste management, which only focuses on collection to disposal, into a more sustainable way that considers different alternatives and their related costs (Mautla, 2022).

The Department of Environmental Affairs (DEA) 2012 views IWMPs as a legal instrument to integrate and optimise waste management planning to maximise efficiency and minimise the associated environmental impact. IWMPs are implemented for five years and monitored annually by providing progress reports in municipal annual performance reports.

Goal 5 of the NWMS of 2011 was to achieve IWMPPlanning by having all municipalities integrate IWMPs in their Integrated Development Plans (IDPs) and meet all the IWMP targets by 2016 - similarly, pillar 2 of the NWMS of 2020 highlights IWMPPlanning as one of the focus areas. The focus area aims to support the local government in implementing IWMPs and services that better address the constraints and varying circumstances the local government faces (NWMS, 2020).

The Waste Act requires municipalities to include the provisions of their IWMPs in their IDPs, as section 5 of the Local Government: Municipal Systems Act 32 of 2000 (Municipal Systems Act) stipulates. The inclusion allows for streamlining waste management with other essential basic services to ensure that waste management gets a stake from the equitable share funding (DEA, 2012).

2.6.6 Regulations on waste management in local government

The Local Government: Municipal Structures Act 117 of 1998 assigns powers and functions to the municipalities depending on either local or district in sections 83 to 84. It further addresses the delegation of functions and powers temporarily. These powers align with those allocated to it in sections 156 and 229 of the Constitution (Afrika, 2010).

The Municipal Systems Act provides powers to deliver waste collection services to municipalities. Municipalities must develop municipal by-laws to regulate waste management

to exercise legislative authority over waste management activities within their jurisdiction (DEA, 2011; Pholose, 2019).

In general waste management, these powers and functions include integrated development planning, municipal waste by-laws, wastewater treatment and disposal, and establishing and managing waste disposal sites (Afrika, 2010).

Figure 2-1 provides the evolution of the integrated waste management legislation in South Africa dating back from 1989 to the era of National Environmental Management: Waste Act 59 of 2008 as amended in 2014.

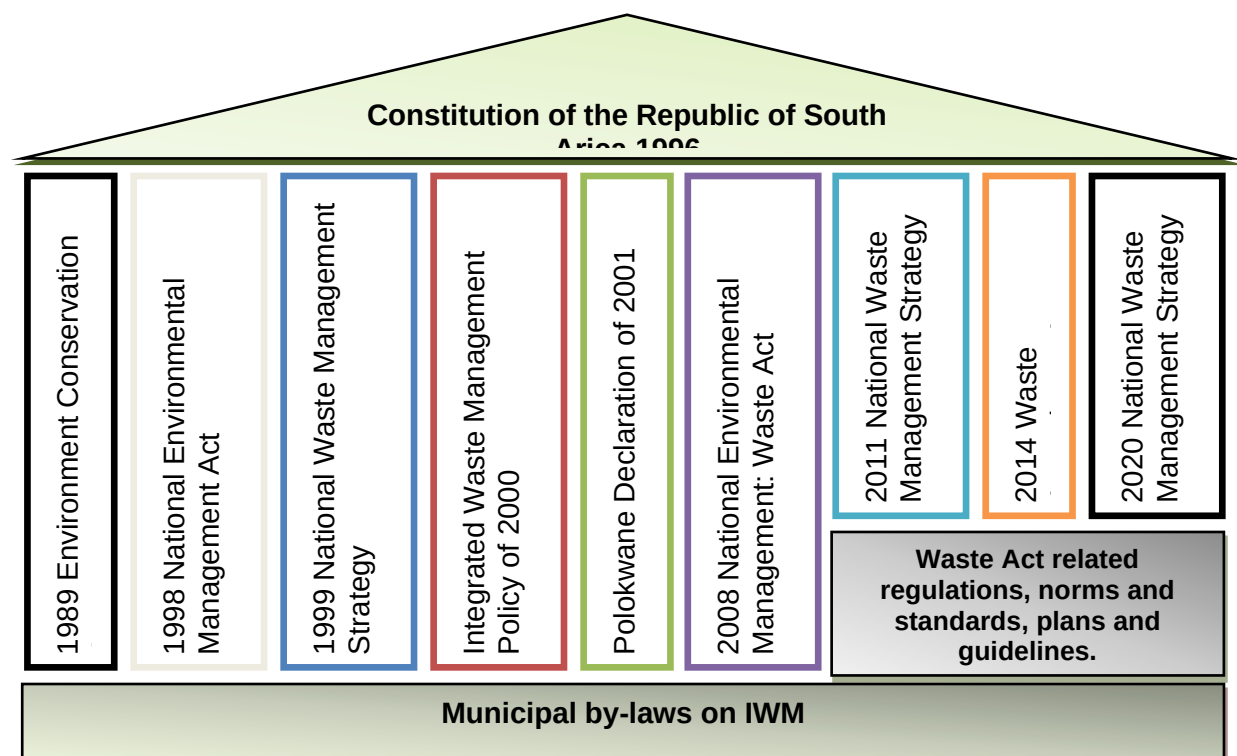


Figure 2-2: Summary of the IWM legislative framework evolution in South Africa.

2.7 Waste Management Plans internationally

Due to the increasing awareness of waste management, mainly on construction and demolition waste, the Hong Kong government has employed various measures to control waste, including the mandatory implementation of the Waste Management Plan (WMP) for all construction projects in 2003. The measure of WMPs received negative feedback from the industry as it affected their productivity. It takes a long time to draft, demonstrating the ineffectiveness of using the measure in construction projects. However, some contractors found the WMP method useful and effective (Tam, 2007).

Additionally, many construction organisations complained that they lacked experience drafting and implementing the WMP. It is costly as implementing a WMP requires a large amount of

money in the initial stages. In the evaluation of the effectiveness of the WMP, it was discovered that it helps minimise waste generation and disposal levels. Further benefits of implementing the WMP were that it helps in pollution prevention, better allocation of resources, better regulatory compliance, and evaluation of risks and plans for preventing potential problems (Tam, 2007).

Again, due to the increase in the construction and demolishing waste generation in Hong Kong, the White Paper issued in 1989, as amended in 2005, introduced the development of the ten-year WMP for controlling and reducing construction waste. It planned to review the progress of implementing the plan at two-year intervals. The plan is aimed at improving public awareness of waste reduction. It further sets out programmes to avoid and minimise waste, promote recovery, recycling, and reuse of waste materials, prolong existing landfills' life and reduce the increasing costs of waste transportation, treatment, and disposal. The plan is expected to change from the traditional attitude of collecting and transporting waste to preventing and reusing waste materials. The survey conducted on its effectiveness on four hundred firms and professionals received effective responses, and most of the contractors recognised the benefits of implementing the plan in reducing waste on site (Tam *et al.*, 2014).

De Souza *et al.*, 2021 recorded that more than 90% of MSW in Brazil is disposed of in dumping areas, controlled, or sanitary landfills. To change this situation, the Brazilian government approved in 2010 a national solid waste policy which requires states to develop a Solid Waste Management Plan. The State of Paraná has, in 2012, produced its first version of its plan. In 2018, the State of Paraná released an updated plan with a comprehensive, strategic approach to guide the decision-making and actions of governments and the private sector. The plan contained a 20-year target to be achieved in four terms. The plan defines strategies and targets for waste reduction, collection, and adequate disposal for 2018 to 2038. This plan was a crucial first step in addressing changes to the problematic waste management into sustainable integrated systems (de Souza *et al.*, 2021).

The plan targets 100% of the waste collected to be properly disposed of by 2020. This is unrealistic due to the lack of investment and time needed to adapt every waste management system in the State of Paraná. The gaps in this plan were that it was limited to state-level analysis and not private institutions. It was further assumed that the potential sustainable benefits would be achieved by enforcing the plan. Following the plan's implementation, the assessment of its effectiveness could not show positive results due to a lack of available information at the municipality level (de Souza *et al.*, 2021).

Cetrulo *et al.*, 2018 recorded that waste management policy effectiveness evaluation is important to understand whether the results achieved correspond to the policy goals, identify

obstacles and outline implementation strategies. A case study in Brazil found that the waste management policy in Brazil has not attained the expected changes in municipal waste management, municipal waste generation, frequency of waste collection, rate of recyclable waste recovered, and proportion of sanitary landfills developed (Cetrulo *et al.*, 2018) because half of the 5570 Brazilian municipalities did not have an IWMP. This was a failure to comply with the policy targets for including legislation in municipal plans (Costa and Dias, 2019).

Failure to achieve the waste management policy, programmes or plans' targets was due to the municipalities and states having the autonomy to set missing targets, lack of technical knowledge, negligence, or lack of financial resources, which has compromised both the implementation of legislation and plans (Costa and Dias, 2019).

The United States of America's waste management strategies compel local governments to look beyond a singular solution to a comprehensive WMP. Due to increasing waste generation and fresh kills, landfills are causing traffic and odours to the surrounding communities. Authorities introduced a long-term Solid Waste Management Plan in 1992 (Clarke *et al.*, 1999).

In 2000, Hostovsky indicated that several provinces and states had created guidelines for waste management planning in the United States of America, and these planning techniques were favoured in the environmental management literature (Hostovsky, 2000). Clarke *et al.*, 1999 described the waste planning approach as an in-demand tool by SWM policymakers worldwide. It provides them with sound and reliable information on the technical performance, environmental impact and costs of solid waste collection, recycling, treatment, and disposal (Clarke *et al.*, 1999).

The New York State Solid Waste Management Act of 1988 contained the requirement for SWM planning. All planning entities in New York State, mostly municipalities, must prepare a ten-year IWMP designed to meet the New York State's 1997 goal of 50% reduction, recycling, and composting and 50% waste to energy. However, due to several waste management measures put in place not being effective in the City of New York, authorities proposed their measures of IWMP planning for the City of New York in 1991, which was finally approved in 1992 with the key themes of 9% waste prevention by the year 2000 and a target to recover or recycle 32% of MSW. The implementation of this plan oversaw the closure of the Fresh Kills Landfill Proposal in 2001 and the introduction of the acceleration of waste prevention, recycling, and composting programmes (Clarke *et al.*, 1999).

In 2017, Crowley conducted a study to examine how the presence of a plan makes disaster debris management effective and efficient in the United States of America. Ninety-five United States counties receiving major disaster declarations between 2012 and 2015 were surveyed to examine the quality of their debris management processes. The study's findings suggested

that communities with pre-disaster debris management plans have more effective debris management processes than communities without such plans (Crowley, 2017).

The Blackfeet Nation Environmental Office developed its IWMP several years ago. The plan has helped bring the Blackfeet Nation closer to having a sustainable waste management programme that protects human health and the environment. The plan has become a backbone towards meeting the Blackfeet Nation's Environmental Office goal to protect, preserve, and enhance the environment on its tribal lands through environmental stewardship. The IWMP has also been helpful in meetings with the Blackfeet community and elected officials to demonstrate what the Environmental Office is doing, its future goals, and what resources are needed to manage waste on tribal lands. In addition, the IWMP illustrates how every tribal member plays a role in keeping the Blackfeet Reservation and Big Sky Country clean and safe (EPA, 2009).

2.8 Integrated Waste Management Plans in South Africa

A national policy regime was proposed for municipalities to implement integrated pollution and waste management planning to address some of the challenges of waste management in South Africa (Ogola *et al.*, 2011; King *et al.*, 2018; Ngcobo, 2022). IWMPs in South Africa date back to the 1999 NWMS, and more than 20 years later, through the Waste Act, they are now a legal requirement in terms of section 12 (Muswema, 2012; Mautla, 2022). Municipalities are further required regarding the Municipal Systems Act to prepare an IDP and, importantly, to integrate the IWMP into the IDP. The IDP is considered a cornerstone for municipal service delivery (Muswema, 2012), and the significance of integrating the IWMP is to secure a budget for its implementation (Molaba, 2019: ii).

The primary objective of an IWMP is to integrate and optimise waste management planning to maximise efficiency and the associated environmental impacts and financial costs and to improve the quality of life for all South Africans. Secondly, it is intended to support a shift from the fragmented, uncoordinated approach of managing waste and encourages integration of waste management activities between different role players (Godfrey, 2006).

Whilst Godfrey and Dambuza in 2006 recorded that 81.7% of the completed municipal IWMPs have been prepared by consultants resulting in the lack of internalisation and successful implementation (Godfrey and Dambuza, 2006), there is limited information available on the effectiveness of these IWMPs or whether the municipalities are implementing the IWMPs (Godfrey and Dambuza, 2006:6). Muswema, 2012 and Polasi *et al.*, 2020 concurs that the implementation remains a concern (Muswema, 2012 and Polasi *et al.*, 2020). Additional challenges against implementing IWMPs include a lack of supporting data, the relevance of the IWMP, financial and human resources, and public participation (Kolaventi, 2021).

A study conducted by Malope in 2012 on the effectiveness of the IWMP in reducing solid waste in the City of Johannesburg found that implementing the IWMP requires improvement. It was suggested that if the challenges identified in the study are addressed, the IWMP may be implemented more effectively. Additionally, the study's findings and recommendations demonstrate that the successful, effective implementation of the IWMP requires resources invested into it (Malope, 2012).

In addition, a study conducted by Molaba in 2019 on the critical analysis of the IWMP of local municipalities within the Fezile Dabi District Municipality found that the IWMPs' implementation was below 20% as major implementation targets were either not achieved or not achieved in time. Challenges identified were inadequate knowledge among waste management officials and insufficient financial provision (Molaba, 2019).

The evaluation of the monitoring and review of the IWMPs of the Drakenstein Local Municipality by Mautla in 2022 found that, although the IDP and Service Delivery and Budget Implementation Plan (SDBIP) contained waste management projects, these projects could not be traced back to the IWMP. These findings equally doubt the effectiveness of implementing the IWMPs locally in South Africa due to a lack of human capacity and skills (Mautla, 2022).

There are some beneficial opportunities lost in failure to implement environmental management instruments like IWMPs, which include reducing the socio-economic impact of waste, increasing the trend to promote sustainability, improving the environmental quality, harnessing the economic value and green jobs creation through recycling and other beneficiation activities (Asnor, 2022). With an efficient waste plan, the amount of waste generated can be audited, minimised, prevented, and financial losses can be tracked and quantified (Asnor, 2022 and Kolaventi, 2021:3).

Similarly, the MLM adopted the same IWMP tool in 2018 to address waste management issues. However, little is known about the opportunities and barriers affecting the implementation of their IWMP. Moreover, despite the existence of their IWMP since 2018, waste management issues remain a challenge in the MLM (MLM, 2018).

2.9 Conclusion

"Today, it is easy to conclude that we live in a world of waste" (Skenderovic *et al.*, 2015:2) because of population growth, industrialisation, and production increasing amounts of waste. Increased waste generation further increases landfill demands, ultimately deleting the environment (Yukalang *et al.*, 2017).

Countries like Nigeria, Ethiopia, Morocco, Botswana, and South Africa still depend on landfilling, which is considered cheap and easily accessible. Considering that most waste

generated in Africa is recyclable, it makes no sense that Africa's waste is still disposed of on land and in uncontrolled and controlled dumpsites. However, this provides an opportunity to consider economically friendly mechanisms like recycling (Kgathi and Bolaane, 2001).

This literature review demonstrated the similarities in factors behind the increase in MSW generation, such as growing population, urbanisation, and industrialisation in both developing and developed worlds. It has become clear from the literature that waste management is a global concern, and different countries are applying various measures to address waste problems at multiple levels. Developing countries are still lagging in using current technologies and adopting measures compared to the developed world.

The global waste generation trajectory is expected to outpace population growth by more than double by 2050 (El-Fadel and Maalouf, 2019). Therefore, the world must adopt measures to reduce waste generation and dependency on landfill sites to reduce global warming and climate change, which are accompanied by devastating implications (Nanda and Berruti, 2020:1436).

CHAPTER 3 METHODOLOGY

3.1 Introduction

This section describes the methodology used in the execution of the study. As indicated by (Molaba, 2019:23), research methodology highlights the methods and tools used during the research undertaking, which is mostly ascertained by the nature of the study, hence the qualitative approach to this research. The qualitative approach to the collection of data can be used in cases where the findings could be obtained from small but quality numbers of subjects from within the population or from observable cases. A qualitative method helps researchers understand deeper levels of meaning and understand the participants (Al-Fayez, and Jubran., 2012:56).

According to Aspers and Corte, 2019, qualitative research is an iterative process in which an improved understanding of the scientific community is achieved by making new significant distinctions resulting from getting closer to the phenomenon studied. Qualitative research usually focuses more on words than numbers, and it is broadly inductive, constructive, and interpretive (Bryman, 2012).

As a research methodology, qualitative research provides an added advantage to the exploratory capability researchers need to explore and investigate their research studies. It allows researchers to advance and apply their interpersonal and subjective skills to their research exploratory processes (Alase, 2017).

The qualitative research method is further subject in nature and relies heavily on texts and discussions of the participants under study (Babbie and Mouton, 2001). It would usually involve a small number of participants in the research process, as it requires in-depth information gathering. The limitation of the approach is acknowledged, including its inability to utilise enormous sample representatives (Molaba, 2019:23). Three qualitative data collection techniques were used in the study, including interviews (semi-structured questionnaires), document reviews, and observations.

According to Olmos-Vega et al., and Francisco, et al., 2023, qualitative research has gained credibility and strives to reveal fundamental truths that are as free as possible from researcher “bias”. Qualitative research depends on subjectivity researchers engage in reflexivity to account for how subjectivity shapes their inquiry (Olmos-Vega et al., & Francisco, et al., 2023).

“Reflexivity is a set of continuous, collaborative, and multifaceted practices through which researchers selfconsciously critique, appraise, and evaluate how their subjectivity and context influence the research processes” (Olmos-Vega et al., 2023).

Although the researcher had knowledge and experience on waste management municipal challenges, the data collection and analysis was purely made on what was provided by the research participants with certain data being confirmed through observation. The interviews question drafted in line with the MLM implementation plan and were approved by the supervisor as a way eliminating subjectivity in data collection.

3.2 Research design

Research design outlines a clear plan for assembling data to answer the researcher’s questions (Hopf, 2004; Babbie, 2007). Generally, a good research design minimises bias and maximises data collection and analysis reliability. A good research design includes objectivity, reliability, validity, generalisability, and adequate information. Table 3-1 below details the research design for this study.

Table 3-1: Research design.

Research objective	Data collection	Data analysis
RO 1: Determine the extent to which MLM has implemented its IWMP.	Document reviews: MLM IWMP (Implementation Plan), MLM IDP, MLM Waste Management By-laws, MLM Waste Management Policy and other applicable legislations,	Mixed data analysis approaches were used: content analysis is the process of organising information into categories related to the central questions of the research
RO 2: Identify the opportunities and barriers to implementing MLM’s IWMP.		

Research objective	Data collection	Data analysis
	including the Constitution, Waste Act and Municipal Systems Act. Interviews: Semi-structured interviews were held concerning the IWMP Implementation Plan. This was to understand the reasons for the data presentation outcome derived from the document analysis. Implementing partners identified by the IWMP were targeted for interviews: officials in both MLM and Vhembe District Municipality, officials in the provincial department, the national department, and implementing partners. Observations: According to Kabir, 2016:240, observation is a fundamental way of discovering the surroundings. However, as a method of data collection for research purposes, observation is more than just looking or listening. Observations were undertaken mainly to confirm the verifiable goals and targets of the MLM IWMP Implementation Plan and to consider the interview requirements of dependability, honesty, and comfortability.	(Fereday and Muir-Cochrane, 2006; Durak <i>et al.</i>, 2016). Data from observation was used to support the document and interview data analysis.

3.3 Data collection

Document review, interviews, and observation were used to collect data and verify the MLM IWMP implementation conformity levels of the goals as predetermined in the implementation plan. Document review, interviews, and observations were used to measure the extent of MLM IWMP implementation and further identify barriers and opportunities.

3.3.1 Document review

Document review is a way of collecting data by reviewing existing documents. The documents, such as records, may be internal or external to a programme or organisation. Documents may be hard copy or electronic, including reports, programme logs, performance ratings, funding proposals, meeting minutes, newsletters, and marketing materials (Bowen, 2009; CDC, 2018).

Document review is frequently combined with other qualitative research methods for triangulation. Triangulation is the combination of methodologies in the study of the same phenomenon, which may include observations and interviews to validate and corroborate data obtained during the study (Denzin, 2012). As recorded by Bowen, 2009, a researcher draws upon multiple "(at least two)" sources of evidence to seek convergence and corroboration using different data sources and methods (Bowen, 2009). Bowen, 2009:31 argues that document review is often preferred as a data source due to its cost-effectiveness and the fact that certain information is already collected.

The MLM IWMP with a focus on the Implementation Plan of 2018, MLM invitation to comment on the development of its IWMP stamped 23 October 2017, Municipal Waste Management By-laws of 2014, MLM community services waste management policy of 2014, MLM IDP of 2021/22 and Member of the Executive Council (MEC) IWMP endorsement of 2018 were reviewed. The purpose of the study was to analyse the extent of MLM IWMP implementation and identify gaps or challenges. The IDP review was to verify if the IWMP is integrated into the IDP for budgeting and implementation processes as provided for in section 11(4)(ii) of the Waste Act. Municipal Waste Management By-laws were reviewed to verify the alignment of the IWMP and the by-laws governing waste management. It was further reviewed as part of the extent of the implementation of the IWMP as part of the plan's goals.

The MEC IWMP endorsement was reviewed to ensure the research focuses on the valid and approved IWMP. This is because the approval itself by the council is captured in the confidential meeting minutes, which could not be provided.

3.3.2 Interviews

According to Green *et al.* (2015: 510), interviews are among the most used qualitative data collection methods in research. Interview questionnaires were developed from the start based

on the IWMP goals and objectives to answer the research aim and specific objectives as indicated in section 1.4. Semi-structured interviews were used to collect data concerning the Municipal IWMP Implementation Plan. The interviews were conducted with at least six officials from different spheres of government with the responsibility to implement and/or support the development and implementation of the MLM IWMP. These officials include the two MLM Municipal Waste Management Officers, one Vhembe District Municipality official responsible for waste management, two Limpopo Department of Economic Development and Tourism (LEDET) officials accountable for waste management in the Limpopo Province, and one Department of Forestry, Fisheries and the Environment (DFFE) official responsible for municipal waste support nationally. Further interviews were conducted with the MLM IWMP implementation partners (recyclers) identified by the MLM IWMP. The municipal database of recyclers, which contained at least 18 formal recycling stakeholders, was obtained from the MLM. All these participants were identified by MLM IWMP implementation plan as implementing partners.

Purposeful sampling for the recyclers' identification for interviews was applied to select only those in operation since or before 2018, coinciding with the year the IWMP was developed and approved to get meaningful contributions from them. The database from MLM contained 18 recyclers. Only 10 out of 18 recyclers passed the selection criteria, and nine were interviewed, with one refusing to be interviewed. In total, 15 out of 23 potential identified participants were interviewed equaling 65% of the implementing partners being interviewed which can be deemed sufficient representative sample size. The researcher targeted the potential active participants who either played a role in development or in implementation. These were identified in the MLM IWMP as implementing partners and were deemed to have relevant participants to the study.

According to Palinkas *et al.*, 2015, purposeful sampling is used in qualitative research to identify and select information-rich cases related to the phenomenon of interest. Furthermore, this involves identifying and selecting individuals or groups knowledgeable about or experienced with a phenomenon of interest (Palinkas *et al.*, 2015). The interviews were conducted anonymously to promote interviewees' participation and to elicit honest responses to questions (Saunders *et al.*, 2015). The researcher purposefully selected research participants, as Table 3-2 indicates.

Table 3-2: Interview participants/respondents.

No.	Name of participant	Institution	Years of experience in waste management
1.	Respondent 1	MLM	15 years in waste management

No.	Name of participant	Institution	Years of experience in waste management
2.	Respondent 2	MLM	Ten years in environmental management (inclusive of waste management)
3.	Respondent 3	Vhembe District Municipality	More than 30 years in environment and waste management
4.	Respondent 4	LEDET	17 years in waste management
5.	Respondent 5 ¹	LEDET	One year in waste management
6.	Respondent 6	DFFE	More than 20 years in environment and waste management
7.	Respondent 7	Orinea Waste Recycling	More than 30 years in environment and waste management
8.	Respondent 8	Vhadau T/A Kharishume Pty Ltd	Nine years in waste management
9.	Respondent 9	Xikhirhi Pty Ltd	12 years in waste management
10.	Respondent 10	Rothoma recycling	Three years in waste management
11.	Respondent 11	Trash Converters Pty Ltd	Five years in waste management
12.	Respondent 12	DoveCom group	Four years in waste management
13.	Respondent 13	Wamadeli Trading CC	15 years in waste management
14.	Respondent 14	Dziphathu Greentech	Four years in waste management
15.	Respondent 15	Matongoni General Trading	12 years in waste management

¹ Respondent 5 is an intern who participated in the interview same time with respondent 4 as a supervisor. The number of years' experience is aligned with the internship program.

The interviewees were recruited through a telecommunication where the researcher explained the background and importance of the study and their participation. The interviews were conducted in one-on-one and face-to-face sessions on the date, time, and place pre-agreed by the researcher and the participants. Voice recording during the interview was undertaken based on permission to record through a cell phone. The data was further typewritten or transcribed on a computer and transcript. The researcher obtaining informed consent through signing of the consent letter as shown in annexure A.

3.3.3 Observations

According to Kabir, 2016:240, observation is a fundamental way of discovering the surroundings. However, as a data collection method for research purposes, observation is more than just looking or listening.

Observations were undertaken mainly to confirm some of the verifiable goals and targets of the MLM IWMP Implementation Plan to consider the interview requirements of dependability, honesty and comfortability. Goal 1 of the IWMP Implementation Plan provides for establishing at least eight buyback centres, and based on the responses, observations were undertaken to verify the buyback centres. Pictures were taken on the first observation exercise (and there was no need to a followup observation exercise) and presented as part of the data collected. Observation was built in as method of verification in annexure A (MLM officials' interview questionnaires). Observations were conducted in Limpopo at Ha-Rabali village, Elim and Makhado in April, June and October 2023. Observations evidence were gathered in the form of pictures which as provided in annexure C.

3.4 Data analysis

Data analysis involves browsing or shallow examination, reading (thorough examination), and interpretation. This iterative process combines elements of content analysis and thematic analysis. Content analysis is organising information into categories related to the central questions of the research (Fereday and Muir-Cochrane, 2006).

As described by Goldstein and Reiboldt, 2004, document review assisted in generating interview questions for the researcher, mainly the MLM IWMP and its Implementation Plan. This was done to get insight into themes/concepts currently under study (Goldstein and Reiboldt, 2004). The implementation plan had already pre-defined the themes/concepts as goals to determine the extent of the MLM IWMP implementation.

According to Elliot and Timulak, 2005, qualitative research also requires flexibility during the analysis, with procedures developing in response to the ongoing analysis. All analysis steps must be carefully taken with much reflection (Elliot and Timulak, 2005).

Data was analysed using the content analysis method as explained by Stemler, 2001; Fereday and Muir-Cochrane, 2006; Kleinheksel *et al.*, 2020. The analyses include themes/concept results of word count, themes/concept tables and qualitative responses from the respondents. The content analysis was used to identify the barriers, opportunities and areas of improvement in implementing the MLM IWMP.

While the content analysis may appear the same as the thematic analysis approach due to the use or generating themes, this study has adopted the content analysis approach (Vaismoradi *et al.*, 2013:398).

Content analysis is a method to make reasonable deductions that can be replicated from data or information in their context of use (Krippendorff, 1989). This technique is used to determine and record stakeholders' attitudes, views, perceptions, and interests as individuals or groups (Drisko and Maschi, 2016). Content analysis examines what the data says, followed by arranging the outcome information into themes, categories, or codes emanating from the key questions posed by the research (Bowen, 2009). Conventional content analysis is mostly applied in a study design to describe a phenomenon by analysing or observing respondents' emotional reactions. Such a design is often applicable when there is limited research literature on a phenomenon (Fox *et al.*, 2015).

According to Zhang and Wildermuth, 2009), content analysis uses an inductive method by which themes/concepts emerge from the data through the researcher's careful examination and constant comparison. Content analysis uses deductive reasoning, which involves generating concepts or variables from theory or previous studies (Zhang and Wildermuth, 2009).

Zhang and Wildermuth, 2009 defined content analysis as:

1. a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns,
2. an approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytic rules and step-by-step models, without rash quantification, and
3. any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings (Zhang and Wildermuth, 2009).

Because of these three definitions, content analysis was chosen for this study, as it illustrates that content analysis emphasises an integrated view of speech/texts and their specific contexts. It goes beyond merely counting words or extracting objective content from texts to examine meanings, themes and concepts that may be evident or latent in a particular text. It allows the researcher to understand social reality in a subjective but scientific manner. This definition is in alignment with the purpose of this study.

According to Kleinheksel *et al.*, 2020, content analysis is a method designed to identify and interpret meaning in recorded forms of communication by isolating small pieces of the data that represent salient themes/concepts and then applying or creating a framework to organise the pieces in a way that can be used to describe or explain a themes/concept. Its biggest advantage is being useful in situations with many unanalysed textual data (Kleinheksel *et al.*, 2020).

Content analysis rests on the assumption that texts are rich data sources with great potential to reveal valuable information about themes/concepts. It involves considering both the participant and context when sorting text into groups of related categories to identify similarities and differences, patterns, and associations, both on the surface and implied in the research (Kleinheksel *et al.*, 2020).

Furthermore, the most generic view is that a content analysis means doing a word-frequency count with the assumption that the words that are mentioned most often are the words that reflect the greatest concerns or matters of importance. However, it may be untrue in some cases. A rule of thumb to follow in the content analysis is to use word frequency counts to identify words of potential interest and then to use a keyword-in-context search to test for the consistency of words (Stemler, 2001).

Content analysis allows a researcher to decipher what is communicated, why it is being communicated, and with what effects. Content analysis can be recognised by the appearance of the codification process, which involves placing coded data into key categories (Babbie, 2004).

Dixon, 2008 identifies five advantages to using content analysis. First, it is an unobtrusive research method. Second, it is useful in analysing interview and observational data. Third, the researcher can interpret the social life of an earlier time by examining records and documents. Fourth, it saves time and resources. This is particularly true if information is readily available in books, periodicals, newspapers among others. Finally, because data is readily available, it is possible to replicate the conditions of a content analysis study (Dixon, 2008).

Data from observations and document review was mainly used to confirm the results of interviews i.e. MEC endorsement was used to determine the approval of the MLM IWMP.

The content data analysis followed the following steps in the study:

3.4.1 Transcription

Data for this research was collected using mixed data collection tools: interviews and observations. All data collected through interviews was recorded in scripts or writing, computer, and/or cell phone recording system. Observations where pictures were taken using cell phones were conducted, and the images were later stored in the computer.

The interviews focused mainly on the extent of the MLM IWMP implementation of each goal as pre-defined in the implementation plan, with identifying barriers and opportunities. The interviews were conducted directly to answer the research aim and two objectives. This study explores the opportunities and barriers in implementing the MLM IWMP. The specific objectives were to determine the extent to which the MLM has implemented its IWMP and identify the opportunities and barriers towards implementation of MLM's IWMP.

3.4.2 Organising the data

After data was collected and transcribed, it was recorded in the Excel spreadsheet for word-frequency count, and words mentioned most often reflected the greatest concerns or matters of importance. Themes/concepts emerged using frequency manual coding on the opportunities, barriers, and improvement areas in the MLM IWMP implementation, as indicated in Tables 4-2 and 4-3. Themes/concepts were counted based on the number of mentions by participants. The similar ones were counted as one to form themes/concepts. Names and other identifiable information were removed from the organised transcripts, and interviewees were manually allocated name codes as numbers as indicated in Table 3-2.

Conformity standard was used to determine the extent of MLM's IWMP implementation. The conformity standard assesses the degree to which MLM has successfully implemented its IWMP goals (Vartanian and Hopkinson, 2020). According to Hossu *et al.*, 2021, many environmental plan outcomes are difficult to measure, and little is known as to whether such plans achieve their goals, whether outcomes are performed, and whether lessons are learned to influence future planning. The conformance approach relates to the rational principles of planning. It considers plans as having been successfully implemented if the proposed policies are carried out and the outcomes on the ground correspond to these policies. Like in this study, most conformance research uses numeric indicators (Hossu *et al.*, 2021). The conformance approach was measured during the interviews.

The study carefully examined the IWMP Implementation Plan, and the municipal officials' interviews were conducted based on the implementation plan. The questionnaires included the goals, target, actions, conformity standard measurement, and method of verification for

the implementation. Interviews specific to the Vhembe District Municipality, LEDET and DFFE were also administered to the relevant institutions and officials. Further interviews were conducted with stakeholders identified by the MLM IWMP as implementing partners (recyclers, the Vhembe District Municipality, LEDET and DFFE). The IWMP Implementation Plan is critical to measuring the performance of the IWMP. This chapter provided the research findings for the 2018 MLM IWMP.

The MLM IWMP Implementation Plan contains eight pre-defined themes as goals, each further containing targets and actions to be achieved within certain specified timeframes of the main five-year period. To determine the conformance to the achievement of each goal, the focus of determination was on the achievement of each action, which concludes the conformity achievement level of each goal. The achievement was determined through either conformance, partial conformance, or non-conformance standards, as described in the paragraph below. Depending on conformity standards, each action was manually marked with “X”, indicating the action level of conformity as indicated in the example Table 3-3. A comprehensive table is provided in Table 4-1 and Annexure 1.

Conformity determination was grounded on whether the activity was done or achieved to completion and was marked as conformance. Where the activity achievement process was underway but not yet completed, it was marked as partial conformance. Where the activity was not done or in process, it was marked as non-conformance, including where the activities were not aligned with the goal. The Excel worksheet was then used to calculate the average conformity level per goal and the overall implementation. The level of conformity is indicated in Table 4-1 and Figures 4-1 and 4-2.

Table 3-3: Example of MLM IWMP implementation conformity analysis (complete table in Annexure 1).

Goals	Targets	Actions	Conform- ance	Partial conform- ance	Non- conform- ance
Goal 4: Sound budgeting and financing of waste management services	Cost-reflective and volumetric tariffs	Develop and implement a tariff model (as developed by the DEA).			X
	Enhanced revenue collection	Set up appropriate			X

Goals	Targets	Actions	Conform- ance	Partial conform- ance	Non- conform- ance
		fund-raising mechanisms.			
		Implement revised budget.			X
		Identify shortages in the budget, identify possible funding sources, and amend the budget accordingly.		X	
		Conduct a detailed financial investigation for proper waste management budgeting to ring-fence the service.			X

3.5 Familiarisation

The researcher read and re-read the data and listened to the recordings, making notes and summaries before the formal final analysis. After familiarisation with the data, the data collected from the research participants was numerically coded based on its conformity, as indicated in Tables 3-3 and 4-1.

3.6 Themes/concepts

Emergent themes were generated and identified from the data through a word count approach and presented in tables and graphs. Themes were later recorded in an Excel worksheet. The researcher reviewed the interpretations of the data according to the extent of focus on a theme.

3.7 Ethical considerations

The research proposal was submitted to the North-West University's Faculty of Natural and Agricultural Sciences Research Ethics Committee (FNASREC), and the FNASREC approved the study. The scientific committee has found that the project proposal followed the scientific method and adhered to the prescripts and guidelines of the North-West University. The FNASREC concluded that the proposed methodology posed a minimal ethical risk. The FNASREC approved the application with an ethical approval number NWU-01234-23-A9.

The researcher requested formal permission from MLM's Manager to utilise the municipality as a case study, and it was granted. The researcher further asked for written informed consent from the respondents before the interviews commenced and concluded. Anonymity and confidentiality assurance were given to the participants, and they were informed about their right to withdraw from the study at any point without prejudice.

3.8 Makhado Local Municipality as a case study

The MLM was chosen because it has an existing IWMP developed in 2018, which is due for review, further suggesting the general availability of information on its IWMP implementation. Additionally, it is due to easy access to the information required to complete the study in time.

The MLM provides a compelling case study due to the approval of the Musina-MLM SDZ, with the anticipated waste generation that will increase significantly in ten years and the need for the municipality to start putting long-term measures in place to address the expected waste generation.



Figure 3-1: Locality map of the Limpopo Province depicting the MLM (LEDET, 2020).

3.9 Conclusion

This chapter outlined the research methodology, design, and data analysis approaches used in the study. It further provided the ethical approval the North-West University granted and a brief methodological limitation that may be experienced during data collection.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 Introduction

The MLM IWMP was developed in-house using the IWMP toolkit developed by the DFFE, the then Department of Environmental Affairs, which includes the IWMP guidelines and IWMP web-based portal. The IWMP was approved in and around April 2018 and endorsed by LEDET, which is responsible for provincial environmental matters. Both evidence of approval were requested from the MLM, but only the endorsement letter from LEDET was made available. The researcher was informed that the actual council approval of the IWMP is in the confidential council meeting minutes, hence the provision of Provincial MEC endorsement as evidence that the IWMP under study was approved in 2018. The IWMP MEC endorsement letter is required in terms of section 11(4)(a)(i) of the Waste Act, and as a consequence, the MEC cannot endorse an unapproved IWMP. The MLM IWMP contains eight goals, which, for this study, are considered predefined themes/concepts. In addition, the IWMP provides targets and actions to achieve the goals.

As described in Chapter 3, content analysis was used to analyse the extent to which MLM has implemented its IWMP. It was further used to analyse the opportunities and barriers in implementing the MLM IWMP. From Tables 3-3, the results were further presented in percentages to determine performance against conformity standards, moving from Tables 3-3 and 4-1.

4.2 Results related to research objective 1: Determine the extent to which the MLM has implemented its IWMP

Table 4-1: Findings of the MLM IWMP's overall implementation of the pre-defined themes as goals.

MLM IWMP Implementation Plan goals	No. of activities	Confor- mance	Partial confor- mance	Non- confor- mance
Goal 1: Promote recycling and recovery of waste	11	3	3	5

MLM IWMP Implementation Plan goals	No. of activities	Confor- mance	Partial confor- mance	Non- confor- mance
Goal 2: Ensure the effective and efficient delivery of waste services	7	4	2	1
Goal 3: Ensure that legislative tools are developed to deliver on the Waste Act and other applicable legislation	5	2	3	0
Goal 4: Sound budgeting and financing of waste management services	5	0	1	4
Goal 5: Ensure the safe and proper disposal of waste	3	0	1	2
Goal 6: Education and awareness	7		4	2
Goal 7: Compliance and enforcement	8	3	2	3
Goal 8: Reporting on monitoring the implementation plan for Goal 8: Compliance and enforcement	9	0	0	9
Total averages	55	12	16	26

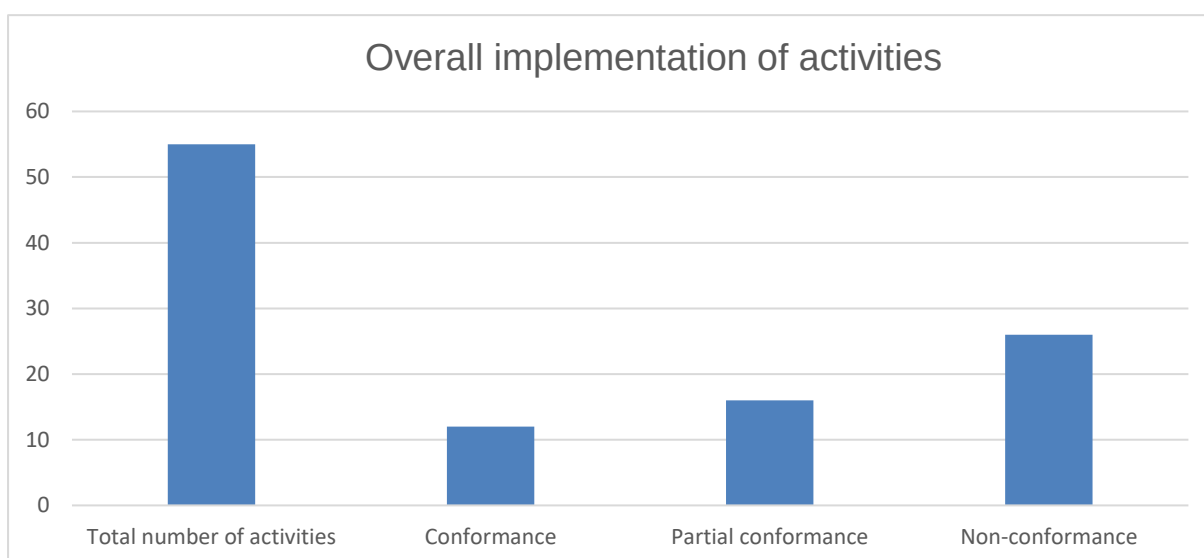


Figure 4-1: Findings of the MLM IWMP's overall implementation of activities to conformity standards.

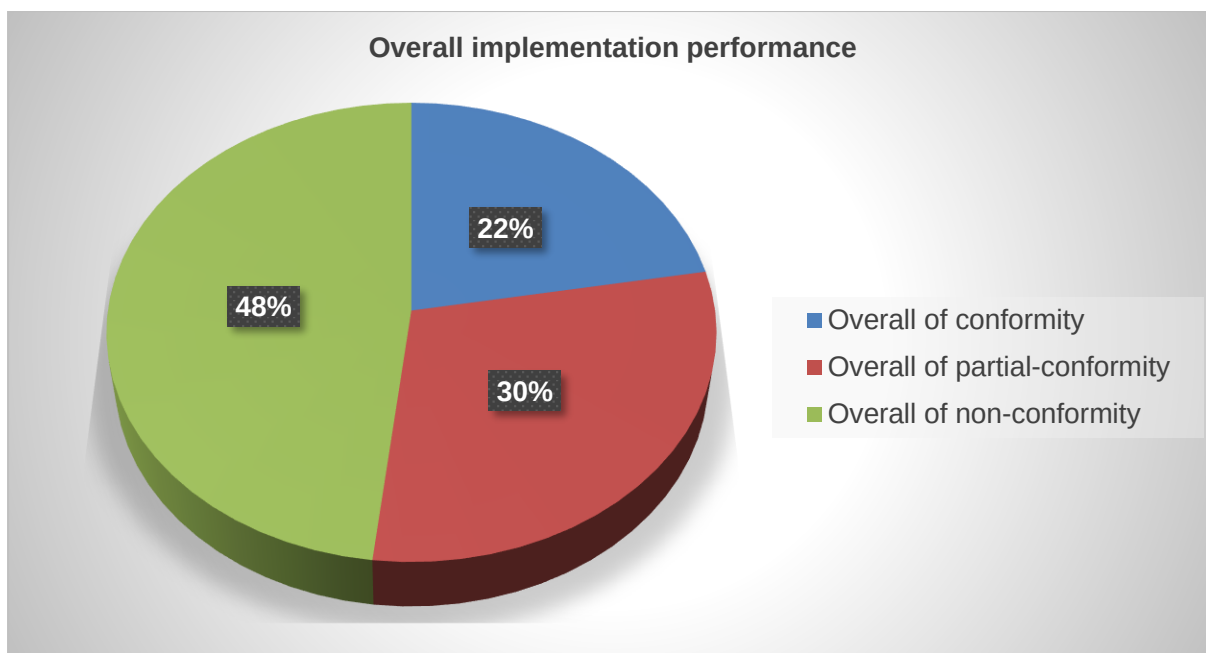


Figure 4-2: Findings of the MLM IWMP's overall implementation performance to conformity standards.

Table 4-1, Figures 4-1 and 4-2 present the level or extent of the MLM IWMP implementation. Almost half of the MLM IWMP Implementation Plan goals are not achieved or are in non-conformance, with more than half being either partially conformed to or conformed to. It is disappointing that the conformance rate is only 22%.

Findings discussion on the extent to which the MLM has implemented its IWMP

4.2.1 Goal 1:² Promote recycling and recovery of waste

In terms of the MLM IWMP of 2018, this goal contains several actions to give effect to the goal at year five of the implementation. The first set of actions for goal one addresses the establishment of at least eight buy-back centres by "partial conversion" (as is in the implementation plan) with the current garden refuse sites, implementing sorting and collection of recyclables at source. It further includes instituting a recycling programme and facilitating small recyclers into the programme. Lastly, it aims to establish recycling drop-off points at all municipal buildings and composting facilities. The critical question asked during the interviews with MLM officials, as depicted in Annexure A, was, "Your IWMP identified eight goals to be fully achieved by year five, which is 2023. To what extent have you achieved all these goals?". This question applies to all eight goals.

² All goals of the MLM IWMP Implementation Plan are regarded as pre-defines themes.

Figure 4-3 and 4-4 summarises the overall conformity implementation performance of the MLM against goal 1 of the IWMP.

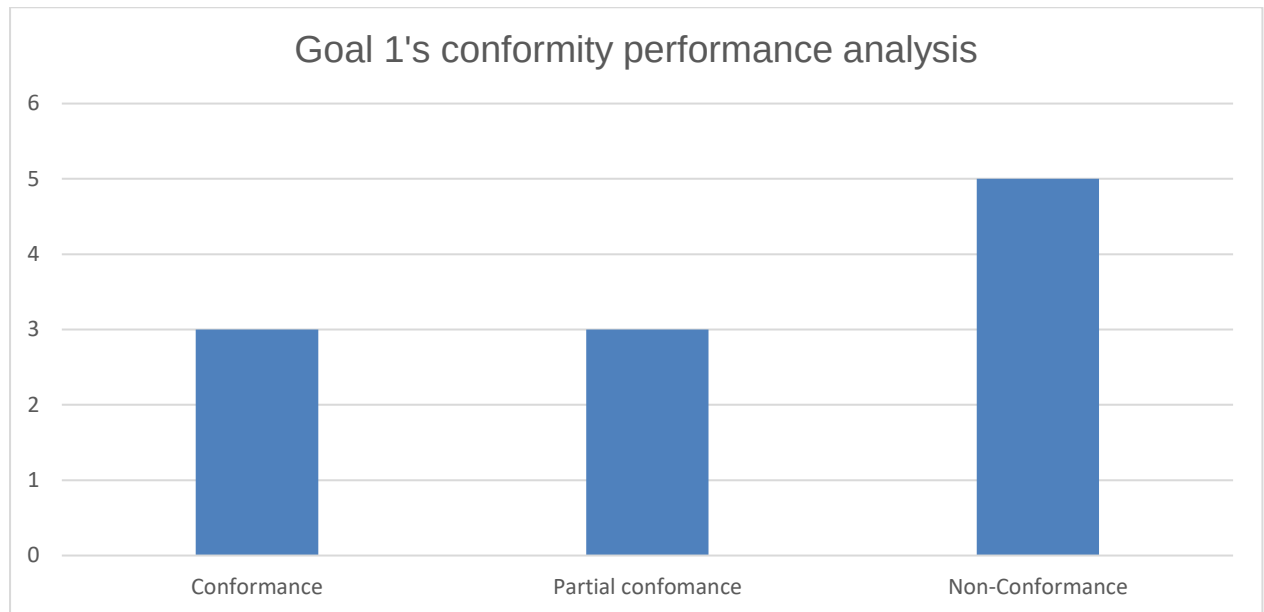


Figure 4-3: Promote recycling and recovery of waste activities' conformity performance.

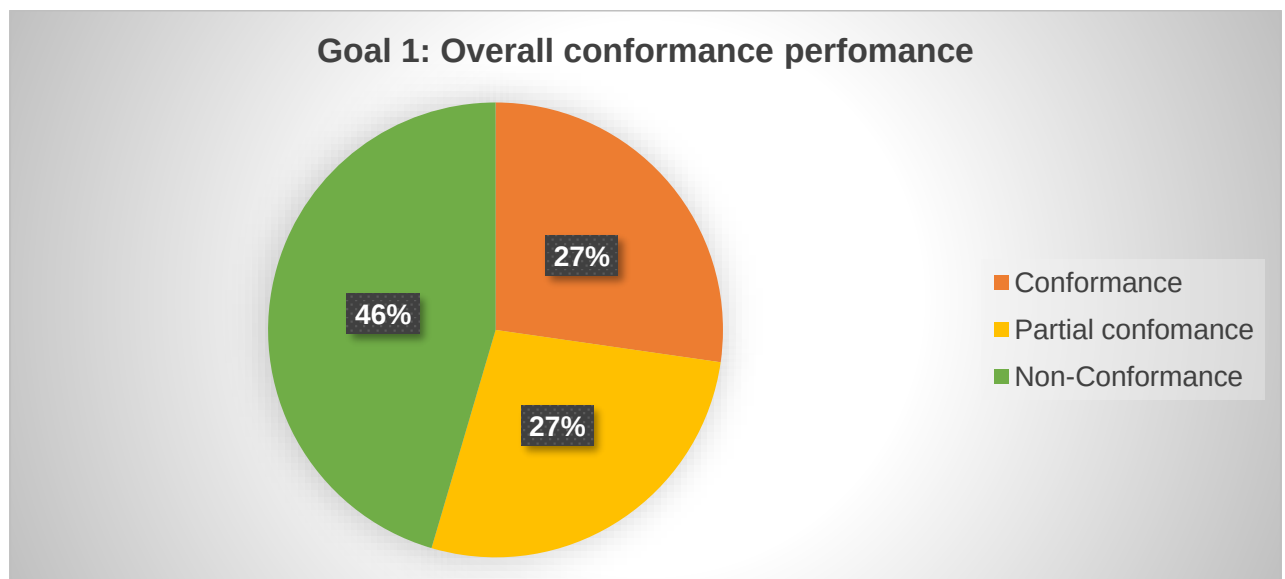


Figure 4-4: Promote recycling and recovery of waste overall conformity.

Goal 1 is aligned with the government's intentions of the White Paper on Integrated Pollution and Waste Management, the three versions of the NWMS, and the Polokwane Declaration aimed at mapping South Africa's transition towards zero waste. In all these programmes, targets for recycling were set and ratified by all key and relevant stakeholders (Godfrey and Oelofse, 2017).

Recyclable materials present in MSW have increasingly gained the attention of SWM decision-makers, as recycling of MSW can contribute to sustainability-related objectives, including resource recovery, reduced energy consumption, and lower emissions (Pressley *et al.*, 2014).

According to Pressley *et al.*, 2014, waste management facilities such as material recovery and buyback centres are an integral part of the MSW system because they often determine the amount of collected recyclable material that can be recovered for recycling (Pressley *et al.*, 2014).

According to Godfrey and Oelofse, 2017, recycling in South Africa has been practised for over three decades, driven by social and economic needs. It is argued that the local recycling economy in South Africa is on par with many developed countries due to the active contribution and participation of the informal waste sector. Separation at source across South African cities and towns is still behind, providing informal waste pickers with the opportunity to divert significant volumes of waste towards recycling and other beneficiation activities. Conversely, driving around some towns of the MLM, one hardly notices any waste picker, unlike in cities such as Pretoria and Johannesburg (Godfrey and Oelofse, 2017).

While Brazil and the cities in South Africa brag about its developing informal waste sector that plays an important role in its waste management, the MLM had no signs of waste pickers in its streets except those that are based in the MLM landfill site (Poletto *et al.*, 2016).

The interviews have established that this goal was partially conformed to through supporting privately owned waste recycling buyback centres³ that are more than eight within its jurisdiction. The MLM appointed three privately owned buyback canterers supported by municipalities to recover and divert waste from the landfill site through its internal legitimate tender process. Observations were undertaken, and the evidence of the observations is captured in the form of pictures, as indicated in Annexure C.

However, conformance results find that out of 11 activities under this goal, three were conformed to, three were partially conformed to, and five were not conformed to. Partial and non-conformance share a total percentage of 63%, with conformance at 27%. This contrasts with the municipal officials' view that *"the municipality performance on this goal is conformance"* for a simple reason. Their conclusion was based on one activity out of 11 goals that deal with "establish at least eight buy-back centres by partial conversion with the current garden refuse sites" which they have done well in working with other stakeholders to support the establishment of waste recovery facilities. However, this further put doubt on their focus towards implementing other activities to achieve Goal 1.

³ Evidence of some of the waste facilities is provided in Annexure C.

The support by MLM to private recycling buy-back canterers is in line with the role of government in general, which is not to establish and manage businesses or enterprises but to support, promote and upgrade businesses, as argued by Masutha and Rogerson, 2014:142. Masutha and Rogerson, 2014:142, further argued that through its policies, the government must create a conducive platform for businesses to strive for economic development, poverty alleviation and job creation (Masutha and Rogerson, 2014). Similarly, the MLM supports these businesses by organising expert workshops, creating and managing social media platforms for all formal and informal recyclers within MLM, providing waste collection bags and assisting with marketing their products.

It is only fair for the MLM to play a support role to the private recycling industry in the recycling sector as the sector itself in South Africa is relatively well established, driven primarily by industry-led, voluntary initiatives with funds managed independently from the government via non-profit associations, which oversee recovery/recycling processes and facilities (Muzenda *et al.*, 2012).

To attempt to achieve Goal 1, the MLM has established 14 drop-off centres in the Kutama/Sinthumule region, and the contractor is said to be completing setting up the facility at the interview. Twelve drop-off centres in Dzanani, 12 in Luvuvhu, and 12 in the Waterval region have been approved and funded but have not yet been erected. The MLM has also refurbished the old Dzanani region refuse transfer station.

The approved composting facility targeted to be established in the MLM township could not be erected as the land was earmarked in the land claim process. The land claim was identified as a barrier to this intended and planned action. The MLM has decided to halt the process and look for an alternative land in another region. The MLM township and its nearby residential area generate more garden waste than other townships or regions. Moving the composting facility to another region was discussed internally but did not meet the sustainability parameter. Two of the three privately owned existing composting facilities have since stopped operation for reasons known to the facility's management.

Garden waste is still accepted at the MLM landfill site, either disposed of by private individuals or by the municipality itself. This further complicated the practice of zero garden refuse waste to landfill sites by 2021, an action of the IWMP Goal 1. Since 2001, a waste recycling economy has emerged in South Africa. Still, as the last official waste statistics show, South Africa has only been able to divert 10% of the waste from landfills towards recycling in 2010 and approximately 35% in 2020. It is further argued that recycling is still far from maturity in South Africa (Godfrey and Oelofse, 2017).

Regarding establishing drop-off points at all municipal buildings, according to MLM officials, *“there are no drop-off centres at the municipal buildings”*. Still, the normal collection is carried out through a normal collection schedule based on the location of the municipal building. Since the approval of the MLM IWMP, the actions to facilitate the establishment of and partner with the private sector electronic waste recycling have not been initiated or established, and there is no plan for its implementation. Although the volume of electronic waste (e-waste) generation is very low, e-waste generated within the municipality is disposed of at landfill sites.

One area that the MLM has put more effort into is implementing the last action of Goal 1, where the municipality planned to extend service delivery to new developments, be they business or residential. In its preparation, the MLM has procured ten refuse removal trucks and 80 skip bins for waste collection services. No one currently requires municipal waste collection services; however, the new residential area is still being planned. The MLM has further engaged with the Musina-MLM SDZ, which the government has approved. Both the SEZ and MLM management have signed service-level agreements for the MLM to provide waste management services.

4.2.2 Goal 2: Ensure the effective and efficient delivery of waste services

Figure 4-5 and 4-6 summarises the overall conformity implementation performance of the MLM against goal 2 of the MLM IWMP.

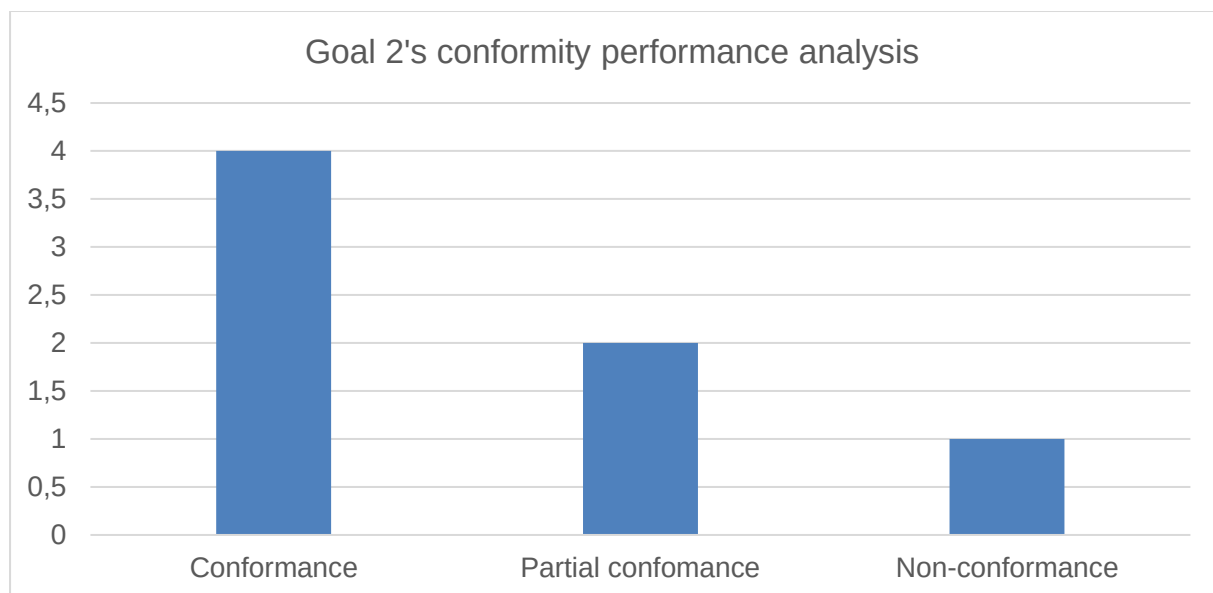


Figure 4-5: Ensure the effective and efficient delivery of waste services activities' conformity performance.

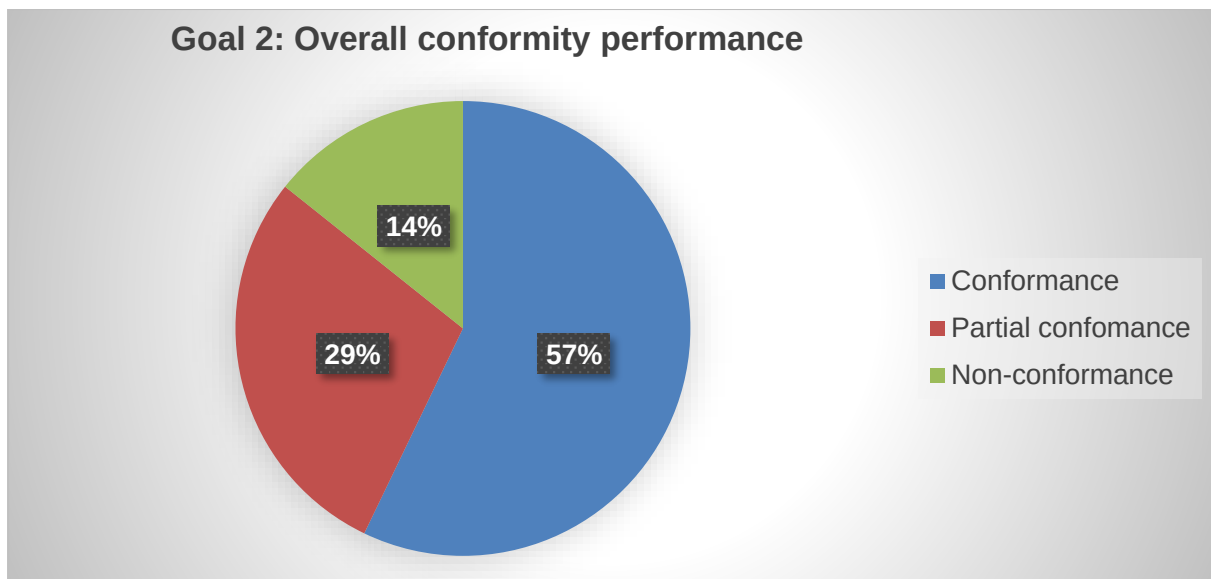


Figure 4-6: Ensure the effective and efficient delivery of waste services overall conformity.

This goal contains actions related to conducting a transportation study to identify and optimise collection routes and the number of service points, establish receptacle requirements within the MLM and supply the receptacles to residents to optimise collection efforts, effective structures and extension of human resources and extend and maintain the waste collection fleet for service delivery.

Solid waste management in South Africa is the primary function of municipalities as specified in Section 156(1)(a) of the Constitution (Fakoya, 2014). Although considerable progress has been made in expanding access to refuse removal services, mostly in urban centres, substantial challenges remain. Lack of access is highest in the rural areas of the MLM. The MLM's performance on this goal is just below 60%, with above 40% contributing partial conformance and non-conformance. While progress is encouraging, above 40% suggests that a lot is still required. Fakoya, 2014, maintains that effective waste management can improve public health, while failure to provide effective waste management systems by municipalities has dire environmental consequences on poor households; hence, municipalities must do more (Muzenda *et al.*, 2012; Fakoya, 2014).

In South Africa, the Bill of Rights, as enshrined in the Constitution, provides in section 24 that communities have fundamental rights to an environment that is not harmful to their health and well-being (Fakoya, 2014). However, failing to accomplish 100% of this goal directly affects this human right.

The MLM has over 200 villages and four townships: MLM, Dzananai, Luvuvhu, and Waterval. The municipality collects waste in the townships through the curbside collection approach. All

the township households have a waste services account with the MLM and pay for the services. Unfortunately, according to MLM officials, they could not appoint a service provider to conduct the transportation study to identify and optimise collection routes and the number of service points as it was not budgeted. The municipality has indicated that with the existing experience, central collection points/drop-off centres were established to reduce collection routes, providing an opportunity to optimise and minimise collection loads and routes. Establishing main collection points/drop-off centres further assists the municipality in maximising waste diversion for recycling.

The MLM provides bins to commercial or businesses with charges; however, it has stopped providing black plastic bags in rural and township dwellings. Before 2018, the MLM was providing mass wheely bins to its township residents, and it has since stopped. The municipality has since procured 1000 240l wheely bins for businesses for waste collection, collected daily in the central business district and twice a week in the industrial area.

An additional 150 skip bins were procured. Business areas like shopping malls, complexes, and rural communities have 20 nine-cube skip bins placed strategically for easy access. Each village where the skip bins are placed has three to four skip bins.

By the MLM officials' admission, no study was conducted to determine the need for three to four skip bins in each village. However, communities contact them to provide skip bins in the villages. These requests are also used to determine the skip bins' needs.

Regarding filling the vacant position and securing an effective structure and extension of human resources, the status quo of the IWMP does not talk about the number of personnel at the point of the IWMP development. It appears that there were opportunities to increase human capacity at this point. The MLM had 65 service workers who were and are still responsible for street, river, and bush cleaning, six drivers, one technician, and one assistant manager, positions which have since been abolished.

Six waste management general workers, four new skip loader drivers, a weighbridge operator, and a waste manager, who were vacant positions at the time of the IWMP development, have since been filled. There is still a need for drivers since the vehicles are there. There is a further need for more vehicles to maintain the waste service, especially during breakdowns.

Between 2000 and 2014, the MLM had five refuse compactor trucks, four tractors and forty mass containers. Since 2018, six new refuse compactor trucks, seven skip loader trucks, 150 skip bins, an eight-ton truck with a cage, and four light-duty vehicle bakkies have been procured to assist in the waste collection service for all municipality residents. Breakdowns of the vehicles, especially the old ones, are compounded by the internal procurement process, which causes delays in procuring spare parts, which is a big challenge. However, the

municipality has appointed a service provider for major vehicle maintenance, whereas minor maintenance is done in-house.

These results are concerning. The research revealed increased community impatience related to basic municipal service delivery in South Africa. Many scholars have further argued that the rise in service delivery protests in South Africa can be attributed to organisational failure to provide satisfactory basic services because many communities remain un-served, similar to the MLM (Masiya *et al.*, 2019).

Koma, 2016 recorded that the South African government has devoted much attention and resources to the local government to ensure constitutional imperatives of service delivery efficacy. However, the performance of many municipalities throughout South Africa has utterly shown tremendous failures in fulfilling their constitutional and legislative obligations (Koma, 2016).

Ensuring all communities have access to waste collection services, followed by compulsory waste separation at source and dedicated collection points, is key to successful waste management. The MLM is failing mainly due to its current single bin of mixed waste in most households, and at times, refuse collections are not always on schedule because of backlogs caused by breakdowns (Mazhandu *et al.*, 2021).

4.2.3 Goal 3: Ensure legislative tools are developed to deliver on the Waste Act and other applicable legislation

As argued by Ross and Rogoff, 2012 technical professionals typically can successfully implement IWMPs if laws, and policies (Ross D.E and Rogoff M.J, 2012). Figure 4-7 and 4-8 provides the conformity implementation level against goal 3 of the MLM IWMP.

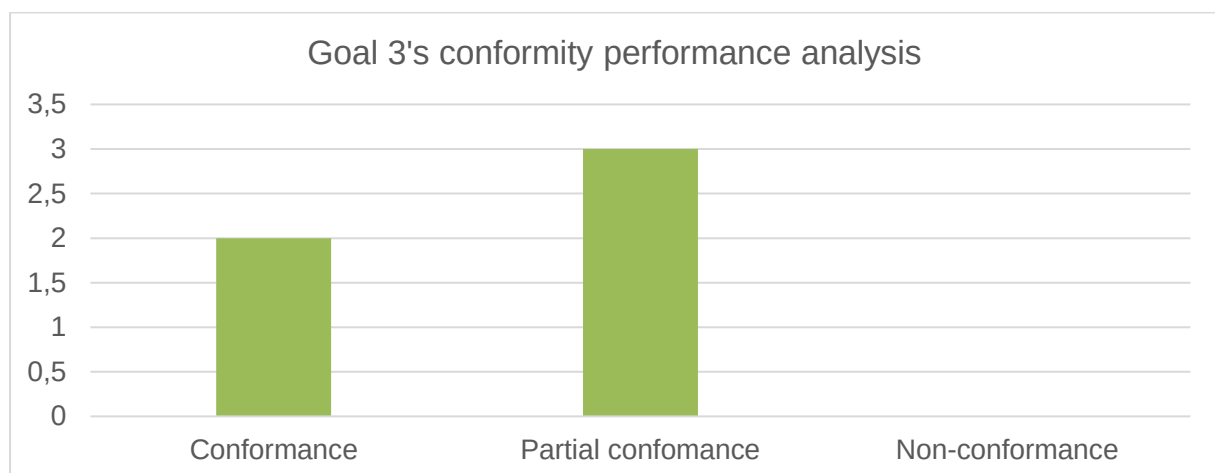


Figure 4-7: Ensure legislative tools are developed to deliver on the Waste Act and other applicable legislation conformity performance.

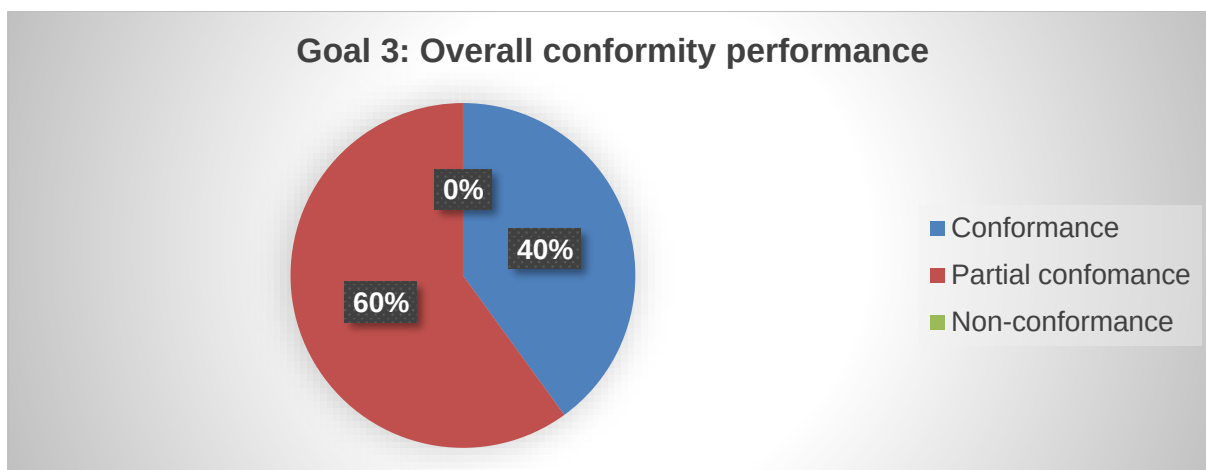


Figure 4-8: Ensure legislative tools are developed to deliver on the Waste Act and other applicable legislation overall conformity.

A by-law is legislation passed and enacted by a municipal council. Municipalities develop by-laws for parking meters, street trading, littering, nuisance, noise, and parks (Memeza, 2018). A municipality's executive and legislative powers are outlined in section 156 of the Constitution. This section provides that a municipality has executive authority and the right to administer, among others, by-laws. It may make and administer by-laws for the effective administration of the matters that it has the right to administer (Koma, 2016).

Furthermore, the Municipal Systems Act, section 11(3)(a-n) provides that a municipality exercises its legislative or executive authority in various ways, particularly by, among others, developing and adopting policies, plans, strategies, and programmes, including setting targets for delivery and implementing applicable national and provincial legislation and its by-laws (Koma, 2016).

The implementation of Goal 3 is very positive, sitting at 100% partial conformity and conformity levels. All the activities of this goal are either in process or achieved, as demonstrated by Figures 4-7 and 4-8.

The target and actions of this goal are to ensure each customer has a printed copy of the by-laws, amend the by-laws, and collect, sort, collate, analyse, interpret, and report waste volumes to the South African Waste Information System (SAWIS) and to keep proper records of waste quantities and types received at the waste management facilities as well as providing information to LEDET.

The existing waste by-law was developed and approved in 2014. According to the officials from the MLM, the waste by-law has been uploaded to the municipal website for everyone's access. However, upon inspecting the website to access the waste by-law, it appears it was not uploaded or removed. Further, municipal officials indicated that anyone could request a

copy of the waste by-law from the office, which will be provided. Copies of a summary of the waste by-law are also offered during the education and awareness campaigns.

According to the IWMP, the amendment of the waste by-law commenced in January 2018. However, it has not been completed, which brings many questions to the process. Similarly, Debrah *et al.*, 2021 argued that the absence of an effective and comprehensive legislative framework governing the MSW sector and inadequate enforcement mechanisms create gaps in SWM.

Muswena 2014 argued that waste management facilities reporting their activities to the SAWIS remains a compliance problem (Muswena 2014). Reporting on waste statistics in the SAWIS for a country is more than just about collecting routine data on waste. It must facilitate improved waste management by providing timely, reliable information to the relevant role-players. It must support waste governance challenges ranging from strategic management issues at the national government level to basic operational challenges at local government levels (Godfrey, 2008). Intriguingly, while other municipalities have challenges with SAWIS reporting, this has not been an issue of concern with the MLM.

The interview established that the waste by-law is also placed at the community library, although this was not verified. It further found that reporting to the SAWIS is done monthly. The MLM provides LEDET with the same information or SAWIS report. The requested 2018 to 2023 report from the SAWIS indicates that the MLM has been reporting to the SAWIS within the implementation period of the IWMP, which is 2018 to 2023 (DFFE, 2023).

4.2.4 Goal 4: Sound budgeting and financing of waste management services

Additionally, technical professionals can effectively implment IWMPs if budgets are made available (Ross D.E and Rogoff M.J, 2012). Figure 4-9 and 4-10 provides the conformity impenetation level against goal 4 of the MLM IWMP.

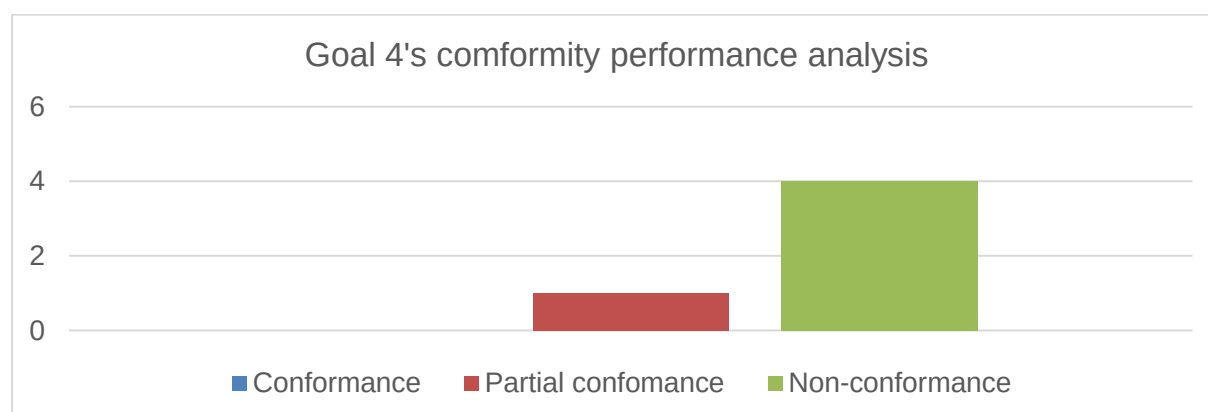


Figure 4-9: Sound budgeting and financing of waste management services' conformity performance.

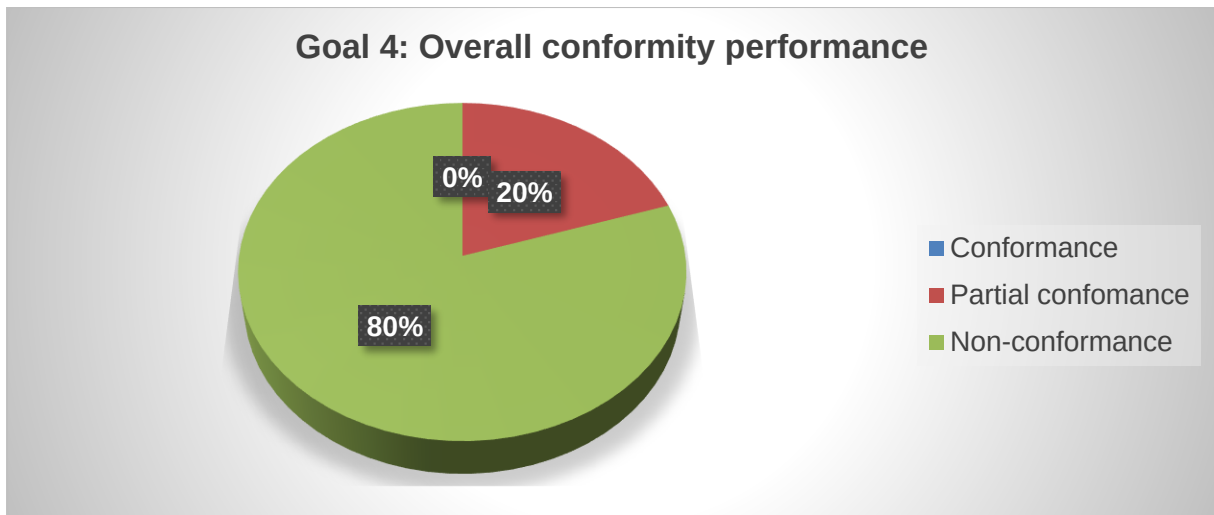


Figure 4-10: Sound budgeting and financing of waste management services overall conformity.

Finance and budgeting were raised during the interviews with implementing research participants as one of the barriers towards successful implementation of the IWMP. Muswena, 2014 has found that because of the low budget allocations, implementation of the approved IWMP has more insignificant outcomes than anticipated (Muswena, 2014).

It is clear from the argument by Muswena, 2014 that even the MLM is experiencing the same problem. This is witnessed in the findings presented in Figures 4-9 and 4-10, where the findings are 0% conformance and 80% non-conformance. Even though the MLM's IWMP has been integrated into the IDP, this is true.

According to Fakoya, 2014:121, it is not only the responsibility of the local government but also the national, provincial, and other agencies to set policies and targets for waste reduction and recycling. Municipalities are further responsible for general waste management planning and the development of by-laws. These responsibilities include providing economic incentives to support waste minimisation and recycling in their areas. However, there are often discrepancies in different municipalities since each has its budgeting process and waste management financing (Fakoya, 2014).

According to Fakoya, 2014, municipal by-laws should be specific to the services provided with charges and associated tariffs proportional to the services offered. While this is the case with MLM, it is unclear since the amendment supposedly to be started in 2018 was not completed in 2023 (Fakoya, 2014).

Goal 4 contains four actions: developing and implementing the tariff model (as developed by the DEA), setting up an appropriate fundraising mechanism, identifying budget shortages and possible funding sources and amending the budget accordingly. It includes implementing a

revised budget to conduct a detailed financial investigation for proper waste management budgeting to ring-fence the service.

It is equally important to indicate in advance that, according to the interviews with municipal officials, the waste management unit within the municipality receives the lowest budget of all the units. This is mainly due to waste not being a priority compared to other services such as housing, water, electricity, and other infrastructure other than waste. Similarly, Sango *et al.*, 2014 recorded that many of the IWMPs still lack technical and financial substance, providing limited guidance in terms of both future infrastructural and operational requirements (Sango *et al.*, 2014).

In response to these actions, it was indicated during the interviews with two officials from the MLM that the municipality adopted a tariff model developed by the DFFE instead of creating a new one. Besides adopting the tariff model from the DFFE, the MLM is still utilising its system for annual tariff review. The system, which includes setting a yearly percentage increase, has long been adopted but is not based on any tangible and legitimate process or guidelines.

Even though no specific mechanism is put in place for sourcing additional waste management funds, the municipality received a Municipal Infrastructure Grant to establish a new landfill site. The MLM claims to assist formal recyclers in accessing other funding, such as the Recycling Enterprise Support Programme Grant.

According to the system, the private individual disposal tariff is R37.00 for volume less than a ton and anything above a ton is charged R37.00 per ton. This tariff is alleged to be not cost-reflective. The municipality generates an annual revenue from waste management of nine to ten million rand, which is claimed to be the highest of all the local municipalities in the Vhembe District. Unfortunately, this revenue is not ringfenced to be reinvested into the municipality's waste management services.

4.2.5 Goal 5: Ensure the safe and proper disposal of waste

Figure 4-11 and 4-12 summarises the overall conformity implementation performance of the MLM against goal 5 of the MLM IWMP.

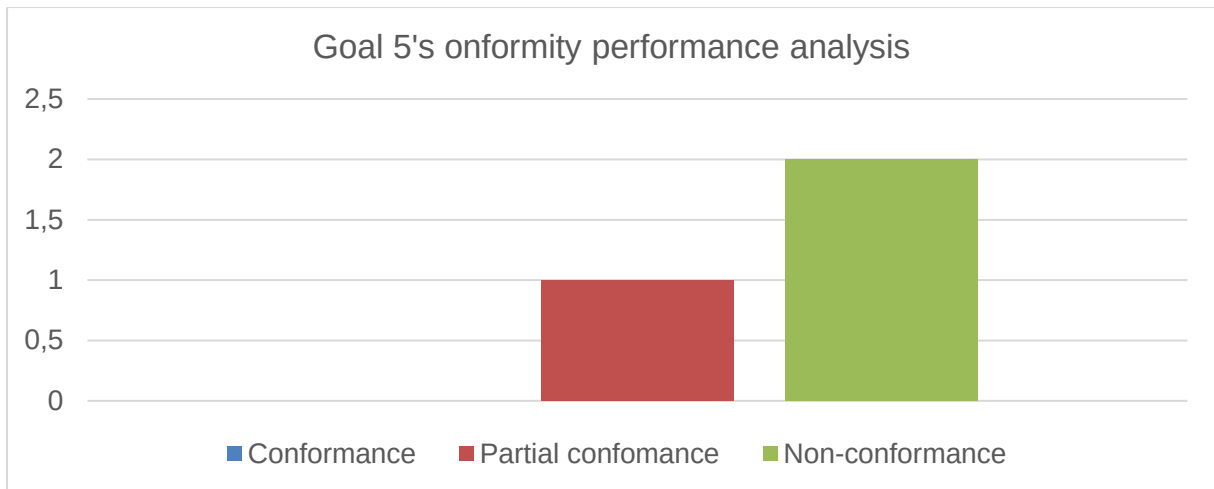


Figure 4-11: Ensure the safe and proper disposal of waste conformity performance.

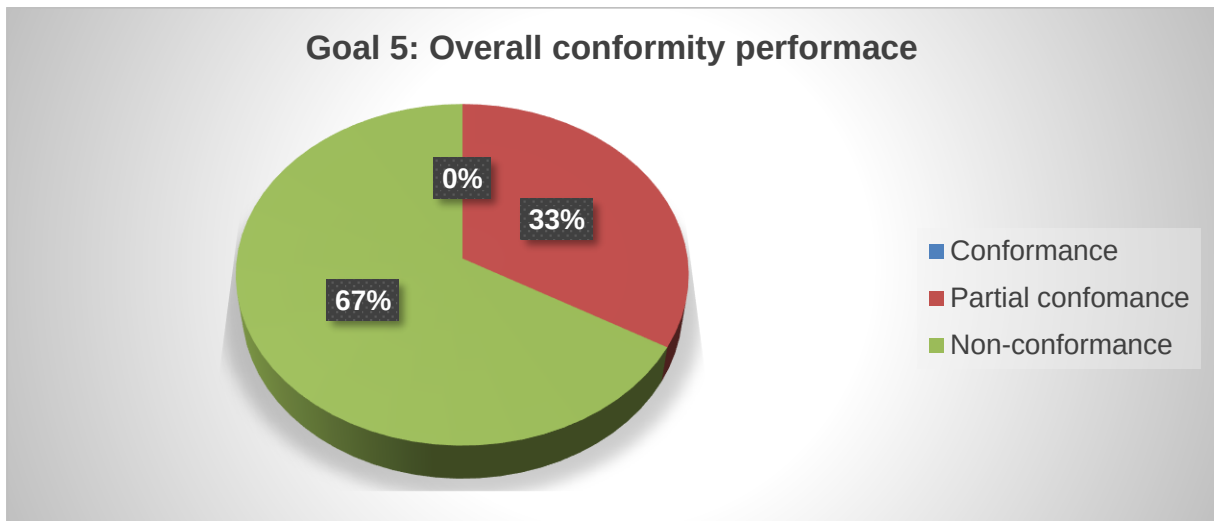


Figure 4-12: Ensure the safe and proper disposal of waste overall conformity.

According to Godfrey and Oelofse, 2017, landfilling in South Africa remains the dominant choice for all types of waste. This is because of low landfill gate fees, unwilling municipalities, and waste generators to investigate other solutions. These low gate fees make it very difficult to implement alternative waste treatment technologies economically. The disposal of clean builders' rubble or garden waste at landfills is often free, the same as in the MLM (Godfrey and Oelofse, 2017). While 33% progress on implementing this goal is encouraging, it is very concerning that none of the activities of this goal is at a conformance level.

It is, however, concerning that while other municipalities like the City of Cape Town are shifting the focus towards waste minimisation, sustainability goals and programmes attentive to reducing the amount of waste disposed of in landfills, the MLM has established a new five-year landfill site with a lifespan of more than 20 years (van Rensburg, 2022).

Final disposal is the least favoured option in the waste management hierarchy; however, due to the high volumes of waste generated in the MLM, waste collection by the MLM is still being landfilled. Because of insufficient waste diversion and recycling facilities, landfilling in the MLM is still preferred. This is similar to most local municipalities in South Africa and the African region (Bundhoo, 2018).

The MLM plans to achieve this goal by investigating the conversion of waste to energy and clean development mechanisms by conducting a study to determine whether the establishment of composting facilities, construction, and demolition waste facilities is feasible. It further aims to stabilise the quantity and investigate the reduction of pollution potential of waste disposed of to landfills and reduce the volume.

To date, no gas plant and builders' rubble and crusher facilities feasibility studies have been conducted for the MLM except the study done by the DFFE for waste-to-energy policy direction. As previously indicated, the earmarked establishment of 50 drop-off centres is purposed to divert and reduce the volume of waste disposed of at the landfill site.

Accepting Koma's 2016 argument that the performance of many municipalities throughout South Africa has so far utterly shown tremendous failures in fulfilment of both their constitutional and legislative obligations, it is not surprising that the MLM is, in this case, at 0% conformance to the activities of implementing goal 5.

4.2.6 Goal 6: Education and awareness

According to Debra *et al.*, 2021, waste management is a complex problem comprising political, socioeconomic, institutional, and environmental aspects. The gap in environmental knowledge among the youth and the old within developing countries contributes to waste management problems, with important consequences in low-income countries (Debra *et al.*, 2021). Figure 4-13 and 4-14 summarises the argument on the overall conformity implementation performance of the MLM against goal 6 of the MLM IWMP.

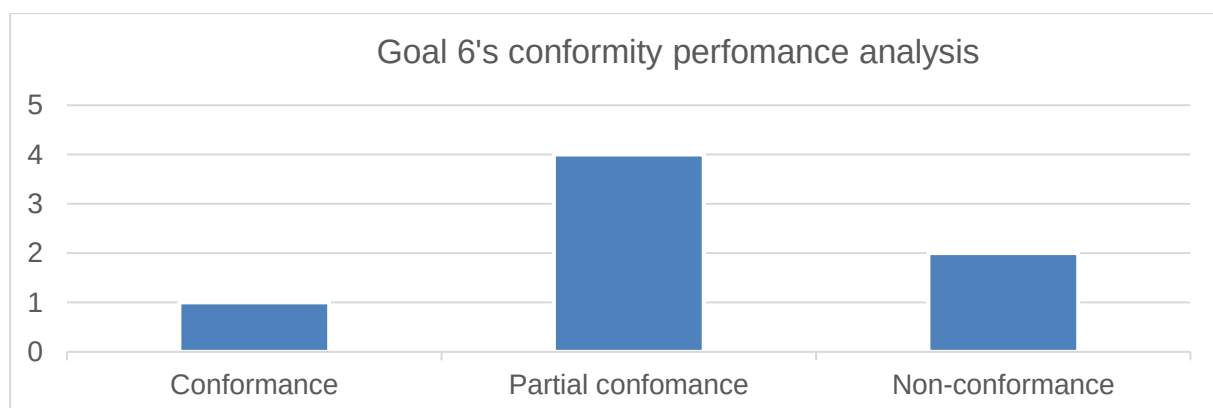


Figure 4-13: Education and awareness conformity performance.

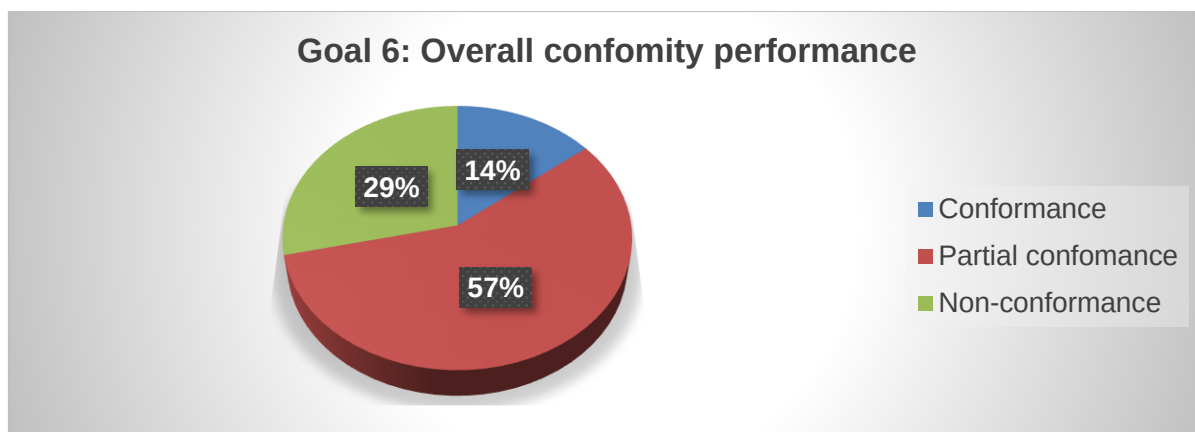


Figure 4-14: Education and awareness overall conformity.

The actions of door-to-door education and awareness commencing in June 2018, clean-up campaigns, distributions of by-laws and pamphlets with waste information in every household are continuously implemented through the DFFE's good-green-deeds (GGD) programme and clean and green programme. Since the discontinuation of the GGD programme whilst the clean and green programme is not yet in its implementation phase, the MLM has not been able to continue the activities. The failure to continue the activities is due to a lack of knowledgeable human capacity and budget.

The MLM has an education and awareness programme called "Nakisani-vhupo", which was started in 2013. This programme has led to the adopting of a school programme with LEDET, which is implemented annually, whereby five schools were adopted. The waste forum was established in 2017 and renewed in 2022 with new leadership. Quarterly forum meetings and workshops are conducted as planned.

4.2.7 Goal 7: Compliance and enforcement

Figure 4-15 and 4-16 summarises the overall conformity implementation performance of the MLM against goal 7 of the MLM IWMP.

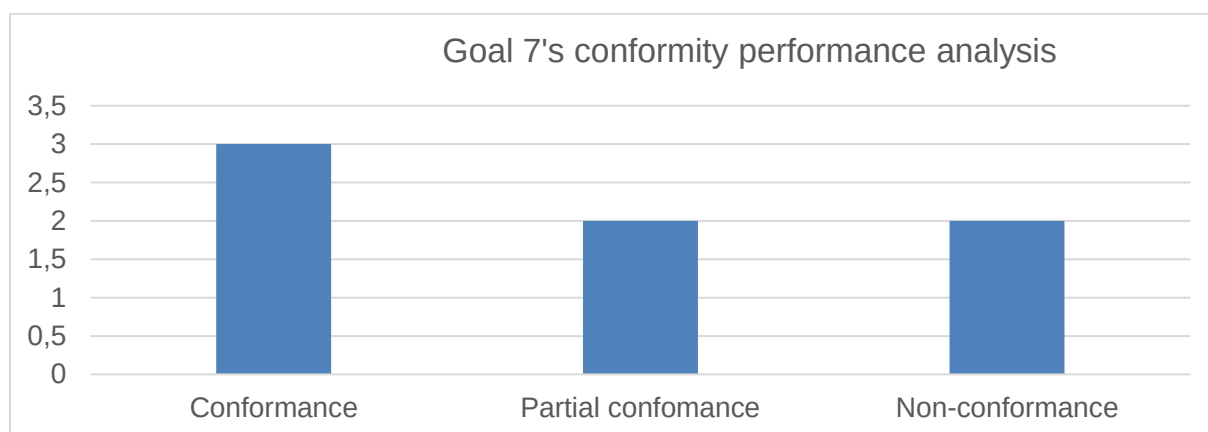


Figure 4-15: Compliance and enforcement conformity performance.

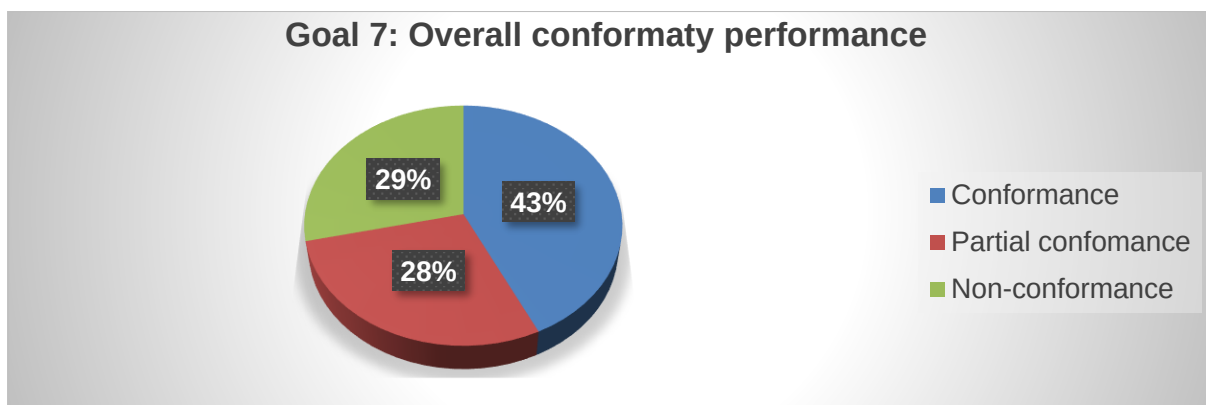


Figure 4-16: Compliance and enforcement's overall conformity.

Existing increased waste generation and the need to manage it effectively resulted in the introduction of a range of legislative measures in South Africa. These regulations aim at driving waste up its hierarchy towards reuse, recycling, and reduction (Godfrey and Oelofse, 2017). In addition to the above regulations, specific provinces and municipalities manage waste under several by-laws. Re-evaluating these regulations towards an integrated system is essential for their effective compliance and enforcement in MSW activities (Godfrey and Oelofse, 2017). Similarly, the review on amendment of the waste by-law in the MLM is claimed to have been in process since 2018 and has not yet been completed in 2023. The time lag is concerning.

According to the MLM officials, reviewing the IWMP commenced in October 2023. The municipality has procured 500 no-dumping signs erected after identifying and cleaning the illegal dumping area. The MLM has established a toll-free number for reporting waste-related incidents such as illegal dumping. In 2019, the municipality successfully persecuted three cases of unlawful dumping.

The waste management unit has sought the assistance of the internal traffic department for compliance and enforcement of the waste by-law; however, the response has not been positive. The plan to train the existing relevant waste management personnel as peace officers was not approved. The medical waste database of all industries is planned to be developed as the MM indicated that medical waste is the responsibility of the district municipality.

According to Bundhoo, 2018, a lack of enforcement legislation in developing countries leads to illegal dumping and open waste burning. Further, the lack of legislation means that separation at source cannot be enforced. At the same time, the absence of charges or taxes also implies that a considerable source of revenue is not collected. Similarly, the MLM process of waste by-law amendment since 2018 manifests and aligns itself with this argument (Bundhoo, 2018).

4.2.8 Goal 8: Reporting on the Monitoring Implementation Plan: Compliance and enforcement

Failure to monitor the implementation of the IWMP and provide an annual report by the MLM is a direct violation of section 13(3) of the Waste Act, which provides that;

“an annual performance report on the implementation of the IWM plans must, in the case of the annual performance report prepared in terms of section 46 of the Municipal Systems Act, contain information on the implementation of the municipal IWM plan, including the information set out in paragraphs (a) to (j) of subsection (2) insofar as it relates to the performance of the municipality” (DEA, 2008).

Figure 4-17 and 4-18 provides a summary of arguments of the overall conformity implementation performance of the MLM against goal 8 of the MLM IWMP.

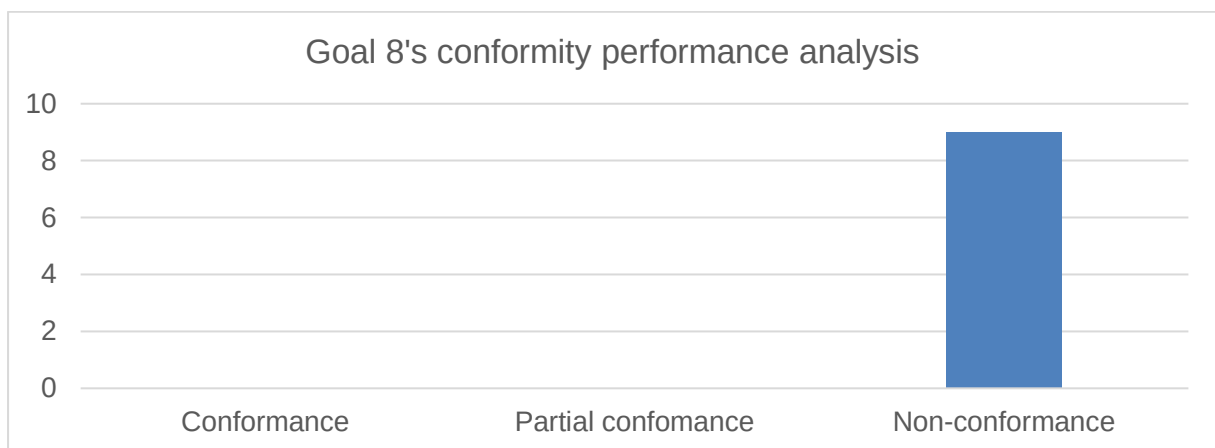


Figure 4-17: Reporting on the Monitoring Implementation Plan: Compliance and enforcement conformity performance.

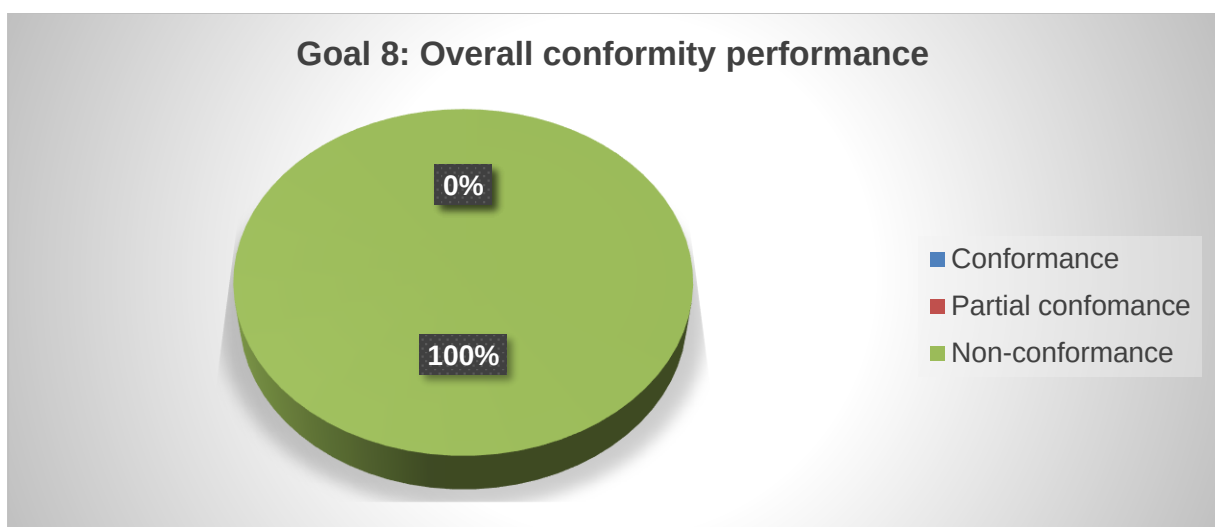


Figure 4-18: Reporting on the Monitoring Implementation Plan: Compliance and enforcement's overall conformity.

Although Goal 8 talks about reporting on monitoring its implementation, there is no monitoring of the implementation of its IWMP by MLM as there is no annual monitoring report developed in terms of section 13(3) of the Waste Act. These results are similar to those of Molaba, 2019 who found that the implementation of the IWMP of local municipalities within the Fezile Dabi District was below 20%, with no evidence of IWMP implementation progress being reported and monitored (Molaba, 2019).

During the interview, the MLM claimed that a five-year annual draft report is in the final stage and will be completed before the IWMP review process starts in October 2023. The request for the draft report was not granted until the report was finalised.

Upon review of the targets and activities supposed to be undertaken to achieve this goal, it was found that none of these targets and activities are aligned with the reporting on monitoring the IWMP Implementation Plan. The misalignment concluded that it would still be impossible for the MLM to conform with the goal even if the activities listed were to be undertaken. Similarly, Molaba, 2019 conducted a study to critically analyse the IWMPs of local municipalities within the Fezile Dabi District Municipality. The study's findings revealed that, although IWMPs were developed, important exclusions and misalignment were identified, which had a bearing on the implementation outcomes (Molaba, 2019).

4.3 Results related to research objective 2: Identify the opportunities and barriers to implementing the MLM's IWMP

Waste management poses a major challenge to local governments in developing countries, with South Africa not being an exception. Municipalities face many constraints, including inadequate budgets, frequent waste collection, and lack of proper equipment and infrastructure. These obstacles lead to further problems, such as littering and illegal dumping in South Africa (Viljoen *et al.*, 2021). Local governments cannot cope based on current governance mechanisms, resulting in unsustainable management of MSW (Banda *et al.*, 2021). During the interviews, the research participants, both the MLM officials and other research participants, identified several barriers limiting the MLM from effectively implementing its IWMP and providing sufficient general waste management services. Figure 4-19 shows the level of research participant respondents.

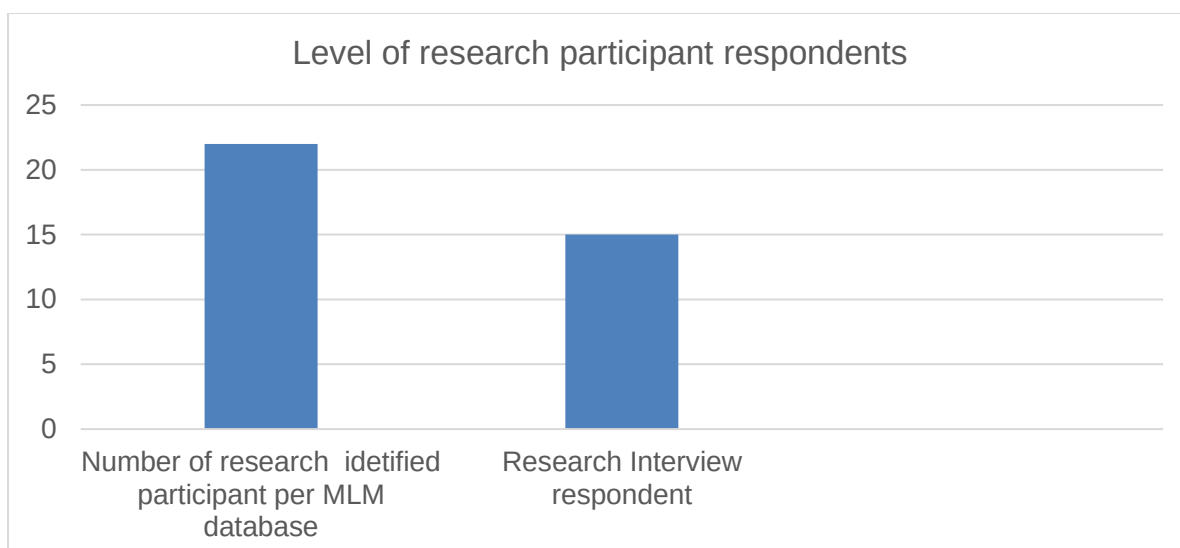


Figure 4-19: Level of research participant and respondents.

4.3.1 Barriers and opportunities identified by the MLM on the implementation of its IWMP

RO 2 identifies the opportunities and barriers to implementing MLM's IWMP. Table 4-2 provides research participants (MLM) identified barriers and opportunities per each goal of the MLM IWMP goals.

Table 4-2: Emerging themes/concepts on barriers and opportunities identified by the MLM.

Goals	Themes on barriers	Themes on opportunities
Goal 1: Promote recycling and recovery of waste	• Lack of support to recyclers by MLM due to lack of budget. • Non-compliance by recyclers with the law (operating in areas not permissible for waste recycling activities). • High transportation costs and lack of access to the recyclables market within the Province.	• Recyclable material is available for small, medium and micro enterprises (SMMEs) to grow their business (landfills receive 7000 tons monthly, and recovery and diversion is only 30%). • Dropoff zones provide opportunities for recyclers to recover recyclables for free. • SMME development and green job creation in recycling.

Goals	Themes on barriers	Themes on opportunities
		• Opportunity for waste recovery and diversion. • Creation of a clean environment. • Landfill site lifespan prolonged.
Goal 2: Ensure the effective and efficient delivery of waste services	• Road infrastructure conditions and distances in rural areas, mainly gravel, unsuitable for MLM trucks (most villages are remote areas). • Inadequate collection vehicles and skip bins for drop-off centres.	• Creation of a clean environment. • Job creation through the Expanded Public Works Programme model. • Uphold constitutional environmental human right. • Avoid illegal dumping and the socio-ecological and economic implications associated with illegal dumping.
Goal 3: Ensure that legislative tools are developed to deliver on the Waste Act and other applicable legislation	• Lack of enforcement and compliance. • By-law is old and needs to be reviewed. • Untoward mindset and attitude of communities.	• Change of attitude through fines on the amendment of the by-law. • Improvement of environmental quality. • Less dumping and littering.
Goal 4: Sound budgeting and financing of waste management services	• Insufficient budget for waste infrastructure and resources. • Waste is not prioritised within the MLM and is always allocated less budget than other units. • Waste revenue is not ringfenced.	• Opportunity for more revenue collection (waste generating a lot of revenue within the whole district, between R9 million to R10 million annually). • Increased budget for waste management. • Procurement of more waste equipment and resources to

Goals	Themes on barriers	Themes on opportunities
		improve waste collection services.
Goal 5: Ensure the safe and proper disposal of waste	• Lining requirements are expensive. • Lack of suitable and certified engineers for landfill lining requirements. • Lining material manufactured outside the Province, i.e., in Cape Town, increases the cost of lining. • High waste volumes are still disposed of at landfill sites. • The MLM's supply chain management procurement process and requirements for broad-based black economic empowerment lead to the appointment of inexperienced contractors, especially in landfill site lining.	• Compliance with legislation. • Underground water protection via lining.
Goal 6: Education and awareness	• Lack of capacity for door-to-door education and awareness activities. • No budget for education and awareness material.	• Change of mindset and behaviour. • Creation of a clean environment. • Information sharing on the creation of recycling projects (SMME development and job creation).
Goal 7: Compliance and enforcement	• Lack of compliance and enforcement.	• Change of mindset and behaviour, especially on illegal dumping and littering.

Goals	Themes on barriers	Themes on opportunities
	• Lack of human capacity with compliance and enforcement knowledge. • The unwillingness of internal law enforcement to enforce waste by-law.	
Goal 8: Reporting on monitoring the implementation plan for Goal 8: Compliance and enforcement	• Oversight for annual reporting.	• Improve the implementation of the IWMP. • Identify gaps and intervention measures.

Aligned to RO 2 which aimed at exploring the opportunities and barriers to implementing MLM's IWMP. Table 4-3 provides research participants (implementing partners) identified barriers and opportunities per each goal of the MLM IWMP goals.

Table 4-3: Emerging themes/concepts on the MLM IWMP implementation barriers and opportunities identified by implementing partners.

Themes on barriers	Themes on opportunities
No or lack of monitoring on the implementation of the IWMP by the MLM.	Establishment of waste processing plant by MLM.
Unskilled technical position appointments	Creation of a clean environment.
Political interference and corruption.	Enhance tourism through a clean environment.
Insufficient budget for waste infrastructure and resources.	Illegal dumping conversion to recreation facilities (parks or open-door gyms).
Poor planning, transport breakdowns and poor infrastructure maintenance.	SMME development and job creation.
Lack of skilled human capacity and unskilled technical position appointments.	Change of mindset and behaviour, especially on illegal dumping and littering.
Unreliable service and collection frequency challenges and lack of rural waste collection.	Information sharing on the creation of recycling projects (SMME development and job creation).

Themes on barriers	Themes on opportunities
Lack of community education and awareness.	Establishment of waste processing plant by MLM.

Figure 4-20 and 4-21 provides for the Summary of the barriers and opportunities identified by research participants on implementing the MLM IWMP.

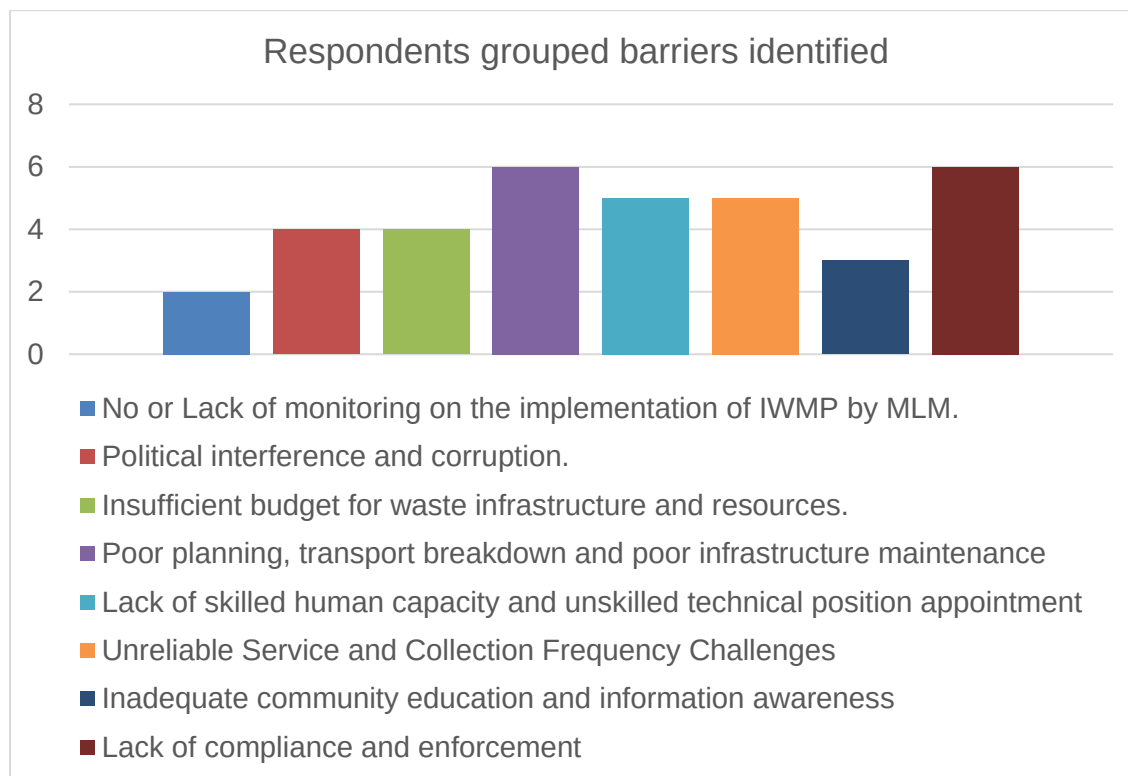


Figure 4-20: Respondents grouped barriers identified.

4.3.1.1 No or lack of monitoring on the implementation of the IWMP by the MLM

Although Goal 8 in the MLM IWMP talks about the reporting on monitoring of its implementation, there is no monitoring of its IWMP by the MLM as there is no annual monitoring report developed in terms of section 13(3) of the Waste Act. Research participants identified this as a barrier as there is a further lack of monitoring of the effectiveness of the MLM's waste management programmes, such as education and awareness initiatives. While some appreciate and recognise the little that the MLM is doing, the lack of monitoring has been to the detriment of the little effort, especially where the projects are implemented by community members such as private organisations. Molaba, 2019 added that the failure to monitor implementation by the provincial department condones poor performance by the local government in implementing the IWMP (Molaba, 2019).

The main monitoring activities the MLM has invested in are the landfill site's general management and groundwater monitoring. There has been an attempt to standardise the

borehole water analyses from the site since its establishment. The interviews with key management personnel indicate that this has been strictly adhered to and complied with, mainly to comply with the landfill licence condition.

The Waste Management Licence stipulates that borehole water monitoring should be conducted quarterly. Internal and external audits are conducted to monitor the landfill site operations per the licence conditions. External monitoring facilitates the lack of capacity that may be experienced by internal monitoring to cover all aspects of monitoring comprehensively and to show integrity and reduce public doubt and suspicion, where external monitoring will be able to disclose all facts and figures as is in the landfill site.

Failure to monitor the implementation of the IWMP by the MLM in itself is a direct violation of section 13(3) of the Waste Act, which provides that;

“an annual performance report on the implementation of the IWM plans must, in the case of the annual performance report prepared in terms of section 46 of the Municipal Systems Act, contain information on the implementation of the municipal IWM plan, including the information set out in paragraphs (a) to (j) of subsection (2) insofar as it relates to the performance of the municipality” (DEA, 2008).

According to Stem *et al.*, 2005, there is a growing recognition among practitioners and scholars that good project management is integral to well-designed monitoring and evaluation systems. It is defined as a continuing function that uses systematic data collection on specified indicators to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in using allocated funds (Stem *et al.*, 2005).

According to Stem *et al.*, 2005 the lack of monitoring of its IWMP implementation by the MLM demonstrates a clear narrative that the MLM is not improving in its general implementation of the IWMP and the recognition of this barrier by participants is well grounded.

MLM officials claimed there was an oversight regarding this failure to report on its implementation of their IWMP. Reporting and monitoring of the IWMP is not done adequately (Mautla, 2022).

4.3.1.2 Political interference and corruption

This barrier was identified during interviews with external research participants, not MLM officials. According to Naidoo, 2009, politics generally influence municipalities, and such influence cannot be underestimated. Solid waste management is not a priority in South Africa but has recently gained considerable attention. Interviews with MLM officials have established that, as argued by Naidoo, 2009, waste management is not prioritised in the municipality,

especially for budget purposes compared to other services. The emphasis has always been on necessities such as potable water, safe sanitation, electricity, and road infrastructure (Naidoo, 2009).

Political interference in the administration of service delivery is a serious problem in many municipalities, including the MLM, as claimed by research participants, and it is experiencing serious challenges in dealing with the interface between politicians and officials. Inappropriate political interference in administrative matters strained relations between key political and administrative officials in the municipalities. Molaba, 2019 further argued that due to lack of knowledge, the support by councillors in implementing IWMPs is sometimes very poor in some municipalities (Molaba, 2019).

Political interference in the administration, especially in budgeting, has manifested in the municipality, mainly in the prioritisation of budgets. Although there was reluctance to detail how political interference affects the implementation of the IWMP and service delivery in detail from internal and external research participants, there is, however, a general feeling and understanding that, at times, political preference takes precedence over service delivery requirements. It is, therefore, difficult to divorce political interference with corruption. A typical example narrated by one of the external participants is the appointment of entrepreneurs who were expected to recover waste directly from landfill sites. Regardless of their successful application, they still have no access to recover waste from the landfill due to political interference. However, they can buy from one cooperative diverting directly from the landfill site.

4.3.1.3 Insufficient waste management budget

Insufficient funding, inadequate budget allocation, and budgetary constraints seem to be common reasons that impact the implementation of IWMPs (Mautla, 2022). Molaba, 2019 records that the IWMP may be in place, but the availability of funds or resources is a major challenge in the municipality (Molaba, 2019).

One important reason why waste management is a challenge for authorities in developing countries is the burden posed on municipal budgets because of the high costs associated with its management. Municipalities have failed to manage waste due to financial factors, as a huge expenditure is needed to provide the service. The absence of financial support, the unwillingness of the users to pay for the service and the lack of proper use of economic instruments have hampered the delivery of appropriate waste management services in South African municipalities, including MLM (Guerrero *et al.*, 2013).

Municipal waste service departments often experience problems in their current waste collection systems that can be linked to poor institutional practices (Fakoya 2014). However,

MLM expressed insufficient funds as a major problem. This is concerning because MLM officials say the municipality collects waste revenue of about R9 million to R10 million annually. While this is still very low, it is claimed to be the best-performing municipality in this area in the Vhembe District Municipality.

Although the MLM has recently procured a new waste management fleet, the operational expenditure, such as fuel and maintenance, is persistent. The administrative or procurement procedures for approving parts and equipment purchases when there are funds also hamper the procurement in time. The increase in the cost to maintain waste management-related equipment, infrastructure, fleet, and fuel has worsened and compromised the MLM waste management's sufficient budget availability for waste services.

While Fakoya (2019) noted that municipalities in developing countries usually spend between 20 to 50 per cent of municipal expenditure on solid waste management service delivery, this is not the situation with MLM, which ultimately results in a low level of service provision. Poor waste service recovery deters further effective waste management behaviour within MLM. Although MLM is charging private disposal fees, it is not charging reflective tariffs equivalent to the cost spent in the general disposal and management of the landfill site. Like other rural local municipalities, MLM faces community resistance to increasing cost-reflective tariffs annually. MLM receives its budget from the national government's medium-term allocation through the provincial treasury. The poor waste service recovery challenges have made operational expenses such as capital expenditure, maintenance, and fuel unrealistic.

4.3.1.4 Poor planning, transport breakdown and poor infrastructure maintenance

"If you fail to plan, you are planning to fail!" is a quote by Benjamin Franklin. According to research respondents, especially the MLM implementing partners, this is the reality with MLM planning.

The ability of MLM to provide effective waste management services has been made worse by the deterioration in the solid waste infrastructure. According to municipal officials, the recent procurement of a new fleet was expected to absorb waste collection pressure; however, there are still more areas and communities, especially in rural areas, that are either communal or not serviced. Waste from the communal serviced areas still requires frequent collection as skip bins get full quickly.

Research participants, especially external ones, feel that poor maintenance planning and poor infrastructure, if not lack of available waste infrastructure such as waste transfer stations and transport/equipment, are the main drivers of poor waste services and MLM IWMP implementation. The landfill site is in the MLM township and is at a distance that is not accessible to all MLM residents and waste generators.

The vehicles and equipment used in waste collection processes are also deemed inefficient because of the distance. Some of these vehicles are not designed for long and stop-and-go distances and are not near disposal sites. These trends have turned off their effective use, often resulting in a short lifetime. This was further confirmed during the interview with MLM officials that distances between some villages in remote areas and gravel roads make it difficult for their vehicles to access.

According to MLM officials, although there is an existing plan and schedule for collection, it is always difficult to plan for the collection route with limited vehicles. At times, the available ones also spent time at the depot for maintenance or breakdown.

These barriers are not new, as Viljoen *et al.*, 2021 recorded that municipalities face many obstacles with waste collection due to lack of proper equipment, infrastructure, and treatment centres. These obstacles lead to further problems, such as littering and illegal dumping, especially in remote and rural towns of South Africa (Viljoen *et al.*, 2021).

4.3.1.5 Lack of skilled human capacity and unskilled technical position appointment

According to Mautla, 2022, insufficient human resource capacity is a problem in implementing the IWMP (Mautla, 2022). While the MLM believes there is sufficient skill within the municipality, research participants believe that the shortage of skilled and qualified staff in MLM is often the reason for inefficient, ineffective and unsustainable waste management services in general and poor implementation of the IWMP. The two municipal incumbents directly involved in the day-to-day business of waste management in the MLM have nine to 14 years of experience and the required academic competence. However, they are often supported by unskilled personnel, which, according to the research external participants, is insufficient and compromises the required standard. Furthermore, the technical capacity in this case is not equivalent to the general demands and the size of MLM.

During the interviews with the MLM officials, it was indicated that a process is underway to review the waste management structure, hoping to create additional technical positions to support the existing ones. This review is also to address the existence of discrepancies between the job requirements and actual qualifications. The current challenges/constraints affecting IWMP planning at local municipalities include capacity building of employees and recruiting capable and qualified staff. The greatest challenge can be inadequate knowledge among waste management officials in implementing the IWMP, especially supervisors, who are the first line in enforcing the IWMPs (Molaba, 2019).

There is an appropriate structure with a clear definition of roles and duties per the demands of individual staff members within the MLM waste section. Such structure includes clear job descriptions to achieve efficient waste service delivery. Although some officials, due to age

and other factors known to them, are reluctant to be capacitated, the MLM has further put in place training interventions such as bursaries for the existing staff who lack the required technical skill to capacitate them to a satisfactory level to perform their duties as expected. The training intervention in place is further meant to address the inadequate human capacity to handle technical matters.

4.3.1.6 Unreliable service and collection frequency challenges

MLM's total population has decreased from 516 031 in 2011 to 416 728 due to the new demarcation of the municipal boundaries. The number of households has also dropped from 134 889 to 116 371. At the same time, the number of households without refuse removal sits at 99 104, equivalent to 85.1% of its total households in 2021.

MLM generate most of the waste from households and businesses. According to municipal officials, MLM collects approximately 190 tons per week from its main township, about 90 tons weekly from the Waterval region, about 65 tons from the Dzanani region, and about 25 tons from the Luvuvhu region. The total monthly waste collection is approximately 1 425 tons, translating to 17 098 tons per year. All this waste is collected by both compactor and skip loader trucks.

Dlamini *et al.*, 2019 argued that the ability of local authorities to provide effective waste management services in South Africa has been made worse by the deterioration in the solid waste infrastructure (Dlamini *et al.*, 2019). The waste collection in MLM, Dzanani, and Waterval townships is mainly curbside, while other areas are collected through communal skips or drop-off centres. The frequency of waste collection is once a week in the townships, while it is expected that the same frequency is applied in the other areas, mainly rural, where waste is collected through skip drop-off centres; however, this is often not the case. This inefficient waste collection is often visible through skips that are full and not collected, with waste lying around the skips for some days, if not weeks. MLM relies on communities or its councillors in communal skip waste collection areas to report if the skips are full for collection; however, failure by communities and councillors to report results in waste not being collected, causing nuisance and environmental pollution.

According to Fakoya, 2014, many rural municipalities commit the mistake of purchasing large numbers of vehicles for collection that are not designed for long stop-and-go distances, which is the case with MLM in this regard (Fakoya. 2014). MLM lacks transfer stations where waste can be recovered, and only non-recyclables can be transferred to the waste disposal facility, reducing the distance and loads of their compactor and skip loader trucks. This results in more breakdowns, unreliable frequency and collection service challenges.

4.3.1.7 Inadequate community education and information awareness

According to Molaba, 2019, the respondents said that the IWMP had not undergone the public participation process as mandated and that the consultant had presented to the local municipality's mayor only (Molaba, 2019). Some IWMPs did not include comments received from the public. Fifteen respondents (75%) did not know whether the process occurred, while only one respondent (5%) indicated that the IWMP had undergone a public participation process. However, from the IWMPs reviewed, there is no indication or evidence that a public participation process was undertaken at any of the four municipalities as part of the IWMP development process.

Interviewees with MLM pointed out that education and awareness programmes such as Adopt-a-School, where five schools have already been adopted, the Nakisani Vhupo programme, the greenest municipality competition, the executive mayor quarterly imbizos and monthly environmental education and awareness are in place. The research participants outside the municipality believe the municipality can do more, especially communicating with the communities in time. They must include broader stakeholders for it to be meaningful and impactful.

Kubanza and Simatele, 2019 argued that education and awareness are the keys to establishing environmental consciousness and conservation (Kubanza and Simatele, 2019). However, the impact of the education and awareness programme was further highlighted by the municipal officials, who expressed their disappointment in the change in attitudes and behaviour of the communities.

In this age of technological advancement, it is surprising that research participants believe that MLM is not fully exploiting platforms such as social media and their website to enhance public awareness. While others felt that MLM could use newsletters for education and awareness, the municipality indicated during the interview that newsletters have no budget. Molaba, 2019 further argued that knowledge and information dissemination could be major stumbling blocks in implementing IWMPs (Molaba 2019).

Other research participants has expressed frustration with how MLM invites them to the workshops or awareness programmes as follows:

“The municipality does not include everyone in their activities like awareness. Some get the invitation but I don’t and I only hear about the workshops from other people”

And

“MLM must change the strategy on how to conduct education and awareness programme. People attend these activities because municipality is providing food and T-shirts. People still go and dump waste after cleaning campaigns”

And

“I was not involved in the development of this IWMP. I don’t know what it is all about. They don’t contact us because they have their own people they invite”

4.3.1.8 Lack of enforcement and compliance

Radzilani, 2019 found that compliance and enforcement in many municipalities is a challenge and failing to enforce compliance affects the implementation of the IWMP. According to Radzilani, 2019, the lack of enforcement could be due to a lack of resources (Radzilani, 2019).

Misunderstanding the functions, responsibilities, and powers of specific levels of the MLM is a major obstacle that limits effective compliance, enforcement, and monitoring. There is a lack of enforcement and compliance with legislation, including waste by-laws, in the municipality. Municipal waste management officials have already demonstrated a lack of capacity and skills. They have since requested to be trained as peace officers, and their request was not approved. The motivation for disapproval had always been the existence of the municipal traffic department that could assist with the enforcement. It was indicated that the traffic department was then requested to assist and demonstrated a lack of willingness to carry such responsibilities. According to the research participants, this has led to widespread illegal dumping and littering.

It must be noted that this failure by MLM to carry this mandate is interfering with the Bill of Rights, as enshrined in the Constitution, which provides in section 24 that a community has the right to live in an environment that is not harmful to their health and wellbeing (Fakoya, 2014).

4.3.2 Gaps in the IWMP Implementation Plan and IDP

While research participants did not identify this, upon review of the IWMP Implementation Plan, the researcher established misalignment of some goals, status quo, target and/or actions. By nature of the IWMP, the status quo informs the municipality of the existing gaps in its IWM system. The status quo informs goals, targets, and actions. This misalignment is also an attribute to the negative performance of implementing the IWMP. A typical example is the target of establishing e-waste recycling, but the action talks to discourage people from referring garden waste to landfill sites. According to Mautla, 2022, the successful implementation of the IWMP depends on the quality of the implementation plan, of which the MLM IWMP Implementation Plan has gaps in its content and quality (Mautla, 2022).

A target related to investigating waste-to-energy options contained the action that talks to the private sector or a partnership commencing e-waste recycling. The status quo identified by the IWMP Implementation Plan states, “a *transportation study needs to be conducted to optimise waste collection*”; however, this fits to be at least a target or action or the grammar used could have been a status quo reflective.

The IWMP is implemented through an implementation plan, which needs to be incorporated into the IDP as a sector plan. Upon review of the IWMP and its Implementation Plan and IDP, it was established that only for IWMP linked projects are incorporated into the IDP, which are the distribution of refuse bags to townships and villages, extending the waste collection to villages, refurbishment of six drop-off points, the establishment of a new landfill site and rehabilitation the old Vondeling landfill site. It must be noted that the rehabilitation of the old Vondeling landfill site is not in the IWMP but is included in the IDP. Many IWMP-identified projects for 2018 to 2023 are not integrated into the IDP. This was further identified by Mautla 2022 when evaluating the Drakenstein Local Municipality's monitoring and review of its IWMPs (Mautla, 2022).

4.3.3 Opportunities towards implementation of MLM’s IWMP

During the interviews with all the research participants, there was an admission that opportunities were gained and/or lost in either successful implementation and/or failure to implement the municipal IWMP. This is because, as argued by Kubanza and Simatele, 2019, SWM is a major environmental challenge to communities in both developed and developing countries (Kubanza and Simatele, 2019). Figure 4-21 introduces the opportunities as identified by research participants.



Figure 4-21: Respondent-grouped opportunities identified.

Poor waste management threatens the well-being of communities through infectious diseases. It undermines the efforts to sustain the environment and the aesthetic appeal of tourism attraction centres and the tourism industry from creating a clean environment. In this case, the successful implementation of the MLM IWMP holds the opportunity to develop and improve environmental quality while attracting tourists.

Sustainable waste collection further assists the municipality in creating an opportunity to clean up illegal dumping and littering and establish recreational facilities like parks and park-based gyms. This, in turn, increases social and health benefits to municipal residents.

According to the IDP, in 2011, the MLM had an economically active population of 118,469, representing about 21.60% of the entire population, with a total of 70088 unemployed or discouraged work seekers in 2012. The interviews with all participants have further established that 70% of waste collected by the MLM is disposed of in the landfill site while only 30% is recovered and diverted. The municipality has again indicated huge opportunities for SMME development and green job creation to contribute to municipal micro-economic development and poverty alleviation.

MLM and its recyclers have indicated that the recyclable market is challenging as they must transport recyclables mainly to the Gauteng Province. The existence of formal and informal recyclers in the MLM provides an opportunity to investigate the viability of establishing its waste processing plant as identified in its IWMP. This will further create jobs and improve micro-economic development.

The existence of recyclers in the MLM further provides an opportunity for waste diversion and recovery, thereby implementing high levels of the waste management hierarchy. This, in turn, means compliance with legislation and national priorities on waste minimisation, recovery, diversion, and the CE, as detailed in the 202 NWMS. Waste minimisation, recovery, diversion, and the CE will further assist the MLM to save landfill airspace and prolong its lifespan (DFFE, 2020).

The participation of both recyclers and SMMEs in green space within the MLM and the IWMP target to extend waste services to new development presents an opportunity for the MLM for additional waste-related revenue collection. This might lead to waste management being allocated additional or sufficient budget for waste collection and other related services.

4.3.4 Areas of improvement

Research participants further identified areas where the MLM must improve; the summary is provided in Figure 4-22.

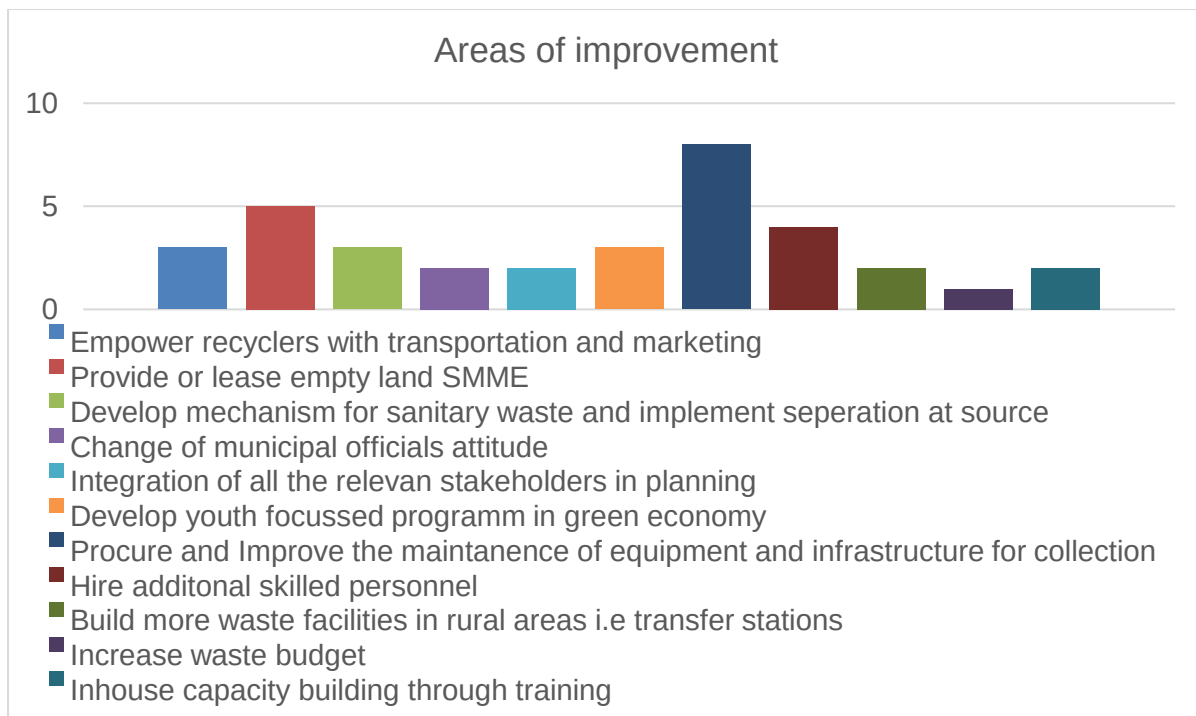


Figure 4-22: Areas where the MLM must improve.

4.4 Conclusion

This chapter discussed the results related to the study's aim, RO1 and RO2. Figures 4-1 and 4-2 presented show 22% conformance in implementing all the goals based on each goal's activity performance. The results show 30% partial conformance and 48% non-conformance in implementing the MLM IWMP. The possible barriers and opportunities were explored. While the MLM IWMP, IDP, waste by-law, and MEC endorsement formed part of the documents reviewed, the SDBIP and annual municipal performance reports were unavailable to the researcher.

Opportunities were also identified, such as MLM's establishment of a waste processing plant, a clean environment, enhanced tourism through a clean environment, SMME development and job creation and waste recovery and diversion, which prolong landfill lifespan by saving airspace.

The document review further revealed critical gaps in the IWMP Implementation Plan, the primary driver of IWMP implementation. Some of the targets and actions of the Implementation Plan are misaligned with the goals and do not relate to each other, i.e., the target associated with the establishment of e-waste recycling, but the action talks to discourage people from referring garden waste to landfill sites.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study aimed at exploring the opportunities and barriers in implementing the MLM IWMP with the specific objectives being:

To determine the extent to which MLM has implemented its IWMP and identify the opportunities and barriers towards implementation of MLM's IWMP. The preceding chapters have set out the context of the study, the literature review conducted, what questions the study aimed to answer to achieve its study objectives and the findings generated from the data collection. This chapter provides critical conclusions and recommendations in line with the specific objectives and further provides recommendations on identified research gaps in the waste management planning body of knowledge for effective service delivery.

This chapter provides critical conclusions and recommendations on exploring the opportunities and barriers to implementing the MLM IWMP. This chapter further provides recommendations on identified research gaps in the waste management planning body of knowledge for effective service delivery.

5.2 Conclusion to the dissertation (Research review)

IWMP planning is essential for designing or improving a waste management system (Mautla, 2022). The plan provides the municipality with an understanding of its performance of waste management services to its stakeholders. It further allows the municipality to assess current waste management practices (situation analysis), identify gaps, and consider and evaluate intervention programmes or options suitable for the desired end state, resources availability and required implementation timeframes.

The development and implementation of the IWMP date decades back and are currently a legislative requirement in terms of section 12 of the Waste Act. It is a five-year plan that must be reviewed after five years of implementation. It is implemented by integrating its implementation plan into the IDP as a sector plan (Fakoya, 2014).

Municipalities are required, in terms of section 13 of the Waste Act, to report on an annual basis of their IWMP implementation before the five-year review. The annual reporting assists the municipalities in identifying areas of success and gaps in the implementation performance and identifying and applying intervention measures for better waste management services. The monitoring and review phase is one of the essential steps that municipalities must undertake to evaluate how the IWMP is performing (Molaba, 2012; Mautla, 2022;).

This research aimed to explore the opportunities and barriers in implementing the MLM IWMP with the specific objectives of determining the extent to which MLM has implemented its IWMP and identifying barriers and opportunities.

A qualitative approach was applied to address the research aim and objectives, document review and open-ended questionnaires and observations were further applied for data collection. Open-ended questionnaires explored the barriers and opportunities in implementing the IWMP. The observation method and document review were additionally used to verify and confirm the level of implementation after the interviews. A content data analysis method was applied to analyse the data collected.

Although there were limitations on the availability of certain documents such as annual reporting reports and the SDBIP, the targeted research documents for review focused on the IWMP document, IDP, and waste by-laws obtained and readily available from the municipal offices and officials, library, municipal website, and internet.

All the methods used for data collection provided the research outcomes and findings. The critical outcome was that the MLM is partially conformance in the implementation of its IWMP. The partial conformance can be attributed to barriers identified, such as the non-existence of annual reporting, which serves as implementation progress tracking, lack of capacity within the municipality, insufficient budget allocated for waste management services because of lack of prioritisation of waste services compared to services like water, sanitation housing and electricity. Non-annual reporting is a contravention of and non-compliance with section 13 of the Waste Act and section 46 of the Municipal Systems Act (Fayez, 2012).

Opportunities were also identified, such as MLM's establishment of a waste processing plant, creation of a clean environment, enhanced tourism through a clean environment, SMME development and job creation, and waste recovery and diversion, which prolong landfill lifespan through saving the airspace.

The document review further revealed critical gaps in the IWMP Implementation Plan, the primary driver of IWMP implementation. Some of the targets and actions of the Implementation Plan are misaligned and do not relate to each other, i.e., targets associated with the establishment of e-waste recycling - however, the action talks to discourage people from referring to garden waste to landfill sites.

5.3 Conclusions related to the research objectives

This section outlines conclusions regarding the two research-specific objectives and conclusions grasped through document review, open-ended questionnaires, and observations.

RO 1: Determine the extent to which MLM has implemented its IWMP.

RO 2: Identify the opportunities and barriers to implementing MLM's IWMP.

Conclusions on research objective 1: Determine the extent to which MLM has implemented its IWMP

This study can conclude that the extent of MLM IWMP implementation is overall non-conformance, and the municipality performed poorly in certain goals, targets, and actions of the Implementation Plan. Table 4-1 summarises the extent of implementation of the MLM IWMP. Similarly, Muswema, 2012 and Polasi et al., 2020 concurs that the implementation of IWMPs at local level remains a concern (Muswema, 2012 and Polasi et al., 2020). Equally and according to Kolaventi, 2021, challenges against implementing IWMPs include a lack of supporting data, the relevance of the IWMP, financial and human resources, skills & knowledge and public participation (Kolaventi, 2021).

Nengwekhulu, 2009, Ntliziywana, 2017, and Motubatse et al., 2017 has found that municipalities in the country have identified a number of stubborn service delivery and governance factors which includes among others, huge service delivery and backlog challenges, poor communication and accountability relationships with communities, political interference with administration process including corruption & fraud, poor financial management, weak civil society formations, lack of skills and serious poor leadership (Ntliziywana, 2017). Similarly, the overall conformance level of certain goals of MLM IWMP implementation could be attributed to the same factors, mainly the:

1. Lack of annual reporting on implementing the IWMP as required by section 13 of the Waste Act and section 46 of the Municipal Systems Act. The findings by Mautla, 2022 further revealed that municipalities in the Fezile Dabi District are not reporting on implementing their IWMPs, similar to MLM.
2. Gaps and misalignment between the IWMP and the IDP. Misalignment of the goals, targets, and actions of the IWMP Implementation Plan. There is no integration of certain goals of the IWMP Implementation Plan into the IDP. As argued by Mautla, 2022, the IWMP goals, targets, and actions to be set are aligned with each other and implementable, as discussed by Mautla, 2022.
3. Lack of sufficient budget allocated to waste management because of low prioritisation of waste management in the municipality compared to services such as sanitation and electricity, among others.

Conclusions on research objective 2: Identify the opportunities and barriers to implementing MLM's IWMP

Regarding the barriers and opportunities experienced by MLM in implementing its IWMP, research participants identified areas listed in Tables 4-2 and 4-3.

In addition, the failure to integrate certain projects and budgets into the IDP from the IWMP impeded the implementation of the IWMP. These barriers align with other authors' findings (Mautla, 2022).

5.4 Contribution to the body of knowledge

While prior studies have generally focused on the importance of the development and implementation, including the evaluation of the IWMP and compliance with the provisions of the legislation, such studies further emphasised the need to explore the extent of IWMP implementation within municipalities (Muswema 2012, Molaba, 2019 and Mautla, 2022).

Simialarly, Sango et al., 2016, argued that the development of an IWMPs over the last 20 years in South Africa indicates a positive shift towards waste management by municipalities. However and unfortunately there has been a limited detail on implementation of these plans and its adopted strategies due to among others lack of infrastructure, budgetary and human capital capacity needs (Sango et al. 2016).

Several studies and research have been conducted on IWMPs, but there are still gaps in the opportunities and barriers to IWMP implementation, specifically in MLM (Muswema, 2012; Molaba, 2019; Mautla, 2022). This study seeks to close this identified knowledge gap using MLM's IWMP.

5.5 Recommendations

The research concludes by providing a programme of action for improving the implementation performance of the IWMP. It will further enhance the IWMP integration into the IDP to improve the overall municipal basic service delivery performance, especially waste management. Recommendations for further research and those raised by the study respondents are included herewith.

Recommendations related to the research objectives

5.5.1 Recommendations on research objective 1: Determine the extent to which MLM has implemented its IWMP

Monitoring adequate IWMP implementation is critical in exploring the opportunities and challenges for constant improvement (Fayez, 2012; Muswema, 2012; Molaba, 2019; Mautla, 2022). However, document review revealed that the annual reporting on the implementation

of the IWMP, as provided for in terms of section 13 of the Waste Act and section 46 of the Municipal Systems Act, is lacking due to the unavailability of the annual reports. Therefore, the MLM must start reporting annually on the implementation of the IWMP. This will assist the MLM in tracking the implementation performance and progress, identifying gaps and challenges, and developing intervention measures relevant to the gaps and challenges.

The MLM IWMP was developed and approved in 2018 and is due for review by the end of 2023. Therefore, the MLM should commence with a process that will necessitate the review in time, such as drafting project terms of reference.

The municipality must ensure that the goals, targets, and actions to be set during the review are realistic to its available resources and that the goals, targets, and actions to be developed are aligned with each other and implementable, as argued by Mautla, 2022.

After reviewing, the MLM must integrate the IWMP into its IDP as a legislative requirement. The MLM must continue to implement the IWMP and continue with annual reporting of its second-generation IWMP for ease of review into the third generation.

Mautla, 2022 further proposed that when integrating projects from the IWMP Implementation Plan into the IDP and SDBIP, it is advisable to use the same names and project descriptions to be easy to identify when reporting and tracking progress. Mautla, 2022 further suggested that public participation should not be a once-off process (during the IWMP and IDP adoption process). It should also be conducted during the review of the IWMP and when there has been a significant amendment to the IWMP document (Mautla, 2022).

By-law amendments claimed to have commenced in January 2018 must be completed urgently to ensure compliance within the municipality.

Other research participants has expressed frustration regarding their participation in the development of the MLM IWMP as they claimed not to have been notified of the process. It is therefore recommended that MLM consult and engage with its communities in the review and update of the 2018 IWMP of which the review process is aimed to start by end of 2023.

The government of South Africa has developed a specific program aims at supporting the micro and small enterprises in the recycling sector. This program promotes integrated solid waste management at local and community levels and committed to improve the formal and the informal recyclable waste workers and waste pickers' socio-economic and social conditions. In addition, South Africa developed the waste picker integration guidelines in 2020 (DEFF, 2020). Municipalities are required to include integration of waste pickers in their plans. It is therefore recommended that the MLM 2023 review of its IWMP considers the role that the waste pickers may play in waste management.

5.5.2 Recommendations on research objective 2: Identify the opportunities and barriers to implementing MLM's IWMP

It is recommended that the MLM consider a long-term plan for staff capacity and upskilling the available personnel. The plan should consider making jobs in the waste management field attractive and competitive. Research should also be conducted to determine staff turnover in the municipal government's waste management sector and identify the causes of the staff turnover (Mautla, 2022). Provisions should be made to allocate an adequate budget and competent personnel in response to insufficient funding and a shortage of human resources and skills capacity. It is recommended that the MLM consider utilising the existing waste management forum to monitor the implementation of IWMP quarterly. An annual review of the IWMP is proposed in line with the IDP yearly review to ensure that changes in technology, policy and waste-related modifications are updated.

5.5.3 Recommendations on areas of improvement based on the interviews

Research participants made the following recommendations as areas of improvement:

1. Empower recyclers with transportation and marketing.
2. Make the empty land and unused buildings available through sale or lease to SMMEs in waste recycling and beneficiation.
3. Develop mechanisms for sanitary waste management and implement separation at source.
4. Integration of all the relevant stakeholders in planning and implementation.
5. Develop a focussed programme on the green economy.
6. Procure and improve the maintenance of equipment and infrastructure for collection.
7. Hire additional skilled personnel and provide in-house capacity building through training.
8. Build more waste facilities in rural areas, i.e., transfer stations.
9. Increase the waste management budget.

5.5.4 Recommendations and areas of future research

The following are the recommended areas for future research:

In 2020 the government developed of South Africa has developed the waste picker integration guidelines (DEFF, 2020). Municipalities are required to include integration of waste pickers in their plans. It is therefore recommended that further research on the role of waste pickers specific to MLM in relation to waste management may be.

Further research on the potential and sustainable means relevant to MLM to integrate waste pickers and inclusion of the informal sector be investigated.

Conduct a study to determine the potential, sustainable and suitable means to provide basic waste service delivery based on the availability of different resources, residential settings (mainly rural and urban) and infrastructure

The skills required at the local municipal level are critical for the effective development, implementation, monitoring, and review of IWMPs – conduct a study to determine the capacity needed to ensure that staffing is adequate for rendering waste management services.

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ANNEXURES

ANNEXURE A: MLM PARTICIPANTS QUESTIONNAIRE

RE: Participant Information Sheet (Interview Questions)

Date: 14 June 2023

Good day,

I am Prince Radzuma, a Master (MSC) student in the Unit for Environmental Management and Sciences School at the North-West University, Potchefstroom. As part of my studies, I must undertake a research project. I am **exploring the opportunities and barriers to implementing the MLM IWMP in the Limpopo Province in South Africa** under the supervision of Dr Phathutshedzo Mukwevho. This research project aims to determine the extent to which the MLM has implemented its IWMP and identify the opportunities and barriers towards implementation of the MLM's IWMP.

As part of this project, I invite you to participate in an open-ended questionnaire interview. The interview will be face-to-face with you at the agreed place and time. It is estimated that the interview will take about 10 - 30 minutes of your time. If you participate in this project, there will be no personal costs. You will not receive any direct benefits from participation, but there are no disadvantages or penalties if you do not participate or withdraw from the study. You may withdraw at any time or not answer any question if you do not want to. The interview will be confidential and anonymous as I will not ask for your name or any identifying information, and the information you give me will be held securely and not disclosed to anyone else. If you experience any distress or discomfort during this process, you can stop completing the interview or resume another time.

The study has been approved by the Faculty of Natural and Agricultural Sciences Research Ethics Committee and classified as a minimal risk category with ethics number NWU-01234-23-A9.

If you have any questions about this research during or after, please get in touch with me at the details listed below. This study will be written as a research thesis and available online through the university's library website. If you wish to see a summary of this report, I will gladly send it to you. If you have any concerns or complaints regarding the ethical procedures of this

study, you are welcome to contact the Senate Committee for Research Ethics at 018 299 4849, Nkosinathi.Machine@nwu.ac.za.

Yours sincerely,



Researcher: Prince Radzuma

Student No: 26325985

Cell: 082 569 7363/Tel: 012 399 9806

Email: radzumap@gmail.com



Supervisor: Phathutshedzo Mukwevho

Cell: 079 406 3812/Tel: 018 299 1581

Email: phathu.mukwevho@nwu.ac.za

Thank you for taking the time to conduct the interview. Before we start, kindly give your consent on the following:

Participant consent

I confirm that the above information was explained to me in a language and manner that I understood. I further confirm that I am older than 18 and now volunteer to participate in the study.

YES	NO
-----	----

Do you consent to the recording of our interview, recordings which will be shared with the supervisor only and with no one else without your consent?

YES	NO
-----	----

Section 1: Demographic Information

Kindly complete the demographic information in the table below:

Participant's Institutional Association (e.g. Government (department/municipality), Academia, Industry. NGO/Civil Society, Other)	
Designation/Position	
Related Experience (Years and months)	

Section 2. Questionnaire interview about the implementation of your IWMP

1. Who developed your IWMP, and what was your role?

Comments:

2. To what extent has the council approved your IWMP?

Comments:

3. Your IWMP identified eight goals to be fully achieved by year five, which is 2023. To what extent have you achieved all these goals?

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
				Document review/interviews/observations	Conformance, partial conformance or non-conformance	
Goal 1: Promote recycling and recovery of waste	Many recyclable materials are going to the landfill site, which is cost-effective (i.e. transportation cost of the material to and from the landfill to the recycling/recovering centre).	Diversion of waste to the landfill site.	Establish at least eight buy-back centres with the current garden refuse sites by partial conversion.			
			Implement sorting and collection of recyclables at source, e.g. curbside recycling programmes. Via by-law amendment, institute recycling. Invite and facilitate small recyclers into the programme.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			Establish recycling drop-off points at all municipal buildings.			
		Established composting facilities.	Encourage companies to establish composting facilities and make available waste for compost.			
		Establishment of e-waste recycling.	Discourage people to refer garden waste to landfill sites.			
			Practice zero garden refuse waste to landfill site by 2021.			
			Facilitate the establishment of e-waste recycling.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
		Investigate waste-to-energy options.	The private sector or a partnership commences e-waste recycling.			
		Provide new service delivery to residential areas as well as its new developments.	Effectively plan to extend service delivery to any new developments within the Municipality.			
Goal 2: Ensure the effective and efficient delivery of waste services	The Municipality should include new developments to provide a waste collection and disposal service.	Amend and optimise the collection route.	Conduct a transportation study to identify and optimise collection routes and the number of service points.			
	A transportation study needs to be conducted to optimise waste collection.	Phase in receptacles to existing development.	Establish receptacle requirements within the Municipality and supply the receptacles to			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			residents to optimise collection efforts.			
	Optimise receptacle use within the municipal area.	Fill current vacant positions.	Effective structure and extension of human resources.			
	Shortages of personnel for waste collection and for the proper management of the disposal facilities.	Employ additional staff to service new areas and to manage management facilities.	Effective structure and extension of human resources.			
	Municipalities have few waste management vehicles and are severely short of collection and disposal equipment. The vehicle fleets must be extended	Compile and maintain. Equipment replacement plan.	Extend and maintain waste collection fleet for service delivery.			
		Purchase required equipment and replace	Extend and maintain waste collection fleet for service delivery.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
	once waste collection services are extended to new areas when they develop. Vehicle replacement plans should be developed.	equipment as and when needed.				
		Maintain equipment.	Extend and maintain waste collection fleet for service delivery.			
Goal 3: Ensure that legislative tools are developed to deliver on the Waste Act and other applicable legislation	The municipality has good legislation (such as Municipal Waste Management By-Law and Waste Management Policy). Still, they are unknown by all concerned/ the citizens of MLM.	Ensure understanding of by-laws by all concerned	Ensure each customer has a printed copy of the by-laws. Proposed amendments commenced in January 2018			
		Ensure understanding of by-laws by all concerned.	Ensure each customer has a printed copy of the by-laws. Proposed amendments commenced in January 2018.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
		Report effectively to the SAWIS.	Collect, sort, collate, analyse, interpret, and report waste volumes to SAWIS. Keep proper records of waste quantities and types received at the waste management facilities.			
			Provide information to LEDET.			
Goal 4: Sound budgeting and financing of waste management services	Improper budgeting and funding of waste management services.	Cost-reflective and volumetric tariffs.	Develop and implement a tariff model (as developed by the DEA).			
		Enhanced revenue collection.	Set up appropriate fund-raising mechanisms.			
			Identify shortages in the budget, identify possible funding sources, and amend the budget accordingly.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			Implement revised budget.			
			Conduct a detailed financial investigation for proper waste management budgeting to ring-fence the service.			
Goal 5: Ensure the safe and proper disposal of waste	Waste diversion from landfill sites is not practised, and the existing Vondeling dumping site is full.	One gas-to-energy plant by 2022.	Investigate the conversion of waste to energy and clean development mechanisms.			
		One composting facility by the end of 2020.	Conduct a study to determine whether the following are feasible: • Establishment of composting facilities • Establishment of building rubble crusher facilities			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
		One material recycling facility by 20200	Stabilise the quantity and investigate the reduction of pollution potential of waste disposed of to landfills and reduce this volume.			
Goal 6: Education and awareness	Illegal waste disposal and littering is a challenge.	Every household should be informed on waste management matters.	Door-to-door education and awareness commencing June 2018. Clean-ups campaigns. Distributions of by-laws and pamphlets with waste information in every household.			
		Educational and awareness strategic plan.	Develop educational and awareness strategic plan. Develop training materials to roll out			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			education and awareness campaigns. Establish a recycling competition at the school level as part of the Nakisani Vhupo Hashu Programme. Recruit environmental/ waste education personnel.			
		Discuss waste recycling challenges and possible solutions. Coordinate waste minimisation, encourage growth in recycling, and discuss	Establishment of a local recycling forum committee. Hosting quarterly forum meetings and workshops.			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
		possible initiatives for or by entrepreneurs.				
Goal 7: Compliance and enforcement	The level of illegal dumping sites is high.	Reduction in illegal dumping and littering.	Review the by-laws and enforce the by-laws. Put signs in the open spaces with fine and toll-free numbers for illegal dumping. Implement fining procedures. Use of designated whistle-blowing facilities. Develop an Illegal Dumping Management Strategy (for example, place mass containers at identified dumping hot spots and establish			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			community watch and incentive schemes). Develop a system for residents to report waste transgressions, for example, illegal dumping.			
		Increase in the number of prosecutions for littering and dumping.	Train the existing relevant waste management personnel as peace officers to practice enforcement.			
	Lack of information about the generation, collection, and disposal of hazardous waste (including medical and industrial waste) within the Municipality.	Development of Industrial and medical waste database.	List or database of all industries and medical waste facilities (including nursing homes and other private institutions) in their area of jurisdiction, with a contact person and an indication of what is			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			being done with their medical/industrial waste not collected by the Municipality, i.e. who collects the waste, how much and where is it being disposed of.			
Reporting on the Monitoring Implementation Plan for Goal 7: Compliance and enforcement	The level of illegal dumping sites is high.	Reduction in illegal dumping and littering.	Review the by-laws and enforce the by-laws. Put signs in the open spaces with fine and toll-free numbers for illegal dumping. Implement fining procedures. Use of designated whistle-blowing facilities. Develop an Illegal Dumping Management Strategy (for example, place mass containers			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
			at identified dumping hot spots and establish community watch and incentive schemes). Develop a system for residents to report waste transgressions, for example, illegal dumping.			
		Increase in the number of prosecutions for littering and dumping.	Train the existing relevant waste management personnel as peace officers to practice enforcement.			
	Lack of information about the generation, collection, and disposal of hazardous waste (including medical and industrial	Development of industrial and medical waste database.	List or database of all industries and medical waste facilities (including nursing homes and other private institutions) in their area of jurisdiction, with a			

Goals	Status/Situation	Target	Action	Method of verification	Conformance	Comments
	waste) within the Municipality		contact person and an indication of what is being done with their medical/industrial waste not collected by the Municipality, i.e. who collects the waste, how much and where is it being disposed of.			

4. What are the barriers and opportunities for implementing the following goals of the IWMP within the MLM?

Goals	Barriers	Opportunities
Goal 1: Promote recycling and recovery of waste		
Goal 2: Ensure the effective and efficient delivery of waste services		
Goal 3: Ensure that legislative tools are developed to deliver on the Waste Act and other applicable legislation		
Goal 4: Sound budgeting and financing of waste management services		
Goal 5: Ensure the safe and proper disposal of waste		
Goal 6: Education and awareness		
Goal 7: Compliance and enforcement		
Goal 8: Reporting on the Monitoring Implementation Plan for Goal 8: Compliance and enforcement		

ANNEXURE B: MLM IWMP IMPLEMENTING PARTNERS QUESTIONNAIRE

Thank you for taking the time to conduct the interview. Before we start, kindly give your consent on the following:

PARTICIPANT CONSENT

I confirm that the above information was explained to me in a language and manner that I understood. I further confirm that I am older than 18 and currently volunteering to participate in the study.

YES	NO
-----	----

Do you consent to the recording of our interview, recordings which will be shared with the supervisor only and with no one else without your consent?

YES	NO
-----	----

Section 1: Demographic Information

Kindly complete the demographic information in the table below:

Participant's Institutional Association (e.g. Government (department/municipality), Academia, Industry. NGO/Civil Society, Other)	
Designation/Position	
Related Experience (Years/Month)	

Section 2: Questionnaire interview about the implementation of the MLM IWMP

1. What was your role in the development of the MLM IWMP?

Comments:

2. What has been your role while implementing the MLM IWMP?

Comments:

3. What have you observed or learned as barriers and opportunities in implementing MLM IWMP?

Barriers	Opportunities
4. To what extent do you think MLM must improve its implementation of the IWMP?Comments:	

5. What support are you getting from the MLM in implementing the IWMP?

Comments:

ANNEXURE C: EVIDENCE OF SOME OF THE WASTE FACILITIES IS PROVIDED



ANNEXURE D: REQUEST TO CONDUCT MASTER RESEARCH IN THE MLM

Mr Mbavhalelo. Kent Nemaname

Municipal Manager – MLM

Civic Centre

No 83 Krogh Street

MLM

0920

Tel: 015 519 3003/063 693 5042

E-mail: municipal.manager@MLM.gov.za

Copy: Humbulanit@MLM.gov.za/ Tshivhula2019@gmail.com

Dear Mr Nemaname

REQUEST TO CONDUCT MASTER RESEARCH IN MLM WITH THE TITLE- “EXPLORING THE OPPORTUNITIES AND BARRIERS IN IMPLEMENTING THE MLM MUNICIPAL IWMP”

This letter requests your permission for Mr. Prince Radzuma to conduct his master’s research in the MLM. Mr Radzuma is a student at the North-West University, Potchefstroom Campus, **student number 26335985**, specialising in waste management. As part of the pre-requisite for graduation, the master’s programme requires Mr Prince Radzuma to conduct research in an area of speciality.

The research requires access to municipal documentation, and most are already in the public domain, namely the IWMP, IDP, IWMP implementation annual report/s, and SDBIP, amongst others. No confidential and/or classified information will be used. The outcomes and recommendations of the study will be shared with the municipality.

It is for the above reasons that this permission is therefore requested, and the approval will be greatly appreciated.

Yours sincerely,

Signature of Mr. Phathutshedzo Mukwevho:

Signature of the student:

Lecture and Research Supervisor

Date:

Date:

ANNEXURE E: ENDORSEMENT OF THE MLM IWMP



MAKHADO MUNICIPALITY

Vision: A dynamic hub for socio-economic development by 2050
Mission: To ensure effective utilization of economic resources to address socio-economic imperatives through mining, agriculture and tourism

Reference : 16/4/1/1
Enquiries : Director Community Services
Date : 11 May 2023

2023-05-15

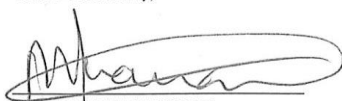
To : P Mukwevho
Lecturer and Research Supervisor (Masters in Environmental Management)
Department of Environmental Sciences
Northwest University, Potchefstroom campus
Contact: 018 299 1581

Dear Sir/Madam

SUBJECT: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY IN MAKHADO MUNICIPALITY WASTE MANAGEMENT.

1. The above matter refers to your letter requesting permission to allow your student Mr Radzuma Prince (Masters student in Environmental Management at Northwest University) to conduct a research study in Exploring the Opportunity and barriers in Implementing Makhado Municipal Integrated Waste Management Plan within Makhado Local Municipality.
2. The permission is hereby granted and the Municipality will assist with required information with regard to your research study request.
3. After receiving this letter, you are requested to visit the municipality (Department of Community Services- Waste Management section) to formally plan on how the study will be executed.

Yours faithfully,


MR. KM NEMANAME
MUNICIPAL MANAGER

11 May 2023
DATE



ANNEXURE F: PARTICIPANT CONSENT

I have read and understood this information document. My questions before answering the questionnaire have been answered to my satisfaction. I know that I am free to request further information at any time.

I know and understand that:

1. My participation in the study is voluntary.
2. My personal information will be kept confidential.
3. I can withdraw from participating in the study at any time.
4. I agree to participate in the study by signing this document. Name of the participant

Name of the participant

Signature

Date