

**Indigenous Solid Waste Management Practices for Sustainable Environment: A
Case of Thalahane Village, Limpopo Province, South Africa**

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A Thesis for the Doctor of Philosophy Degree in Social Sciences

To the

Department of Arts and Social Sciences

Faculty of Humanities, Social Sciences and Education

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2024

DECLARATION

I, **Masila Joshua Masipa**, confirm that this research work for the degree **Doctor of Philosophy in Social Sciences** at the University of Venda is my original work and has not previously been submitted for any degree at any other university. I further confirm that all sources cited or quoted are duly acknowledged by a list of references.



10 November 2023

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Signature

Date

DEDICATION

I dedicate this work to JAHWEH, my God and God of my children, for His grace. I also dedicate it to my late grandfather, Matome Daniel Masipa, and his late wife, Asnath Mosetedi Masipa, for instilling in me a sense of reading at an early age. I also dedicate it to my late parents, Japhet Moditja Masipa, and his wife, Moribula Maria Masipa, for the opportunity they gave me to go to school and for the support they have given me at the tertiary level. My late siblings, Kachipa and Kgokolowa, this is for you. I will always remember you. My sister, Kwena A. Manthata, your prayers have worked wonders.

ACKNOWLEDGEMENTS

I sincerely thank my supervisor, Adv. Prof. P. E. Matshidze, and my co-supervisors, Prof. N. V. Netshandama and Dr. N.V. Mudau, for their mentoring throughout the study. Thanks to Prof. N.V. Netshandama for sharpening my research skills. I am also indebted to Blouberg Municipality, the Honourable Mayor Pheedi, and the Municipal Manager for making municipal solid waste management documents available and accessible for research purposes. Also, I am grateful to Herbert Masipa for facilitating the process of communication with the municipality. Thank you, the people of Thalahane village, especially those who made themselves available for interviews. Thanks go to the local traditional leader, His Royal Highness Chief Molebo. My sincere thanks to my wife, Kwena Ernah Masipa, and our children, Matome, Phuti, and Kachipa Lucky, for giving me space and support during the research period.

ABSTRACT

Solid waste management (SWM) in developing countries remains a challenge due to economic constraints, governance inefficiencies, consumption patterns changing, an increasing population, and subsequent increased waste generation. The study aimed to explore the indigenous solid waste management system of Thalahane village for a sustainable environment since there is an increasing urgency to address the health and environmental implications associated with inefficient solid waste management. The current paradigms of solid waste management are effective in developed countries but ineffective in developing countries due to differences in contexts. To achieve the aim of the study, the following objectives were used: to investigate indigenous waste management practices that the Thalahane local community uses to manage solid waste; to analyse the implementation of a waste management system by the Blouberg Local Municipality in Thalahane village; and to develop an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management. Employing a qualitative method, 65 participants were purposively selected and interviewed using an unstructured interview guide to gather data. The data were analysed qualitatively using a thematic approach. The results show that separation of waste, burying, composting, burning, repurposing, recycling, reuse, reduction, and avoidance are the indigenous solid waste management (SWM) practices within Thalahane village. Some of these solid waste management (SWM) practices have positive effects on the environment and were integrated and adopted to enhance the management of municipal solid waste. The study resulted in a theoretical framework to develop an integrated, sustainable solid waste management system that accounts for indigenous solid waste management practices in Thalahane. The study recommends the design of homegrown solid waste management that incorporates indigenous solid waste management practices for a sustainable environment in rural municipalities.

Key words: *indigenous knowledge, solid waste management, sustainable environment alternative approach, rural municipalities.*

TABLE OF CONTENTS

DECLARATION.....	i
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
TABLE OF CONTENTS.....	vi
LIST OF FIGURES AND TABLES	xv
LIST OF ACRONYMS.....	Error! Bookmark not defined.
CHAPTER 1: INTRODUCTION AND BACKGROUND	Error! Bookmark not defined.
1.1 INTRODUCTION.....	Error! Bookmark not defined.
1.2 BACKGROUND OF THE STUDY.....	Error! Bookmark not defined.
1.3 PROBLEM STATEMENT	Error! Bookmark not defined.
1.4 AIM OF THE STUDY	Error! Bookmark not defined.
1.5 RESEARCH OBJECTIVES	Error! Bookmark not defined.
1.6 RESEARCH QUESTIONS.....	Error! Bookmark not defined.
1.7 JUSTIFICATION FOR THE RESEARCH	Error! Bookmark not defined.
1.8 LIMITATIONS OF THE STUDY	Error! Bookmark not defined.
1.9 DEFINITIONS OF KEY TERMS.....	Error! Bookmark not defined.
1.10 STRUCTURE OF THE STUDY.....	Error! Bookmark not defined.
1.11 CONCLUSION	Error! Bookmark not defined.
CHAPTER 2: LITERATURE REVIEW.....	Error! Bookmark not defined.
2.1 INTRODUCTION.....	Error! Bookmark not defined.
2.2 FACTORS INFLUENCING THE RECRUITMENT AND HIRING PROCESS	Error! Bookmark not defined.
2.2.1 Human Resource Policy of the Organisation	Error! Bookmark not defined.
2.2.2 Nature of the job.....	Error! Bookmark not defined.
2.2.3 The Reputation of the Firm.....	Error! Bookmark not defined.
2.2.4. External Factors	Error! Bookmark not defined.
2.3 MEASURES FOR A TRANSPARENT AND FAIR RECRUITMENT PROCESS	Error! Bookmark not defined.
2.3.1 Overview of the recruitment and hiring processes.....	Error! Bookmark not defined.
2.3.2 Recruitment and selection process	Error! Bookmark not defined.

2.4.1 Application of Recruitment Methods	Error! Bookmark not defined.
2.4.2 Allowing sufficient time for responses	Error! Bookmark not defined.
2.4.3 Screening of applications	Error! Bookmark not defined.
2.4.4 Shortlisting of candidates	Error! Bookmark not defined.
2.4.5 Thanking applicants for applying	Error! Bookmark not defined.
2.5 THEORETICAL FRAMEWORK	Error! Bookmark not defined.
2.6 CONCLUSION	Error! Bookmark not defined.
CHAPTER 3: RESEARCH METHODOLOGY	Error! Bookmark not defined.
3.1 INTRODUCTION	Error! Bookmark not defined.
3.2 RESEARCH PARADIGM	Error! Bookmark not defined.
3.3 RESEARCH APPROACH	Error! Bookmark not defined.
3.4 RESEARCH DESIGN	Error! Bookmark not defined.
3.5 STUDY SETTING	Error! Bookmark not defined.
3.6 SAMPLING, SAMPLING TECHNIQUE AND SAMPLING SIZE	Error! Bookmark not defined.
3.7 DATA COLLECTION PROCEDURES	Error! Bookmark not defined.
3.8 DATA ANALYSIS	Error! Bookmark not defined.
3.9 PRETEST	Error! Bookmark not defined.
3.10 VALIDITY AND RELIABILITY	Error! Bookmark not defined.
3.10.1 Validity	Error! Bookmark not defined.
3.10.2 Reliability	Error! Bookmark not defined.
3.11.1 Confirmability	Error! Bookmark not defined.
3.11.2 Transferability	Error! Bookmark not defined.
3.11.3 Credibility	Error! Bookmark not defined.
3.11.4 Dependability	Error! Bookmark not defined.
3.12 DATA ANALYSIS	Error! Bookmark not defined.
3.13 ETHICAL CONSIDERATION	Error! Bookmark not defined.
3.13.1 Avoidance of harm	Error! Bookmark not defined.
3.13.2 Informed Consent	Error! Bookmark not defined.
3.13.3 Right to Privacy	Error! Bookmark not defined.
3.13.4 Voluntary participation	Error! Bookmark not defined.
3.14 CONCLUSION	Error! Bookmark not defined.
CHAPTER 4: EMPIRICAL FINDINGS	Error! Bookmark not defined.

4.1 INTRODUCTION	Error! Bookmark not defined.
4.2. QUALITATIVE FINDINGS	Error! Bookmark not defined.
4.3 BIOGRAPHICAL DATA	Error! Bookmark not defined.
4.4 THEMES	Error! Bookmark not defined.
4.4.1 Theme 1: Lack of Transparency	Error! Bookmark not defined.
4.4.2 Theme 2: Nepotism	Error! Bookmark not defined.
4.4.3 Theme 3: Incompetency	Error! Bookmark not defined.
4.4.4 Theme 5: Appointment of an independent recruitment body or agency	Error! Bookmark not defined.
4.5 QUANTITATIVE FINDINGS	Error! Bookmark not defined.
4.6 Descriptive analysis of quantitative results	Error! Bookmark not defined.
4.6.1 Demographic profile of respondents	Error! Bookmark not defined.
4.6.2 Views of staff members on the recruitment and hiring processes practice	Error! Bookmark not defined.
4.6.3 Factors influencing the recruitment and hiring processes in Molemole Local Municipality.	Error! Bookmark not defined.
4.6.4 Measures for transparent and fair recruitment and hiring processes in Molemole Local Municipality can be adopted.	Error! Bookmark not defined.
4.7 DISCUSSION OF QUANTITATIVE FINDINGS	Error! Bookmark not defined.
4.7. CONCLUDING REMARKS	Error! Bookmark not defined.
CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS ...	Error! Bookmark not defined.
5.1. INTRODUCTION	Error! Bookmark not defined.
5.2. CONCLUSIONS	Error! Bookmark not defined.
5.3. RECOMMENDATIONS	Error! Bookmark not defined.
REFERENCES	Error! Bookmark not defined.
CHAPTER 1: STUDY OVERVIEW	19
1. INTRODUCTION	19
1.1 Background	19
1.3 Problem Statement	26
1.3.1 The Study Area	28
1.4 Aim of the Study	29
1.4.1 Research Objectives	29
1.4.2 Research Questions	30

1.4.3	Significance of the Study.....	30
1.5	Overview of literature review.....	31
1.6	Meta-theoretical framework	31
1.7	Materials and methods	32
1.8	Delimitations of the study	32
1.9	Ethical Issues	33
1.10	The Study's Theoretical Foundation.....	33
1.10.1	Integrated Solid Waste Management theory.....	33
1.10.2	The DPSIR framework.....	34
1.11	Concept Clarification.....	36
1.12.	Outline of the Study	37
	CHAPTER 2: LITERATURE REVIEW	39
2.1	Introduction	39
2.2	Municipal solid waste management challenges.....	39
2.3	Indigenous knowledge as alternative to 'Western' knowledge	42
2.4	The relevance of indigenous knowledge to human welfare and development	44
2.4.1	IKS in South Africa	46
2.5	Past experiences are a base to current waste practices.....	47
2.6	The concept, waste	50
2.7	How Solid waste is management in developed countries.....	51
2.8	How solid waste is management in developing countries.....	53
2.9	Deportation of the waste problem from land to the ocean	58
2.9.1	The trend and quantity of ocean dumping.....	60
2.9.2	International environmental law as a tool in waste management.....	62
2.9.3	Legal framework on the prevention of ocean dumping	66
2.9.4	The prevention of ocean pollution and global conventions on ocean dumping.....	67
2.9.5	Prevention of ocean pollution and Regional Conventions	72
2.9.6	Observations on Global and Regional conventions on ocean dumping	74
2.9.7	International environmental law and public health	75
2.9.8	International law environmental successes and health protection in developing countries	78
2.10	Gender perspective and waste management	82
2.11	Environmental justice as a tool to protect people and the environment.	84

2.12 Livelihood and waste mismanagement.....	86
2.13 Legislative framework for the environment in South Africa.....	89
2.13.1 Extended producer responsibility in waste management	92
2.13.2 Extended Responsibility Producer in South Africa	94
2.10.3 Extended Producer Responsibility implementation challenges in South Africa	98
2.13.4 Advantages of Extended Producer Regulations	101
2.13.5 Observation on Extended Producer Responsibility	103
2.14 Solid waste management status in South Africa	106
2.15 Solid waste management service delivery in South Africa	106
2.16 Ethics in Solid Waste Management.....	109
2.17 Traditional Moral Theories	110
2.17.1 Ethics	110
2.17.2 Ethical egoism	111
2.17.3 Utilitarianism	112
2.17.4 Kant's deontology.....	116
2.17.5 Virtue ethics	121
2.17.6 Rights ethics	123
2.17.7 Challenges with traditional ethical theories.....	124
2.18 Environmental ethics.....	126
2.19 Waste management ethics	127
2.20 The concept, Indigenous knowledge.....	128
2.21 Indigenous knowledge and sustainable development.....	133
2.21.1 The history of sustainable development.....	133
2.21.2 The concept of sustainable development and its relation to Indigenous Knowledge	135
2.21.3 Indigenous solid waste management practices in Africa	137
2.22 The rationale for using indigenous knowledge in solid waste management.....	138
2.23 The DPSIR framework and solid waste	142
2.24 Theoretical frameworks of the study	148
2.24.1 DPSIR framework	148
2.24.2 Integrated Sustainable Solid Waste Management framework.....	150
2.25 Chapter summary.....	151
CHAPTER 3: RESEARCH METHODOLOGY	154

3.1 Introduction	154
3.2 Area of study	154
3.3 Research design	155
3.4 Study population	156
3.5 Gaining community entry.....	159
3.6 Sampling	159
3.7 Data collection instruments.....	161
3.7.1 Unstructured interviews with members of Thalahane village	161
3.7.2 Interviews of the Municipality waste management staff	164
3.7.3 Observation as data gathering technique.....	165
3.7.4 Focus group discussion.....	165
3.7.5 Review of Blouberg municipality waste management-related official documents.....	167
3.8 Data analysis.....	167
3.9 Trustworthiness.....	170
3.10 Study delimitations and limitations.....	173
3.11 Ethical Considerations	173
3.12 The researcher’s role	175
3.13 Chapter summary.....	175
CHAPTER 4: THE STATE OF INDIGENOUS WASTE MANAGEMENT IN THALAHANE VILLAGE	177
4.1 Introduction.....	177
4.2 Indigenous solid waste management practices by the Thalahane community.....	177
4.2.1 Waste avoidance and reduction.....	179
4.2.2 Basis for sustainable waste management.....	180
4.2.3 Energy recovery method	182
4.2.4 Waste disposal methods	182
4.2.5 The existence of indigenous practices for solid waste management.....	185
4.3 DPSIR and Thalahane village indigenous solid waste management.....	193
4.4 Transfer of indigenous waste management knowledge	199
4.5 The application of “Hohfeldian incidents” to Thalahane indigenous solid waste management.....	201
4.6 Integrated indigenous solid waste management framework.....	202
4.7 The Precautionary Principle, Prevention Principle, Rectification Principle, and the Principle of Sustainable Development in Thalahane village.....	1

4.7.1 The Precautionary principle and indigenous solid waste management.....	1
4.7.2 The Prevention principle and indigenous solid waste management.....	2
4.7.3 Rectification principle and indigenous solid waste management.....	2
4.7.4 Sustainable Development principle and indigenous solid waste management.....	3
4.8 Thalahane indigenous solid waste management and Extended Producer Responsibility...	4
4.9 Chapter summary	4
CHAPTER 5: MUNICIPAL WASTE MANAGEMENT IN THALAHANE VILLAGE.....	6
5.1 Introduction.....	6
5.2 An analysis of the implementation of waste management system by Blouberg local municipality in Thalahane village.....	6
5.2.1 Long distance of Thalahane community from the landfills of Blouberg Municipality	6
5.2.2 Thalahane community's lack of waste plants and equipment.....	7
5.2.3 Waste services in Thalahane village.....	8
5.2.4 Lack of enough public participation in matters relating to waste	9
5.2.5 Lack of implementation of EPR.....	10
5.2.6 Blouberg municipality waste management and DPSIR.....	10
5.3 Blouberg municipality waste management and Extended Producer Responsibility	11
5.4 Chapter summary	11
CHAPTER 6: FRAMEWORK INCORPORATING INDIGENOUS WASTE MANAGEMENT PRACTICES IN MUNICIPAL INTEGRATED PLAN (IWMP).....	13
6.1 Introduction.....	13
6.2 Development of an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.....	13
6.4.1 Part 1 – Introduction.....	19
6.4.2 PART 2 - Solid Waste Generated.....	24
6.4.3 PART 3 - Existing Solid Waste System	24
6.4.3.1 Solid waste system needs	24
6.4.4 PART 4 - Special Waste.....	24
6.4.5 PART 5 - Waste Education and Awareness Campaign	25
6.4.6 PART 6 – Implementation.....	25
6.5 Key observations at the household waste management sites and document analysis.....	27
6.6 Discussion.....	28
6.7 Chapter summary	29
CHAPTER 7: DISCUSSION OF FINDINGS	31

7.1 Introduction	31
7.2 Summary of findings	31
7.3 Findings in the context of literature	32
7.4 Theoretical frameworks in the study	37
7.5 Conclusion	38
CHAPTER 8: EVALUATION, JUSTIFICATION, CONCLUSION, AND RECOMMENDATIONS	40
8.1 Introduction	40
8.2 Evaluation of the study	40
8.2.1 Summary of key findings and critique	41
8.2.1.1 Investigating the indigenous waste management which the Thalahane local community uses to manage solid waste.	41
8.2.1.2 Analysing the implementation of a waste management system by the Blouberg Local Municipality in Thalahane village.	43
8.2.1.3 Development of an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.	43
8.3 Justification of the study	44
8.4 Limitations of the study	45
8.5 Conclusion	45
8.6 Recommendations.....	45
8.6.1 Indigenous waste practices that promote good health and environmental sustainability	46
8.6.2 Waste management education and cleaning campaigns	46
8.6.3 Municipalities that control villages should have an integrated sustainable solid waste management plan that accounts for indigenous knowledge.	46
8.6.4 Budget for waste management should be increased in municipalities.	46
8.6.5 Integrated sustainable solid waste management planning framework be adopted by municipalities controlling villages.....	47
8.6.6 Village system of leadership be used in solid waste management enforcement.....	47
8.6.7 Specific community based sustainable waste management in rural municipalities.....	47
8.6.8 The integration of Ubuntu and environmental ethics knowledge to bring change of behaviour to households' waste management.	47
8.6.9 The extended producer responsibility be speedily implemented in municipalities.....	47
8.6.10 Communities in rural areas should be supplied with 8-yard dumpsters.....	48
8.6.11 The integration of informal recyclers into the municipal waste management systems	48

8.6.12 Facilitation of cheap, effective, and sustainable community environmental cleanliness.....	48
9. References	49
ANNEXURE A	102
ANNEXURE B	106
ANNEXTURE C	108
ANNEXURE D	109
ANNEXURE E.....	110
ANNEXURE F	111

LIST OF FIGURES AND TABLES

Figure 1.1: Thalahane map.....	25
Figure 1.2: Integrated Solid Waste Management Framework.....	30
Figure 1.3: Integrated Solid Waste Management Framework.....	31
Figure 2. 1: Depiction of environmental, social, and economic aspects.....	78
Figure 2. 2: Waste hierarchy.....	96
Figure 3. 1: Map of Thalahane Village.....	106
Figure 3. 2: Map of Thalahane Village.....	144
Figure 4. 1: Environment-friendly waste management hierarchy.....	162
Figure 4. 2: Thalahane village solid waste management hierarchy.....	167
Figure 4. 3: Thalahane waste DPSIR	178
Figure 4. 4: Thalahane Indigenous positive response.....	180
Figure 4. 5: Thalahane Indigenous negative responses.....	181
Figure 4. 6: Depiction of Thalahane indigenous waste management knowledge transfer.....	183
Figure 4. 7: Thalahane Integrated indigenous solid waste management framework.....	185
Figure 6. 1: Indigenised Integrated Sustainable Solid Waste Management framework.....	189
Figure 8. 1: Indigenised Sustainable Solid Waste Management Framework.....	223

List of Tables

Table 2. 1: Waste Management facilities licence status in South Africa.....	97
Table 6. 1: Goals and objectives of Thalahane waste management.....	203

Table 6. 2: Thalahane village’s goals for the integrated sustainable solid waste management plan.....	205
Table 6. 3: Thalahane village integrated sustainable solid waste management activity plan.....	207
List of Pictures	
Picture 4. 1: Fireplace for bread baking and beer brewing.....	166
Picture 4. 2: Life stock feeding from a waste dump.....	168
Picture 4. 3: Disposable nappies waste trapped in a dry stream	169
Picture 4. 4:Traditional beer place signposts.....	171
Picture 4. 5: Repurposed goat skin for home décor.....	171
Picture 4. 6: Community street water tank.....	172
Picture 4. 7: Pictures of containers repurposed to store and fetch water.....	173
Picture 4. 8: Road repaired using rubble	174

LIST OF ABBREVIATIONS AND ACRONYMS

BDP	BARCON Dumping Protocol
CDM	Clean Development Mechanism
CFC	Chlorofluorocarbons
CHS	Commission on Human Security
COP	Conference of the Parties
CWG	Collaborative Working Group
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and Environment
EPR	Extended Producer Responsibility US United States
EEZ	Exclusive Economic Zones
EU	European Countries
FEPA	Federal Environmental Protection Agency
GHG	Green House Gases
GPML	Global Partnership on Marine Litter
HELCOM	Helsinki Commission
HDR	Human Development Report
IISWMM	Indigenised Integrated Sustainable Solid Waste Management
IAEA	International Atomic Energy Agency
IKSSA	Indigenous Knowledge Systems of South Africa Trust
IP	Integrated Pollution
IMO	International Maritime Organization
ISSWP	Integrated Sustainable Solid Waste Management Plan

LC	London Convention
IUCN	International Union for Conservation of Nature
LOSC	Law of the Sea Convention
MMA	Mordenised Mixture Approach
MEAs	Multilateral Environment Agreement
MDGs	Millennium Development Goals
NEMA	National Environmental Management Act
NEMWA	National Environmental Management Act
OSPARCOM	Ospar Commission
POP	Persistent Organic Pollutants
PRO	Producer Responsibility Organization
RIPPLE	Research Inspired Policy and Practice
S. A	South Africa
SDGs	Sustainable Development Goals
SWM	Solid Waste Management
UN	United Nations
UNFCCC	United Nation Framework Convention on Climate Change
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WCED	World Commission on Environment and Development
WHO	World Health Organisation
WP	Integrated Waste Management
WWF	World Wildlife Fund

CHAPTER 1: STUDY OVERVIEW

1. INTRODUCTION

1.1 Background

Throughout the history of humankind, human beings have always been confronted with environmental-related challenges such as waste, excessive greenhouse gases, ozone layer depletion, global warming, and threats to biodiversity at the global level. This is attested to by various international conferences such as the 1972 United Nations (UN) Stockholm Conference on the Human Environment, the UN Conference on Environment and Development, which brought about the Agenda 21 document, and the United Nations Framework Convention on Climate Change (UNFCCC). These conferences resulted in the evolution of the concept of 'sustainable development' which is at the centre of environmental management (UNESCO, 2009; Ruppel-Schlichting, 2022). The concept of sustainable development found its first definition in the *Our Common Future* report (WCED, 1987; Peters, 2023). Environmental protection is a pillar of sustainable development, and environmental protection is the practice of protecting the environment at the individual, household, organisational, or governmental level for the benefit of the natural environment and (or) humans (Cox *et al.*, 2013; Peters, 2023).

The international conferences on environmental protection also led to multilateral agreements such as the Stockholm Convention on Persistent Organic Pollutants, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, the Vienna Convention on the Protection of the Ozone Layer, the Montreal Protocol on the Protection of the Ozone Layer, the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal, the Convention on Biological Diversity adopted in 1992, the Kyoto Protocol of the United Nations, and the Framework Convention on Climate Change. Most of these agreements push Sustainable Development Goal (SDG) 13 - namely, 'action to combat climate change and its impact' - as the most urgent goal, as its failure can defeat many SDGs. The 2002 World Summit on Sustainable Development (WSSD) emphasised the importance of waste management

in addressing environmental issues (UN, 2002). The WSSD prioritised waste prevention and minimisation, reuse, recycling, and sound disposal facilities.

It is estimated that about four (4) billion tons of municipal solid waste are produced globally (Kaza *et al.*, 2018; Maalouf & Mavropoulos, 2023). In addition, the amount of waste produced by low and middle-income countries may rise by more than three times by 2050 (Kaza *et al.*, 2018; Maalouf & Mavropoulos, 2023), from one hundred and seventy-four (174) billion tons in sub-Saharan Africa to two hundred and thirty-one (231) billion tons in Latin America and three hundred and thirty-four (334) billion tons in South Africa (Kawai & Tasaki, 2016). This creates a systematic increase in surplus waste, which ultimately leads to pollution. Lack of proper solid waste management causes environmental contamination and ultimately leads to environmental degradation. As such, environmental mismanagement is a global concern. Both developed and developing countries are negatively affected by environmental mismanagement. The results of mismanagement of solid waste are marine litter, air, soil, and water contamination, and this affects people's and animals' health negatively. The long-term effects are climate change and unsustainable development. Without sustainable development, there will be no environmental sustainability, economic sustainability, or social and cultural sustainability. This could mean that people will be incapacitated to meet their livelihood needs.

Nature is a sustainable system if left to its own devices (Cuenca-Soto, Martínez-Muñoz, Chiva-Bartoll & Santos-Pastor, 2023). All the natural cycles of ecology take place automatically and sustainably. It provides living things with fresh air, clean water, and quality food, and it can replenish itself if it is not disturbed by anthropogenic activities such as waste. However, humans impact the earth, threatening the existence of all living beings. One way is through the mismanagement of solid waste. Humans impact the environment negatively on air quality, water quality, and soil quality and even disturb the natural cycles of ecology. Even though the earth can deal with waste, the amount of waste produced by human beings surpasses the rate at which the earth can deal with it (Hantoko, Li, Pariatamby, Yoshikawa, Horttanainen & Yan, 2021). The problem of waste management challenges is common in all countries, whether they are developed or developing countries (Tushar *et al.*, 2023). It has taken many years for developed countries to be in a better state of solid waste management (Coad & Coffey, 2010; Banerjee, Nair & Smitha, 2023). Similarly, it will take a long time for

developing countries to have an effective state of solid waste management (Wilson, 2007; Gören, 2023). This assertion, however, shows that the situation in developing countries warrants more attention.

Africa has a growing waste management challenge crisis (Hossain, Islam, Shanker, Khan, Locock, Ghose, Schandl, Dhodapkar & Sahajwalla, 2022). This is supported by Godfrey et al. (2019) and Edodi (2023) when they say that the rate of growth in waste generation in Africa is expected to be so significant that any decrease in waste generation expected in other regions globally will be overshadowed by Africa. They go on to indicate that half of all municipal solid waste (MSW) generated in Africa remains within its cities and towns, dumped onto sidewalks, open fields, stormwater drains, and rivers, and that the situation is worse in rural areas where often no formal waste collection services exist. This environmental problem facing Africa is mainly due to poor governance. Sustainable waste management is an environmental and public health imperative, and without it, the 2030 Agenda for Sustainable Development will not be achieved.

In Africa, solid waste challenges were made worse by African inconspicuousness. African inconspicuousness is encouraged by alien knowledge, which recognises only ideas, interests, concerns, and practices perpetuated by Eurocentric hegemony. This exogenous knowledge finds its way through by dominating the production of knowledge and by ensuring that the indigenous knowledge system is disabled through Eurocentric social institutions. The indigenous knowledge system is made to look inadequate, irrelevant, and alien to its indigenous community, thereby removing the lived experience and action knowledge from the formal knowledge and rendering it informal. The challenges of solid waste did not start with the advent of colonialism. Indigenous people have faced solid waste challenges and had a way of dealing with those challenges. Part of decolonisation is to integrate the indigenous knowledge system into the formal knowledge of solid waste management.

Before 1994, blacks in South Africa were controlled by the Group Areas Act, and this led to most resources and services being skewed towards the whites due to the policy of segregation. This meant that services rendered to black communities, such as solid waste management, were limited. However, this situation was better in urban areas, as they could organise themselves and protest against poor waste services. In

addition, there is a difference between cities and rural areas in terms of waste facilities available (Ferronato *et al.*, 2019; Maiurova, Kurniawan, Kustikova, Bykovskaia, Othman, Singh & Goh, 2022). However, the rural areas were highly neglected when it comes to basic services such as sanitation, electricity, water, and refuse removal (Zerihun & Mashigo, 2022). Road networks were also neglected, and this made going into rural areas a nightmare. Furthermore, there were no municipalities to provide services such as waste management. People had to ensure that waste was managed. Even the Homeland system that was in place did not offer waste management services in rural areas (Zerihun & Mashigo, 2022). However, the problem of waste was not as profound as it is now. This was because communities were doing something to address it that can be investigated to assist the current waste management system.

Waste contributes to climate change as it leads to more greenhouse gases (Bian, Zhang, Zhao, Chen, Liang, Li, Sun, Chai, Fang & Yuan, 2022). A certain quantity of greenhouse gases is good for the earth, but if it is more, it leads to global warming, which results in extreme weather events. Already, there is an increase in global temperature (global warming). A further increase in global temperature will lead to high ocean levels (Calafat, Wahl, Tadesse & Sparrow, 2022). The need for environmental sustainability became paramount. As a result, in 1987, the Brundtland Commission clarified what sustainable development is. Later, in 2000, came the Millennium Development Goals and then the Sustainable Development Goals (SDGs), which were meant to reduce poverty, improve social equity, and decrease environmental degradation. The sustainable development goals (SDGs) have to be met by 2030 (Cojocaru, Ionescu, Firoiu, Cismaş, Oţil & Toma, 2022). Sustainable development has led to many climate agreements to try and mitigate climate change. Therefore, the issue of solid waste management is not only a health and environmental issue but also a concern for human security and sustainable development. As a result, governments are looking for correct ways of dealing with solid waste management challenges (Schwartz-Herion *et al.*, 2008; Anuardo, Espuny, Costa & Oliveira, 2022).

In the South African context, solid waste management has been mainly confined to urban areas because of the influx of people from rural areas. The high generation of solid waste in urban areas has led to health hazards, and this led researchers and environmentalists to focus on urban areas (Al-Dailami, Ahmad, Kamyab, Abdullah, Koji, Ashokkumar & Zabara, 2022). After 1994, the new democratic government of

South Africa embarked on improving the quality of life of its people (Francis and Webster, 2019). The preamble of the Constitution of the Republic of South Africa, 1996, attests that the Constitution, as the supreme law of the Republic, is committed to, amongst other things, improving the quality of life of all citizens. One way of doing this is through Sections 24(a) and (b) of the Constitution of the Republic of South Africa, 1996, which state that:

“Everyone has a right -

- (a) To an environment that is not harmful their health or well-being; and*
- (b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –*
 - (i) Prevent pollution and ecological degradation;*
 - (ii) Promote conservation; and*
 - (iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.*

This constitutional mandate was passed to the Local Government through Section 152(b) of the Constitution of the Republic of South Africa, 1996, read with Section 156. Waste, if not properly managed, can lead to an environment that is harmful to the health or well-being of the citizens of South Africa and thereby defeat the commitment of the Constitution of the Republic of South Africa of 1996.

With changes in the political landscape of South Africa after 1994, the government promulgated several changes in the management of solid waste. The 1998 White Paper on Local Government resulted in many rural areas being transformed into peri-urban settlements. More services than were mainly found in urban areas, such as electricity, clean tap water, and sanitation, as well as infrastructure development, such as roads and shopping malls, were brought closer to rural people. Infrastructure development in rural areas attracted rural to rural mobility. This, consequently, also led to an increase in solid waste. According to Tchobanoglous *et al.* (1993); Waheeg, Adesola and Garba (2022), when the population is small, the disposal of waste does not pose a problem as there is adequate land to assimilate the waste. Despite this increase in solid waste challenges, government policies on solid waste management, such as the National Waste Management Strategy (NWMS), are silent on the need to intensify solid waste management in rural settings using indigenous knowledge

systems. With this background, the study sought to explore the existence of indigenous solid waste management practices for a sustainable environment.

To deal with the challenges of waste management, South Africa has to comply with the National Waste Management Strategy (NWMS) at the national, provincial, and local government levels. The purpose of this

“is to give effect to the objects of the Waste Act, which are to protect health, well-being and the environment through sound waste management and the application of the waste management hierarchy” (NWMS, 2011).

NWMS has the following eight strategic goals: “(1) Promote waste minimization, reuse, recycling, and recovery of waste; (2) Ensure the effective and efficient delivery of waste services; (3) Grow the contribution of the waste sector to the green economy; (4) Ensure that people are aware of the impact of waste on their health, well-being, and the environment; (5) Achieve an integrated waste management planning; (6) Ensure sound budgeting and financial management for waste services; (7) Provide measures to remediate contaminated land; and (8) Establish effective compliance with and enforcement of the Waste Act”. The NWMS instructs municipalities to integrate integrated waste management plans (IWMPs) in their Integrated Development Plans (IDPs) and that the annual performance report of the municipality must include information on the implementation of the IWMP. Municipalities are also tasked to provide removal, storage, and disposal services. Municipalities must also cooperate with other stakeholders to extend recycling at a municipal level and provide bins for diverting organic waste from landfills and composting it (NWMS, 2011; Abubakar, Maniruzzaman, Dano, AlShihri, AlShammari, Ahmed, Al-Gehlani & Alrawaf, 2022). Even in the face of these good pieces of legislation and the NWMS, South African rural settlements are experiencing massive challenges in the area of solid waste management. Uncontrolled dumping in the streets on vacant land has been observed. The South African government is making considerable efforts to address solid waste challenges in rural areas. However, the progress, it would appear, is hampered by obstacles to policy and programme implementation.

South Africa is a developing country. There is enough literature on solid waste management in developing countries due to the mounting challenges that are experienced, which harm health and the environment. Some scholars have studied solid waste management from a financial perspective and concluded that the lack of financial sustainability is a negative factor in the management of solid waste in municipalities (Sharholy *et al.*, 2007; Sujauddin *et al.*, 2008; Lissah, Ayanore, Krugu, Aberese-Ako and Ruiters, 2021; Hajar, Tweissi, Hajar, Al-Weshah, Shatanawi, Imam, Murad & Hajar, 2020). Part of the cause of unsustainable financial control in solid waste management is the unwillingness of solid waste service beneficiaries to pay for the services (Sharholy *et al.*, 2008; Fattah, Rimi & Morshed, 2022) and the impression they have that municipalities should carry all the financial burden of solid waste management without them contributing anything (Vidanaarachchi *et al.*, 2006; Sondh, Upadhyay, Patel & Patel, 2022).

Other scholars have looked at the challenges of solid waste management from a management perspective and concluded that challenges in solid waste management in developing countries are compounded by a lack of capacity (Guerrero *et al.*, 2013; Hazra & Goel, 2009; Awuah & Abdulai, 2022) and poor infrastructure (Moghadam *et al.*, 2009; Henry *et al.*, 2006). Lack of political will is another factor that leads to solid waste management not being prioritised (Moghadam *et al.*, 2009; Awuah and Abdulai, 2022).

Shekdar (2009), Sujauddin *et al.* (2008), Geng *et al.* (2009), and Tai *et al.* (2011) looked at the important stakeholders in solid waste management, while Tadesse *et al.* (2008), Sujauddin *et al.* (2008), Zhuang *et al.* (2008) and Moghadam *et al.* (2009) focused on the factors that influence solid waste management. Most of these scholars are keen to see developing countries achieve the success experienced by developed countries. This has proven near impossible for many decades because transplanting success from developed countries has been found to have limited applicability (Schübeler *et al.*, 1996; Zheng, Shen, Li, Jian, Zeng, Mao, Zhang, Halder & Qu, 2022) due to habits, routines, social expectations, and cultural values (Jackson, 2005; McKenzie-Mohr, 2011). This has led to several studies on solid waste management casting their nets wider in search of solutions to the challenges of solid waste management in developing countries (Singh, Elgie, Noll & Eckelman, 2023). The search has included indigenous knowledge systems (IKS). Ajibade (2007), Ibodje

(2017), and Kosoe *et al.* (2019) have identified and examined several indigenous waste disposal practices, most of which have been covered under the literature review of this study. Studies on waste management in developing countries were conducted by Hettiarachchi *et al.* (2018); Abubakar, Maniruzzaman, Dano, AlShihri, AlShammari, Ahmed, Al-Gehlani and Alrawaf (2022) on Organic Waste Buyback as a Viable Method to Enhance Sustainable Municipal Solid Waste Management in Developing Countries, Ouda *et al.* (2016) on Waste to energy potential: A case study of Saudi Arabia, Sadeh *et al.* (2016) on Waste-to-energy and recycling value for developing integrated solid waste management plan in Lahore, Sawadogo *et al.* (2017) on Cleaner production in Burkina Faso: A case study of fuel briquettes made from the cashew industry waste, and many others, have recorded a limited improvement on solid waste management challenges (Nikiema, Asamoah, Egblewogbe, Akomea-Agyin, Cofie, Hughes, Gebreyesus, Asiedu & Njenga, 2022).

Waste management practitioners, researchers, and administrators around the world are responding to the international concern about pollution caused by waste and are working towards zero waste strategies (Ahmed, Hasan, Rana & Sharmin, 2023). The key to the call is compliance achievement. Therefore, developing an effective waste management system that has a build-in compliance mechanism is an essential component for successful environmental and public health protection. Solutions that are not foreign to the local population have been found to achieve compliance more than foreign ones (Litvinenko, Petrov, Vasilevskaya, Yakovenko, Naumov & Ratnikov, 2023). Hence, Wilson *et al.* (2013) indicated that there is an emerging agreement “that viable and sustainable solutions for solid waste management in developing countries need to be designed for the specific local circumstances and conditions”.

Indigenous waste management practices are not foreign to local people, hence the examination of existing indigenous solid waste management practices for a sustainable environment in Limpopo province, a case of Thalahane village.

1.2 Problem Statement

Human beings have always been confronted with waste challenges. The inability to understand the problems of waste generation, especially in rural areas, has led to solid

waste management being a compelling problem of environmental degradation in the rural municipalities of developing countries. The perception, entrenched by colonialization, that solid waste management solutions developed for and successful in developed countries can successfully be transplanted into the different context and conditions of African countries (El Bari & Trois, 2023) has led to disregard for indigenous solid waste management practices for environmental sustainability. This is the case in most South African rural municipalities (Soni, Das & Kumar, 2022). The question is: How did the indigenous community address waste management challenges? Since indigenous knowledge is not static, are there currently indigenous solid waste management practices that can be used for environmental sustainability?

As the population increases, it leads to increased waste accumulation. As lifestyle and consumption patterns change, this leads to an increase in the quantity of waste generated, and the waste composition becomes more varied. Rural areas in South Africa are modernising at a phenomenal rate, increasing the number of people per square km, or population density (Bleking, Kapatula, Davies, Nelson, Robeson, Waldman & Lusaka, 2022). More importantly, shops and malls are today a common feature in rural areas, and these generate large amounts of waste that end up being improperly managed, and which is a cause for concern. Solid waste management services pose a challenge to many rural municipalities in South Africa, especially in areas that were controlled by former homelands (Adeniyi, Adebara & Oladehinde, 2022). Limpopo Province has many such areas as it is home to four homelands. About sixty-six comma five (66,5) percent of Limpopo Province's rural households have no access to solid waste management services, even though Section 78 of the Local Government: Municipal Systems Act 30 of 2000 empowers municipalities to render such a service (Patji & Selepe, 2022). However, rural solid waste management needs expertise, something lacking in many rural municipalities. Solid waste, if not properly managed, harms the environment. The integrated waste management plan of municipalities does not take into account the indigenous solid waste practices of the local communities (Patji & Selepe, 2022). Instead, it has a one-sided representation of perspectives on solid waste management, which is Eurocentric.

The national guideline document for the development of IWMP does not acknowledge indigenous waste management practices either (Shyamal, Sawai & Kazmi, 2022). The disregard for indigenous ways of managing solid waste management in most rural

municipalities is expressed by excluding them from the municipal integrated Waste Management Plan (IWMP). This does not assist in mitigating climate change, as waste contributes to an increase in greenhouse gases.

Thalahane community members have always had their own indigenous solid waste management practices. These practices were passed from one generation to the next. However, little research is conducted on these practices; moreover, these practices are not funded by municipalities. Furthermore, indigenous solid waste management practices are not being recognised by municipalities (Senekane, Makhene & Oelofse, 2022). One would therefore assume that there have been indigenous ways of managing waste that can be used to abate the situation. However, there is an outcry in the community about the relationship with waste management, which has raised serious questions on how to deal with waste. The problem is that the current solid waste management practice is failing to deliver in rural areas (Ahmed, Hasan, Rana & Sharmin, 2023). This is evidenced by the many solid waste hot spots that harm the environment and the health of people and animals.

Waste is a source of Global Greenhouse Gas (GHG) emissions (Bian, Zhang, Zhao, Chen, Liang, Li, Sun, Chai, Fang & Yuan, 2022). Most developing countries are contributing less towards greenhouse gas emissions (Chien, Hsu, Ozturk, Sharif & Sadiq, 2022). But as they are gradually becoming part of the global world in terms of production and consumption patterns, their contribution to greenhouse gas emissions increases (Chien, Hsu, Ozturk, Sharif & Sadiq, 2022). The form of waste management in developing countries is key to mitigating increases in greenhouse gas emissions and ultimately fighting climate change. Taking into account that waste in developing countries is expected to more than double by 2025 (World Bank, 2003; Awuah & Abdulai, 2022), solid waste management warrants enough attention.

1.3. The Study Area

The research was limited to Thalahane village in the Maleboho area. This area is at the foot of Blouberg Mountain in the Blouberg Municipality in Limpopo Province. This area was selected because it is familiar to the researcher and it is one of the rural areas where there is no household door-to-door waste management collection by the municipality, and the area still relies on traditional ways to manage waste. Therefore,

the area qualifies as a study area to explore how indigenous waste management practices are done.

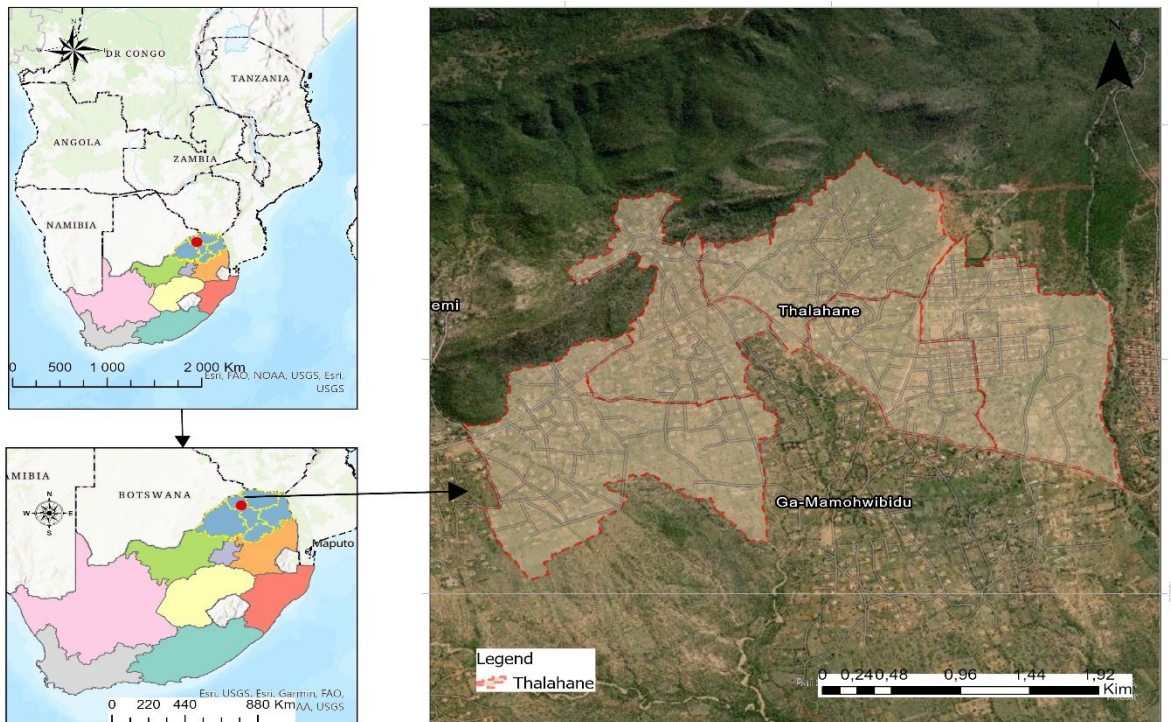


Figure 1.1: Thalohane map (Masiya and Masipa, 2021).

1.4 Aim of the Study

This study aimed to examine existing indigenous solid waste management practices for a sustainable environment in Thalohane village within the Limpopo Province.

1.4.1 Research Objectives

The objectives of this study are:

- To investigate indigenous waste management, which the Thalohane local community uses to manage solid waste.
- To analyse the implementation of a waste management system by Blouberg Local Municipality in Thalohane village.
- To develop an integrated sustainable solid waste management plan for Thalohane village that accounts for indigenous solid waste management.

1.4.2 Research Questions

The study sought to answer the following main research question:

What are the indigenous solid waste management practices for a sustainable environment in Thalahane village within Limpopo Province?

To help answer this main research question, the study dealt with the following secondary questions:

- Which indigenous solid waste management practices does the Thalahane local community use to manage solid waste?
- How does Blouberg municipality implement solid waste management in Thalahane village?
- How can an integrated, sustainable solid waste management plan for Thalahane village be developed that accounts for indigenous solid waste management?

1.4.3 Significance of the Study

Research on solid waste management has been conducted for over a decade in South Africa. However, little research has been conducted on indigenous solid waste management for a sustainable environment. The study highlights the indigenous solid waste management hierarchy. Its findings will show that indigenous solid waste management can contribute to a sustainable environment and mitigate climate change. By so doing, it will fill the gap in indigenous perspectives on solid waste management. It will also augment several debates on the connection between environmental management and human health. By focusing on rural areas, the study provides the voices of the voiceless in rural communities on issues of solid waste management. It will assist in the development of an integrated sustainable solid waste management plan that accounts for indigenous solid waste management in the villages by creating an integrated sustainable solid waste management framework that will assist municipalities in that regard. Providing a solution to the challenges of solid waste management in Thalahane village will assist in bringing multiple benefits for the

realisation of sustainable development goals (SDGs) in Thalahane village. The study will also assist in the realisation of the National Waste Management Strategy (NWMS).

1.5 Overview of literature review

The review of literature dealt with the concept of waste in full, covering the history of waste management and the concept of sustainable development. The challenges of solid waste management in developing and developed countries were covered. It went on and dealt with a waste legislative framework in South Africa and the status of solid waste management service delivery in South Africa, considering rural municipalities.

The importance of ethics in waste management, the different ethical theories, and the need for waste management ethics were dealt with in the literature review. It covered indigenous solid waste management, and its relation to sustainable development and the rationale for using indigenous knowledge. The concluding part of the literature review shed light on how countries respond to drivers, pressures, states, and impacts on the environment that arise due to waste.

1.6 Meta-theoretical framework

Philosophical ideas influence research (Creswell & Creswell, 2018; Bhat, Sillalalee & Kandasamy, 2023). The same thing applied in this study. This is why philosophical world views are made explicit in this section to help explain why the qualitative approach was chosen as opposed to other approaches. Philosophical world views are “a basic set of beliefs that guide action” (Guba, 1990; Vargas & Peña, 2022). The researcher has a strong belief that reality is socially constructed; hence, social constructivism has influenced his views of the world and the nature of research in this study (Creswell & Creswell, 2018; MacLeod, Burm & Mann, 2022). Bryman *et al.* (2017) assert that ‘social phenomena’ are produced by ‘social actors’ and reality is subjective. This means that as people interact with one another and their world, meanings of reality are being socially constructed, which is subjective according to their different experiences of the world.

In this study, the starting point is that the people of Thalahane have been interacting with one another and with their world regarding solid waste management. In the process, they have developed a subjective understanding of their experiences with solid waste management. The study relied on the sampled people of Thalahane's views of solid waste management and how they shared their experiences of their socially constructed meanings of solid waste management. Thus, the interviews contained unstructured questions to allow the participants to share their broad experiences and socially constructed meanings of solid waste management. The researcher's role was to make sense of the participants' experiences in solid waste management (Creswell & Creswell, 2018).

1.7 Materials and methods

The influence of philosophical world views adopted in the study, the aim of the study, and the objectives of the study rendered this study a qualitative study with a phenomenology approach and a case study design. The population of the study comprised individuals in Thalahane village, and purposive sampling was used to select the participants.

The data was collected from the participants through unstructured interviews, focus group discussion, and a review of Blouberg municipality waste-related documents. Visits to solid waste management sites and focus groups were used to validate the data collected through unstructured interviews. Then thematic data analysis was used on the collected data. The methodology section appears in full in Chapter Three.

1.8 Delimitations of the study

There were conscious restrictions made in the study that resulted in exclusionary and inclusionary decisions (Coker, 2022). These delimitations were necessary due to the limited amount of financial resources and time frame. The study is about indigenous solid waste practices for a sustainable environment, and as it is not possible to cover all the indigenous solid waste practices in all areas, the study was limited to indigenous solid waste management practices in Thalahane village of Blouberg municipality. Thalahane village was the seat of Chief N. Maleboho's royal office. The village of

Thalahane is at the centre of all of Chief N. Maleboho's villages in Blouberg. Chief N. Maleboho's villages make up almost 80% of Blouberg municipality.

The study is qualitative and it is delimited to the indigenous solid waste management practices of Thalahane village. The target population was all the people in Thalahane village and Blouberg municipality who are solid waste management officials. The study was also delimited to purposive sampling, interviews, focus group discussion, observation, and review of municipal records as data collection methods.

1.9 Ethical Issues

The study was about the indigenous solid waste disposal practices of the people of Thalaane village. It did not violate the dignity of the participants or promote any unethical behaviour. The researcher applied for ethical clearance from the University of Venda research ethics committee and was granted permission to conduct the study. The project number is SHSS/19/AS/02/1906. The local chief and Blouberg Municipality also granted permission for the research after receiving a formal request to conduct the study. The participants were requested to participate voluntarily. Furthermore, they were given a consent form to sign willingly. The researcher respected the dignity and privacy of the participants. The principle of confidentiality was observed, as their names were kept secret by using code names.

1.10 The Study's Theoretical Foundation

This section presents the theoretical approach that was used in this study, namely the Integrated Sustainable Solid Waste Management framework and the DPSIR framework. The researcher used these theoretical approaches to advance the purpose of the study.

1.10.1 Integrated Solid Waste Management theory.

The Integrated Solid Waste Management (ISWM) was developed by an NGO called Waste in 2004 (WASTE, 2004; Devi, Gangaraju, Kumar & Balakrishna, 2023). The Collaborative Working Group (CWG) on Solid Waste in Low- and Middle-Income

countries improved it further in the 1990s (WASTE, 2004; Devi, Gangaraju, Kumar & Balakrishna, 2023). ISWM has three dimensions: stakeholders, elements, and aspects.

Stakeholders are the people using, benefiting from, or having an interest in solid waste management. Elements refer to the generation, collection, transportation, treatment, and disposal of solid waste. For ISWM to get off the ground, technical, financial, social, institutional, political, legal, and environmental aspects are needed. The effective combination of these dimensions in practice leads to sustainability.

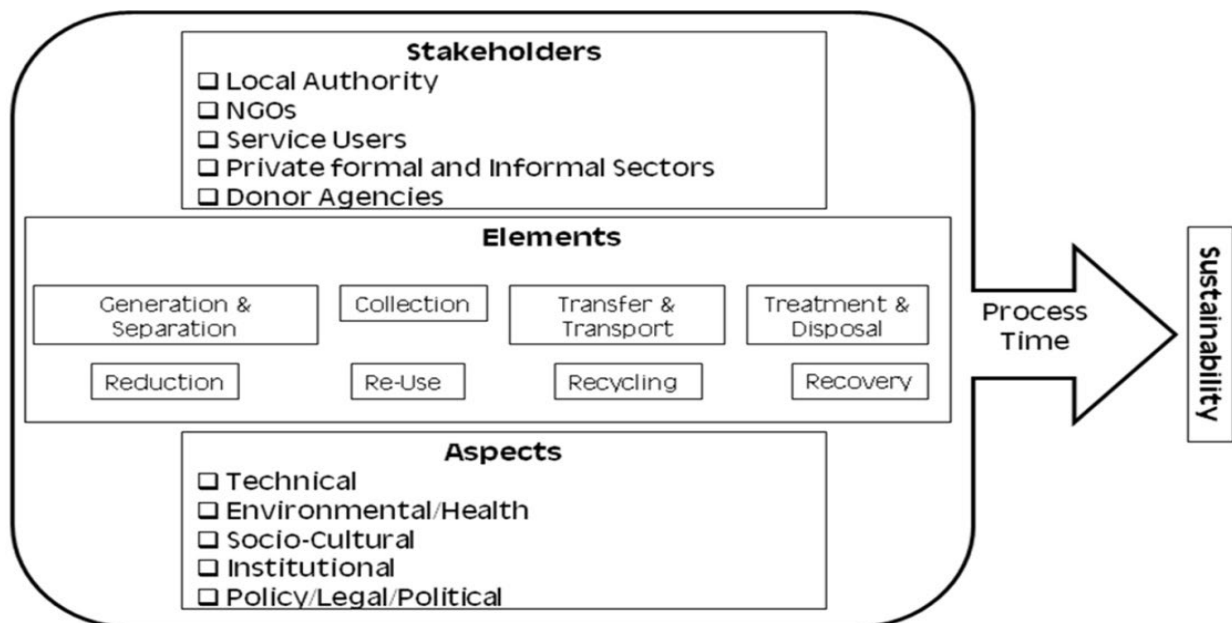


Figure 2.2: Integrated Solid Waste Management Framework (Kumar & Agrawal, 2020)

ISWM encourages different ways of thinking and supports every locality in developing a solution that matches its context.

Sustainable waste management is aimed at addressing the overuse of natural resources, changes in land use, and emissions that pollute the air, water, soil, vegetation, and habitat through the recovery, recycling, and reuse of resources and the minimization of waste streams. This should consider the social and economic issues, the stakeholders, governance, and technical issues. The sustainable solid waste management framework assisted in aligning sustainable management issues.

1.10.2 The DPSIR framework

The DPSIR is a framework for describing the interactions between society and the environment. It was developed in late 1990 by the Organisation for Economic Co-operation and Development (OECD). The OECD is an intergovernmental economic organisation founded in 1961 to stimulate economic progress and world trade. It has thirty-seven (37) member countries. Per the DPSIR framework, there is a connection between driving forces, pressures, states, impacts, and responses. It has been adopted by the European Environment Agency (EEA) for reporting on the state of the environment (Kristensen, 2004; Naghdipour, Hasheminejad & Keyvanpour, 2021).

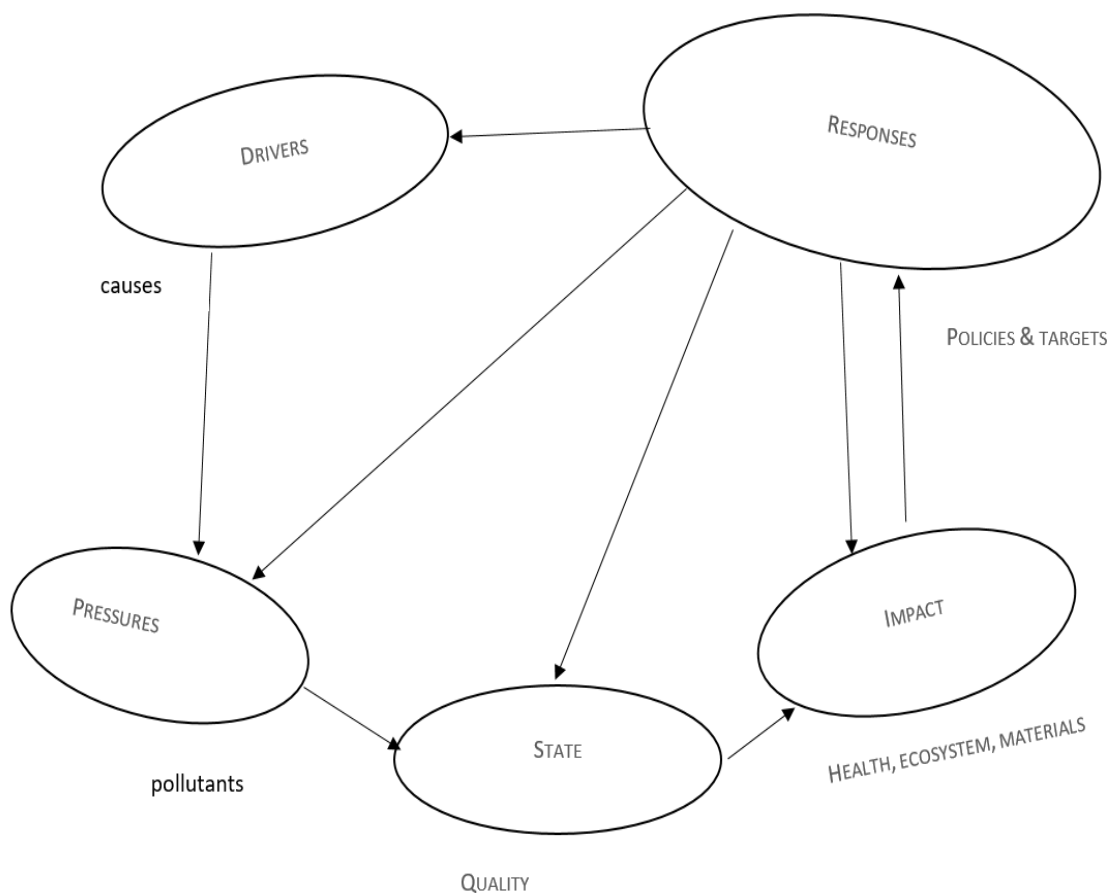


Figure 1.3: Integrated Solid Waste Management Framework (Naghdipour et al., 2021)

The driving force is a need. There are primary and secondary driving forces, and even industrial sector as well as national driving forces. The primary driving forces are the need for shelter and food, whereas the secondary driving forces are transport and entertainment. The industrial sector's driving force is the need to be profitable at low

costs. The national driving force is the need to keep unemployment levels low (Kristensen, 2004; Fu & Shi, 2022). The need leads to human activities that will assist in meeting the need. Activities to meet human needs result in pressure on the environment. The pressure can be caused by the excessive use of environmental resources, changes in land use, and emissions that pollute the air, water, and soil (Kristensen, 2004; Fu & Shi, 2022).

The pressure affects the state of the environment, that is, the quality of air, water, soil, habitat, and vegetation. The quality of the air, water, and soil determines the quality of the ecosystem and human welfare. Changes in the state of the environment affect the functioning of the ecosystems and their life-supporting abilities and ultimately the three pillars of sustainable development, namely the social dimension, the economic dimension, and the environmental dimension. The undesired impact results in society or policymakers acting to mitigate the consequences of the impact. The taking of action is a response.

DPSIR is a social-ecological framework that allows interdisciplinary thinking about complex problems in a social-economic-environmental system's settings. Waste management is a complex of social, economic, and environmental problem that warrants an inter-disciplinary approach. In this regard, it has been adopted in this research. DPSIR assisted in tackling and analysing the social-economic-environmental problems of waste management and also assisted in providing a solution. Thus, it was a useful tool in that it is adaptive and interdisciplinary as it considers the social, economic, and environmental systems.

1.11 Concept Clarification

The concepts of solid waste, uncontrolled waste, and integrated solid waste management are clarified below.

Solid waste is unwanted solids that arise from domestic and animal activities and are thrown away as useless. In the context of this research, these throwaways refer to waste discarded by rural communities.

Uncontrolled waste dumping refers to the littering of solid waste from domestic and animal activities in places not designated as dumping sites.

Indigenous waste management practices refer to the knowledge and practices that have been handed down from generation to generation that guide communities to reduce, reuse, recycle, and dispose of waste in ways that will foster a pleasant relationship between human beings, other species, and the natural environment.

Integrated solid waste management is a comprehensive waste prevention, recycling, composting, and disposal programme that manages the waste in ways that effectively protect human health and the environment, taking into account local needs and conditions (the United States Environmental Protection Agency, 2002).

Sustainable development refers to development that meets the needs of the present without compromising the ability of future generations to meet their needs (WCED, 1987).

A sustainable environment is a state in which the ability of people to meet their needs does not cause environmental degradation and endanger people's and animals' health, and the natural cycles proceed smoothly.

Indigenous solid waste management is practiced by indigenous people, carried from generation to generation, who assist in solid waste prevention, repurposing, and disposal in such a way that solid waste does not bother them.

1.12. Outline of the Study

This study was conducted following the chapter sequence provided below.

Chapter One

This chapter includes the introduction, background to the study, statement of the problem, aim and objectives, research questions, and justification for the study.

Chapter Two

Chapter two covers the literature review.

Chapter Three

Chapter three deals with the research methodology.

Chapter Four

Discusses the state of indigenous waste management in Thalahane village.

Chapter Five

It is about municipal waste management in Thalahane village.

Chapter Six

Discusses the framework for incorporating indigenous waste management practices into the municipal integrated waste management plan (IWMP).

Chapter Seven

Discusses the findings in the context of the literature and theoretical framework.

Chapter Eight

Summarises the key findings, evaluation, conclusion, and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter examines solid waste management in developed countries, the developing world, and South Africa. It indicates how solid waste legislation has not been matched by solid waste practices and the major health-related, environmental, and socio-economic problems associated with ineffective solid waste disposal. The chapter then covers indigenous solid waste disposal practices.

2.2 Municipal solid waste management challenges

Increasing populations and the growth of living standards give rise to increased waste generation in countries all over the world. Developing countries have significant problems managing solid waste due to increased population, limited resources (financial and social), and the enforcement of relevant regulations (Chen *et al.*, 2010; Sono *et al.*, 2022). Therefore, efficiency in solid waste management and its affordability are key to successful solid waste management in developing countries (Topić and Biedermann, 2015; Sondh, Upadhyay, Patel & Patel, 2022). But in most cases, the developing countries address their challenges through 'copy and paste' from developed countries without regard to their context and situation (Topić & Biedermann, 2015; Oksamytna & Wilén, 2022), whereas they were supposed to develop individual solutions to solid waste management challenges that are appropriate to their own specific history, economy, demography, and culture and in accordance with their unique institutional, environmental, and financial resources.

The main contributor to global warming is greenhouse gas emissions related to waste (Caiado *et al.*, 2017; Nordahl, Preble, Kirchstetter & Scown, 2023) which are caused by growing populations and consumption pattern change, and this makes solid waste management (SWM) an issue of global concern (Marshall & Farahbaksh, 2013; Li, Zhang & Liu, 2022). This is made worse by issues like constraints on municipal budgets (Azevedo *et al.*, 2019), which hamper the implementation of effective solid waste management. Other challenges include system elements like collecting, storing, separating, transporting, processing, and recovery. To deal with challenges posed by the elements requires multidisciplinary skills (Rada *et al.*, 2013; Singh, Kumar, Mishra

& Kumar, 2022), which are lacking in most municipalities. Chen et al. (2010) raise the challenge of the lack of participation of community and public authorities in waste-related matters, and this led to less public awareness, which makes the adoption of preventative approaches to waste easy (Batista *et al.*, 2021).

Chalhoub (2018) looks at the challenges of waste management from the perspective of technology by raising the point that municipalities in developing countries resort to less expensive low-tech approaches as they mainly focus on survival. This goes back to the issue of budgetary constraints (Azevedo *et al.*, 2019; Rondón Toro, López Martínez & Lobo García de Cortázar, 2023).

Public health is the driver of solid waste and the management of human excreta (sanitation) in many municipalities (Wilson *et al.*, 2013; Han, He, Shao, Wang, Qiao, Zhang & Yang, 2023). Public health is pushed in this direction by outbreaks of diseases such as cholera and acute respiratory infections in children (UN-Habitat, 2009; Han *et al.*, 2023). This makes waste service a public good regardless of whether people can afford it or not (Wilson *et al.*, 2013; Han *et al.*, 2023). But what is notable is that there is a gap, which indicates inequality, in terms of waste collection between affluent neighbourhoods, and low-income and illegal settlements (Hoorweg & Bhada-Tata, 2012; Marks, Miller & Vassanadumrongdee, 2023). This is because different areas are often treated in the same way by the municipalities, irrespective of the challenges.

Many municipalities have an active informal sector, which has been shown to save municipalities around 20% or more of their waste management budget (Scheinberg *et al.*, 2011; Kathuria, 2022). This means that the informal sector is an important stakeholder in municipal solid waste management (MSWM). But there are challenges of integrating the informal sector with the formal sector (Velis *et al.*, 2012; Gómez-Maldonado, Ospina-Espita, Rodríguez-Lesmes & Rodríguez-Rodríguez, 2023). If this challenge can be addressed, the recycling rate of many municipalities would increase (Wilson *et al.*, 2013; Gómez-Maldonado *et al.*, 2023). Even if it is the legal responsibility of the municipalities to deliver waste services, the municipalities need other stakeholders in the form of users and service providers. Inclusivity in the provision of waste services is important to beef up where municipalities lack capacity to provide full service to poor communities and informal settlements (Keita *et al.*, 2010;

Omar & Bullu, 2022), and this will lead to community-based waste management. Hence the call by Memon (2010) for inclusive plans in a participatory manner to serve without discrimination all parts of the user society.

Kartz *et al.* (2018) estimate that around 4 billion tons of MSW are generated every year in the world, and this creates solid waste-related challenges. Solid waste management is worse in developing countries (Minghua *et al.*, 2009; Kumar, Ramakrishna, Tiwari, Saxena, Mishra, Tiwari, Kumar, Yadav & Sharma, 2022), and it is expected to increase by more than three times by 2050 (Kaza *et al.*, 2018). Solid waste-related challenges compel governments to search for solutions to challenges posed by solid waste (Schwarz-Herion *et al.*, 2008; Awasthi, Sarsaiya, Kumar, Chaturvedi, Sindhu, Binod, Zhang, Pandey & Awasthi, 2022). Amuda *et al.* (2014) confirm that researchers and policymakers continue the search for the most effective and efficient solid waste management in developing countries.

Most constitutions in different developing countries give power to the municipal authorities to provide solid waste services. However, according to Sujauddin *et al.* (2008) and Óskarsson, Agnarsson and Davíðsdóttir (2022), some municipalities are often faced with challenges beyond their capacity to deal with solid waste, such as limited resources (financial and social). Public sector dominance in service provision has been identified as responsible for the lack of effectiveness and efficiency in solid waste management (UNESCO / ECA, 2005; Hemidat, Achouri, El Fels, Elagroudy, Hafidi, Chaouki, Ahmed, Hodgkinson & Guo, 2022) as it creates less competition. Oteng-Ababio (2010) and Luz (2023) touted the involvement of the private sector in the provision of services to improve the efficiency of the system. Many governments fell for private sector participation and public-private partnerships in municipal waste management (Oteng-Ababio, 2010; Luz, 2023). What has been notable is that private sector participation is not a panacea (Cointreau-Levine, 1994; Hemidat *et al.*, 2022). Coad (2005) confirms that private sector participation's effectiveness depends more on the local government client than the private sector service provider.

Solid waste, if not well managed, becomes a source of pollution to the environment, impacting the state of air, water, and soil negatively (UN-HABITAT, 2010; Siddiqua, Hahladakis & Al-Attiya, 2022), while Owusu-Sekyere *et al.* (2015) reiterate that the

impact of pollution is more in low-income and peri-urban settlements where there is a challenge of access routes to the settlements.

A study by Scheinberg et al. (2010b) indicates that more funds are needed to manage solid waste, and this makes financial sustainability a challenging issue. This challenge is made worse by failing cost recovery measures from users (Wilson *et al.*, 2010; Armstrong & Li, 2022). Other than financial sustainability, underlying issues relating to management structures, contracting procedures, labour practices, accounting, cost recovery, and corruption (Wilson *et al.*, 2013; Armstrong & Li, 2022) need the attention of the municipality. The lack of adequate services for lower-income communities makes it difficult for municipalities to address issues of urban poverty and equity.

As a result of these challenges that are facing municipalities in developing countries, Wilson *et al.* (2013) propose that “solutions need to be developed locally and tailored specifically to local needs and conditions. Users and potential users need to be involved in designing their own services, which in turn need to be delivered by a diversity of types of service providers. Critically, those services must be provided at a cost that is locally affordable”.

The challenges raised indicate that there is still a need to develop a framework to guide the implementation of sustainable municipal SWM (Azevedo *et al.*, 2019). But Chand Malav *et al.* (2020) raise the need to identify the ISWM alternatives available that must be the most effective, attainable alternatives adapted to society to reduce environmental damage caused by MSW. Ross (2018) sees the challenges in the municipalities as a clarion call for lobbying for a departure from the development model of ‘experts’ designing and implementing solutions for local communities that have been transplanted from a foreign environment to a state where local conditions and activities, including indigenous waste practices and traditional beliefs, are considered (Ojolowo & Wahab, 2017).

2.3 Indigenous knowledge as alternative to ‘Western’ knowledge

According to Mapira and Mazambara (2013); Hadlos, Opdyke and Hadigheh (2022), indigenous knowledge systems were developed to be a solution to survival challenges. This knowledge has been around for a long time, and it is tied to culture, location,

experience, and environment. As such, it is humanity's legacy and heritage that are homegrown. It is regarded as 'lived knowledge' (IPEBS, 2013; Holtorf & Högberg, 2022). IPEBS stands for Intergovernmental Platform on Biodiversity and Ecosystem Services. Bhat et al. (2018) regard indigenous knowledge as knowledge that has survived the test of time in a particular place or community. The indigenous knowledge is rich with human-environment interaction (Wahab & Ogunlola, 2014; Hadlos, Opdyke & Hadigeh (2022); as such, it is still a cornerstone for many communities, especially in rural areas, when it comes to human-environment interaction decision-making. According to Ajibade (2007), indigenous knowledge practices are above all human activities, including waste management, and they should be improved for the good of society.

Bruinsma (2003) and Jessen, Ban, Claxton and Darimont (2022) define indigenous knowledge (IK) as knowledge that comes from the past and changes with time that people in certain areas possess. Whereas Cheserek (2005) defines it as knowledge possessed by the local people through informal means as they interact with the natural environment. UNESCO (2006) maintains that IK is about practices that are commonly practiced in communities that are indigenous to a specific place. Warren (1991) and Kennedy, Wang, Maundu and Hunter (2022) see IK as knowledge that differs from one culture to another or from one society to another and has developed over time. Warren (1991) and Kennedy, Wang, Maundu and Hunter (2022) also contend that indigenous knowledge systems have an impact on agriculture, health care, medicine, food preparation and preservation, land use, the management of natural resources such as water, and many other activities in the community. IKS assists with problem-solving strategies and self-efficiency for local communities (Warren, 1991; Dlamini, 2006; Mohoang, 2022). This study adopted the definition by Naidoo et al. (2003), which states that "IK is a large body of knowledge and skills that are developed outside the formal educational system, and are embedded in culture, and are unique to a given location or society." Location will refer to a tribal village. From the above definitions, one can conclude that (1) IK is common in each locality or community and that it may differ from one locality or community to another. (2) That IK was developed by the previous generation and passed on to the current generation. (3) That IK is informal knowledge that is acquired through experience. (4) That IK is dynamic and that it is not static. It evolves over time to respond to changing times. (5) That IK is informed by

the local tribe or village; (6) That IK informs the foundation of the decisions taken by the local people or village; therefore it can be used as the basis for problem-solving strategies and survival strategies. (7) That IK informs the practices of the local people. (8) That IK can be transferred as people move from one area to another; (9) That IK is experiential rather than theoretical.

Seeman et al. (2017) stated that the literature revealed gaps such as a lack of Waste Information Systems (WISs) in rural areas, a lack of health education on proper management in the rural areas, a lack of legislative frameworks that govern SWM in the rural areas, insufficient management of solid waste due to a lack of implementing existing laws and policies, and negative impacts on human wellbeing and the environment.

Rural communities believe in their culture and want to maintain it. Mphande (2016) further built on the idea that rural communities have their own way of living and doing things in favour of their culture, norms, and values.

The absence of a formal waste collection system is a concern from both an environmental and health perspective. Uncollected household waste, including nappies, food waste, sand, gravel, paper, plastic packaging, metal, and glass is known to contribute to several health impacts (Suleman *et al.*, 2015; Senekane *et al.*, 2022). Although some publications offer literature on the healthcare risks associated with waste management in urban areas, they do not provide solutions to help communities without formal waste collection. This gap calls for rural communities to engage in indigenous practices of SWM. Therefore, there is a need for continuous research in rural communities looking for the impact of indigenous solid practices on human wellbeing and the environment, which would also inform policymakers to respond.

2.4 The relevance of indigenous knowledge to human welfare and development

There is growing recognition of the role of indigenous knowledge may play in addressing global environmental issues. This recognition is becoming part of the global agenda due to continued influence by delegations to the United Nations (UNEP, 2015). The following bodies recognizes the importance of IK: the International Labour Organization (especially convention 199), the Rio Declaration, World Summit on

Sustainable Development, The Convention on Biological Diversity, the World Health Organization, UNESCO, and the Commission of Human Rights.

The World Commission on Environment and Development (WCED), in *Our Common Future*, recognises that indigenous knowledge is necessary for sustainable development of the world's environmental resources. The Commission sees the disappearance of indigenous knowledge as a loss and deprivation of the opportunity to learn from indigenous practices in sustainably managing a very complex ecosystem (WCED, 1987; Olaopa & Ayodele, 2022). The Convention on Biodiversity (CBD) calls for indigenous knowledge and its institutions to be part of the global agenda to conserve the ecosystem (McGregor, 2010). Article 8j of the Convention on Biological Diversity (CBD) mandates that countries

“respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices”.

The importance of indigenous knowledge prompted the International Council of Science and UNESCO to propose the following principles (ICSU 2002):

- Ensure the full and effective participation of traditional knowledge holders during all stages of elaboration of sustainable development policies, plans and programs,

alongside the scientific and technological community

- Acknowledge and respect the social and cultural bases, including the authority

structures within which traditional knowledge is embedded

- Recognise the rights of traditional people to own, regulate access and share benefits

of their unique sets of knowledge, resources, and products

- Ensure that traditional knowledge holders are fully informed of potential partnerships and that these are only entered into with prior informed consent.
- Promote models for environmental and sustainable governance that incorporate principles of genuine partnership and collaboration between scientific and traditional knowledge.
- Promote training to better equip young scientists and indigenous people to carry out research on traditional knowledge.

2.4.1 IKS in South Africa

The IKS Policy was introduced in South Africa in 2004 to consider IK in development solutions. The policy recognises, promotes, develops, protects, and affirms IKS in South Africa. The key drivers promulgated in the IKS policy are:

- The affirmation of African culture in the face of globalization
- Practical measures for the development of services provided by IK holders and practitioners.
- Underpinning the contribution of IK to the economy, the role of IK in employment and wealth creation, and
- Interfaces with other knowledge systems.

This is a positive step towards formalising IKS, but the challenge is that there are still some gaps, especially in terms of practical implementation (Naidoo *et al.*, 2013; Weaver, 2023).

Ubuntu is influencing IKS in South Africa. Ubuntu as an African value impacts every aspect of the African people's well-being. This is the case in South Africa. Ubuntu is about collective existence. Umuntu, ngumuntu, ngabantu, or motho, ke motho, ka batho. This can be translated as "a person is a person because of or through others"

(Molokoti, 2009; Aharimpisya, Kasekende & Kiyingi, 2023). This is a moral attribute that makes a person a person. The concept of Ubuntu brings with it a sense of sharing, compassion, reciprocity, dignity, humanity, justice, mutual caring, oneness, non-domination, and communality (Mandela, 2006; Khoza, 2006; Haaga, 2022). In terms of Ubuntu, an African is not an individual but a person within the community. That is, in Africa, the sound biological functioning of a person depends on the sound biological functioning of another person. IK is about practices that are commonly practiced in the communities that are indigenous to a tribal village.

2.5 Past experiences are a base to current waste practices.

The use of the earth's resources to support life and remove waste is not something new to human beings. It started with a primitive society. Waste has been produced by non-nomadic societies since around 10 000 BC (Worrell & Vesilind, 2012). The general trend among societies was to bury solid waste or get rid of it in local rivers, but this practice created problems of odour and disease as time went on. Recycling materials is not something new. The farmers of ancient times were involved in agricultural practices that used waste as fertilisers (Tchobanoglous *et al.*, 1993; Litskas, Ledo, Lawrence, Chrysargyris, Giannopoulos, Heathcote, Hastings, Tzortzakis & Stavrinides, 2022). But the shortage of planned waste management resulted in the spread of diseases. The Black Death, which resulted in the deaths of many fourteenth-century Europeans, may have been caused by the littering of solid waste (Louis, 2004, Tchobanoglous *et al.*, 1977; and Worrel & Vesilind, 2012; Maalouf & Agamuthu, 2023). That is why public health concerns, scarcity of resources, and aesthetics are regarded as drivers of solid waste management (Louis, 2004; Wilson, 2007; Maalouf & Agamuthu, 2023).

Organised solid waste management took place in the old city of Mahenjo-Daro in the Indus Valley around 2000 BC (Worrell & Vesilind, 2012; Nelson, 2022). The Greeks did it around 500 BC (Melosi, 1981), and the Chinese around 200 BC. England passed the Urban Sanitary Act in 1888 to stop the disposal of solid waste into trenches and rivers, which was followed by the passing of the Rivers and Harbours Act of 1899 in the United States (Tchobanoglous *et al.*, 1993; Dowell, 2023). With time, scarcity of

resources led to the repair and reuse of discarded items (Woodward, 1985; Kurniawan, Othman, Liang, Goh, Gikas, Kusworo, Anouzla & Chew, 2023).

The cholera outbreak in the nineteenth century resulted in municipal solid waste collection services in major European and US cities by 1900 (Tarr, 1984; Wilson, 2007; Malin, 2022). This health concern led to the collection and removal of waste from housing areas. This led to the formation of landfills. However, from 1900 to 1970, waste management was not regulated that much. Furthermore, it was dominated by discarding and burning (Wilson, 2007; Kalina, Makwetu & Tilley, 2023). Environmental concerns in solid waste management started around 1960. There was a move, then, to move from open dumps to controlled discarding (Rushbrook & Pugh, 1999; Nayahi, Ou, Liu & Janjaroen, 2022). by some developed countries, then by 1990 they improved leachate and gas control (Wilson *et al.*, 2013). But the developing countries were still tied to open dumping and open burning (World Bank, 2012). By 2009, 95% of developed countries had state-of-the-art facilities for disposal as compared to 50% of developing countries (Wilson, 2007; Wilson *et al.*, 2013; Nayahi, Ou, Liu & Janjaroen, 2022). Waste disposal is still a problem in many developing countries due to high capital investment and high operating costs (Wilson *et al.*, 2013; Makwetu & Tilley, 2023). The driver for improved disposal facilities has been environmental protection.

The Three Rs (reduce, reuse, recycle) also played a role as drivers of solid waste management. Shortages of money and material resources improved the selling power of materials and products, and these led to waste minimisation, reusing of products, recycling of materials, and composting (Strasser, 1999; Wamba, Fotso, Mosconi & Chai, 2023). Developed countries have improved their capacity to increase recycling as recycling markets offer a competitive 'sink' as an alternative to increasing expensive landfilling and incineration (Scheinberg, 2011; Khaturia, 2022). Many developing countries still rely on the informal sector for recycling, which is motivated by the selling power of materials.

In 1972, the issue of sustainable development started to appear on the world agenda. First, in the book related to the 1972 United Nations (UN) Stockholm conference on the human environment, and then in the title of a 1980 report on World Conservation for Sustainable Development. Our Common Future report (WCED, 1987) defined

sustainable development. In 1992, in Rio de Janeiro, the UN Conference on Environment and Development brought about the Agenda 21 documents showing the issues, players, and means of achieving sustainable development (Elliot, 2013; Sianes, Vega-Muñoz, Tirado-Valencia, & Ariza-Montes, 2022). In 2000, the UN community came up with the Millennium Development Goals (MDGs). They were followed in 2002 and 2015 by the Johannesburg Declaration on Sustainable Development and Sustainable Development Goals (SDGs), respectively. The issue of sustainable development brought about the issue of sustainability in solid waste management. This was evident by the coming into being of the waste hierarchy and integrated solid waste management.

This short history of the evolution of waste management indicates that the challenges of solid waste have been with human beings since the earliest times and that the search for better ways of dealing with solid waste management should continue. Even though all Sustainable Development Goals (SDGs) are essential, the world community sees sustainable development goal (SDG) 13: namely, “action to combat climate change and its impact,” as the most urgent one. This is so because the impact of climate change can make the following sustainable development goal (SDG) goals unrealisable, as it harms the environment, economy, and society: sustainable development goal (SDG) 1: “end poverty in all its forms”; sustainable development goal (SDG) 2: “end hunger, achieve food security and improved nutrition and promote agriculture”, sustainable development goal (SDG) 3: “ensure healthy lives and promote sustainable use of terrestrial” and sustainable development goal (SDG) 15: “protect, restore and promote sustainably managed forests, combat desertification, and halt and reverse land degradation and biodiversity loss”.

Life-threatening weather conditions, such as floods and droughts, caused by climate change, will affect food security in many developing and underdeveloped countries. This will mean that the world population will suffer from hunger and its related diseases. The African population will also be affected. Drought and floods will also destroy some species of animals and plants and, thereby, affect ecosystems. This will ultimately cause land degradation. One of the things that contribute to climate change is waste; therefore, a reduction of waste can play a positive role in the reduction of climate change.

From the history of solid waste management, a deduction can be made that the main drivers of solid waste management development are public health, environmental protection, and three Rs (3Rs). Epidemics like cholera led to solid waste management and collection services.

2.6 The concept, waste

According to the Waste Act, 2008 (Act No. 59 of 2008), waste means “any substance, whether or not that substance can be reduced, reused, recycled, and/or recovered, that is surplus, unwanted, rejected, discarded, abandoned, or disposed of, which the generator has no further use of for production and that must be treated or disposed of.” The UNEP regards waste as substances or objects that are disposed of or are intended to be disposed of or are required to be disposed of by the provision of national law. From the two definitions, one can conclude that for an object or substance to qualify as waste, it has to be non-wanted and useless, have no purpose, and be discarded.

For waste to be reduced, this calls for waste management. The concept of waste management involves planning, controlling, and supervising. This means that for waste to be managed, there should be proper planning, organisation, leading, monitoring, controlling, and supervision of the entire process. The European Council Directive on Waste’s definition of waste management involves the collection, transportation, recovery, and disposal of waste and supervision (European Council, 1991; Wang, Tang, Sun & He, 2022). On the other hand, Tchobanoglous *et al.* (1993) define waste management “as the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid waste in a manner that is per the best principles of public health, economics, engineering, aesthetics and other environmental considerations, as well as response to public attitude”. While these definitions have tried to capture the essence of waste management, they have left out avoidance, reuse, reduction, recycling, and recovery, which contribute significantly to waste management. This means the descriptive definition of waste management should include control of generation, storage, collection, avoidance, production, reuse, recycling, recovery, transfer and transport, processing, disposal, and supervision of the entire process. This should be done to deal with issues related to the health, environmental, aesthetic, land use, resource,

and economic challenges related to irregular disposal of waste (Henry *et al.*, 2006; Nemerow *et al.*, 2009; Wilson, 2007; Abubakar *et al.*, 2022).

2.7 How Solid waste is management in developed countries.

Developed countries generate large amounts of solid waste. However, they have well developed technical, financial, and institutional aspects to manage waste (Srinivas, 2003; Hemidat, 2022). Hence, they have moved away from concentrating on sanitation-related diseases, such as cholera, to diseases of affluence and sustainability (Konteh, 2009; McGranahan, 2001; Bantider, Hailelassie, Alamirew & Zeleke, 2022). This makes them less prone to the challenges of solid waste management. The drivers towards integrated solid waste management in developed countries are public health, nature, scarcity of resources, climate change, and public awareness and participation (Marshall & Farahbakhsh, 2013; Soni *et al.*, 2022). Most research has established that there is cooperation between the private sector and the public sector in solid waste management. The cooperation of public-private partnerships has been found to improve municipal solid waste management in developed countries (Cointreau *et al.*, 2000; Zhu *et al.*, 2007; Abdrabo, 2008; Filimonova, Krivosheeva & Mishenin, 2023). Key to cities like Tokyo (Japan), Sydney (Australia), London (United Kingdom), and New York (United States of America) is that recovery and recycling are prioritised and solid waste that cannot be recovered and recycled is treated before it is disposed of at well-designed landfills (UNEP, 2002; El-Saadony, Saad, El-Wafai, Abou-Aly, Salem, Soliman, Abd El-Mageed, Elrys, Selim, Abd El-Hack & Kappachery, 2023).

One concluded therefore that the developed countries were able to address the physical elements and governance elements. The physical elements are linked to public health, environment protection, and the 3Rs (reduce, reuse, and recycle) (Wilson, 2007; Mekonnen, dos Muchangos, Ito & Tokai, 2022), while the governance elements refer to the stakeholders (users, providers, and enablers), financial sustainability (cost-effective, and affordable, and sound institutions), and proactive policies (Wilson *et al.*, 2013; Aslam, Maqsoom, Tahir, Ullah, Rehman & Albattah, 2022). What has also been noted in developed countries is that big cities and smaller towns are not on the same level of solid waste management. However, developed countries have fewer challenges compared to developing countries in solid waste

management. Public health interests have driven developed countries to improve solid waste management. This was after it was discovered that poor waste management leads to diseases. Officials used enforcement through legislation to ensure that households are responsible for their waste. This interest in public health made American cities improve their solid waste management, bypassing legislation on waste (Louis, 2004; Al-Dailami *et al.*, 2022). European countries also passed legislation that improved their solid waste management (Wilson, 2007; Chioatto & Sospiro, 2023).

The concern for the environment came as a result of environmental movements and led to policies on solid waste management related to the environment (Wilson, 2007; Cheng, Tan, Wong, Koo & Amir Sharji, 2022). This led to the improvement of landfills and waste hierarchy. The waste hierarchy prioritised prevention, reuse, reduction, recycling, energy recovery, treatment, and landfill disposal in that order (Price & Joseph, 2000; Wilson, 2007; Wolsink, 2010; D'Sa & Patnaik, 2022). Care for the environment resulted in integrated solid waste management that took into account stakeholders, waste system elements, and aspects of solid waste management such as technical, health, financial, socio-cultural, institutional, and political (McDougall *et al.*, 2001; van der Klundert & Anschutz, 2001; Wilson, 2007; Kaur, 2023). Waste hierarchy still poses a challenge in developed countries. The environmental movement arose from public concern and awareness. With time, public concern and awareness became a driver of solid waste management, as more and more people became aware of the dangers of waste and were not keen to have waste near them. The scarcity of resources has led to resource scarcity as a driver of waste management in developed countries. Waste goods were collected and used again, and that led to the rise in waste pickers and the reduction of waste to be disposed of at landfills (UNI-HABITAT, 2010; Kazemi Moghaddam, Walker, Pakdel, Ahmadinejad & Mohammadi, 2023).

Climate change can be attributed to the increase of greenhouse gases. Climate change, being a driver of solid waste management, has resulted in the reduction of greenhouse gases. According to UNI-HABITAT (2010) and Wilson (2007; Saha & Handique, 2023), climate change awareness has reduced the major sources of methane (greenhouse gas) emissions to the landfills and improved energy recovery from solid waste. This was enforced through policies such as the EU Landfill Directive (Wilson, 2007; Saha & Handique, 2023). The weakness of climate change as the driver of solid waste management is that developed countries often pull out of

agreements relating to the combating of climate change with impunity. Notable in this case is the United States of America, which recently pulled out of the Paris Agreement. This means the climate agreements are not binding. Another major challenge with developed countries is their affinity to dump waste in developing countries, thereby practicing out-of-my-country type of waste management. When it comes to waste, they are concerned with intergenerational equity at the expense of intragenerational equity. They fail to recognise that there is one global world. Lack of assistance in solid waste management in developing countries will have a ripple effect on developed countries. That is, one way or another, the consequences of improperly managed waste in developing countries will affect developed countries, as climate change will not happen in one part of the world.

2.8 How solid waste is management in developing countries.

In this section, the researcher looks at waste management in Ethiopia and Nigeria, as developing countries, and then looks at the general trend of waste management in developing countries. There is a widespread challenge to waste management in Ethiopia. Solid waste is still being disposed of along roadsides and in open areas. Around sixty percent of the population disposes of their solid waste in open fields. However, studies conducted by Research Inspired Policy and Practice Learning in Ethiopia and the Nile Region (RIPPLE) indicate an improvement, as the number of household latrines has increased. However, the situation in rural areas is far from improving. In Nigeria, the problem of solid waste management has led the federal government of Nigeria to promulgate Decree 58 for the formation of the Federal Environmental Protection Agency (FEPA). The national policy was aimed at achieving the following goals: secure quality of environment suitable for health and wellbeing; increase public awareness and encourage consideration of linkages between the environment and development; and inspire individuals in the community to be involved in environmental protection and increased determination (FEPA, 1989; Puntillo, 2023). Concerning solid waste management, the collection and disposal of solid waste were to be collected in an environmentally safe manner (FEPA, 1989; FRN, 1981; Soni, Das, Hashmi, Yusuf, Kamyab & Chelliapan, 2022). However, according to Adegoke (1989); Singh (1998) and Scholar (2022), these were not achieved, as improperly sited open dumps defaced several cities.

Studies conducted by Seng *et al.* (2018) on households' knowledge, attitudes, and practices towards solid waste management in suburbs of Phnom Penh, Cambodia; Chiemchaisri *et al.* (2007) on municipal solid waste management in Thailand and disposal emission inventory; Al-Khatib *et al.* (2015) on public concerns about and perceptions of solid waste dump sites and selection of sanitary landfill sites in the West Bank, Palestinian territory; Aderoju *et al.* (2020) on A GIS-based analysis for sanitary landfill sites in Abuja, Nigeria; and Dos Muchangos *et al.* (2015); Bui, Tseng, Tseng, Wu and Lim (2023). Analysis of the structure of barriers to municipal solid waste management policy planning in Maputo city, Mozambique, conducted in Cambodia, Thailand, West Bank Palestine territory, Abuja and Maputo, respectively, indicates that there are problems relating to solid waste management in developing countries.

The general trends in solid waste management are that many developing countries are still experiencing sanitation-related diseases (Konteh, 2009; Fadhullah, Imran, Ismail, Jaafar & Abdullah, 2022). This is because their solid waste management systems are still primitive. Some of them are mainly concerned with making sure that there is food for their communities (Wilson, 2007; Pheakdey, Quan, Khanh & Xuan, (2022), and waste management is not an urgent matter. Where solid waste management is a priority, the main concern is just to take it out of the community. A comparison between developed and developing countries indicates that enforcement of waste management laws and environmental protection is relatively low in developing countries (Wilson, 2007; Pheakdey *et al.*, 2022). Marshall & Farahbakhsh (2013) see

“soaring inequality, and the struggle for economic growth, varying economic, cultural, socio-economic, and political landscape; governance, institutional, and responsibility issues; and international influences have created locally specific, technical and non-technical challenges of immense complexity”.

This statement necessitates the need for more research that will provide homegrown solutions to waste management in developing countries.

A United Nations Report (2004) maintains that developing countries are advancing in terms of access to clean water but are not succeeding in achieving sanitation goals. This was confirmed by the World Health Organisation (WHO) report (2004) and the United Nations International Children Education Fund report (2004), which indicate that an estimated 2,4 billion inhabitants have the prospect of facing the risks of needless diseases and death resulting from improper sanitation. Irregular dumping of solid waste and uncollected solid waste remains a public health challenge in developing countries. There are higher rates of diarrhoea and severe respiratory diseases for children living in households where solid waste is dumped or burned in the locality (UN-Habitat, 2010). Health data (UN-Habitat, 2010; Fadhullah et al., 2023) show public health challenges in developing countries such as diarrhoea and severe respiratory diseases for children living in households situated closer to dumping sites. In 2021, the World Bank website showed that 30% to 60% of solid waste in developing countries was uncontrolled (World Bank, 2010; Vinti & Vaccari, 2022), but the situation has since changed for the better, even though there is a gap between formal and informal settlements (Wilson *et al.*, 2013; Vinti & Vaccari, 2022). According to Wilson *et al.* (2013), the challenge lies in how to extend services to informal settlements, and such challenges are related to governance issues and the failure to adapt services to local conditions.

One of the drivers of solid waste management is public health (Marshall & Farahbakhsh, 2013; Bui & Tseng, 2022). They also see resource shortages, climate change, and public concern and awareness as drivers of waste management in developing countries.

Solid waste management in developing countries is behind that of developed countries, as they still experience challenges from sanitation-related diseases like cholera. This is, in part, due to a shortage of financial sustainability. Budgets are drawn for waste management but often cater to less than fifty percent of the inhabitants (Henry *et al.*, 2006; Memon, 1999; Duggan, A.R.; Carr & Yan, 2022). This is caused by a shortage of financial management and analysis of data on solid waste management (Hanrahan *et al.*, 2006; Zurbrügg *et al.*, 2007; Parthan *et al.*, 2012; Mulya, Zhou, Phuang, Laner & Woon, 2022). To bring about financial sustainability, short-term and long-term financial costs, including revenues to cover these costs, need to be considered (Lohri *et al.*, 2013; Carr & Yan, 2022). The challenge of financial

sustainability forces many developing countries into survival mode. Hence, issues of solid waste management are only prioritised due to the pressure on public health. This forces some developing countries to apply disposal methods that do not comply with the 3Rs (reduce, reuse, and recycle), as a shortage of financial capital hampers capacity building and improvement of solid waste management (Henry *et al.*, 2006; Mulya *et al.*, 2022). There are regulations available to shield the health of people and the environment, but unplanned solid waste disposal is still evident due to a shortage of enforcement (Wilson, 2007; Ross & Law, 2023). This means that even if developing countries have policies and legislation in place, they lack implementation. The lack of implementation can be attributed to management failure, unwillingness on the part of the beneficiaries of waste management to pay for the services, and corruption. Elements of good governance are highly needed if solid waste management is to improve to the required level. With good governance, corruption can be defeated. Corruption stifles economic growth, which is key in solid waste management. The issue relating to governance aspects, namely inclusivity, financial sustainability, and good institutions and good policies that are not reactive but proactive, is also a challenge in developing countries as compared to developed countries.

“inclusivity in service provision is important, particularly where municipal services lack capacity to provide a full service to poor communities and informal settlements” (Wilson *et al.*, 2013).

But most local municipalities, especially rural municipalities, deliver on the obligation of waste management by operating in isolation, not involving other stakeholders. This makes them fail to get buy-in from other stakeholders, like service users. Lack of buy-in results in a lack of cooperation and failure to pay for services.

Poor waste management can also indicate poor governance. Functional management bodies, good contracting procedures, good labour practices, responsible accounting and cost recovery, and a lack of corruption can improve waste management (Wilson *et al.*, 2013; Soni *et al.*, 2022). Governance in this regard plays a positive system driver role as it improves the existing waste management system.

There is a rapid growth of informal settlements, which is taking a toll on the capacity of the municipalities to deliver solid waste management services. It is difficult to deliver

such a service in unplanned settlements, as sometimes the roads are too narrow for vehicles to travel on. In cases where there is vehicular access, the municipality will not be able to recover or recoup the costs of solid waste management services. It will also be difficult to enforce solid waste management-related policies and legislation.

International financial institutions influence developing countries. They perform an important role in helping developing countries through loans. However, these loans at some point become a barrier for developing countries to grow economically and thus affect solid waste management negatively. International financial institutions sometimes assist in building expensive facilities for solid waste management, which become unsustainable when the funds are used up (Wilson, 2007; Abubakar *et al.*, 2022). There is a false perception among international financial institutions that the success story in developed countries will be the success story in developing countries. This belief came as a result of colonialism, and it was also entrenched by it. This belief is continuing under neo-colonialism. Neo-liberal thinking is also playing a role in this regard. Transferring creatives that are successful in a certain context may not necessarily be effective in another context (Southerton *et al.*, 2011; Al-Okaily & Al-Okaily, 2022). The reality is that developing countries are faced with high and ever-increasing debts that have to be serviced year in and year out at the expense of services like solid waste management. For them to succeed in solid waste management, what is needed is an affordable, homegrown system that is based in the context of developing countries and free from the influences of complicated solid waste management initiatives in developed countries. This is a call to action to find new solid waste management approaches for developing countries.

Irrespective of the solid waste management challenges documented by various scholars of developing countries, a study by Wilson, Velis, and Rodic (2013); Sajid, Raheem, Ullah, Asim, Rehman and Ali (2022) is drawing an optimistic picture of solid waste management in developing countries. The study collected data from twenty (20) reference cities. It shows that there has been an improvement in solid waste management in the past ten (10) years. This improvement is in waste collection service, recycling rates, and the adoption of integrated solid waste management (ISWM). Integrated solid waste management is a system that addresses both the physical (technical) and elements (collection, disposal, and recycling) stakeholders

and “soft” governance aspects (Wilson *et al.*, 2013; Aslam *et al.*, 2022). The study examined how those cities tackled their solid waste problem. It concluded that:

“there are no universally right or wrong answers. Rather, solutions need to be developed locally and tailored specifically to local need and conditions. Users and potential users need to be involved in designing their own services which, in turn, need to be delivered by a diversity of types of service provider. Critically, those services must be provided at a cost that is locally affordable” (Wilson *et al.*, 2013; Rostad, Skinner, Wentzel-Larsen, Hellesø & Sogstad, 2023).

This implies that solid waste management solutions for developing countries should be searched within the context of developing countries. Marshall and Farahbakhsh’s (2013); Soni *et al.*’s (2022) studies indicate that the drivers of solid waste management in developed countries are public health, environment, resource scarcity, climate change, and public awareness and participation. However, for them, what makes it difficult for developing countries to reach the level of developed countries are “urbanisation, inequality, economic growth, cultural and socio-economic aspects, policy, governance, and institutional issues; and international influences (Marshall & Farahbakhsh, 2013). For them, this is what makes successful approaches in developed countries have limited applicability in developing countries. Their review contrasted the solid waste management practices of developed countries with the “current challenges and complexities” of solid waste management in developing countries (Jagun, Daud, Ajayi, Samsudin, Jubril & Rahman, 2022). Their review “demonstrates the importance of founding new solid waste management (SWM) approaches for developing countries’ contexts”. This new way of dealing with solid waste management in the context of developing countries is what is to be researched (Khan *et al.*, 2022). Scholars are still struggling to find this new practice of dealing with waste in the context of developing countries (Tushar, Alam, Barin & Karmaker, 2023). Hence this study.

2.9 Deportation of the waste problem from land to the ocean

Waste can be managed through avoidance, reuse, recycling, energy recovery, and disposal (Khan, A.H., López-Maldonado, Khan, Villarreal-Gómez, Munshi, Alsabhan & Perveen, 2022). The trend when it comes to the use of the ocean to manage waste has, in most cases, been through disposal means (Hossain, Islam, Ghose & Sahajwalla, 2022). The most common disposal has been to dump it in the ocean. Ocean dumping refers to any purposeful release of waste into the sea from vessels and airplanes or other human-made designs at sea. Simply put, ocean dumping refers to the disposal of waste into the marine environment while being aware (Rehman, Iqbal, Khan, Ullah, Shah & Tariq, 2022). This kind of waste disposal was regarded as one of the better ways to manage waste from the land. It was seen as safe and cheap compared to disposing of waste on land. It also raised less public concern compared to the pressure that was mounting about environmental concerns on land. Ocean dumping became a new route and an alternative to land waste disposal (Rehman *et al.*, 2022).

The ocean has been used by human beings as a means of transport and a source of food. To this day, many countries remain dependent on the ocean for transport and food. Ocean dumping, unless it is curtailed, will cause irreversible damage to marine life and affect the quality of human life as it causes marine pollution. Pollution is about the release of harmful materials into the environment (Siddiqua *et al.*, 2022). The polluting materials damage the quality of air, water, and soil. That is the reason they are called pollutants. Pollution does occur in the ocean and it is called marine pollution. Marine pollution occurs when harmful materials enter the ocean and harm the marine environment. Eighty percent of marine pollution comes from land waste mismanagement because of human activities (Sibaja-Cordero & Gómez-Ramírez, 2022). One of the major causes of marine pollution is ocean dumping. For years, ocean dumping as a form of waste management was practiced without control.

After World War I and World War II, countries were faced with the challenge of how to dispose of unwanted war materials. The solution was, in most cases, to dump them in the sea. But these dumped materials pose a risk to fishermen as they can fish them out with their nets, and they also pose a potential threat to users of beaches (HELCOM, 2013; Gilman, Humberstone, Wilson, Chassot, Jackson & Suuronen, 2022). That is the reason the United Nations General Assembly adopted in 2010 a resolution noting the importance of raising awareness of the environmental effects

related to waste originating from dumped war materials (UNGA, 2010; Dawson, 2023).

Marine pollution has a long history, but it became a concern around the 1950s (Dawson, 2023). Before then, scientists used to believe that the oceans were so vast that they could render harmful materials harmless. The dumping of radioactive waste caused controversy, especially the dumping of radioactive waste off the coast of the United States into the Irish Sea from British facilities and the French Commissariat' al'Energie Atomique into the Mediterranean Sea (Amiard, 2023). This was followed by the 1967 crash of the oil tanker Torrey Canyon and the 1969 Santa Barbara oil spill off the coast of California.

The concern over ocean dumping led President Nixon to request that the Council on Environmental Quality (CEQ) research the problem in 1970. This study highlighted in its report, "Ocean Dumping: A National Policy", that ocean dumping needed immediate attention. Congress then enacted remedial legislation, known as the Marine Protection, Research, and Sanctuaries Act. Although this was a step in the right direction, it was not enough; as marine pollution was not only a national problem but also an international problem (Gonsoulin III, 2022). It quickly proved that international agreements are necessary to alleviate the problem of marine pollution.

2.9.1 The trend and quantity of ocean dumping

The reports submitted under the 1972 London Convention (LC) and 1996 London Protocol indicated the release of radioactive waste and sewage sludge into the ocean. Belgium reported fifty-two (52) million tons of dredged material, Australia dumped up to twenty (20) thousand litres, and the Republic of Korea reported fifty-five hundred and six thousand and five hundred and thirty-four tons of sewage sludge. The dumping of fish from various countries was around a hundred (100) thousand tons (IMO, 2014b; Kizlarkhon, 2022).

The first reported dumping of radioactive waste took place in 1946. From then on, different countries have used more than eighty (80) sites to dispose of approximately eighty-five (85) thousand terabecquerels of radioactive waste (IAEA, 1999). The act of dumping war remainders in the sea started and increased as per a decision made by the Soviet Association and the heads of France, the United Kingdom, and the

United States under the framework of Article 3 of the 1945 Potsdam Agreement. Afterwards, other states followed this trend (Dawson, 2023). In the Arctic Ocean, chemical armaments and atomic material have been disposed of exclusively by the Soviet Union in zones that range from tens to hundreds of metres from top to bottom. The exact extent of the disposal of chemical armaments by the Soviet Union from the 1940s to the 1980s in the Arctic Ocean is uncertain (Dawson, 2023). Notwithstanding, it has been set up that the Soviet Union disposed in the Barents Sea and the Kara Sea approximately 75 000 tons of mustard and lewisite; 40 000 tons of these chemicals in the White Sea; and moreover, around 2 000 tons of sarin and 30 000 tons of tabun in the Barents Sea and the Kara Sea. The Soviet Union, the United Kingdom, and the United States disposed of 220 000 tons of German chemical weapons in the Baltic Sea and Skagerrak (Muzaffar, Khan, Srivastava, Gorbatyuk & Athar, 2023).

The International Atomic Energy Agency (IAEA) estimated in 1991 that the ocean dumped nuclear waste between 1949 and 1982 of 46 PBq of radioactive material and that 42,31 PBq was discarded in the North-East Atlantic (Alwaeli & Mannheim, 2022).

In 1989, the IAEA (International Atomic Energy Agency) set the consolidated figure at 63 PBq. The Russian Federation revealed its thirteen (13) disposal places in the Arctic Ocean, which, as per the IAEA's 1993 estimate, hold double the measure of radioactive waste (90 PBq) as all recently realised discarding locales on the planet joined together.

As indicated by the Russian authority figures, approximately 17,000 holders of atomic waste were unloaded at the Arctic Ocean, notwithstanding nineteen (19) sunken ships with radioactive squander; furthermore, five nuclear reactor compartments, one nuclear reactor, one holder with protecting assembly of a nuclear icebreaker; seven hundred and thirty-five radioactive construction units; and three nuclear undersea vessels.

The Soviet atomic undersea vessel K-278 Komsomolets lies in the Norwegian Sea and is accepted to be excessively deep (1 655 m) to be retrieved. Undersea vessel K-159 lies in the Barents Sea at a depth of 250 meters. Another Soviet nuclear submarine, K-27, was made to sink in 1981 off Novaya Zemlya.

The Baltic Marine Environment Protection Commission dumped materials weighing around forty (40) thousand tons in the Baltic after World War II. The dumping area “in

the Baltic was south-east of the Swedish islands of Gotland and south-west of the Latvian city of Liepa, east of the Danish Island of Bornholm, and south of the Little Belt between the main Danish islands and Schleswig-Holstein in Germany” (HELCOM, 2013; Ortega Medina, 2023).

The information provided by the OSPAR commission indicates that one million tons of war materials were disposed of in Beaufort’s Dyke, about one hundred and sixty-eight (168) thousand tons in Skagerrak, some three hundred (300) thousand tons of bombs, grenades, torpedoes, and mines were dumped in the North Sea and about thirty-five (35) thousand tons were dumped off Knokke-Heist, Belgium (OSPAR, 2010; Kuhn, Van Franeker & van Loon, 2022).

Around one thousand and five hundred (1500) tons of war material had to be moved from relatively shallow seawater and re-dumped in deeper water by the New Zealand government in 2006 as they were a threat to human lives (LC-LP, 2006).

2.9.2 International environmental law as a tool in waste management

This section on International environmental law paves the way for the discussion of global, regional, and multilateral environmental agreements. International environmental law is about agreements between nations to control the Anthropocene by resolving the most damaging environmental challenges (Du Toit & Kotzé, 2022). The Anthropocene is the current period in which human activity dominates the influence on climate and the environment (Harris, 2022). The International Environmental Law has been created to manage pollution, waste, and the depletion of natural resources, considering sustainable development. In most cases, it is drafted by states for states to manage challenges that are a threat to human health and the environment that arise between states (Atapattu, 2022). The international accords are recognised in terms of Article 38 (1) of the Statute of the International Court of Justice. International environmental law includes environmental topics like biodiversity, climate change, ozone protection, all forms of waste, desertification, marine resources, and the negative impacts on air, land, and water (Atapattu, 2022; Du Toit & Kotzé, 2022).

This research has covered global and regional conventions. These conventions are tools employed by states to bind themselves to be compliant with specific environmental goals. These tools are called multilateral environmental agreements

(MEAs). Multilateral environmental agreements can be in the form of a convention, protocol, treaty, or agreement (Sand & McGee, 2022). The multilateral environmental agreements are binding if and only if they comply with international environmental law. Multilateral environmental agreements bind those states that are committed to them, for example, regional conventions (Gupta, Vegelin & Pouw, 2022). But they can still have restrictive measures on business by parties with non-parties. Multilateral environmental agreements have been around for almost a century. But a lot of them appeared after the 1972 International Stockholm Conference on Human Environment (Gupta, Vegelin & Pouw, 2022). A number of them are discussed in the coming sections of this research work.

The context of multilateral environmental agreements changed after 2015, when the seventeen (17) Sustainable Development Goals (SDGs) were embraced. It is expected that new multilateral environmental agreements should support the attainment of the Sustainable Development Goals (Baste & Watson, 2022). The targets of each of the 17 goals have to be achieved by 2030. The multilateral agreements are central to the achievement of the Sustainable Development Goals.

For a multilateral environmental agreement to be adopted, there should be negotiations. If it is a new multilateral environmental agreement, then an intergovernmental negotiating team is key to the negotiation, but if it is an existing multilateral environmental agreement, as in the revision of a convention, the Conference of the Parties plays a pivotal role (Sand & McGee, 2022; Baste & Watson, 2022). In most cases, states come to the negotiating table of a multilateral environmental agreement having taken a position on the multilateral environmental matter to be negotiated. A national delegation negotiates from the standpoint of their national interest, looking at how a new multilateral environmental agreement will affect their national interest (Barros Leal Farias, 2022). Hence, compromises and loopholes are usually found in many multilateral environmental agreements. Rules of procedure are put in place to allow smooth negotiations. Rules of procedure indicate, amongst other things, the place and date of the meetings, the agenda, the establishment of a bureau (to assist negotiations not to collapse), and the language of the meetings.

The course to be followed by states to commit to a multilateral environmental agreement is guided by the Vienna Convention of the Law of Treaties of 1969 (Shirlow

& Gore, 2022). The steps to be followed for the agreement to succeed are adoption, signature, ratification, and entry into force. It is in the diplomatic conference that the agreement is drafted, agreed upon and embraced by the parties. The agreement is signed by an authorised state representative. The signature indicates that it is the right agreement for the diplomatic conference that has been agreed upon. If a state has an interest in becoming a party to the multilateral environmental agreement, it should follow the ratification or accession process (Sand & McGee, 2022). Through ratification or accession, the state indicates its permission to be bound by the accord. It is not a must that states ratify an agreement. In the case of the Paris climate agreement, Iran, Libya, Yemen, and Eritrea did not ratify the agreement. The multilateral environmental agreement enters force after a specified period if an agreed number of states have ratified it (Hunter, 2022).

Once the states have ratified the agreement and it is in force, in terms of the fundamental principle of international law, that agreement must be observed and implemented. In some cases, states should adopt or amend policies and legislation to implement the agreement. The multilateral environmental agreements have compliance mechanisms and dispute settlement procedures (Hunter, 2022).

The body that runs operations and implements the agreement is called the Conference of the Parties (COP). The Conference of the Parties is made up of states that are part of the accord. The convenor of the Conference of the Party is the Secretariat. The Secretariat ensures that the Conference of the Parties meets regularly per the multilateral environmental agreement to assess and check the effectiveness of the multilateral environmental agreement and to do appraisals when the need arises (Tounsi, 2023).

States do withdraw from the multilateral environmental agreements even if they have ratified them. An example is the United States pulling out of the United Nations Framework Convention on Climate Change (UNFCCC) in 2020. This happens when the state feels that being part of the accord does not serve the national interest. When parties withdraw from the agreement, they are exercising their sovereignty. The withdrawal is not permanent, as each time the state wants to return to the agreement, it may do so (Felter, 2023).

Multilateral environmental agreements usually have a specified structure. The key elements of the agreements are context, commitment, institutions, and compliance. The context has the preamble, definitions, objectives and principles, and general provisions. Commitments include substantive commitments, financial support, technological assistance, education and training, and research and monitoring. Institutions consist of the Conference of the Parties, subsidiary bodies if necessary, and secretariats. Compliance consists of communication, compliance, and dispute settlements (Hunter, 2022).

The basic principles of international environmental law can assist multilateral environmental agreements with the structure to pave the way for talks and implementation of talks; how to interpret the agreement and how to deal with disagreements; direction for the development and concurrence of national law; and an overarching framework for different multilateral environmental agreements (Hunter, 2022). The basic principles are based on: state sovereignty over natural resources; right to development; sustainable development; common heritage; common concern for humankind; prohibition to cause transboundary harm; intergenerational equity; common but differentiated responsibility; prevention; precautionary principle; notification, consultation; cooperation and environmental assessment; the right to transparency and public participation; and the polluter pays principle (Baste & Watson, 2022).

The mechanisms that are, in most cases, used in multilateral environmental agreements include prohibition or restricting polluting activities; prohibition or restricting the use of biological resources; product and process standards; emission standards; prior licensing and permits; and prior informed consent (Shirlow & Gore, 2022). The parties to the multilateral environmental agreement have to ensure compliance at the national level. Compliance is achieved through implementation and enforcement (Hunter, 2022). Implementation is about the adoption or amendment of laws and regulations and the putting into place or reorganisation of national institutions, while enforcement is about putting in place procedures, and actions, and persons to comply with environmental laws and regulations, for example, inspections and sanctions. The substantive commitments relate to implementation and enforcement, while the procedural commitments relate to the functioning of the agreement (Coen, Kreienkamp, Tokhi & Pegram, 2022).

Moving towards the application of specific measures that improve the particular environmental issue committed to a particular multilateral environmental agreement is a substantive commitment. Meeting the procedures established by multilateral environmental agreements, such as reporting on the status of national implementation, is a procedural commitment. Many multilateral environmental agreements have in place mechanisms to encourage compliance and measures to determine and address non-compliance. These may be in the form of compliance mechanisms, reporting obligations, and dispute settlements. There are no clear binding means of international imposition in the multilateral environmental accords. However, other members of the agreement use business connections to sway adherence (Coen *et al.*, 2022).

2.9.3 Legal framework on the prevention of ocean dumping

This section of the research looked at the history of the Protocols, their dissimilarities, and similarities and how they were aligned or not aligned to modern trends in waste management, the protection of the ocean, Agenda 21, and sustainable development. It also looked at how some conventions delayed the establishment of a harmonised European market, and how they built a favourable position for other member states to be more profitable than their rivals in the business realm.

The 1972 Stockholm conference encouraged countries to act upon ocean disposal and thermal processing, globally and regionally. It also urged countries to manage the practice of ocean dumping (Stockholm Conference Report, 1972). This was supported by the UN High Seas Convention Article 25 (1). Due to the 1972 Stockholm Conference, the world experienced responses to ocean disposal and thermal processing in the form of a global legal framework for the management of ocean disposal and thermal processing and also regional accords for the control of ocean disposal and thermal processing (Wang, Zhang, Huang & Zhang, 2023).

The legal framework on ocean dumping is based on Chapter 17 of Agenda 21, the 1972 London Convention (LC) and its 1996 protocol, the 1974 Helsinki Convention, and the BARCON with its 1976 BARCON Dumping Protocol (BDP). The legal framework for the prevention of ocean pollution and the control of ocean disposal can be divided into the global legal framework and the regional conventions (Mejjad, Laissaoui, Fekri & Hammoumi, 2023).

The definition of ocean dumping is commonly adopted by different conventions except for some minor changes, centred around the intentional dumping of unwanted materials into the ocean from human-made structures, which have been framed by the Law of the Sea Challenges (LOSC), Article 1(5) a. According to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR), Article 1(h), incineration refers to the intentional burning of waste material in the ocean (Mejjad, Laissaoui, Fekri & Hammoumi, 2023).

2.9.4 The prevention of ocean pollution and global conventions on ocean dumping

This research work limited itself to the LOSC (Law of the Sea Convention), London Convention (LC), and its 1996 Protocol in its review of the prevention of ocean pollution and global conventions on ocean dumping.

2.9.4.1 Prevention of pollution and the LOSC legal framework

LOSC Article 210(1) obliges a country to create laws and regulations to manage the disposal. And dumping has to be managed using prevention, reduction, and control. In terms of Article 210 (3), dumping can only be carried out if there is a permit from the national authority. Dumping in the local sea should be done with the consent of the coastal states and other states that may be negatively affected by the dumping (Tanaka, 2023).

LOSC recognises the effectiveness of regional rules as being appropriate to deal with ocean dumping. And bodies like the International Maritime Organisation (IMO), the International Atomic Energy Agency (IAEA), the Oslo and Paris Commission (OSPARCOM), and the Helsinki Commission (HELCOM) are regarded as competent organisations in the management of ocean dumping. In terms of Article 1.1(5)(a)(ii) of the LOSC, the definition of ocean disposal includes the discarding of all human-made structures and platforms, and this is done to protect the marine environment, navigation safety, and fishing (Gullett, 2023).

2.9.4.2 Ocean dumping and the 1972 London Convention

The 1972 London Convention (LC) can be regarded as the first global convention on ocean dumping. It consequently came to the Stockholm Conference. The drawing of

the accord was concluded on 29 December 1972, hence the 1972 London Convention. The 1972 London Convention regime was swayed by the 1972 Oslo Convention. Some members of the 1972 London Convention were also members of the 1972 Oslo Convention, which was adopted in February 1972 as a regional convention. More on the 1972 Oslo Convention has been covered under regional conventions on ocean dumping in the next sections of this research (Hong, Vivian, Vogt, Haag, Zuo & Qin, 2023).

In terms of Article I and Article II of the 1972 London Convention, the contracting parties should ensure that their policies are aligned to accommodate the restriction of contamination by ocean disposal as ocean dumping of hazardous waste affects human well-being negatively and harms the marine environment. The definition of ocean dumping in the 1972 London Convention is almost the same as the definition of ocean dumping by the LOSC, but it leaves out from its definition of ocean dumping the discarding of squalor due to offshore exploration and the exploitation of the seabed minerals (Shree & Angadi, 2023). The 1972 London Convention was not clear on whether seabed disposal fell under the definition of ocean disposal. And this was the weak point of the 1972 London Convention, as the same kind of waste that cannot be disposed of from a ship can be disposed of during offshore mineral search and mining of the seabed minerals (Shree Angadi, 2023).

The weakness of the 1972 London Convention led to countries like the UK, France, Japan, and the US. Germany, Switzerland, Belgium, and the Netherlands took advantage of its weaknesses and developed a sub-seabed dumping option for high-level radioactive squander in 1980. The 1972 London Convention did not cover incineration within its scope of application, but it was introduced in 1978. In terms of OSPAR, Article 1(h) incineration refers to:

“deliberate combustion of wastes or other matters in the maritime area for the purpose of their thermal destruction.”

The weakness of the LC not to cover incineration encouraged states to continue to pollute the ocean through incineration, and this defeated Article I and Article II, which demanded the contracting parties to align their policies with the restriction of marine contamination (Hong, 2023).

The LC, in its original form, had two lists of substances to be dumped, which were in Annexures I and II. Annexure I included high-level nuclear waste, and it is called the Black List. All substances listed in Annexure I were completely prohibited from ocean dumping. Annexure II contains a list of low-level nuclear waste, and it is called the Grey List (Kleverlaan & Reichelt-Brushett, 2023). All substances listed in Annexure II, as well as low-level nuclear squander, can be dumped on condition that there is a special license granted by an authorized, knowledgeable national authority. The LC demands that the special permit be issued, taking into account Annexure III. The criteria for issuing special permits included the characteristics and composition of the materials, dumping sites, the possible effect of the dumping, and the practical availability of land-based disposal alternatives (Hong, 2023; Kleverlaan & Reichelt-Brushett, 2023).

Even though Article I and Article II of the 1972 London Convention require contracting parties to align their policies to accommodate the restriction of contamination by ocean disposal, and LC Article VII supports Article I and Article II, the challenge is the enforcement of these LC articles. The LC does not indicate what parties should do to enforce the convention. Article VIII of the LC, instead of coming clean on the issue of enforcement, merely encourages states to cooperate and to have an agreement that assists in managing ocean dumping, taking into account relevant conditions (Kleverlaan & Reichelt-Brushett, 2023).

The International Maritime Organisation (IMO) is the permanent administrative office of the convention. Contracting parties have to report all discarding activities and effects on the sea to the IMO. Parties to the agreement meet every two years to discuss possible changes to the convention, considering national reports on implementation (Rodríguez, Jiménez, Arce & Thompson, 2023).

2.9.4.3 Prevention of ocean pollution and the 1996 Protocol.

The London Convention (LC) went through a revision process in 1990. The revision process is in line with Article XIV of the 1972 London Convention. The revision process aimed to bring the LC into compliance with the latest trends in waste control and three environmental principles. The principles are the precautionary principle, the prevention principle, and the sustainable development principle.

The precautionary principle is explained as follows in terms of Agenda 21:

“A precautionary and anticipatory rather than a reactive approach is necessary to prevent the degradation of the marine environment. This requires, inter alia, the adoption of precautionary measures, environmental impact assessment, clean production techniques, recycling, waste audits and minimization, construction and/or improvement of sewage treatment facilities, quality management criteria for handling of hazardous substances and a comprehensive approach to damaging impact from air, land and water” (Agenda 21, chap.17).

The 1992 Rio conference states:

“In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (Rio Declaration, 1992; Morin, Allan & Jinnah, 2023).

The precautionary principle is concerned with the direct action of human beings that results in environmental degradation. What is key to the precautionary principle is that states should not wait for convincing scientific proof of damage to the environment before they can act. States should always act with caution on matters that will impact the environment (Morin, Allan & Jinnah, 2023).

In terms of the prevention principle, restricting environmental degradation is better than repairing environmental damage.

“States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources

pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction” (Principle 21, Stockholm Declaration).

Preventing environmental disasters is cheaper and easier than reacting to environmental harm that has happened. This principle demands of states to take the necessary measures to prevent disasters from taking place, as it is better to prevent disaster than repair after a disaster. It is mainly concentrating on the direct action of the human being that may have destructive consequences for the environment (Umukoro & Oboreh, 2023).

The Sustainable Development Principle promotes economic growth simultaneously and maintains the quality of the environment for future generations (Almi & Boumar, 2023). The sustainable development principle is about environmental protection and socio-economic development, which translate to poverty relief. It was first implied by the Stockholm Declaration, which wanted a balance between environmental protection and socio-economic development. Later in 1985, the Sustainable Development Principle was stated clearly in the 1985 ASEAN Agreement on the Conservation of Nature and Natural Resources (Almi & Boumar, 2023).

Agenda 21 influenced the revision process, and this led to the elimination of disposal of industrial waste, the banning of marine disposal of all classes of radioactive waste, and the phasing out of the thermal processing of industrial squander and sewage refuse.

In 1996, a new protocol, called the 1996 Protocol was adopted after the LC revision process came to an end. The LC revision process came to an end in 1996. But it came into force in March 2006. When one compares the London Convention (LC) and the 1996 Protocol, one can assume that the 1996 Protocol is a new convention as it is more restrictive than the LC. The 1996 Protocol was concerned not only with prevention and control but also with the elimination of contamination of waste (Hettiarachchi & Meegoda, 2023). It moves from the black-and-grey listing of the LC to the “reverse listing” structure.

The contracting parties to the 1996 Protocol have extended the geographical scope to include internal waters. In addition, the definition of dumping in the protocol included the storage of waste in the seabed in terms of Article 1(3). The Protocol also introduced a ban on the export of waste for dumping or incineration purposes. Thus, harmonising the protocol with the Basel Convention on the Control of Transboundary Movements of Waste and their Disposal (Farrell & Chitaka, 2023).

The 1996 protocol encourages and promotes compliance with Article II and came up with ways to settle the dispute in Article 16.

2.9.5 Prevention of ocean pollution and Regional Conventions

There are many regional conventions on the control, restriction, and phasing out of ocean dumping. This research work limited itself to the 1972 Oslo Convention, the 1992 OSPAR Convention, the 1974 Helsinki Convention as amended, and the 1976 BARCON and its dumping Protocol as amended.

2.9.5.1 The Prevention of ocean pollution, the 1972 Oslo Convention, and the 1992 OSPAR Convention

The 1972 Oslo Convention regulates ocean dumping in the North-East Atlantic. The North-East Atlantic has been a dumpsite for the West European nuclear industry, and it is home to much offshore gas and mineral extraction and has many oil platforms. The 1972 Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft allowed a permit system but required that contracting parties provide records of who dumped what, where, and how much to the Oslo Commission. But it was still difficult to stop parties from dumping waste in the North-East Atlantic. Then, in 1990, the Oslo Convention went through a revision process. The revision process of the Oslo Convention led to the phasing out of ocean incineration, the banning of sewage sludge, and the banning of industrial waste (Schäli, 2022).

The 1992 Oslo Convention was replaced by the 1992 OSPAR Convention, which entered into force in 1998. The 1992 OSPAR Convention was relevant to internal waters and the Exclusive Economic Zone (EEZ). The OSPAR Convention employed the precautionary principle and a “reverse listing system per which all dumping is banned

unless there is a permit. In terms of the OSPAR Convention thermal processing is completely banned, the discarding of radioactive waste is prohibited, and the disposal of deep-water attachments in the North Sea is also prohibited” (Kleverlaan et al.,2023).

2.9.5.2 Prevention of ocean pollution and the 1974 Helsinki Convention as amended.

It was indicated earlier that the Baltic Sea was used as a dumpsite for military waste. As such, it had been highly affected by ocean disposal. This made the Helsinki Convention more restrictive. In terms of the 1974 Helsinki Convention, Article 9(1), disposal was completely banned, excluding the ocean-excavated material. Even the dredged material to be dumped required a special permit. The 1992 Helsinki Convention used the precautionary and reverse listing systems, provided direction and instructions on how to get rid of dredged material, and incineration was completely prohibited in terms of Article 10(1). Its definition of dumping covered the discarding of any human-made installation at sea and disposal into the seabed (Article 2 [4]), but differentiated it from land-based pollution through disposal with entry from land by tunnel or pipeline. The Helsinki dumping authority is put to use in the internal waters and Exclusive Economic Zone (EEZ) (Schäli, 2022).

In terms of Article 2 (5), parties should report to HELCOM dumping activities, their location, the amount and quality of the material discarded, and monitor the dumpsite, and they are also compelled to assist in the inquiry of suspected unlawful ocean dumping.

2.9.5.3 Prevention of ocean pollution and the 1976 BARCON and its Dumping Protocol, as amended.

The Mediterranean Sea was a target for dumping chemical armaments from World War II and the Balkan War. In terms of 1976 BARCON, under Article 5, contracting parties are required to take steps to eliminate and reduce contamination resulting from ocean disposal by ships and aircraft. Article 5 was supported by the Protocol for the Prevention of Pollution of the Mediterranean Sea from Ships and Aircraft. The protocol is known as the 1976 BARCON Dumping Protocol (BDP). The 1976 BDP is almost the same as the 1974 Helsinki Convention in terms of the definition of waste disposal, the

exclusion of thermal processing, the listing structure, and the licensing system, but differs from it in terms of listing high- and low-level radioactive waste and banning their disposal (Trincardi, Francocci, Pellegrini, d'Alcalà, and Sprovieri, 2023).

The 1976 BARCON Convention and the 1976 BARCON Dumping Protocol were amended in 1995. In terms of Article 5, the Revised Convention aimed to

“Prevent, abate, and to the fullest possible extent, eliminate pollution.”

The objective of the revised BDP was also to eliminate ocean contamination by discarding it from ships and aircraft and thermal processing it at sea. In terms of the 1995 BDP, Article 3 (c), the definition of dumping included,

“any deliberate disposal or storage and burial of waste or other matters on the seabed and in the marine subsoil from ships and aircraft.”

The 1995 BDP followed a similar reverse listing system as the global accords. But the 1995 BDP, Article 7, completely banned incineration, while in terms of the 1995 BDP, Article 4(1) and (2), dumping is prohibited for dredge material; fish waste; vessels; platforms, and other human-made structures at sea. But the dumping of these materials should be done with a special license from a knowledgeable national authority. The dumping license should be submitted to the secretariat, indicating the nature, quantities, and dumpsite. Unlike other regional conventions, the 1995 BDP does not provide for the removal of disused offshore platforms (Grbec, Scovazzi & Tani, 2023).

2.9.6 Observations on Global and Regional conventions on ocean dumping

The 1972 Stockholm conference paved the way for the progressive elimination of waste disposal and thermal processing, thereby contributing a lot to waste management. It has also attributed to the establishment of international regimes for the prevention of ocean pollution. The giant steps that were made in the formulation of global and regional conventions can be contributed, in part, to the 1972 Stockholm conference (Chen & McDonough, 2022).

The LC and 1996 Protocol were drafted during a period when states' interest in economic growth was prioritised at the expense of waste management, thus resulting in too much compromise. The compromise led to loopholes. The states exploited the existing weaknesses of the LC and the 1996 Protocol to carry on discarding harmful waste into the ocean (Joos, 2023). The LC and the 1996 Protocol lacked imposition mechanisms and power procedures to make sure that states eliminated ocean pollution. Even though contracting parties were required to report their dumping activities in terms of the convention, there was less reporting on the part of parties to the agreement. The lack of a land-based approach in LC robbed it of an integrated approach to waste management. However, the 1996 Protocol was a giant step in improving the LC (Chen & McDonough, 2022; Joos, 2023).

Most of the loopholes in the LC and the 1996 Protocol are closed by the regional sea conventions (Stöfen-O, Naji, Brooks, Jambeck & Khan, 2022). The regional sea conventions are more restrictive, represent less compromise, and in most cases, follow a holistic approach that combines dumping and land-based pollution. However, the territorial bodies have less power to enforce full compliance and the monitoring of obligations.

In 2015, the 2030 agenda for sustainable development and its seventeen sustainable development goals (SDGs) were adopted by 193 countries. The 2030 agenda calls on all countries of the world to eliminate poverty and attain sustainable development by 2030. The sustainable development goals are a road map for the changeover to a healthier planet and a better, fairer world for now and future generations. The SDGs aim to eliminate indigence and hunger, increase access to health, education, justice, and jobs, and promote inclusive and sustained economic growth while at the same time eliminating negative environmental impacts on the planet.

Even though the global and regional conventions on ocean dumping have a weakness, they have contributed in part to preparing the fertile ground for the adoption of sustainable development goals, especially goal 14 - life below water (Rocchi, Ricciolini, Massei, Paolotti & Boggia, 2022).

2.9.7 International environmental law and public health

Human activities are increasingly responsible for the adverse environmental consequences that have resulted in ill health. The connection between environmental factors and ill health has led to many multilateral environmental agreements having health implications. The agenda to protect the environment reinforces the agenda to protect human health, as environmental protection and human health protection reinforce each other. This is evident in Agenda 21 when it stresses the need to come up with preventative measures to reduce environmental pollution and other hazards to promote human wellbeing (Yuan, Nag & Cummins, 2022).

Principle I of the Rio Declaration on Environment and Development states that

“human beings are at the centre of concerns for sustainable development entitled to a healthy and productive life in harmony with nature”.

The declaration confirms that the shielding of public health is important in the sphere of a global agenda.

Land-based pollution of local rivers due to untreated sewage can lead to cholera outbreaks. Air pollution is linked with health risks like acute respiratory infections. Climate change has also been found to have negative effects on public health. The UN’s Intergovernmental Panel on Climate Change and other scientific panels have shown that climate change can raise the chances of infectious diseases, including malaria, sleeping sickness, river blindness, and waterborne diseases like cholera and diarrhoeal diseases (Yuan, Nag & Cummins, 2022).

Most of the multilateral environmental agreements that protect the environment also have health implications, e.g., the Stockholm Convention on Persistent Organic Pollutants; the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; the Vienna Convention on the Protection of the Ozone Layer; the Montreal Protocol on Protection of the Ozone Layer; the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal; the Convention on Biological Diversity adopted in 1992; the Kyoto Protocol of the United Nations; and the Framework Convention on Climate Change (Chen & McDonough, 2022).

This research work limited itself to the Stockholm Convention on Persistent Organic Pollutants; the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; and the Vienna Convention on the Protection of the Ozone Layer.

Multilateral environmental agreements are some of the sources of international environmental law. The Stockholm Convention is a multilateral environmental agreement aimed at protecting human health and the environment from persistent organic pollutants. In terms of Article I of the Stockholm Convention on Persistent Organic Pollutants, the aim of the convention is

“to protect human health and the environment from persistent organic pollutants (POPs)”.

The persistent organic pollutants are persistent and toxic. They can harm endocrine systems and cause reproductive disorders, birth defects, and immune system deficiencies. The Stockholm Convention created a legal mechanism to phase out twelve of the POPs. As listed in Annexure A of the convention, thus, playing an important role in the protection and promotion of public health. Even though there are implementation challenges to the Convention, the Stockholm Convention on Persistent Organic Pollutants is a giant step to defeat the threats to human health and the environment posed by the POPs (Fiedler, Sadia, Krauss, Baabish & Yeung, 2022).

Another multilateral environmental agreement that incorporates health issues and environmental protection is the Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Pesticide use has led to water contamination and the resulting negative health impact. The Rotterdam Convention gives states the liberty to decide which pesticides to import or exclude. The exporting state has the responsibility to inform the importing state of the potential risk associated with such pesticides. The importing state can ban or restrict pesticides based on the provided information. The Rotterdam Convention confirms that a multilateral environmental agreement plays a role in global health protection (Selin, 2023).

The Vienna Convention on the Protection of the Ozone Layer has a legal framework to put in place measures to protect human health and the environment that may result in the depletion of the ozone layer by human activity. Ozone layer depletion has been

attributed to chlorofluorocarbons (CFCs), and it may lead to impaired lung infection, coughing, shortness of breath, chest pain, incidents of cancer, and cataracts. The Vienna Convention on the Protection of the Ozone Layer regulates the use and production of CFCs and related pollutants (Egelston, 2022).

The Vienna Convention, in its preamble, confirms that “the depletion of the ozone layer is a threat to human health and the environment”. The Convention has weaknesses like most multilateral environmental agreements in terms of enforcement mechanisms, but it has helped to eliminate the use of CFCs in most states.

Most multilateral environmental agreements have weaknesses in terms of compliance, monitoring, and enforcement mechanisms. But what is notable to them is that they confirm that there is a threat to public health linked to environmental factors. From the discussion, one can conclude that the International Environmental Law is also a public health law that can be used effectively in focusing human actions to promote public health and environmental protection (Gigiadze, Gorgadze & Gambashidze, 2023).

2.9.8 International law environmental successes and health protection in developing countries

The Stockholm Conference and World Summit on Sustainable Development have ushered in the purpose of international environmental law in advancing public health at global and country levels. It has also led to increased cooperation between health and environmental factors. But the key to the effectiveness of international environmental law is compliance and behavioural change to meet the requirements of the relevant environmental agreement. The Montreal Protocol achieved a ninety percent elimination of ozone-depleting substances by 2004 (Bankobeza, 2005; Lundberg, Szmurlo & Abman, 2023).

The environmental agreement was able to indicate requirements to provide financial and technical support to developing countries. The Global Environmental Facility (GEF) was created in 1991. The Multilateral Fund was created in terms of Article 10 of the Montreal Protocol (Salman, Long, Wang & Zha, 2022). This funding assisted in the implementation of environmental agreements at the national level, and thereby preventing the health threats posed by ozone layer depletion. International

environmental law has also facilitated the participation of the health sector in the formation of environmental conventions.

International environmental law has paved the way for countries to provide constitutional guarantees to shield the environment and human health and to bring about sustainable development (Salman, 2022). For instance, the Constitution of the Republic of South Africa, 1996, Sections 10, 11, and 24 state:

“Human dignity –

everyone has inherent dignity and the right to have dignity respected and protected.

Life -

everyone has the right to life.

Environment-

everyone has the right:

- a) To an environment that is not harmful to their health or wellbeing, and
- b) To have the environment protected, for the benefit of the present and future generations, through reasonable legislative and measures that
 - Prevent pollution and ecological degradation,
 - Promote conservation; and
 - Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”.

This is affirmed by the Stockholm Declaration that which states that everyone,

“has the fundamental rights to freedom, equality and adequate conditions of life, is an environment of conditions of life, in an environment of quality that permits a life of dignity and well-being.”

The Pakistani Constitution, the Indian Constitution, and the Tanzanian Constitution, just to give a few examples, have adopted the right to a healthy environment and favour the protection of public health. The right to life and the right to have dignity are

respected, protected, and promoted through environmental protection, which catalyses health and environmental protection (Shivji, 2022).

These constitutional provisions aim to enforce the environmental law to protect the environment and public health. The minister of health and welfare in South Africa was able to challenge Woodcarb (Pty) Ltd. in court and was able to stop their sawmill from emitting dangerous gases, and the court agreed that Woodcarb (Pty) Ltd.'s emission illegally tramples on the constitutional right to a healthy environment, thereby assisting the Minister to curb air pollution and its related health risks. In the case of Rural Litigation and Entitlement Kendra vs. Ultra Pradesh, in which it was claimed mining damaged the environment, the court ordered the mining to be stopped. In Tanzania, a case was brought before the court of Festo Balegale vs. Dar es Salaam City Council. The city council was dumping garbage in Dar es Salaam Suburbs, and this was causing respiratory problems in the local population. The court ordered the City Council to stop garbage dumping in the locality. This indicates that environmental justice assists in affirming health justice (Shivji, 2022).

The multilateral environmental conventions have promoted most developing countries to develop national plans of action for the environment. The challenge is that in some cases, the national plans promote curative health over preventative health. The Nation States like Bangladesh and Thailand managed to develop action plans that combine environmental issues and health issues (Markiewicz-Stanny & Szuniewicz-Stępień, 2022; Varella, 2023).

The international environment agreements have ushered in the framework of environmental laws, and the number of developing countries that have developed the framework of environmental laws is increasing. UNEP has assisted in pushing for the framework of environmental laws. WHO also played a role in urging countries to develop framework environmental laws that would accommodate environmental health activities (Varella, 2023).

Since the 1972 Stockholm conference on the human environment, environmental impact assessment (EIA) has started to find prominence in the socio-economic development of most countries. The environmental impact assessment gives a picture of the effects of the development project on the environment and human health. Most developing countries have established EIA laws. The challenge is that in some cases,

important health impact assessment aspects are left out, thereby excluding the health dimension of EIA. This is due to a lack of technical experience to conduct health impact assessments in EIA. The remedy for the ills of EIA in developing countries is integrated environmental impact assessment, which will combine health, social, economic, cultural, and environmental factors (Castelblanco, Guevara, Rojas, Correa & Verhoest, 2023).

International environmental conventions require the establishment of national institutions for the environment, which will run environmental protection activities for the government. Most countries have ministries as institutions to run environmental activities. In some cases, countries like Uganda employ the National Environmental Management Authority (NEMA) to implement international environmental obligations. International environmental law also assisted in allowing civil society in developing countries to be effective in the implementation of environmental law. Agenda 21 played a role in this regard by requesting states to have laws that would enable nongovernmental organisations to defend the public interest through legal action. Through developing countries' enactment, the following groups of civil society emerged: the scientific community, non-profit environmental groups and associations, private companies and business concerns, legal organisations, and the academic community (Muheirwe, Kihila, Kombe & Campitelli, 2023).

This has led some civil society organisations to push for health and environmental rights. In Uganda, the matter between the Environmental Action Network Ltd. vs. Attorney General and the National Environmental Management Authority was brought before the court. The NGO was complaining about the right to a clean and healthy environment, the right to life, and the right to the general good of public health in Uganda, as there are no smoke-free laws.

Article 50 of the Uganda Constitution 1995 is under 'Enforcement of rights and freedoms by courts' of Chapter 4 of the Constitution. Chapter 4, titled 'Protection and promotion of fundamental and other human rights and freedoms' states:

“(1) Any person who claims that a fundamental or other right or freedom guaranteed under this constitution has been infringed or threatened, is entitled to apply to a competent court for redress which may include compensation.

(2) Any person or organisation may bring an action against the violation of another person's or group's human rights”.

The court ordered NEMA to enact smoke-free laws and NEMA complied with the order (Muheirwe, 2023).

2.10 Gender perspective and waste management

Gender refers to the dissimilarity between men and women that has been socially and culturally constructed in the past and perpetuated in the present and affects their roles and relationships of power among them. The socially constructed differences are perpetuated in the present through religion, politics, education, and legal systems. The traditional gender roles maintained and sustained biases in social relations and limited the freedoms, opportunities, and choices of individuals and groups in terms of “feminine” and “masculine” (Amoah, Britwum, Essaw & Mensah, 2023). The main focus of gender is to do away with biased gender relations and to create just and equal relations.

“A gender perspective thus looks at how society, including both men and women, acts in terms of reinforcing and/ or challenging patterns of domination in the multiplicity of social interactions” (Oztekin *et al.*, 2017; Murphy, 2023).

A lot has been written about waste, looking at the health and economic consequences of waste practices in developed and developing countries. But in most cases, that was done using the development lens. In terms of gender context, social relations biases affect even waste management. Therefore, waste generation and management are not gender-neutral, neither in concept nor in practice (Buckingham *et al.*, 2019; Bayu, 2023). UNEP (2015), UNEP-IETC, & GRID-Arendal (2019) confirm this when they say that the waste sector is not immune from gender ways of thinking. This means that the waste management hierarchy is gendered, and any attempt to modernise the waste sector without a gender perspective is likely to continue to perpetuate traditional gender hierarchies. Most countries in the world have gender inequality, which cuts across social and economic life. Changes in social and economic life are likely to widen

the gender inequality gaps if there is no gender compass to guide the change process (Bayu, 2023).

Household waste dominates municipal waste everywhere in the world. The process of properly managing waste should start at this level. This means a reduction in waste should take place at the household level to properly manage waste. Women in most households are responsible for household chores as well as controlling household waste (Fredericks, 2008; Gani *et al.*, 2012; UNEP, 2015; Bayu, 2023). This makes women household waste managers, as they ultimately decide how different waste streams are handled (Seager, Rucevska & Schoolmeester, 2020). This traditional role is reinforced in children through observation, and this further reinforces gender bias (Seage, Rucevska & Schoolmeester, 2020).

Recently, most street sweepers in developing countries are women. The argument is that women are better than men in terms of cleanliness. But positions like truck driving and tractor driving for solid waste management are almost exclusively for men. Gender bias reserves such positions for men and pushes women away from them. This is due to traditional gender roles that imply that men are better drivers than women. The same thing happens in the case of management positions in solid waste management. More men occupy senior managerial positions than women. One can conclude that, typically, in the waste sector, better-paying positions are occupied by more men than women. Positions that carry status with them in the waste sector are, in most cases, for men (Wittmer, 2023).

Globally, wealth is gendered and masculinized (Gonzales, 2015; Oxfam, 2018). Locally, regionally, nationally, and globally, wealth is disproportionately dominated by men. In 2017, 95% of the top 42 richest people were men, owning half of the 'world's population wealth (Oxfam, 2018). The gendered wealth and control of resources give men undue influence in all spheres of life, including the waste sector, and help perpetuate the same gender stereotypes. Policy decisions in the waste sector depend on the values that are linked to the men who determine the problem and the solution (Bayu, 2023).

The social relations biases due to traditional gender hierarchies led to the UN Beijing Women's Conference in 1995. The conference came up with the principle of 'gender mainstreaming. According to the gender mainstreaming principle, policies and

practices should be evaluated based on their impact on men and women and should not be biased towards any group. This means that the objective of gender mainstreaming is gender justice (Brulé, 2023).

What is notable is that in the corporate world, gender mainstreaming is about gender balance on the boards of companies. That is why McRobbie (2009) sees gender mainstreaming in the corporate world as pushing neoliberal managerialism that benefits women rather than freedom and opportunities for them. Walby (2005) sees gender mainstreaming benefiting the corporate social agenda as well as the wider society. Verloo (1999) doubted if there is enough expertise amongst professionals to challenge the status quo since institutions, due to their masculinist nature, can hinder the opportunities of women (Reehr *et al.*, 2008; Magnusdottir and Kronsell, 2015), and this makes women who progress in these institutions join the masculine practices due to the dominant masculinity in these institutions. Minto and Mergaert (2018) see the shortage of capital for gender mainstreaming training as a challenge, whereas Vida (2017) sees the lack of Horizon 2020 reviewers' gender expertise as a challenge that can obstruct gender equality in the research and innovation programme (Acosta, van Bommel, van Wessel, Ampaire, Jassogne & Feindt, 2019).

Gender mainstreaming is achievable and realisable, but taking into account social challenges in society, one can, without doubt, assume that it is a long walk to gender mainstreaming success.

2.11 Environmental justice as a tool to protect people and the environment.

Waste has an impact on the environment, and the primary polluters are, in terms of Extended Producer Responsibility (EPR), the producers. But the literature has enough evidence of environmental harm due to the primary polluters that have affected innocent residents. There are many residents in developing countries who have suffered harm due to damage done to the environment. This calls for environmental justice (McGregor, Whitaker & Sritharan, 2020).

Justice is concerned with unsettled issues, such as complaints and grievances voiced by those to whom injustice has been committed, that arose as a result of human interaction. Injustice has many forms, including harm, exploitation, and oppression.

The issue relating to the environment influences or is being influenced by justice (Menton, Larrea, Latorre, Martinez-Alier, Peck, Temper & Walter, 2020).

Environmental justice concentrates on the dispensing of environmental quality and the protection and improvement of well-being through environmental goods (Penz, 1998; McGregor, Whitaker & Sritharan, 2020). This means environmental justice has to do with settling environmental injustices demanded by environmental victims. Environmental victims are those who experienced any form of injustice, including harm, exploitation, and oppression caused or made worse by human-made environmental harm. Environmental justice, as used in this work, extends to any form of injustice, including harm, exploitation, and oppression done to the non-human world as the injustice done to it ultimately affects the human world (Menton *et al.*, 2020).

“... the earth’s natural ecosystems as a totality are seen as a complex web of interconnected elements, with the sound biological functioning of each being dependent on the sound biological functioning of the others” (Taylor, 2003).

For the environment to continue to offer environmental quality, it should be sustained. Something should be done to maintain the environment to provide this quality, which is in the form of fresh air, clean water, quality food, and other life-supporting resources. So, environmental justice is tied to environmental sustainability (Menton *et al.*, 2020). According to Dobson (1998), what is to be sustained is the critical natural capital that is key to life support systems. Since environmental justice covers what is to be distributed, this is the answer to what is to be distributed. What is to be sustained and what is to be distributed are two sides of the same coin.

“Inequality is the planet’s main environmental problem” (WCED, 1987).

This implies that inequality is the source of environmental injustice. Bullard (1994) suggests five principles to promote environmental justice, which are: “guaranteeing the right to environmental protection; preventing harm before it occurs; shifting the burden of proof of contamination to polluters, not the residents; obviating proof of intent to discriminate; and redressing existing inequalities”.

For environmental justice to actualize, equality in terms of freedom and capabilities should be taken into account.

“If there is a positive relationship between quality of life and quality of the environment, it can be argued that the range and quality of one’s freedoms,, may also be measured by one’s environment.” (Dutta *et al.*, 2001). According to Sen (1988), human beings that have the freedom to choose or decide who to be, what to do, and how to live have an advantage in terms of their capability to function. This means cases in which those who have freedom and capabilities to function are, in most cases, more powerful than cases in which those who do not have freedom and capability to function are powerful. The absence of freedom leads to an inability to function and disempowerment, which causes vulnerabilities.

Environmental injustice may worsen the vulnerabilities of environmental victims. The powerless and the vulnerable are always in a weaker position in terms of power relations, as they are disadvantaged in terms of the power to exercise their freedom and capability to function (O’Neill, 1988), and this leaves them vulnerable. The outcome of power relations between the vulnerable and the powerful will not be legitimate as long as the procedures are not just.

2.12 Livelihood and waste mismanagement

Livelihood, in simplified terms, means a way of ensuring that one has the necessary things in life. According to Chambers and Conway (1991),

“a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living, and it is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base”.

Capabilities are the ability to carry out a task successfully. It is also a set of valuable functions that a person can perform, like being able to acquire adequate nutrition, being able to acquire good health, and being able to acquire shelter. Assets refer to

things of value that can help sustain the life of a person. The assets can be divided into human capital, social capital, natural capital, physical capital, and financial capital.

Human capital includes things like skills, knowledge, health, and being able to be employed. Social capital includes things like being able to form relationships with members of society. Natural capital includes things like land, soil, and water. Physical capital refers to human-made things like infrastructure, equipment, and even livestock. Financial capital includes things like savings, credit, income, and trade. The major sources of livelihood are financial resources, human resources, natural resources, and political resources.

Activities refer to things to do to achieve a human need, like securing water, medicine, shelter, and clothing. In terms of the DPSIR framework, an activity to achieve a human need creates pressure on the environment. Stress refers to emotional or physical frustrations. whereas shock refers to unexpected happenings like a disaster, war, or economic meltdown. At the centre of livelihood is a need that should be met using the assets. Human need is the driving force behind human activity. Successful human activity leads to positive livelihood outcomes and resilience to shocks and stress. If it is sustainable, it will also lead to reliance on seasonal changes and trends.

Waste mismanagement refers to improper waste management that will result in negative consequences on the three pillars of sustainable development, namely social, economic, and environmental. The three pillars are depicted as follows:

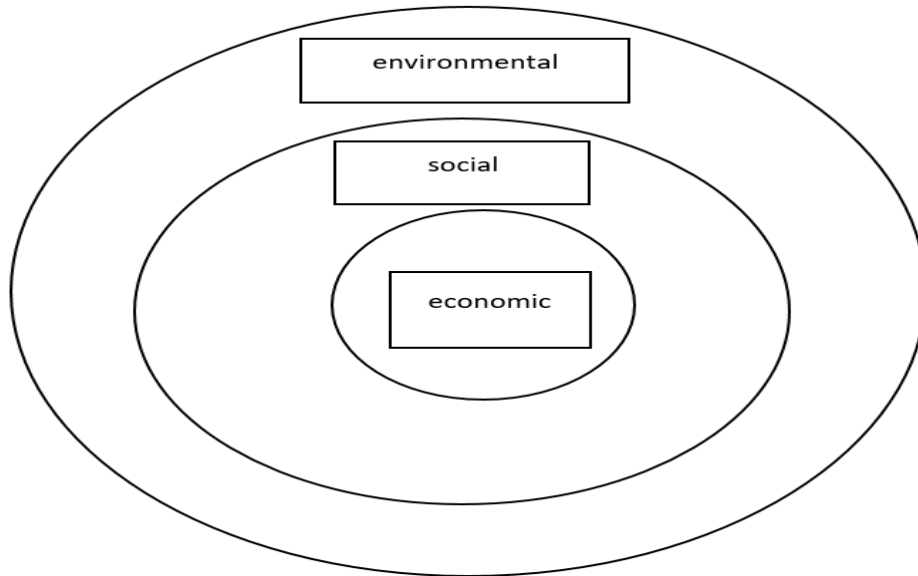


Figure 2. 3: Depiction of environmental, social, and economic aspects

The environmental pillar is represented by the outer circle, the social pillar by the middle circle, and the economic pillar by the smallest circle. What this depiction implies is that both the social and economic pillars operate in the environment. No environment, no social pillar, and no economic pillar. The economic pillar is also found in the social pillar as an activity of society to meet human needs. Waste mismanagement harms the environment and causes pollution in water, air, soil, vegetation, and habitat, which is the natural capital. This negative impact ultimately affects the ecosystem negatively. An ecosystem is a community of living organisms living together with non-living components interacting to sustain life in a specific environment.

According to Taylor (2003), “the earth’s natural ecosystems as a totality are seen as a complex web of interconnected elements, with the sound biological functioning of each being dependent on the sound biological functioning of the others”.

If the ecosystem is negatively affected, the important natural cycles like the water cycle, carbon cycle, and nitrogen cycle will also be negatively affected.

Sustainability in terms of the natural cycles is the capacity of the human species to live forever within the natural cycles, and sustainable development is a development towards a state of sustainability. In the absence of sustainability, the process of human development is not achievable, and this also takes away humanity’s ability to meet its

needs in the present and the future. Society is always in the environment; negative consequences of the environment will have negative consequences for society. Air pollution, soil pollution, and water pollution harm public health. Human needs like food will also be negatively affected. The economy is a societal activity to achieve a human need, so even the economic activity will be negatively affected if the environment is failing society.

The negative impact on the three pillars of sustainable development will harm the five assets of livelihood, namely, human capital, social capital, natural capital, physical capital, and financial capital. Considering that these are major sources of livelihood, this means that the necessities of life will not be acquired. Therefore, waste mismanagement harms livelihoods.

2.13 Legislative framework for the environment in South Africa

The supreme law, which is the Republic of South Africa Act (Constitution) (No.106 of 1996), Section 24, talks of “the right to an environment that is not harmful to health”. And in terms of (Section 24 (b), Constitution) “the government must take legislative measures to prevent pollution and ecological degradation; promote conservation; secure ecologically sustainable development and use natural resources while promoting justifiable economic and social development”. This is the main legislation in South Africa. To attain this right, as in Section 24 of the Constitution of the Republic of South Africa Act (Constitution) (No.106 of 1996), waste has to be properly managed, as it has been found that improper waste management leads to an environment that is dangerous to health. A call by (Section 24(6) of the Constitution of the Republic of South Africa (No.106 of 1996) “to take reasonable measures to prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development” is not achievable in the absence of proper waste management. Therefore, this call is to the government to legislate on waste and to put in place practical measures to prevent and control waste.

There is legislation on the environment, the National Environmental Management Act (No.107 of 1998) (NEMA). It assists to “provide national environmental principles, institutions for environmental management, the procedure for cooperative governance, fair decision-making and conflict management, integrated environmental

management, international obligations agreements, compliance and enforcement, and environmental management cooperation agreements”.

The following statutes fall under NEMA framework legislation:

Environment Conservation Act (No.73 of 1989)

National Water Act (No.36 of 1998) and National Environmental Management (NEM) legislation, including:

- NEM: Air Quality Act (No.39 of 2004)
- NEM: Protected Areas Act (No. 57 of 2003)
- NEM: Biodiversity Act (No. 10 of 2004)
- NEM: Integrated Coastal Management Act (No. 24 of 2008)
- NEM: Waste Act (No. 59 of 2008) (NEM: WA)

The enforcement of these pieces of legislation is through the Environmental Management Inspectorate (EMI). The EMI was created through NEMA.

South Africa is a signatory to the UNFCCC and the Kyoto Protocol of 1997. In 2005, South Africa established the National Authority for the Clean Development Mechanism (CDM). In addition, South Africa committed to reducing its greenhouse gas emissions by 34%, but this is subject to South Africa receiving appropriate technology, finance, and capacity-building support from developed countries. South Africa has a National Climate Change Response Policy (October 2011), which is a national policy. This includes the National Climate Change Response Strategy (September 2004), the South African National Climate Change Conference (November 2005), and the Long-Term Mitigation Strategy Scenarios (2006 and beyond). ANC Polokwane Summit (December 2007), South African Climate Change Policy Summit (March 2009), Green Economy Summit (May 2010), and National Climate Change Response Green Paper (November 2010).

The National Policy aims to create a balance between job creation, poverty alleviation, and climate change. It also seeks to provide measures that will reduce and ultimately prevent climate change. NEM: Waste Act (No. 59 of 2008) NEM: WA is responsible for changes in waste management. Waste management activities should take place

per NEM: WA. However, there are special rules for certain waste, like hazardous waste, which are regulated by the Hazardous Substances Act (No. 15 of 1973) (HSA).

Hazardous waste is grouped as follows:

- Electrical equipment
- Radioactive equipment and
- Other hazardous waste

The classification of general waste according to the Waste Classification Regulations is as follows: paper, plastic, glass, tyres, non-recyclable municipal waste, organic waste, and construction and demolition waste.

From the above, one can conclude that there is a legislative framework for the environment in place in South Africa. The legislative framework is based on the constitution of South Africa, which complies with international trends in developed countries. South Africa's legal framework on waste management is progressive, as it complies with international trends on waste management. This shows that South Africa is serious about considering sustainable development aspects in waste management. This also shows that the country is serious about a clean environment and a healthy society. South Africa also takes seriously the importance of international obligations affecting waste management. This is seen through its legal framework and international agreements like the Basel Convention of 1992, the Montreal Protocol of 1989, the Rotterdam Convention of 1998, the UNFCCC, and the Stockholm Convention of 2004. This legislative framework also provides enforcement, and enforcement is key to the implementation of any legislative framework. But enforcement is stronger in metropolitan areas than in rural municipalities. There is enough Environmental Management Inspectorate (EMI) in urban areas, but in many rural municipalities, there are no EMIs, and this limits the enforcement of legislative frameworks on the environment in rural areas. This limitation can result in environmental degradation. The White Paper on Integrated Pollution (IP) and Waste Management (WM) recognises the importance of research (DEAT, 2009a). But scientific investigations on waste in South Africa remain focused more on urban areas than in rural areas. It also paid more attention to Western ways of disposing of waste than to researching indigenous ways of disposing of waste. Therefore, there is a need for research to uncover what the situation is with waste management in rural areas

and what indigenous waste disposal methods are available to assist in waste management, as waste is a global challenge. However, current legislation solves the challenges of past practices in which legislation dealing with waste was fragmented. This has also led to the development of new standards and regulations, such as the National Standards for the Scrapping or Recovery of Motor Vehicles; National Standards for the Extraction, Flaring, or Recovery of Landfill Gas; National Norms and Standards for the Storage of Waste; Gazette No. 33935, Notice 21; National Domestic Waste collection Standards; and Norms and Standards for the Remediation of Contaminated Land and Soil Quality.

2.13.1 Extended producer responsibility in waste management

Sustainable production can contribute positively to responsible consumption. But in sustainable production, there is a need for change in behaviour and systems that is accountable. Extended producer responsibility (EPR) plays a role in changing behaviour and systems in the management of products after they become waste. The concept of extended producer responsibility (EPR) was first formally used by Thomas Lindhqvist in a report to the Swedish ministry in 1990. Extended producer responsibility is a policy on the environment in which the producer takes accountability for the output even after it becomes waste. That is, the producer takes responsibility for the management of the product even during the waste stage of the product. In this way, it contributes positively to the circular economy. The circular economy intends to design out waste by maintaining the value of waste material at the highest level.

Extended producer responsibility (EPR) in waste management focuses on putting the responsibility of the output on the producer throughout its entire life cycle. The primary aim of extended producer responsibility (EPR) is to minimise the environmental impact of waste materials through increased product recovery, recycling, takeback, and final disposal. The focus of EPR is on upstream and downstream interventions. Research has shown that extended producer responsibility (EPR) has economic, social, and environmental benefits. Extended producer responsibility (EPR) is an environmental policy in which the producer is accountable for the output management even during the waste stage of the product. In this way, we contribute positively to the circular economy. The circular economy intends to design out waste by maintaining the value of waste material at the highest level.

Extended producer responsibility (EPR) is different from product stewardship. In the case of product stewardship, all those involved in producing, selling, using, and disposing of the product, have a shared responsibility concerning the product waste management, whereas in the case of extended producer responsibility for the product, waste management is the liability of the manufacturer of the product only. Putting responsibility on the manufacturer as the primary polluter encourages the producer to come up with environmentally friendly products that will be easy to manage, waste-wise, throughout their entire life cycle.

The extended producer responsibility works from the premise that the manufacturers of the products have the greatest ability and responsibility to come up with environmentally friendly products, that is, products that are recyclable, reusable, and not toxic to protect public health and the environment. The EPR may be mandatory, negotiated, or voluntary.

In most cases, the producers put the EPR-related costs into the product costs to cover all the costs of managing the product at its end of life. The EPR-related costs are usually used by the producer for reuse, buyback, or recycling purposes. The producer may be involved directly or indirectly in the reuse, buyback, or recycling program. The producer may be indirectly involved by using a third-party. The third-party would then take the responsibility of the producer. The third party is referred to as the producer responsibility organisation (PRO). This organisation helps the responsible producer assume responsibility for managing the products after they become waste. The Producer Responsibility Organisation (PRO) can either be non-profit or profit, state-led or industry-led, a single PRO or multiple PROs. EPR has been found to address pollution challenges where other policies have failed to adequately deal with pollution. It has been useful in addressing pollution caused by plastic bags and in addressing the growing challenge of e-waste (electronic waste) pollution. This is the case in the United States of America (US) and many European countries.

According to the Environmental Protection Agency, 2.5 million tons of electronics like cell phones, TVs, and computers were discarded by people in 2007. The chemicals that are found in electronic waste are lead, mercury, brominated flame retardants, and cadmium. These chemicals are dangerous to human health as they can cause harm to the kidneys and nervous system and cause cancer.

In the US, twenty-three states have adopted EPR policies to deal with the challenges of e-waste. China also has EPR policies to deal with e-waste, which are like those of the European Union. The US is one of the countries that export a lot of e-waste to China, but the introduction of EPR policies in countries like China forced it to develop infrastructure to recycle e-waste. Even though EPR contributes positively towards waste management, the concern with it is that products become too expensive for ordinary people, and the manufacturers are not transparent on how the EPR costs are established and used. In addition, the buyback programmes may take second-hand phones, printers, TVs, and computers from the reuse market. On the other hand, EPR assists in job creation and opportunities in the informal sector. The EPR fees help reduce waste collection and processing costs for the government and consumers. It helps reduce waste-related health risks and mismanagement of waste. It increases waste reuse and recycling rates. It gives incentives to responsible producers to move towards eco-design and assists countries in moving to a circular economy. In a circular economy, waste and pollution are designed out of the economic system, and reuse, recycling, repair, and refurbishment are used to keep waste in use (Ashraf *et al.*, 2020).

2.13.2 Extended Responsibility Producer in South Africa

In South Africa, producers had until 5 November 2021, to enrol with the Department of Forestry, Fisheries, and Environment (DFFE) as producers. The responsible producer can either be part of an existing Producer Responsibility Organisation (PRO), create a new PRO, or develop and submit to the Department of Forestry, Fisheries, and Environment (DFFE) an independent EPR scheme for packaging.

Extended Producer Responsibility is based on Section 18 of the National Environmental Management Waste Act (NEMWA) No.59 of 2008. According to NEMWA, EPR means,

“that a producer’s responsibility for their products is extended to the post-consumer stage of a product’s life cycle”. (NEMWA, 2008)

In terms of Section 18. (1) of this Act, “the Minister, may identify products on which extended producer responsibility applies, specify measures that must be taken for the product, and identify the responsible person”. In terms of section 18 (2) of the Act, “the

Minister should specify the requirements in respect of the implementation of an extended producer responsibility programme, specify the financial arrangements of a waste minimisation programme, specify the institutional arrangements for the administration of a waste minimisation programme, specify the percentage of products that must be recovered under a waste minimisation programme, specify the labelling requirements in terms of waste, specify that the producer of the product or class of products identified must carry out a life cycle assessment concerning the product, in such a manner or per such standards or producers as may be prescribed and specify the requirements that must be complied with in respect of the design”. But in terms of Section 18. (3) “the Minister before publishing a notice, under subsection (1) or any amendment to the notice must consult affected producers, take into account the Republic’s obligation in terms of any applicable international agreements, and consider relevant scientific information”.

From 2008 to 2020, there was no clarity regarding the extended producer responsibility as there were no regulations to put flesh on Section 18. (1) of the National Environmental Management Waste Act No.59 of 2008. Another thing is that the EPR then had limited scope and coverage as EPR membership was voluntary. It placed the financial liability of waste collection and disposal on the local people and local government and allowed many product producers to be free riders. But on 05 November 2020, the Minister of Forestry, Fisheries, and the Environment made regulations regarding extended producer responsibility. The regulations were gazetted in the government gazette vol. 665, No. 43-879 of the Republic of South Africa on the 05 November 2020.

The purpose of the regulations, in terms of Section 2, “is to provide for the development, implementation, monitoring, and evaluation of the extended producer responsibility schemes by producers, ensure the effective and efficient management of the identified end-of-life products, and encourage and enable the implementation of the circular economy initiatives”. Section 4 of the Regulation provides the process and timelines for the registration of producers. In terms of Section 4 of the Regulations, “all existing producers of products must register with the department within six months of the publication of the Government Notice in the Government Gazette, and new producers of products, who commence producing after the extended producer

responsibility regulation came into effect, must register with the department within the three months of being established”.

For the producer of the product to register for extended producer responsibility, a producer registration application form must be filled out and a “registration number for each producer that has submitted such form within thirty days of receipt of a form in which all sections are correctly completed”. This means it is an offence for a producer of a product not to comply with Section 4 of the Regulations. This would also enable the department to have a database of all producers of products for monitoring.

Section 5. (1) of the extended producer responsibility regulation deals with measures to be implemented by producers. The measures are as follows:

“The producer of the products, as identified by the Minister in terms of section 18(1) of the Act, must: establish and implement producer responsibility scheme that includes the entire value chain or join another extended producer responsibility scheme that includes the entire value chain or appoint a producer responsibility scheme that includes the entire value chain; be accountable for the operation and performance of their extended producer responsibility scheme; pay extended producer responsibility fee to fund the extended producer responsibility scheme; develop and maintain a system to collect the extended producer responsibility fee; conduct internal biannual financial audits and make these audits and make these audit reports available to the department upon request; make the internal biannual financial audits reports available to the external auditor; appoint an independent financial auditor to annual (Conduct an external audit of the financial records; include the internal biannual audit findings in the annual audit report); submit the external audit report to the department within 30 days after finalisation of the audit; develop and maintain a register of its members, in the event that the scheme has two or more members; collect, record, manage and submit data to South African Waste Information System as required in regulation 8 of these regulations; conduct a life cycle assessment, in relation to the product, in accordance with the applicable standards within 3 years of implementation of their extended producer responsibility scheme; through the life cycle assessment , factor changes in the assessment, factor changes in the design, composition or production process of a product that will result in- (reduction in the consumption of natural resources; design of more environmentally friendly products; waste prevention;

reduction of the volume of the resulting post-consumer waste stream; and reduction of toxicity of the resulting post-consumer waste stream; and reduction of toxicity of the resulting post-consumer waste stream); by agreement with the board of directors, contract with the existing downstream value chain before outsourcing.

Tender and contract for the sorting, collection, recovery and recycling of waste, if outsourced, through a fair and transparent process; keep record of quantity of identified products put on the market, waste generation, collection, sorting, recycling and recovery of waste arising from the identified products; control all services that have been awarded to service providers in particular, and these services include the fulfilment of collection and recycling by waste management companies; co-operate with municipalities to increase to increase the recovery of recyclables from municipal waste within 3 years from the date of implementation of the scheme; prioritise the promotion of small business and entrepreneurs with a special focus on woman, youth and persons living with disabilities; pay a living wage, but not below minimum wage, to all registered informal waste collectors, reclaimers and pickers; develop a broad-based black economic empowerment transformation charter within the waste sector for the products identified in the Notice published in terms of section 18 (1) of the Act within one year of the publishing of the Notice, which transformation charter must comply with section 9(1) of the Broad-based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003); implement transformation within all levels of the value chain within a special focus on woman, youth and person living with disabilities; implement mandatory take-back of all their products at the end of life; and implement environmental labels and declaration for the identified products”.

The New EPR Regulations shift the EPR system significantly. The EPR moves from being voluntary to being mandatory. This means that producers of products are obliged to collect fees to be used to finance improved collection, sorting, and recycling of the priority waste stream. This would decrease the quantity of waste destined for landfills.

It will also assist the South African government to move away from the landfilling system of waste and help with the changeover to the circular economy. The New Regulations assist in shifting the financial and operational burden of waste collection and disposal from the shoulders of citizens and the local government, which was not

the case before, to the responsibility of producers of the products. The new EPR regulation improved the definition of producers of products. The definition of a producer of products is no longer limited to the packaging manufacturing industry but also to brand owners, licence agents, importers, and retailers.

Producer responsibility organisations (PROs) play a crucial role in carrying out EPR plans. In South Africa, the following PROs exist: Glass Recycling Company, MetcPac, Plastic SA, Petco, Polyco, the Polystyrene Association of South Africa, and Fibre Cycle. The question is: will they have the ability to meet the EPR legislative requirements as the new regulations require them to set mandatory levies on how much the producers of products have to contribute financially to be members of an EPR scheme?

2.10.3 Extended Producer Responsibility implementation challenges in South Africa

The first implementation challenge concerns the franchisor and franchisees' relationship under the EPR regulations. It is not clear who is the main producer for the application of EPR regulations and sector notices. The question is whether both franchisors and franchisees should be regarded as producers or as the franchisors only.

Regulation 3(2) of the EPR regulations states,

“Apply to the identified products in terms of Section 18(1)(a) of the Act and its related waste streams published in the government Gazette by the minister that were placed on the market prior to these regulations coming into effect” (NEMA EPR regulations, 2020).

This means Regulation 3(2) of the EPR regulations allows for the retrospective scope of application of the EPR regulations, but in law, the retrospective application of the legislation is not permissible in terms of the common law principle, as there is a presumption in common law that statutes are not intended to have a retrospective effect. Is it possible to transgress a statute that has not yet been made? The answer is, in most cases, no, as it is difficult to comply with a statute that does not yet exist. This is

the reason most courts will not interpret a statute as having a retrospective application. In terms of Article 15 of the International Covenant on Civil and Political Rights:

“No one shall be held guilty of any criminal offence on account of any act or omission which did not constitute a criminal offence, under national or international law, at the time, when it was committed. Nor shall a heavier penalty be imposed than the one that was applicable at the time when the criminal offence was committed. If, subsequent to the commission of the offence, provision is made by law for the imposition of lighter penalty, the offender shall benefit thereby.”

This is supported by Thomas Hobbes in Leviathan when he wrote that:

“Harm inflicted for a fact done before there was a law that forbade it is not punishment, but an act of hostility: for before the law, there is no transgression of the law” (Deigh, 1996).

This was also supported by William Blackstone when he wrote in his commentaries on the Laws of England:

“.. it is impossible that the party could foresee that an action, innocent when it was done, should be afterwards converted to guilt by a subsequent law: he had therefore no cause to abstain from it: and all punishment for not abstaining must of consequence be cruel and unjust. All laws should be therefore made to commence in future, and be notified before their commencement” (Blackstone, 1983).

Another challenge is that the Waste Act is not clear when it comes to delineating the responsibilities of product producers and municipalities. There is also the challenge of the proper allocation of responsibility for recycling. The Constitution of the Republic of

South Africa, 1996, allocates the responsibility for waste to the municipalities. In terms of the Constitution, Section 152 (1), (b), and (d), the objects of local government are:

“To ensure the provision of services to communities in a sustainable manner; and

To promote a safe and healthy environment;”

In terms of Section 156(1) (a) of the constitution, which deals with powers and functions of the municipalities, “A municipality has executive authority in respect of, and has the right to administer-

The local government matters listed in Part B of Schedule 4 and Part B of Schedule 5 and the matters are, among others, the following: refuse removal, refuse dumps and solid waste disposal; air pollution; and water and sanitation services limited to portable water supply systems and domestic waste-water and sewage disposal systems”. Therefore, the Waste Act, the EPR Regulations, and the National Standards need to be harmonised with the Constitution to avoid conflict and different interpretations.

The informal waste pickers have been diverting post-consumer paper and packaging from municipal landfill space for free for many years. The informal waste pickers are active, growing, and have documented success stories in waste picking. The EPR system encourages formal waste collection networks to the detriment of informal waste pickers. These may threaten the livelihood of the informal waste pickers. Another option would be to make the informal waste pickers part of the municipality's waste management system. But the challenge with this option is that most municipalities lack the capacity and financial muscle to integrate informal waste pickers. Other than this, there is a shortage of data on the number of informal waste collectors, and some of them are undocumented immigrants.

In terms of the EPR regulations, the PROs have the authority to set the mandatory levies for producers who want to belong to the EPR schemes. The PROs may set levies that are not in line with the social and environmental cost of materials to avoid inter-company competition. It is not yet clear how the PROs are going to calculate the levies. There is no room for PROs to be transparent to the consumer about how the levies are set.

2.13.4 Advantages of Extended Producer Regulations

Irrespective of the challenges for the implementation of the EPR regulations, these regulations have cleared the way for the EPR to take off the ground. The concepts that are used in the EPR regulations have been well defined. For example, the term “producer” in terms of the EPR regulations means:

“any person or category of persons or a brand owner who is engaged in the commercial manufacture, conversion, refurbishment or import of new and/ or used products as identified by the Minister by notice in the government Gazette in terms of Section 18 (1) of the Act” (NEMA EPR regulations, 2020).

This definition clears up confusion about who the producers are in terms of the EPR regulations. The registration process for producers, which is in terms of Section 4(1) of the EPR regulation, is clear on who should register, and when to register, and this clears the registration confusion that was there before the regulations could be gazetted.

Section 7 of the EPR regulations helps to bring in financial sustainability in the extended producer responsibility scheme. This section guides the producer in terms of the responsibility fee. The items that should be considered when calculating the EPR have been listed in Section 7 (3) and include “the weight of the product; ease of recyclability; the current demand for the material for recycling purposes; costs for establishing a separate waste collection system; collection, transport, and treatment costs for separately waste collected waste; administrative costs i.e. costs linked to the running of a producer responsibility organisation; costs for public communication and awareness-raising (on waste prevention), litter reduction, separate collection, etc.); costs for appropriate surveillance of the system (including auditing and measures against free riders.); and subtract revenues from recycled material sales”. And in terms of Section 7(7), the administration fee of the EPR should not exceed the weight of the product and ease of recyclability.

Research has shown that regulations that lack monitoring, reporting, and evaluation are bound to fail. In the EPR regulations, Section 8 spells out the monitoring, reporting,

and evaluation mechanisms as follows: “A producer must submit an interim performance report measured against the individual targets in the relevant published government notice in terms of Section 18 (1) of the Act; the interim performance report must be submitted to the department within four weeks of the conclusion of the six months, namely, January to June of the calendar year, by the producer; annual external performance audit reports must be submitted to the department within three months of the conclusion of the year-end, which is on 31 December”;

Producers of products who contravene or fail to comply with Sections 4, 5, 6, 7, 8, 10, and 11 of the regulations commit an offence and the penalties are clear to avoid long litigation. In terms of Section 13(1), (2), and (3) of the EPR regulations, the penalties are as follows:

“A person convicted of an offense under these Regulations is liable to imprisonment for a period not exceeding 15 years; an appropriate fine; or both a fine and imprisonment”.

“A registered producer who does not comply with these Regulations may have their registration as contemplated in Regulation 4(1) or 4(2) of these Regulations revoked and/or be compelled to join another extended producer responsibility scheme.

A registered producer responsibility organisation that does not comply with the requirements as contemplated in Regulations 10(1) or 10(2) of these regulations may have its registration revoked”.

The minimum requirements and criteria for extended producer responsibility schemes to operate, in terms of Section 6 of the EPR regulations, “include requirements for cleaner production measures that must include as a minimum but not limited to design for recyclability, and waste minimisation or waste avoidance; waste reduction including as a minimum but not limited to the composition of products; or volume of products; or weight of products to be restricted and reduced with associated timeframes; reuse; recycling; treatment; disposal; implementation and reporting on the following requirements to complement the scheme- minimum recycled standards; secondary materials utilisation rate; and recovery rates; and compliance with the requirements for programmes planned to contribute to government priorities including but not limited to- decent work creation; pay a living wage, but not below minimum wage to all

registered informal waste collectors, reclaimers and pickers for the activities performed on behalf of the producers; social cohesion; inclusive economic growth; and improved quality of life”.

2.13.5 Observation on Extended Producer Responsibility

The Extended Producer Responsibility has adopted the “polluter pays” principle in terms of which the producers as primary polluters should bear the costs of eliminating and controlling pollution to ensure that there is no harm to the environment. This is a commonly accepted principle in the environmental law, that those who produce pollution bear the expenses of managing it to prevent damage to human health and the environment. But in the practical situation, it may be hard to get a perfect proximation of the external costs. Regulation 2(1) of the Extended Producer Responsibility avows:

“The purpose of these Regulations is to provide the framework for the development, implementation, monitoring and evaluation of extended producer responsibility schemes by producers in terms of Section 18 of the Act” (NEMA EPR regulations, 2020)

The second principle adopted by Extended Producer Responsibility is the Prevention Principle. The prevention principle was included in Principle 21 of the Stockholm Declaration, as mentioned in the previous section on global and regional conventions. The prevention principle is a step ahead of the remedy. Remedy occurs after harm has occurred, while prevention is associated with proactive action preventing harm before it occurs. The question is: what anticipatory measures can be regarded as preventative measures? In terms of Article 5 (1) (a) (b) (j) (k) (l) (q) (s) and (y), preventative measures have been put into place to prevent harm before it could happen.

In the case of the prevention principle, harm is prevented before it could happen. The preventative measures are put in place when there is a reason to suspect that harm would happen if the preventative measures were not put in place. Thus, the risk is known. The Prevention Principle, even if it is closely associated to the Precautionary Principle, is a step ahead of it. In the case of the precautionary principle, preventive

measures are put in place even when the risk has not been fully scientifically established. Unfortunately, the precautionary principle is difficult to put in place, as the level of precaution to take under uncertainty is hard to determine. This is the case with the Extended Producer Responsibility regulations.

What is notable is that Regulation 5 (1) (l) (ii) stipulates that:

“through the life cycle assessment, factor changes in design, composition or production process of a product that will result in design of more environmentally friendly products” (NEMA EPR regulations, 2020).

Even though Regulation 5 (1) (l) (ii) may be interpreted as a precautionary principle or a prevention principle, it is a rectification principle. The rectification principle is

“focused on the prevention at the source of environmental pollution, by obliging the potential polluter or polluting activity to make use of the best available techniques in order to prevent the pollution in the first place” (Wibisana, 2006).

Sustainable development is regarded as

“development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

The Sustainable Development Principle is aimed at protecting the environment and also bringing about socio-economic development. It harmonises poverty alleviation, which is socio-economic, and environmental protection for the present generation and future generations. The Extended Producer Responsibility regulations are in line with the Sustainable Development Principle. This is confirmed by Regulation 5 (1) (l), (u), (v), (w), and (x).

The Extended Producer Responsibility contributes towards the achievement of the following SDGs: end poverty and hunger, promote justice and jobs, promote inclusive and sustained economic growth, and defend the world from environmental damage.

In terms of Extended Producer Responsibility regulations, a circular economy means

“a regenerative system in which resource inputs and waste, emissions, and energy leakage are minimised by slowing, closing, and narrowing energy and material loop which can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling, and which is in contrast to a linear economy, which is a ‘take, make, dispose model of production” (NEMA EPR regulations, 2020).

The above explanation mentioned ‘linear economy’. In the linear economy, materials are taken from the earth and turned into products, and when the products are no longer useful, they are discarded as waste. But in the circular economy, waste is eliminated, products and materials circulate at their highest value, and nature regenerates; thus, the circular economy assists in attacking world challenges like climate change, biodiversity loss, waste, and contamination.

In terms of Regulation 2(3) of the Extended Producer Responsibility, the purpose of the Extended Producer Responsibility regulations is

“to encourage and enable the implementation of the circular economy initiatives” (NEMA EPR regulations, 2020).

When Regulation 2 (3) is read with Regulation 6, which deals with minimum requirements and criteria for Extended Producer Responsibility schemes to operate, considering Agenda 21, the Millennium Development Goals, and Agenda 2030 with its SDGs, one can assume that Extended Producer Responsibility regulations indeed assist in moving the South African economy from a linear to a circular economy.

There is monitoring, reporting, and evaluation in the Extended Responsibility regulations. This is done in terms of Regulation 8. The 1998 NEMA Chapter 17 brings in compliance, enforcement, and protection. But the challenge is how to measure the pollution produced, and on the other hand, producers may hide the extent of their pollution. It will be difficult to impose these regulations on multinational companies based in developed countries, as they always have a way of undermining African countries.

2.14 Solid waste management status in South Africa

Waste management in South Africa was at first about cleaning and removing waste. The dawn of democracy and the need for transformation have sparked the need for adequate waste management. Then it became based on the principles of the following pieces of legislation: Integrated Pollution (IP) and Waste Management (WP), the National Waste Management Strategy (NWMS), and the National Environmental Management Waste Act (Act 2008). The aim of waste management is to protect health, well-being, and the environment, and this has to do with the three aspects of sustainable development, namely, social, economic, and environmental. Therefore, waste management in South Africa embodies sustainable development through the NWMS. The strategic goals to be achieved are the following: “promote waste minimisation, re-use, recycling, and recovery of waste, ensure the effective and efficient delivery of waste services, grow the contribution of the waste sector to the green economy; ensure that people are aware of the impact of waste on their health, wellbeing and the environment; achieve integrated waste management planning; ensure sound budgeting and financial management for waste services; provide a measure to remediate contaminated land, and establish effective compliance with and enforcement of the Waste Act” (NWMS, 2011).

2.15 Solid waste management service delivery in South Africa

Considering that the amount of waste produced by developing countries may rise by over three times by 2050 (Kaza *et al.*, 2018) to three hundred and thirty-four (334) billion tons in South Africa (Kawai & Tasaki, 2016). South Africa has the lowest refuse collection rate, at fifty (50) percent of all other upper-middle-income countries in Africa, such as Mauritius and the Seychelles, with ninety-eight (98) percent and ninety-five (95), respectively (Scarlat *et al.*, 2015). Then, integrated waste management is a must

in South Africa with the coming into effect of NEM: WA 2008 (NEM: Waste Act No. 59 of 2008). Integrated waste management demands that municipalities look holistically at waste management. This is all the dimensions of waste management, namely, the stakeholders involved in waste management, the elements of the waste system, and the aspects of the local context that should be taken into account when managing waste.

South Africa supports a waste hierarchy through NWMS, where the first choice in waste management is waste side stepping and lessening. If it cannot be avoided or reduced, it should be reused, recycled, and recovered. The last measure of waste management is treatment and disposal. The highest rank in the hierarchy, avoidance, and reduction are difficult to implement at the municipality level (Tchobanoglous *et al.*, 1993). According to Machete and Shale (2015), during implementation, landfilling is prioritised, defeating the spirit of South Africa's National Waste Management Strategy of recycling. This is supported by DEA (2012) and Tirado-Soto and Zamberlan (2013). According to the DEA, ninety (90) percent of waste generated in South Africa is destined to landfills. The USA disposed fifty (50) percent of its waste for the landfill (Sidique *et al.*, 2010; Pearson *et al.*, 2012), whereas in Germany, one percent of their municipal waste ends up at landfill sites, while thirty-five (35) percent of the solid waste is used as raw (input) material for energy generation (Tan *et al.*, 2015). A reduction in the amount of solid waste destined for the landfills can be attributed to a move away from landfilling to other approaches such as resource recovery, recycling, and energy generation (Machete & Shale, 2015). The challenge is that most landfills in South Africa are open-air dumping, which is associated with major environmental damage, health risks, and high expenditure costs. This may be attributed to a shortage of capacity and financial power to eliminate landfills. Furthermore, waste is not separated from the source. Jewaskiewitz (2011) says that until such time that wastes are separated from the source, the efficiency of any recycling initiative will be hampered. In many municipalities, the main thing is collection and disposal in landfills and there are no consequences for doing this. It is as if landfills are the panacea of waste challenges in local municipalities. However, this poses a challenge as many landfills are far from communities.

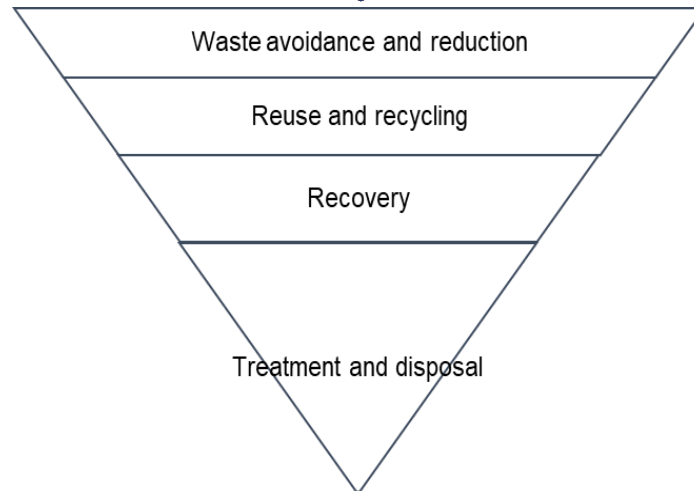


Figure 2. 4: Waste hierarchy (National Waste Management Strategy, 2011)

The management of waste practices is not in line with the waste management hierarchy at the municipal level. This means that even though NWMS aims to eventually reduce disposal and landfills, South Africa still relies on landfills as the main form of waste management. Waste disposal by landfills dominates the other methods in the hierarchy when it is supposed to be dominated by other methods. This is because landfilling seems easier to apply.

Table 2. 2: Waste Management facilities licence status in South Africa

Type of facility	Number of facilities	Number of licenced facilities	% of unlicenced facilities
General waste landfill site	1,203	432	56,4
Hazardous waste landfill site	77	86	46,8
Health care risk waste storage facility	25	25	100,0
Recycling facilities	9	44	77,8

Transfer stations	35	88	65,7
TOTAL	1,336	675	56,4

Source: DEA (2011)

From the table, one realises that 56.4% of the landfills are not licenced. This means these landfills are illegal, and they do not comply with the licence conditions and standards. This results in negative environmental impacts. Where licences have been provided for landfills, they are not correctly operated or managed. This defeats the waste management legislative framework's effort to preserve resources and protect the environment. Out of this, one would notice that there is a gap between the legislative framework on waste and what is being practiced on the ground. According to NWMS (2011), the drivers of waste management legislation, policies, and practices are socio-economic, environmental, and institutional organisations.

2.16 Ethics in Solid Waste Management

There is empirical evidence that ineffective solid waste management leads to soil, air, and water contamination. The burning of solid waste can lead to air pollution. Greenhouse gases are generated from the decay of organic waste, whereas leachate pollutes the soil and water bodies. Ineffective solid waste management can lead to health and safety issues. Using water polluted by solid waste can lead to diseases. Poor sanitation also contributes to ill health (Rathi, 2006; Sharholy *et al.*, 2008). Living things come into contact with solid waste through leaching, soil absorption, plant uptake, polluted water, and ventilation.

The world's population is almost eight billion. All these individuals are producing waste every day. If one takes into account waste coming from industries, this is excessive, considering that the world is finite. The world's capacity to fight the negative effects of waste is finite, and it is about to reach a tipping point as it is being pushed to its limits. Unmanaged waste can be on a collision course with the natural world by inflicting harsh and irreversible damage on it through pollution. Furthermore, it poses a serious risk to the present and future generations' needs by putting critical stress on the

atmosphere, water resources, oceans, soil, forests, and living beings – that is, the environment. This means that action is necessary to stop the carnage of environmental damage and the extinction of living species by waste. There is only one world with no spare world from which all species can make a living. This necessitates the need for ethics in solid waste management to ensure that human beings carry out their moral responsibility towards the earth. The ethic should explicitly or implicitly make judgments about how solid waste should be managed. It should also manage to tell what is right, what is wrong, what ought to be done, what has a right, what is wicked, what is evil, what is irresponsible, what is permissible, and so on (VanDeVeer & Pierce, 2003).

An ethical claim is

“about what someone ought or ought not do, or about the merit or demerit of someone’s character”
(VanDeVeer & Pierce, 2003).

What ought or ought not to be done in solid waste management? Do non-human species matter in solid waste management? Do non-human species have moral standing in solid waste management? These are ethical questions that prompt the need to look at ethics in solid waste management. Firstly, traditional moral theories represented by egoism, utilitarianism, Kant’s deontology, virtue ethics, and rights ethics were discussed. Then the environmental ethic is represented by the ethic of respect for nature.

2.17 Traditional Moral Theories

2.17.1 Ethics

Ethics is concerned with matters of what is morally good and bad, and what is morally right and wrong, and what ought to be done and what ought not to be done, and what is desirable and what is not desirable. Matters of ethics are important in solid waste management, as there is what is good and bad, what is right and wrong, and what ought to be done and what ought not to be done, what is desirable, and what is not desirable. What is good, the right behaviour, and what ought to be done need to be defended and systematised. There are categories of ethical theories, but this research

work will cover ethical egoism, social darwinism, utilitarianism, deontology, virtues, rights, environmental justice, and environmental ethics. To Van DeVeer and Pierce (2003)

“As a minimum, the systematic moral outlook or theory should (1) state whose life, well-being, or integrity morally counts and why (2) yield reasonably determinate implications for how the noted “conflict” situations ought to be handled and why? “

Before an evaluation of ethical theories can be done, two concepts, harm and benefits, need to be laid bare. Good, desirable, right, and what ought to be done represent benefit, whereas bad, undesirable, and what ought not to be done represent harm. To Van DeVeer and Pierce (2003),

“The notion of harm can be explained as (1) premature death (often premature, permanent cessation of consciousness, whether or not accompanied by permanent cessation of all bodily functions); (2) pain (ranging from agony to frustration); and (3) nonfulfillment of wants or desires”.

2.17.2 Ethical egoism

Egoism can be divided into psychological egoism and ethical egoism. To psychological egoism, people act as individuals act being encouraged by a wish to fulfil their self-interest. It is concerned with the motive of every voluntary action. People are motivated by what they perceive to be in their self-interest. On the other hand, in ethical egoism, people act in such a manner that their self-interest will be maximised. To ethical egoism, right and wrong are relative to the interests of an individual as such individuals do not have a duty to others but themselves. People have a duty to themselves and no duty to others or other species.

At the core of ethical egoism is self-interest. Human beings act because of the urge to promote self-interest and oppose actions that are detrimental to the promotion of self-interest. According to ethical egoism, human beings, as rational agents, morally ought to act if it promotes their self-interest. In the case of ethical egoism, the agent does not

give weight to the interests of others. In terms of benefit and harm, the maximisation of self-interest is the benefit, and the defeating of the maximisation of self-interest is the harm. To the ethical egoist, what matters most are the duties that bring the agent the highest payoff. What maximises one's self-interest as the agent may not necessarily bring the highest payoff to those around the agent. This stifles the cooperation between agents as well as all those concerned with the maximisation of their self-interest.

According to ethical egoism, only rational agents have moral standing. The ethical egoism moral principle is aimed at preventing harm to members of one species, human beings. In the same way, the ethical egoism moral principle is aimed at promoting benefits to members of one species, human beings. This means that rational agents can promote their self-interest at the expense of other rational beings, ecosystems, habitats, or some other entity. What is clear with ethical egoism is that nonhuman species have no moral standing and that only and only human beings have moral standing. Therefore, ethical egoism has an anthropocentric view.

2.17.3 Utilitarianism

Utilitarianism is a form of consequentialism. According to utilitarianism, it is the effects of the efforts that determine whether they are right or wrong. Actions that bring about the desired effect are those that promote happiness. The action that does not bring about the desired effect does the opposite. The happiness that is being promoted is that of human beings. Utilitarianism is an ethical theory that decides right from wrong by looking at the consequences. That is why it is regarded as a form of consequentialism. The ethical consequence of utilitarianism is the creation of the finest good for most people, regardless of the action. What is morally right, according to utilitarianism, is the effort that results in the most good. The action that results in anything contrary to the production of the best is regarded as morally bad. The approach of utilitarianism to moral evaluation and moral decision-making is different from ethical egoism in that the utilitarian view considers the good of other people as well as that of the individual. In the utilitarianism approach, one ought to maximise the aggregate good. The utilitarian agent's good does not outweigh the good of other people.

There are several different versions of utilitarianism, but the majority of them claim that morality ought to make life better by increasing the number of good things and decreasing the number of bad things. Jeremy Bentham and John Stuart are key classical utilitarians.

Utilitarianism is based on the principle that one ought to do what produces the best consequences. The best consequences relate to the largest amount of good, or that which “maximises utility”. The question of what is good, according to Jeremy Bentham, is pleasure or happiness. This view that regards pleasure as good is called hedonism. To hedonists, things like shelter and security can be regarded as good, but they ultimately lead to the production of pleasure or happiness. Pleasure or happiness in utilitarianism is regarded as valuable, and the right action is the one that maximises value or produces that which is valuable. The wrong action denies one that is valuable and brings pain, suffering, and unhappiness. Pain, suffering, and unhappiness are bad and are the consequences of wrong actions.

To the utilitarians, the answer to the question of who’s good is individuals and groups, or everyone is affected. From the discussion, what is notable is that the benefit of good is intended for the human species. When the utilitarian talks of the maximisation of the greatest good to the greatest number regardless of action and the good that refers to pleasure or happiness, this ideally leaves out nonhuman species. In short, to utilitarianism, only the consequences matter; pleasure or happiness should be maximised and each person counts impartially. Its strengths are seen as promotion of pleasure and happiness, it values empathy, can form a base of many laws, it is not absolutist, and it is consistent with some religions.

Early forerunners and ancestors of the classical utilitarians are Cumberland, Shaftesbury, Hutcheson, Gay, and Hume. They are British moralists. Richard Cumberland and John Gay were of the view that happiness was part and parcel of human beings, as it was approved by God. Gay (1731) writes:

“it is evident that a full and complete obligation which will extend to all cases, can only be that arising from the authority of God; because God only can in all cases make a man happy or miserable and therefore, since we are always obliged to that conformity called

virtues, it is evident that the immediate rule or criterion of it is the will of God”.

From Gay’s statement, one can conclude that human happiness depends on God’s will. The same thing applies to virtue. The classical utilitarians, Bentham and Mill, were influenced by what was happening in their society. The prioritisation of pleasure over pain in life

“Govern us in all we do, in all we say, in all we think...”
(Bentham, 1789).

Jeremy Bentham popularised the principle of utility as a criterion for right action. The principle of utility implies that actions are approved only if they promote happiness and are disapproved when they do the opposite. Stuart Mill’s version of utilitarianism was not the same as that of Bentham when it comes to intellectual pleasures. According to Bentham, there are no qualitative differences in pleasures, and this meant that human pleasures had the same value as animal pleasures. To Mill, pleasures have different values. The intellectual pleasures are high-order pleasures, and as such, are higher and better. This means they cannot be equated to sensual pleasures that are common to humans and animals. Irrespective of this, to Mill, the good still consists in pleasure.

Mill accommodated virtue evaluation in utilitarianism. Mill (1861) ponders:

“Does the utilitarian doctrine deny that people desire virtue, maintain that virtue is to be disinterestedly, for itself. Whatever may be the opinion of utilitarian moralists as to the original conditions by which virtue is made virtue..... the not only place virtue at the very head of things which are good as a means to the ultimate end but they also recognize as a psychological fact the possibility of its being, to the individual, a good in itself without looking to any end beyond it; and hold that the mind is not in a right state, not in a state conformable to Utility, not in the state most conducive to the general happiness, unless it does love virtue in this manner....”

From this statement, Mill argues that virtue has both instrumental value and the power to establish a good life. To Mill, a person without virtue cannot encourage good. Utilitarianism, as a consequential moral theory, maintains that acts and/or intentions are morally evaluated based on the states of affairs they bring about. If they bring about good states of affairs, then they are morally acceptable. But in certain circumstances, the good state of affairs can be brought about by killing the innocent, beating, lying, oppression, and exploitation of others to produce the good for others. What is striking is that motives for action are less important.

According to Van De Veer and Pierce (2003), the moral theory should

“state those life, well-being, or integrity morally counts and why”.

Given the anthropocentric view of utilitarianism, whose life, whose well-being, whose welfare, and whose utility will, without a doubt refer to human beings, even though Bentham and Mill regard pain as an evil and pleasure as a good, whenever they occur.

It will be illogical for moral agents not to consider animals when deciding which act will maximise the good, as animals experience harm and benefit, pain and pleasure. The empirical evidence advanced by Van De Veer and Pierce (2003) is that:

“The earth’s natural ecosystems as a totality are seen as a complex web of interconnected elements, with the sound biological functioning of each being dependent on the sound biological functioning of the others,”

People are members of the earth’s natural ecosystem. The sound biological functioning of the human species is dependent on the sound functioning of others. This means the harm done to the sound biological functioning of other species may harm the sound biological functioning of the human species. In the same way, the sound biological functioning of other species may benefit the sound biological functioning of human species. Harm can take the form of pain, premature death, and nonfulfillment of desires. From a waste management perspective, the question is: is it permissible to impose harm or the risk of harm to other species to maximise the good of human beings through waste, and to what extent can it be avoided or condoned?

This is a crossroads situation, or “conflict situation,” that utilitarianism has challenges dealing with.

Suppose that a person who mismanages waste derives so much pleasure that his pleasure (benefit) exceeds the sum of the disutility resulting from the act. Then waste mismanagement maximises utility. This is an indication that what is morally right should not always be equated to anything that maximises utility. The challenges relating to justice as distribution are not well catered for in utilitarianism. It does not show how to distribute environmental harm and benefits.

2.17.4 Kant’s deontology

Deontology is an ethical theory that uses regulations to differentiate right from wrong. Following the rules avoids subjectivity and uncertainty (Barrow & Khandhar, 2023). However, most rules are human-centred. The people are expected to apply the rules and follow the rules as they act, even if the results are unacceptable. Immanuel Kant is often connected with deontology. Kant believed that ethical efforts succeed in enforcing universal moral laws. Kant came up with the supreme principle of morality, called “categorical imperative” (Demenchonok, 2019). The categorical imperative, according to Kant, is to be followed at all costs, as moral requirements are justified by it. Actions are judged right or wrong, depending on whether they violate the categorical imperative or not. Moral duties are determined by the categorical imperative. When people act, they should check if they rationally believe that others should act as they do.

The word deontology is derived from the Greek term “deon”. Deon denotes duty or obligation (Udayakumar, Babu & Babu, 2021). What is notable about Kant’s ethics is that it focuses on “deon,” i.e., the duty or obligation. Duties are defined as right or wrong. One can either do right actions or wrong actions. As such, right and wrong are seen as directly prescribing actions. To the question of what ought to be done? The answer to it is that which are regarded as right actions, and this is what is morally required. The question is: What ought not to be done? The answer to it is that those actions are regarded as wrong actions and that is what is morally forbidden.

The major focus of Kant is on duties, regardless of the consequences. This is where Kantian deontology radically differs from utilitarianism. Duty is an essential action that

should be done out of respect for the law. According to Kant (1785), duty should be accompanied by the right motive, and a motive is right if it is for the sake of duty. The proper motive is the one that propels one to the moral duty without obtaining some consequence. The right motive should be reverence for the law and desire for duty, and they will always be biased towards the respect of moral law. The right thing should be done for no other reason than because it is the right thing to do.

Moral agents are rational and autonomous, as such motives are under their control. Due to this fact, Kant believed that morality must be rational, and that right action cannot be divorced from rational action. So, moral law should be universal and based on pure reason. Kant employs the word “imperative” to clear up the confusion around what moral dictates. Imperatives are commands, orders, or what one to do. This is because Kant believes that ethics consists of imperatives. According to Kant (1785), there are two types of imperatives: hypothetical and categorical.

Hypothetical imperatives can be regarded as conditional ought to do or situational ought to do as they are associated with wants, needs, and desires. Imperatives like if you want to pass the examination you need to study the relevant material are hypothetical imperatives.

Studying the relevant material is conditional on the desire to pass the examination. If one does not need the desire, one can disregard the hypothetical imperatives because it is not a moral rule. Hypothetical imperatives are not moral rules because they are situational. The hypothetical imperatives can be identified with the “if then statements”. If you desire X, then you ought to do Y.

The next imperative is called the categorical imperative. Unlike the hypothetical imperatives, categorical imperatives, are commands that cannot be questioned. The categorical imperatives are high-order commands that cannot be disregarded, as is the case with hypothetical imperatives (Kant, 1785). The categorical imperatives ought to be followed. Conditional or situational wants, desires, and needs do not play a role in the categorical imperative.

Imperatives such as “do not cheat” and “do not lie” would qualify as categorical imperatives as they take into account the wants, desires, and needs. But to Kant, these are not categorical imperatives. Kant believed that categorical imperatives should provide direction on what one ought to do. The categorical imperatives should be

universal and apply to all moral beings, irrespective of their status, gender, wants, needs, desires, and goals. This means these universal laws should be equivalent to natural scientific laws.

Two of those universal laws follow below:

Categorical imperative [1]

“...act only in accordance with that maxim through which you can at the same time will that it become a universal law” (Kant, 1785).

Categorical imperative [2]

“...so, act that you use humanity, whether in your own person or in the person of any other, always at the same time as an end, never merely as a means” (Kant, 1788).

The categorical imperative [2] has a rider and is as follows:

“...what has a price can be replaced by something else as its equivalent; what, on the other hand, is raised above all price and therefore admits of no equivalent has dignity” (Kant, 1788).

To understand categorical imperative [1], one has to first understand the words “maxim”, “will,” and universal. Maxim refers to a rule or principle that tells you what to do. A maxim differs from one circumstance to another. The word “will” refers to resolve. The resolve to do the right thing, whatever it is. The word universal refers to that which is generally accepted by the collective and becomes common to all.

By using the word universal, Kant wanted to come up with a categorical imperative that will apply commonly or generally to all, just like the Universal Law of Gravitation by Newton. Remember that Newton’s law of universal gravitation applies to all objects in the universe. Objects refer to anything that can occupy space and has mass; therefore, Newton’s law of universal gravitation would apply to all, irrespective of their status, standing, gender, and qualifications. Newton’s law of universal gravitational applies to non-human species.

Categorical imperative [1] means doing an action that follows a personal rule only and only if one wills that the personal rule applies to all. This is a sort of doing to others that one will do to all in the universal. It also means that if you are a rational being do what you will allow other rational beings, to do to you and other rational beings.

If the rational agent does not believe that what he /she wants to do should also be done to him/her, then that maxim (personal rule) will not be a universal law, therefore it is not a good maxim and should not be followed. But if the rational agent can allow the maxim to be universal, then it is permissible and should be followed. To illustrate the categorical imperative [1], the words 'lie', 'cheat', and 'assist' are employed. Before a rational agent can lie or cheat, the question should be, "Will lying, or cheating be allowed to the children, elderly, adults, and everybody else?" "Is it possible for everyone to live by lying and cheating?" If the answer can be negative, then the rational agent should not lie or cheat. The same thing applies to "assist". Before a rational agent can assist, he/she should ask the following questions: "Will children, adults, the elderly, and everybody else be allowed to assist others? Can everyone live by assisting others?" The answer to these questions will determine whether the maxim of assisting is permissible or not.

The categorical imperative [1] has a test mechanism in it. If it can stand the test of time, then it is permissible, but if it fails the test, it is impermissible. Any permissible maxim means it can be universalised and it does not allow exceptions. It also means that it would be rational for every moral agent to act this way.

The categorical imperative [2] means rational agents should be free from indignity. People should not be treated as tools. To act morally is to respect people as an end, not as a means. Anything outside of treating people as an end in themselves is immoral. To Kant (1785), people as rational agents have an intrinsic value as such; they cannot be treated as tools. The idea that people have an intrinsic value also indicates that rational agents should not be handled as a "means". It also indicates that people should never be misused. The categorical imperative [1] and categorical imperative [2] led to the third categorical imperative, which, when put under scrutiny, is a rider to the categorical imperative [2]. The third categorical imperative is as follows:

“Act in accordance with the maxims of a member giving universal laws for a merely possible kingdom of ends” (Kant, 1788).

This categorical imperative talks of an ideal society in which all people’s dignity is respected, the intrinsic value of rational agents is freely respected, and there is a high regard for the universal moral law. The moral law mentioned is based on pure reason, and the categorical imperative assists people knowing the moral dictates. When evaluating Kant’s deontology, one realises that:

“The presence of the capacity to judge is a necessary condition for being owed any duties” (Van De Veer & Pierce, 2003).

The capacity to judge is limited to humans. When Kant raised this issue, he was convinced that all humans can judge, but the reality is that there are humans who are mentally challenged and cannot judge just like animals. If the animals do not have an intrinsic value, then they can be treated as mere means since they cannot judge. Does this mean that humans who are on par with animals in terms of their capacity to judge can be treated like animals? When Kant’s deontology is faced with a conflicting situation like the one mentioned, it experiences a challenge.

Kant’s deontology has an anthropocentric view as from a

“human-centred standpoint, it is to humans and only to humans that all duties are ultimately owed” (Taylor, 2003).

Every organism and species population can be intentionally harmed. As explained earlier, harm can range from pain to non-fulfilments of needs, desires, and wants to premature death. Harm suffered by other species will affect the sound biological functioning of humans and ultimately lead to the loss of human dignity. In waste management, duty is owed to all living things and the earth. So, there are challenges with the application of Kantian deontology in waste management.

2.17.5 Virtue ethics

Virtue ethics is about how rational agents should live, how they should be, and how they should improve (Slote, 2001). That is, it is about the role of character rather than one's duties or one's good consequences. In virtue ethics, the rational agent should know how to differentiate between virtues and vices.

If one is faced with ethical dilemmas, two principles can be used to solve the challenges: the Golden mean and the use of imagination. According to the principle of the Golden mean, virtue lies between the extremes of excess and deficiency. The two extremes are regarded as vices. The extremes of courage are cowardice and recklessness. So, per the Golden mean, each time one faces an ethical dilemma, one should look for the middle between extremes. Per the principle of the use of imagination, one should imagine being a virtuous person and respond the way a virtuous person would have acted. This would close the gap between the current behaviour and the imagined behaviour. So, in a conflict situation, one should follow the aspirational behaviour that matches that of a virtuous person.

Virtue ethics, unlike deontology, which emphasises the “deon”, and consequentialism, which emphasises the outcome, emphasises the role of moral character. Virtue assists the rational agent to live a virtuous life as opposed to a life characterised by vices. Consequentialists and deontologists also regard virtue as important, but from different angles. To the consequentialist, virtues are traits that bring about a good outcome, but to the deontologist, virtues are traits that enable rational agents to fulfill their duties.

There are two important concepts in virtue ethics: virtue and practical wisdom. Virtue is an excellent character trait that makes rational agents better people. This means that virtues are within the realm of rational agents. Possessors of virtue differ from one rational agent to another. Some rational agents have a fair amount of virtue, and others have a low amount of virtue. These rational agents are striving to possess full virtue, which is an ideal. The following concepts can assist one recognising “virtuous behaviour, courage, temperance, liberality, magnificence, magnanimity, proper ambition, truthfulness, wittiness, friendliness, modesty, and righteous indignation” (Slote, 2001). From these words, one can realise that the concept of virtue makes the possessor morally good.

Practical wisdom (phronesis) can be regarded as the rational agent's capacity to do the right thing in a situation where one has to act concerning the things that are good or bad for humans (Zagzebski, 2004). Practical wisdom enables the possessor to assess the situation and make informed, rational decisions. In a conflict situation or conundrum, one should follow what the "phronimos" (virtuous person) would have done and avoid that which the "phronimos" would have avoided.

Even though virtue ethicists agree that virtue and practical wisdom are required, they disagree about how rational agents should live a life well lived using virtue and practical wisdom. The forms of virtue ethics are agent-based, target-centered virtue ethics, eudaimonist virtue ethics, exemplarist virtue ethics, and platonistic virtue ethics.

Eudaimonist virtue ethics are concerned with eudaimonia. According to eudaimonist version of virtue ethics sees virtue as a moral trait that helps to attain eudaimonia. Eudaimonia means "human flourishing" or the best that a human being could be or a well-lived life. To eudaemonist virtue ethics, the good life is always associated with eudaimonia and virtues are key in attaining the good life. Everything that can be seen has a purpose, the telos. The telos of the axe is to chop. If an axe can chop, then it is fulfilling its telos. In the same way, humans should fulfill their telos, which is eudemonia. For humans to fulfill their telos, they should live a virtuous life.

Agent-based and exemplarist virtue ethics understand rightness and wrongness in terms of the motivational qualities of the agents.

"Agent-based virtue ethics...understand rightness in terms of good motivation and wrongness in terms of agents having bad motives' (Slote, 2001).

To Slote, even the value of eudaimonia should be understood in terms of the motivational qualities of agents. But Zagzebski (2004) adds to this fact the motivational qualities of exemplary agents which can be divided into positive exemplars and negative exemplars. The positive exemplars should be emulated, and negative exemplars should not be emulated. What is evident from agent-based and exemplarist virtue ethics is that the goodness of actions is derived from the agent's purpose. Good purposes translate to good deeds and bad purposes translate to bad deeds.

The major criticism of virtue ethics comes from utilitarians and deontologists. The issue is about the lack of universal rules or principles in virtue ethics that would guide even non-virtuous people on what the right action is in any case. Another criticism is that even non-virtuous people can perform the right action, and this makes virtue not a condition for the right action.

Different cultures have different values. This means what is regarded as a virtue in one culture may not necessarily be regarded as a virtue in another culture. This also raises the question of which traits are character traits.

2.17.6 Rights ethics

Rights are claims that are allowed or owed to people, and they may be legal, human, or contractual (Marx, 1844). These entitlements may be according to social convention or ethical theory. One is allowed to perform actions that are not in line with the rights owed or allowed. And any actions that respect the rights of other people are considered correct, and any decision that does not respect the rights of other people is considered incorrect. Rights dominate the understanding of what is permissible and what is impermissible.

Rights, as a justified claim against another person's behaviour, are always tied to duties. The right of one person implies the duty of another. This means that one's right to be carried out depends on the other person to carry out the duty part. In the illustration, the right not to be killed depends on the duty not to kill. There should be an obligation not to kill another person. Rights can be legal if they arise from the law, there could be human rights if they arise from basic human rights, and there can also be contractual rights arising from an agreement. There are also four basic elements of rights known as "the Hohfeldian incidents" after Wesley Hohfeld and these are the privilege, the claim, the power, and the immunity. The Hohfeldian incidents can be used to analyse the rights (Marx, 1844).

A privilege indicates that its holder has no duty not to do so. For example, the right to choose a table where you want to eat when you are in a restaurant is a privilege since one would not be violating any duty not to choose a table. Claims, on the other hand, correlate to a duty. The right holder has entitlement to the duty.

Power is about when one can alter one's privileges and claims or another person's privileges or claims. If one has no duty to pick up a fallen paper and someone senior imposes that new duty upon the person, thereby annulling the no duty to pick up a fallen paper, then the senior has power. In the case of the above example, if the person who is ordered to pick up the fallen paper cannot alter the senior's claims and privileges, then the senior has immunities to the other person. The summary of "the Hohfeldian incidents" is as follows:

If there are two people X and Y, if X can have a claim, it means X has a no-claim. If X has a privilege, it means X lacks a duty. If X has power, it means X lacks a disability. If X has immunity, it means X lacks a liability. But if X has a claim, then Y has no claim. If X has power then Y has a liability. If X has immunity, then Y has a liability (Stanford Encyclopedia of Philosophy, 2020).

According to Marx (1844), the person who is carrying rights is an

"isolated monad...withdrawn behind his private interests and whims and separated from the community".

To Marx, rights make an individual unrelated to others, as the rights of individuals are explained without reference to others. By doing this, they keep an individual away from other individuals. Another criticism is that economic and political power inequalities continue even in a society with formally equal rights. Another criticism relates to the hierarchy of rights. So, when one's right bridges another right, the challenge that arises is which one should take precedence over another. An example is when the freedom of speech bridges the freedom of not to be discriminated against or the rights of animals versus the rights of people.

2.17.7 Challenges with traditional ethical theories

The challenge with traditional moral philosophy is that they are anthropocentric. As such,

"human actions affecting the natural environment and its non-human inhabitants are right (or wrong) by either of two criteria: they have consequences which

are favourable (or unfavourable) to human well-being, or they are consistent (or inconsistent) with the system of norms that protect and implement human rights. It is to humans and humans only that all duties are ultimately owed” (Taylor, 2003).

For traditional moral theories, the obligation of human beings as rational agents is based on the fact that it should further human values. Rational agents have no obligation to non-human species unless that brings to fruition human values and/or human rights. This means the harm and benefit of non-human species are insignificant to traditional moral theories, as they do not have any moral standing. From the viewpoint of sustainable development, the ecosystem matters for the sake of the needs of the current generation and future generations. It has been scientifically proven that solid waste management, if not properly managed, can bring about environmental degradation and pollution in water, soil and air. Environmental degradation and pollution bring harm to non-human species. For Van DeVeer & Pierce (2003), harm has to do with premature death, pain, and non-fulfillment of desires or wants. It is not justifiable to bring harm to non-human species through solid waste management, as the sound biological functioning of non-human species is paramount to the sound biological functioning of human beings.

“...it is widely and plausibly held that the most acceptable moral outlook will be one that is clear, sufficiently precise, comprehensive, logically consistent, compatible with the best scientific theories results, and compatible with our deepest, most prejudice-free, specific moral convictions about particular cases” (VanDeVeer & Pierce, 2003).

Traditional moral theories do not seem to fit the assertion of the most acceptable moral outlook. This is because feasible and long-lasting solutions for solid waste management have to cater to non-human species and be compatible with scientific results. Therefore, in the case of the management of solid waste, the traditional moral theories are inadequate.

2.18 Environmental ethics

According to DeGuzman *et al.* (2017), “Deontology teaches us that it is our moral duty to prevent the endangerment of the species, as it is the right thing to do”. But Utami *et al.* (2021) believe that “environmental quality degradation is triggered by behaviour patterns of people who are not environmentally friendly, such as throwing garbage in water bodies, causing water to accumulate in waterways, and causing various other inherited problems”. Environmental ethics are based on the belief that nature needs to be respected. What is right or wrong is based on the actions and/or consequences that promote or hinder respect for nature. But from the solid waste management perspective, environmental ethics explicates how one should behave or what rules and moral obligations one should have while managing solid waste and thereby helps to rescue the environment from the Anthropocene (DeGuzman *et al.*, 2017).

Human beings, who are moral agents, should obey the principle of respect for nature as the supreme rule to govern and treat the natural world. Environmental ethics is a life-centred system, and to it, organisms, species populations, and communities of life have an inherent worth that determines the moral agents’ relations with them. This means that organisms, species populations, and communities of life have well-being and welfare which can be intentionally injured or advanced by human deeds. Obeying the principle of respect of nature, in terms of waste management, implies that waste should be managed properly. That is, in such a way that organisms, species populations, and communities of life will not suffer harm, but benefit.

For the ethics of respect for nature, violations of the principle of respect for nature can be detrimental to non-human species and human beings. If it goes unchecked, this may deny humanity its own ability to survive. This is because some human activities can cause environmental degradation. On the other hand, the promotion of respect for nature can be beneficial to non-human species and human beings. This is the case because,

“... the earth’s natural ecosystems as a totality are seen as a complex web of interconnected elements, with the sound biological functioning of each being dependent on the sound biological functioning of the others” (Taylor, 2003).

The principle of respect for nature works in favour of the realisation of the well-being and welfare of non-human species and human beings, and this is good for them. The ethics of respect for nature ensure that non-human species greatly benefit, and this, in turn, will benefit human beings as,

“The well-being of humans is dependent upon the ecological soundness and health of many plant and animal communities, while their soundness and health do not in the least depend upon human well-being” (Taylor, 2003).

Respect for nature in solid waste management will arrest the destruction of non-human habitats, which is caused by pollution and poisoning of the environment. The atmosphere will no longer suffer from ozone depletion and pollution. Oceans will no longer carry the burden of industrial, municipal, agricultural, and livestock waste. Tropical rainforests and tropical dry forests will no longer suffer destruction. The environmental ethics based on respect for nature fit the assertion of the most acceptable moral outlook for solid waste management. A study by Utami *et al.* (2021) on environmental ethics analysis of household behaviour indicates that if household housewives have higher knowledge of environmental ethics, their ability to manage waste increases. Therefore, improved environmental ethics knowledge contributes to improved household waste management.

2.19 Waste management ethics

From the analysis of the literature on ethics, arises the need for the waste management ethic. Central to the ethic should be the principle of respect for the environment. This principle means respect for the atmosphere, respect for water sources, respect for oceans, respect for the soil, respect for forests, and respect for living sentients. According to this ethic, any action is either right or wrong if its consequences are favourable or unfavourable to the principle of respect for the environment. When human beings respect the environment, the atmosphere counts, water sources count, oceans count, soil counts, and forests count. There is such a complex interaction between these environmental elements that they all need to be seen to count. Living things depend on the atmosphere, water resources, soil, and forests for survival.

Waste causes water pollution, air pollution, and soil pollution, and that ultimately negatively affects the biological functioning of plants and animals' lives. Respect for the environment will ensure that the air is not polluted, the soil is not polluted, and the water is not polluted. Respect for the environment will assist to protect plant life and sentient life. Too much waste contributes to climate change. Respect for the environment will contribute to the reduction of waste and the reduction of waste will assist in curbing climate change, enhancing sustainable development, and realising Agenda 2030. Respect for nature will therefore benefit the human and non-human species and help answer moral questions or controversies on how moral beings should act when faced with waste. The waste management ethic will prevent harm to non-human species as it regards all of them as having moral standing. The welfare of non-human species is important to the community of life and their ill-fare is detrimental to the community of life. Human beings are the responsibility bearers of the principle of respect to the environment and all species, human and non-human, are benefit holders of the principle of respect for the environment.

The waste management ethic embraces empirical claims of waste management, such as reduction of waste, reuse of waste, and recycling of waste, as they are in line with the principle of respect for nature. These empirical claims help to ensure that the environment's biological system will not be damaged. It also ensures that global resources are sparsely used for the sake of the present generation and the future generation, thereby ushering in the environment-friendly practices of discharging responsibility towards the environment, which will stop moral agents from damaging it.

2.20 The concept, Indigenous knowledge

The term indigenous is understood to mean 'traditional'. Indigenous people have knowledge that comes from experience, skills, beliefs and a way of life that makes them different from other groups (Dondolo, 2005; Hoppers, 2005; Nel, 2005; Masoga, 2005), whereas to Nel (2008), Indigenous Knowledge is "informed by and relates to all domains of life and environment". The term indigenous knowledge is defined as a,

“cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview” (UNESCO, 2002).

From the definition, one can deduce that IK (indigenous knowledge) is gained through experience as opposed to experiments of scientific knowledge. This is tried and tested knowledge that has stood the test of time. This claim provides the basis upon which the community can decide the best solutions to social challenges. The knowledge provides wisdom to tackle challenging issues, and this makes it classified as applied knowledge.

“Indigenous knowledge is the basis for local-level decision making in many rural communities” (Soropa *et al.*, 2015).

Decision-making covers societal challenges, environmental challenges, and economic challenges. Societal challenges include, among others, poverty, diseases, and conflict. Environmental challenges cover drought, floods, climate change, and environmental degradation. In addition, economic challenges cover access to resources for an improved life. From the preceding definition comes the sense that ‘resource use practices, ritual, spirituality, and worldview’ cannot be divorced from Indigenous Knowledge (IK), as decision-making takes into account resources available, rituals, spirituality, and worldview. This is also confirmed by Feit (1973) and Fienup-Riordan (1990) when they argue that people, nature, and spirituality are intertwined. Therefore, Indigenous Knowledge (IK) can assist in solving humanity’s troubled relationship in the world concerning sustainable development, which covers the social pillar, environmental pillar, and economic pillar. This claim is confirmed by the Indigenous Knowledge of South Africa (IKSSA) Trust. To them

“Indigenous Knowledge Systems emanating from the human spirit are life experiences organized and ordered into accumulated knowledge with the objective to utilize it to the quality of life and to create a liveable environment for both human and other forms of life” (Gila, 2004).

therefore, what is right in Indigenous Knowledge (IK) should bring about,

“the quality of life and liveable environment for both human and other forms of life.” This brings in the ‘principle of utility’ according to which “what is right is whatever maximizes the total amount of net utility” (VanDeVeer & Christine, 2003).

What humanity wants is quality of life or wellbeing. This is what brings pleasure to humans and is right. The question of whose utility remains. The answer would be the utility of humans and other forms of life as Indigenous Knowledge (IK) holders are of the view that people, animals, plants, and other elements of the universe cannot be divorced from one another (Nakashima & Elias, 2002). According to Hoppers (2005), Indigenous Knowledge (IK) has two inseparable levels: namely, the empirical and cognitive levels. According to Hoppers (2005), the empirical level has natural, technological, architectural, and socio-cultural. Naturals include things like ecology, biodiversity, soil, agriculture, medicine and pharmaceuticals. Technological and architectural consist of crafts like metallurgy, textiles, basketry, food processing, building, etc., and socio-cultural include social welfare, governance, conflict resolution, music, art, etc.

Indigenous knowledge (IK) is the knowledge of the community people, for the community people, by the community people, as it is gained by the interaction of the community people with the natural environment to develop human capital and human resources to improve people’s lives. The above statement may give a wrong impression that Indigenous Knowledge (IK) is all about the people. The community interacts with nature through environmental preservation and many other activities. This community does ensure that the earth does what it does best. to provide fresh air, clean water, quality food, energy, and other resources that can improve human

lives. For the earth to provide this forever, the community people have to take care of the plants, animals, and nature in general. Indigenous knowledge (IK) is the knowledge of the community people, for the community people, by the community people, to take care of the continual survival of the community people, which in turn is tied to the continual survival of plants, animals, and nature. Indigenous knowledge systems (IKS) have evolved to assist with survival challenges (Mapira & Mazambara, 2013).

Indigenous knowledge (IK) is exercised within the good “interrelationship and interdependence of all phenomena” (Hoppers, 2005). Therefore, indigenous knowledge (IK) is holistic. In Indigenous Knowledge (IK), human beings have a moral obligation towards nature as people, animals, plants, and nature are in relation. This obligation calls for respect for nature and stewardship of nature. Therefore, Indigenous Knowledge (IK) holders are expected to display morality towards the treatment of nature. However, this respect for nature is not in line with life-centred systems of environmental ethics according to which,

“we have a prima facie moral obligation that are owed to wild plants and animals themselves as members of the earth’s biotic community. We are morally bound (other things being equal) to protect or promote their good for their sake. Our duties to respect the integrity of natural ecosystems, to preserve endangered species, and to avoid environmental pollution stem from the fact that these are ways in which we can help make it possible for wild species population to achieve and maintain a healthy existence in a natural state” (Taylor, 2003).

With IK, the moral obligation humans have to protect the environment is out of consideration of humans' welfare or wellbeing. This means the results of human obligation to nature should be favourable to enrich human lives.

“We may have responsibility with regard to the natural ecosystems and biotic communities of our planet, but these responsibilities are in every case based on the

contingent fact that our treatment of those ecosystems and communities of life can further the realization human values” (Taylor, 2003).

This means that indigenous knowledge (IK) has an anthropocentric view of human interaction with nature.

Is indigenous knowledge (IK) dynamic or static? This question is best answered by The Institute for Indigenous Theory and Practice in this manner,

“we are concerned with the quality of life and the integration and social organization of a contemporary society” (Cohen *et al.*, 1993).

This is also confirmed by Nakashima and Elias (2002) when they say that

“traditional knowledge holders acknowledge, accept and adopt elements from other knowledge systems”.

Indigenous Knowledge (IK) is not static but dynamic in that it can adapt to new challenges in society and can be used in contemporary society in environmental management for conservation and improvement. Knowledge is not static (Basanta, 1990). It is the fountain of knowledge about how human beings interact with the environment (Wahab & Ogunlola, 2015). Why is Indigenous Knowledge (IK) referred to as a system? Nel (2008) argues that a

“system refers to the holistic nature of the knowledge as it links up and relates to all aspects of life and the environment as it refers to the plurality of both its properties and functions”.

This is the main reason for referring to Indigenous Knowledge (IK) as a system.

From the preceding discussions, one can conclude that Indigenous Knowledge (IK) as a system is about the knowledge acquired through human experience in the world in all fields of life, which is valuable to solving challenges experienced in the world. This human experience covers a wide range of things because it is transdisciplinary. This knowledge differs from community to community, but it can be used to solve

challenges even in a different community, as it is dynamic. This knowledge, in many cases, is not documented but preserved in oral traditions, practices, rituals, proverbs, and stories.

2.21 Indigenous knowledge and sustainable development

This discussion will start with background information about sustainable development. The background will cover the history of sustainable development and the concept itself before the relationship between IK and SD (sustainable development) can be clarified.

2.21.1 The history of sustainable development

The concept of sustainable development first was used in 1972 in a book linked to the United Nations (UN) Stockholm Conference on Human Environment. It appeared again in the title of a 1980 report on World Conservation for Sustainable Development by IUCN, WWF, and UNEP. In 1987, the report of the World Commission on Environment and Development was released. This commission was led by Gro Harlem Brundtland, who was the Prime Minister of Norway. The report was called *Our Common Future* (WCED, 1987). The report used the concept of SD expansively. The concept of sustainable development in its entire history was first defined in *Our Common Future* report. The report defined SD (sustainable development) as

“... development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

The report was also able to consider environmental concerns as a consequence of development processes from a political, economic, and social perspective. The report even covered the environmental concerns and prospects of development around the world (Elliot, 2013).

The UN Conference on Environment and Development was held in Rio de Janeiro in 1992. Out of it came the Agenda 21 document, which also laid the groundwork for the Convention on Biodiversity and the Framework Convention on Climate Change. The Agenda 21 document showed the issues, players, and means of achieving sustainable development (Elliot, 2013).

In the year 2000, the UN community had eight Millennium Development Goals (MDGs). The MDGs have eighteen targets linked to the environment. Goal number seven refers explicitly to SD (sustainable development). The UN World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa, in 2002. This led to the Johannesburg Declaration on Sustainable Development. There is now an understanding that the environment, society, and economy are interdependent (Potter *et al.*, 2008).

In 2015, the UN released the seventeen Sustainable Development Goals (SDGs). The SDGs have one hundred and sixty-nine targets, each of which has indicators to measure global progress against the MDGs. At the Earth Summit, the UN Framework Convention on Climate Change (UNFCCC) was released for adoption. The UNFCCC is an intergovernmental agreement established to deal with the challenges of climate change. There is also a negotiated protocol to the Convention. This protocol is called the Kyoto Protocol. It came into being in Kyoto, Japan, in December 1997. The protocol compels industrialised nations to cut their emissions of greenhouse gases (GHGs) by an average of five percent for the period 2008 to 2012. GHGs are gases that cause global warming when their quantity exceeds the required limit and global warming is linked to extreme weather patterns. Examples of GHGs are perfluorocarbons (PFCs), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), and Sulfur hexafluoride (SF₆). These GHGs lead to global warming, which results in extreme weather patterns like floods and droughts and an increased risk of the annihilation of many nonhuman species. To enable countries to reach their targets, the protocol uses 'sinks'; a process that removes greenhouse gases from the air, the Clean Development Mechanism (CDM) which is a technology that will contribute fewer greenhouse gases, and the planting of trees to remove CO₂ (carbon dioxide) from the air.

The Kyoto Protocol was followed by the Paris Climate Treaty. This is a global accord on the reduction of climate change. It deals with GHG mitigation, adaptation, and finance and was established in 2010. While all the SDGs are essential for sustainable development, SDG thirteen, climate action, is seen as the most urgent one in terms of the need for implementation on a global level. Hence the formation of the UNFCCC.

This short history of SD (sustainable development) shows that sustainable development is a global transdisciplinary concept, and it is not just a concept from the past, it is also a concept for the present and for the future, which cannot be ignored by any field.

2.21.2 The concept of sustainable development and its relation to Indigenous Knowledge

This concept of sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). What is clear in the definition is that development in the present should not jeopardise development in the future. However, what should be done to avoid jeopardising future generations remains unanswered by this definition. Another challenge in the definition is knowing the needs of the next generations or should it be assumed that the needs of future generations, will be the same as those of the present generation? Even in the present generation, needs may differ from one area to the next. Therefore, it is problematic to implement the definition. The first-world nations regard SD as an environmental concept concentrating on intergenerational equity and the needs of future generations, while the nations that are developing emphasise intragenerational equity, which focuses on the economic and social needs of the present. There is also a challenge regarding sustainable development literature. Some scholars use the terms sustainable development and sustainability as synonyms, while others use the two as separate concepts. Scholars like Jonathan (2005) regard sustainable development as a process of sustainability, whereas sustainability is about the capacity to continue. Eggert (2009) believes that sustainable development is multidimensional, as it covers all dimensions of sustainability, whereas sustainability is dimensional, as in economic sustainability, environmental sustainability, economic sustainability, and social sustainability, that is, it has one dimension. However, the definition has assisted to take the discussion on sustainable development to a higher level, placing it on the world’s agenda. It also addresses the problem of conflicts between the environment and development goals. The Commission came up with the definition of sustainable development and came to terms with the fact that indigenous knowledge is significant for sustainable development (WCED, 1987), as the objective of IK is to create a liveable environment for both humans and other forms of life (Gila, 2004) for now and for the future. This objective caters to the environmental pillar of

sustainable development. This goes to show that both IK and SD are concerned with the environment, even though Indigenous Knowledge (IK) takes this a step further by tying the environment with spirituality.

There is recognition that sustainable development has three aspects; namely, environmental, economic, and social aspects that are connected (Holmberg, 1992; Reed, 2013). The economic aspect has to do with producing goods and providing services for people forever, without damaging the ecosystem; the environmental aspect has to do with taking care of nature by not over-exploiting natural resources and also avoiding climate change, whereas the social aspect has to do with the provision of social services that will build the capability to have a good and healthy life, to be knowledgeable to lead a decent life, and to participate in the community. These three aspects represent a move from defining development in terms of the economy only. The Convention on Biodiversity (CBD) has realised that indigenous knowledge can contribute to conserving the ecosystem (McGregor, 2010). In Article 8(j) of the Convention, it is stated that “knowledge and practices of indigenous people that carry their traditional lifestyles are relevant for the conservation and sustainable use of biological diversity”.

The concept of sustainable development is related to the concept of sustainability. Sustainability in terms of human society is the capacity of human society to continue indefinitely into the future within the natural cycles, whereas sustainable development is a development towards a state of sustainability. According to Natural Step, the root causes of unsustainability are: the extraction of mined materials from the lithosphere (earth’s crust), such as heavy metals and fossil fuels that accumulate and increase in the natural systems as pollutants, leading to climate change, the creation in society of chemical compounds that accrue in nature that do not break easily, physically removing nature and inhibiting its ability to run natural cycles; and inhibiting people’s ability to make a livelihood.

From the preceding discussion, SD can be regarded as a development that considers the economic, social, and environmental aspects that are connected while avoiding the root causes of unsustainability and disturbance of the natural cycles. It has also been noticed that SD is not static but dynamic, it is a process, not a state. Indigenous knowledge is dynamic as it can be adapted from one situation to another, and it

changes over time. The objective of sustainable development is to address challenges related to unsustainability. The unsustainable challenges are survival challenges. Indigenous Knowledge Systems (IKS) have evolved to assist with survival challenges (Mapira & Mazambara, 2013). Society and the economy are dependent on nature for survival. Without nature there will be no society and, in turn, no economy since the economy is a social activity. This is why natural resource management is key to sustainable development. In Indigenous Knowledge (IK) human beings have a moral obligation toward nature and this obligation calls for respect for nature and stewardship of nature for this generation and future generations.

2.21.3 Indigenous solid waste management practices in Africa

The history of waste dates to the beginning of humankind, and so are the problems of solid waste management. Africans, too, have a history with solid waste management. The challenge with it is that it has not been well documented, like the history of solid waste management on other continents. However, a thorough search can uncover it. Many African countries fall under the category of developing countries. The challenges that are found in developing countries are also challenges in African countries. The examination of documents on the management of solid waste in developing nations has revealed a need for new ways of managing solid waste, that will apply to them. That call is important for researchers and policy makers (Amuda *et al.*, 2014). A search for solutions should be spread to cover indigenous solid waste disposal practices, too.

The study by Ajibade (2007) revealed that Nigerians have always had ways of managing waste. Their way of managing waste involves waste reuse and waste recycling. The challenge they experienced, according to Ajibade (2007), is that their reuse and recycling methods have not evolved to accommodate new waste streams, and the scale of waste produced is greater than their rate of reuse and recycling. The study recommended further research to document methods of indigenous waste reuse and recycling. The researcher recommended this approach because more still needs to be researched on solid waste in indigenous knowledge.

Ibodje (2017) conducted a study, and it revealed that Aluu has less indiscriminate domestic waste management than Choba and Alakahia. This is due to strong traditional institutions that enforce and monitor waste activities. This means that

traditional institutions are important participants in solid waste management. The active participation of this stakeholder can make a positive contribution to solid waste management. However, traditional institutions hinder waste management. This is due to the influence of developed countries. The study recommended that the community should be a party to decisions that involve waste management and that the government should learn from the community members and use good local practices in the management of waste.

The study by Machete (2018) on indigenisation for improved access to affordable household refuse disposal in South Africa has highlighted the existence of indigenous refuse disposal practices. These practices can be used to beef up ailing municipal solid waste management systems in South Africa. These are the following: segregation, burying, composting, burning, conversion, baiting, recycling, mulching, back-yard pits, large landfills, sorting, and animal feeding. Kosoe *et al.* (2019) demonstrated the importance of the following solid waste practices: taboos, communal labour, house composting, waste conversion, and food for domestic animals in urban areas of Ghana. The researchers take the issue of indigenous solid disposal practices further by bringing in the modernised mixture approach (MMA). The modernised mixtures approach is a conceptual framework for putting together adequate and sustainable solutions to sanitation problems (Spaargaren *et al.*, 2006). With this approach, indigenous solid waste practices can be integrated to mitigate the problems of solid waste management in nations that are developing. Supported by the modernised mixtures approach (MMA), the study established that there is an environmental and health benefit in mixing traditional and contemporary waste management practices and that indigenous waste management systems can be used 'in the small-scale decentralised systems where reuse, recycling, and recovery of valuable materials are practiced (Kosoe *et al.*, 2019). According to Rothenberger *et al.* (2006), the benefits of the modernised mixtures approach (MMA) are affordable waste management and less impact by disposal sites on the environment.

2.22 The rationale for using indigenous knowledge in solid waste management.

The history of waste is as old as the history of humanity; even waste-related challenges are as old as the history of humanity, and this is confirmed by Tchobanoglous *et al.* (1993) when they say that the problem of waste can be traced

back to the first formation of villages, tribes, and communities and that the piling of waste became a consequence of life. This means that societies as early as the primitive ages experienced the challenges of waste. Therefore, indigenous people of the world also produced waste as a consequence of life, and they also managed it in ways that were desirable to them in terms of their experiences, know-how, and practices. This implies that there are indigenous ways of dealing with waste. No culture has been found to want to live with materials they regard as waste. This is the same in Africa. Therefore, waste and waste challenges cannot be divorced from Indigenous knowledge.

Waste management is regarded as a human service provision. The present researcher will now look at the rationale for using indigenous knowledge in human service provision. The key to the provision of human services is that the outcome should reflect local inputs and processes; that is, the local people's experiences should inform the knowledge and skills necessary to improve service provision. Furthermore, the system should sustain it so that it can be relevant to local conditions in terms of the psychological, spiritual, economic, social, and political context (Normann *et al.*, 1996).

Pandey (1981) confirms that indigenous knowledge supports service provision that advocates popular participation, human development, and social integration. Therefore, using indigenous knowledge will encourage community participation and help to blend traditional knowledge with scientific knowledge to provide appropriate technology for sustainable development. Through indigenous knowledge, waste management provision will suit the social, economic, and environmental conditions of the local people. This kind of human waste management provision, facilitated by indigenous knowledge, will contribute towards human development in that it will help build the human capabilities to have a long and healthy life, to be knowledgeable, and to lead a decent type of life. It will also take care of sustainable development and human security.

The use of Indigenous Knowledge (IK) in solid waste management will also help increase legitimacy and acceptability in society on issues related to waste management. UL Haq (1976) regards the addition of imported development strategies, even if they are not relevant, and the neglect of local human resources as a problem

in the provision of human services. However, IK integrates social, economic, and environmental aspects, something important and necessary for waste management efforts to succeed. IK also integrates indigenous societies into mainstream national development, by ensuring that development efforts fit the social, economic, and practical environment in which it operates. As Indigenous Knowledge (IK) takes into account local efforts and local human resources, it can avoid the 'crisis of inadequacy' which is created by imported development. Indigenous Knowledge (IK) succeeds in accomplishing this by taking into account the community and the practice environment within the local context. Indigenous Knowledge (IK) has as a starting point, what is good and desirable to the community, and this makes waste management services that are designed to integrate Indigenous Knowledge (IK) desirable to the community. When it is desirable to the community, the community will participate actively in it voluntarily. Therefore, Indigenous Knowledge (IK) can help facilitate beneficiary participation with less enforcement in waste management.

Indigenous knowledge (IK) does not separate development activities from beliefs. As a result, it can help align beliefs and waste management services. Cohen (1991) maintains that societal activities are culturally and socio-economically bound, and therefore successful waste management services must be practiced in that context. This context is to be found in Indigenous Knowledge (IK).

According to Wilson *et al.* (2013), there is an emerging agreement

“that viable and sustainable solutions for solid waste management in developing countries need to be designed for the specific local circumstances and condition”.

This sounds like a call for indigenisation of solid waste management, as according to Cohen *et al.* (1993):

“indigenisation cannot be achieved if the theoretical constructs and the paradigm by which the phenomenon is understood are fully borrowed from foreign contexts and do not take into account the

cultural and contextual reality of African culture, families and communities”.

This issue raised by Wilson *et al.* (2013) is not only in line with Indigenous Knowledge (IK) but also in line with integrated solid waste management (ISWM).

Integrated solid waste management (ISWM) is the current worldwide accepted lens to examine solid waste management in developing countries and how they tackle their solid waste challenges. Integrated solid waste management (ISWM), as advocated by van Klundert and Anschütz (2001), as well as Anschütz *et al.* (2004), consists of stakeholders, waste system elements, and aspects. It calls for the inclusivity of waste users, providers, and enablers for the waste system elements to be functional and the aspects to be in place. Without the stakeholders, effective integrated solid waste management (ISWM) will not take place. Hence, the word integrated is used. Users are as important as the providers and enablers. Users know the things that drive them not to want to live with solid waste, and these drivers are key to the solution of waste management. Therefore, users, as beneficiaries, can also be enablers. The providers are thus expected to understand specific local circumstances and conditions to provide a proper service. Integrated solid waste management (ISWM) also calls for financial sustainability and sound institutions. This is because it is connected to the drivers of solid waste management (Wilson, 2007), which are public health, environmental protection, and the 3Rs (reduce, reuse and recycle).

What is key to integrating indigenous solid waste management (ISWM) is that local solutions can work to solve local problems. Indigenous Knowledge (IK) advocates for local solutions to solve local-level problems. Therefore, it is relevant in solid waste management. Indigenous knowledge (IK) is also linked to sustainable development, human development, and human security, which are also linked to each other. Indigenous Knowledge (IK) takes into account the environment, the society, and the economic activity of the society and its technology. In addition, Indigenous Knowledge (IK) is human-centred, comprehensive, prevention-oriented and multisectoral. It ushers in the move away from ‘experts’ coming up with solutions for the local people (Silitoe & Bicker, 2004; Ross, 2018) to a situation where the local people are an important stakeholder in matters affecting them.

“The sciences should be at the service of humanity as a whole, and should contribute to providing everyone with a deeper understanding of nature and society, a better quality of life and a sustainable and healthy environment for present and future generations” (WCS, 1999).

For scientists to succeed in their endeavours, they should realise that indigenous people’s minds are not like a blank sheet to be imprinted with knowledge from science but rather as having a basic understanding of nature and society, which can assist in the scientific provision of human service.

“...that traditional and local knowledge systems as dynamic expressions of perceiving and understanding the world, can make and historically have made, a valuable contribution to science and technology, and that there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge” (WCS, 1999).

Hence, the rationale for using indigenous knowledge in human service provision is significant in nations that are developing.

2.23 The DPSIR framework and solid waste

The literature review has shown that there is generally, a challenge in waste management around the world. It has also been noticed that waste management is a complex social, economic, and environmental problem. The things that caused the management of waste to develop over the years are people’s health, the shielding of the environment from degradation, the resource value of waste and people’s awareness, climate change, institutional matters, and responsibility issues. The majority of developing countries are still operating, mostly at the resource value of waste, and are struggling to operate at climate change level, environmental protection, institutional issues, and responsibility issues. The countries that improve their waste

management systems are successful due to the following: vision and stability; critical mass; enough and accessible funding; flexible legislation; and the public.

In terms of the DPSIR, the interaction between society and the environment can be described by the drivers, pressures, states, impacts, and responses. The drivers are enough and accessible food, transportation of goods and services, safety needs, shelter hygiene, and wellbeing.

The literature reviewed indicated that drivers in the DPSIR framework are human needs such as food security, transportation of goods and services, shelter, and hygiene, and this is linked to the economic sector. The activities require the use of products from which waste comes e.g., shelters are associated with construction, and during construction, waste will accumulate. The waste that comes from households, municipalities, and industries, and agriculture will result in pressure on nature in the absence of proper waste management. Pressure is a consequence of human activity. The consequences of pressure are the contamination of soil, air, water, vegetation, and habitat. The pressure affects the quality of air, water, soil, vegetation, and habitat, thereby causing a state of change in the environment. The state of change impacts human welfare and animal life, as the state of change can contaminate drinking water and air. Contaminated air and water can affect public health.

The impact of the state of change can result in soil ruin, which in turn can result in challenges to food security. The impact on habitat and vegetation can lead to the destruction of the ecosystem. Contaminated water and air can also affect animal life. The impact of a state of change can have an impact on the tourism industry and thereby contribute to the loss of income. Marine pollution threatens the livelihood of people who rely on the aquatic environment, marine industry, lifesaving missions, leisure industry, telecommunication cables, aquatic wildlife, and food cycles. An example of the impact on the marine environment is the Great Pacific Garbage Patch, which has been formed because of marine pollution. The Great Pacific Garbage Patch stretches about 1.6 million square kilometres between the West Coast of North America to Japan. Most of the waste in the Great Pacific Garbage Patch is not biodegradable and consists mainly of plastic. The loggerhead sea turtles mistake plastic for jellies, which is their favourite food. The abandoned fishing nets in the Great Pacific Garbage Patch kill and injure seals and other marine creatures. Plastic debris

disturbs marine food webs by threatening algae and plankton, which play part in the production of the marine food web. Fish and turtles feed on algae and plankton and less of them means less food for fish and turtles. Tuna, sharks, and whales feed on fish and turtles. If there is less food for tuna, sharks, and whales, it means less food for people.

Pressure, states, and impacts can lead to responses. A response is acting to stop the consequences of activities, pressures, states, or impacts. There can be a response to activities, there can be a response to pressures, there can be a response to states and there can be a response to impacts. The responses have different scales. There are local, regional, national and global scales. There are also different stakeholders like NGOs, institutions, households, governments, etc., which can have different responses. There can be responses in terms of period, life-long, medium-term, or immediate responses.

A response can be directed at human activities. In most cases, such responses would be technological, e.g., enhanced and resolution, mobile sorting, or in the form of regulation (Abalansa *et al.*, 2020). Technology is one of the ways that is used as a response to waste that can end up in landfills, or on land or in the marine environment, e.g., by using it to harvest energy such as hydrogen, methane, and ethylene from waste. The government can regulate the activities that produce materials that end up being wasted through banning (the ban on shopping plastics), taxation, and fines.

Responses to pressures included such measures as decreasing waste, retention at source, and repurposing. The durability of materials encourages reuse. Reuse also contributes to saving money, energy, and nature's resources (Andrady & Neal, 2009). A response can also be in the form of using eco-friendly alternative products. The use of products that do not persist in nature, that is, products that break easily in nature, and as such, nature deals with them easily, e.g., the use of paper drinking straws instead of plastic drinking straws. Other responses that can minimise waste can be in the form of buying back materials or deposit returns. A decrease in imports and production of materials that are not eco-friendly is a measure that reduces the pressure of waste.

Cleaning campaigns are also used as a response to pressure. But this is a short measure and is usually done at the local scale. This included cleaning of villages,

cities, beaches, parks, etc. waste for cash is another way of reducing waste in the landfills and marine environment. Awareness campaigns, sharing of information, and research have been used to mitigate the state of changes and their impact on human welfare because of waste pollution (Abalana *et al.*, 2020). The awareness campaigns assist the public in realising that prevention is better than cure. That is, it is better to prevent pollution than to clean pollution.

Research as a response is key to unlocking more knowledge on pollution due to waste, thereby closing knowledge gaps. The information researched should be made available and accessible to the masses in a simplified form. Challenges to electricity and internet access in emerging nations complicate the sharing of information. But in the first world, it is easy to share information. Education as a response is also important in mitigating waste pollution. It can play a vital role during school age.

Conferences were held as a response to human activities that bring waste, pressures, a state of change, and the impact of waste. Global conferences were hosted to respond at the global level. The United Nations Conference on the Human Environment, held in Stockholm, Sweden, in 1972, was a response to the challenges of waste. This conference was the first on the issue of the environment. This gathering came up with the Stockholm Declaration and a plan of action for the preservation and enhancement of the human environment. The gathering even came up with the United Nations Environmental Program (UNEP).

The other one is the Earth Summit, which was hosted in 1992, in Rio de Janeiro Brazil. This gathering led to the adoption of Agenda 21. What is key in Agenda 21 is the acknowledgment that environmental protection needs cooperation between nations. The conference also came up with the principles of the Statement of Forest and Rio Declaration. Principles of Statement of the Forest reinforce the management of forests sustainably around the world. The United Nations Convention on Biological Diversity and Framework Convention on Climate Change became available for signatures. The negotiations began on the Convention to Combat Desertification, which was available for signature in October 1994 and became binding in December 1996.

A Special Session of the General Assembly was preceded in 1997 by the Earth Summit. A Special Session of the General Assembly came to be called Earth Summit +5. This Assembly scrutinised the feasibility of putting Agenda 21 into practice. The

United Nations Framework Convention on Climate Change was agreed upon in December 1997 and was called the Kyoto Protocol. The Kyoto Protocol aimed to decrease contamination gases that lead to global warming. It was implemented from 2005 to 2012. In 2000, the Millennium Summit was held. This summit came up with the Millennium Development Goals (MGDs), which are eight in number. The World Summit on Sustainable Development was held in Johannesburg, South Africa, in 2002. This summit came up with the new action plan and adopted the Johannesburg Declaration. The United Nations Summit on Sustainable Development resulted in Agenda 2030, and its seventeen sustainable development goals in the year 2015. Then, there was the Paris Agreement adopted by 196 parties at the COP 21 in Paris, on the 12th of December 2015. The signatories agreed to prevent global warming by maintaining a worldwide temperature increase well below two degrees Celsius. The Climate Action Summit was assembled in the year 2019. It was also an initiative to further climate action.

Out of these global responses came responses at the national and local levels. Other responses are illegal, which can be termed negative responses. Responses are meant to relieve pressures, states of change, and impacts on the environment to bring about human development, which is about providing alternatives, freedom, and opportunities for a better life in an inclusive, equitable, connected, and secure manner. Negative responses happen when developed nations dump their waste in developing countries. In 2006, five hundred (500) tonnes of poisonous waste were dumped in the town of Abidjan, the Ivorian capital. One hundred thousand people sought medical assistance, and fifteen people died. In 1980, in a place called Koko in Nigeria, toxic waste was dumped. There is also a Canadian-Philippines waste dispute, where one hundred and three (103) shipping containers carrying mislabeled Canadian garbage were shipped to Manila in 2013 and 2014. On May 30, 2019, some of those containers of Canadian trash began their trip home. There was the dumping of toxic waste in the Republic of Somalia, and Greenpeace International claimed that European and American companies were responsible for it from 1990 to 1997. There is a need for research to uncover this type of response.

Plastic waste is a problem worldwide. According to Tenya *et al.* (2008); Stock, Reifferscheid, Brennholt and Kostianaia (2022), plastic waste was responsible for flooding in low-lying parts of Kampala, Uganda, by blocking the drain system. The

government of Bangladesh suspended plastic bag usage in 2002 as a response to the shocking floods that hit Bangladesh in 1998 when plastic waste blocked drains and made water levels rise (Reazuddin, 2006; Stock *et al.*, 2022). In the same way, the Maharashtra state, India, stopped the sale, manufacture, and use of plastic bags as they were responsible for blocking the drains, which led to the devastating monsoon flooding in the whole of Maharashtra state, killing over nine hundred (900) people and causing material damages of hundreds and hundreds of millions of Us dollars (Talwar, 2005; Ramesh, 2023).

Litter fishing is a step to reduce pressure from ocean litter (Ronchi *et al.*, 2019; Lincoln, Andrews, Birchenough, Chowdhury, Engelhard, Harrod, Pinnegar & Townhill, 2022). Litter fishing has been used in Sweden, the UK, and the Netherlands. It is aimed at reducing marine litter in the ocean. The fishing vessels that take part in the fishing for litter project continue to give hard-wearing bags for the collection of litter. The Mediterranean Region supported the initiative for the Regional Plan for Marine Litter Management (UNEP/MAP, 2013; Graham, 2022) together with the Oslo/Paris Agreement for the Protection of the Marine Environment of the North-East Atlantic (OSPAR, 2007).

Responses to aquatic pollution involve the United Nations Sustainable Development Goals (SDGs), the United Nations Convention of Laws of the Sea (UNCLOS), the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), the London Convention, the Global Programme of Action (GPA), the Honolulu Strategy, the United Nations Environmental Assembly (UNEA) resolutions, and the Marine Strategy Framework Directive (MSFD: 2008/56/EC) (UNEP, 2016).

There are seventeen SDGs. However, SDG 6 target 6.3, SDG 11 target 11.6, SDG 12 target 12.4, SDG 14 target 14.1, and part of 14.2 assist in the prevention of marine pollution (UNEP, 2016). The United Nations Convention on the Law of the Sea (UNCLOS) is a legally binding instrument to control waste pollution to defend and preserve the aquatic environment and demand signatories to take action to prevent, decrease, and take charge of aquatic contamination from land pollutants, contamination from vessels, seabed activities, and other waste discarding activities (UNEP, 2016; Kamiński & Szewczyk, 2022). In 2005 and 2016, UNCLOS annual meetings dealt with issues relating to establishments about marine refuse, plastics,

and microplastics (Kühn *et al.*, 2012). The necessity to respond to the impact of lost or discarded fishing gear and the retrieval of abandoned ones resulted in the United Nations agreement on fish stocks (Galgani, 2014).

MARPOL 73/78 Annex IV and V are answerable to regulate vessel contamination either by sewage or by garbage (David, 2016). The London Convention and the London Protocol are responsible for controlling marine pollution. The Convention of London and its Protocol are important for regulating marine contamination by providing solutions to waste contamination dumped at sea. The Global Programme of Action (GPA) for the defense of the aquatic environment from land that is a cause of marine pollution.

The Honolulu Strategy of 2011 helps reduce the environmental and human effects of aquatic litter. The Global Partnership on Marine Litter (GPML) was started in June 2012 to give more power to the Honolulu Strategy, while the aquatic litter fight by the G7 in 2015 also concentrated on dealing with sea and land sources of contamination. The responses act as positive system drivers as they improve the existing waste management system by addressing the pressures, state of change, and impact of waste through the minimization of waste streams, recovery, recycling, and reuse of resources. Hence, they contribute towards sustainable waste management. They also contribute to the process of achieving human development by addressing a decent standard of living, the foundations of a long and healthy life, and knowledge.

2.24 Theoretical frameworks of the study

2.24.1 DPSIR framework

The Driver-Pressure-State-Impact-Response (DPSIR) is a framework that is flexible and that relates human activities to the environment. Household waste, like municipal waste and industrial waste, is the result of human activity. Waste has an impact on the environment, hence the choice of the DPSIR framework (Federigi, Balestri, Castelli, De Battisti, Maltagliati, Menicagli, Verani, Lardicci & Carducci, 2022). The Organisation for Economic Co-operation and Development was the first to develop DPSIR (OECD, 1994; El-Den, Pham, Anderson, Yang, Moles, O'Reilly, Boyce, Raine & Raynes-Greenow, 2022). Since then, it has been used by the European

Environmental Agency (Kristensen, 2004; Axelrod & Vig, 2023), and the United Nations has also used it (UNEP, 2007). In most cases, it was used where human activities have an impact on the environment.

According to Tscherning *et al.* (2012), drivers are socio-economic sectors that fulfill human needs and exert pressure on the environment. There are human needs for food, shelter, security, health, water, and culture. Driving forces can originate and act at different levels, globally, regionally, and locally. Pressures are caused by human activities that may intentionally or unintentionally exert pressures on certain environments and the result of these pressures changes the state of the environment, consequently, this leads to an impact (Tscherning *et al.*, 2012; Gonzalez, Agrawal, Johansen & Hooker, 2022). The pressure can be the excessive use of environmental resources, changes in land use, and emissions that pollute the air, water, and soil (Kristensen, 2004). Therefore, human activities that exert pressure on the environment include land use change, resource consumption, the release of substances (waste, emissions), and physical damage through direct contact. The pressures exerted by society may lead to unintentional or intentional changes in the condition of the abiotic and biotic components of the ecosystem. The condition of the abiotic and biotic components of the ecosystem refers to the state. The pressure affects the state of the environment, that is the quality of air, water, soil, habitat, and vegetation. The quality of air, water, and soil determines the quality of the ecosystem and human welfare. State change leads to the impact on the ecosystem, human health, and society (Gabrielsen & Bosch, 2003; Wu, Xiong, Zhu & Xiao, 2022). That is, changes in the state of the environment affect the functioning of the ecosystems and their life-supporting abilities. Human beings benefit from the ecosystem services through the provisioning of food, timber, water, regulation of air quality, water quality, and disease. The undesired impact results in society or policymakers acting to mitigate, regulate, directly maintaining or restoring the state of the environment or deliberately doing nothing against the consequences of the impact (Gabrielsen & Bosch, 2003; Bakure, Hundera & Abara, 2022). The response may be directed at the drivers, pressures, states, or impacts.

Carr *et al.* (22) criticise the DPSIR for its hierarchical structure. They say that its hierarchical structure causes a hierarchy of elements and, therefore, also of actors. But the enhanced approach proposed by Niemeijer and De Groot (2008) replaced the

unidirectional causal chains with multiple networks, which provided a more reliable basis for indicator selection. Tscherning et al. (2012), quoted by Moktadir and Ren (2023) in the article “Does research applying the DPSIR framework support decision making?” confirm “the considerable potential of DPSIR and the usefulness of its application in research studies by providing policymakers with meaningful explanations of cause-and-effect relationships.” Svarstad et al. (2008) indited the benefits of DPSIR as transparency and the simplifying of the connection between humans and the environment. They go on to indicate that it enhances communication between scientists (researchers from different disciplines) and stakeholders. While Giupponi (2007) indicates that it is appealing to policy actors because it links political objectives to environmental problems (Hedlund, Nohrstedt, Morrison, Moore & Bodin, 2023).

The DPSIR framework identifies and visualizes the cause-and-effect relationships between socio-economic sectors and the environment (Smaling & Dixon, 2006; Ladi, Mahmoudpour & Sharifi, 2022). Waste emanates from the socio-economic sector. Waste, being an unwanted substance, exerts pressure on the environment and leads to changes in the state of the ecosystem. Changes in the quality and functioning of the ecosystem have an impact on the welfare of humans as they negatively affect the provisioning of ecosystem. Humans decide in response to the impacts on the ecosystem services. Indigenous solid waste practices are a response to waste challenges, hence the choice of DPSIR (Ladi, Mahmoudpour & Sharifi, 2022).

2.24.2 Integrated Sustainable Solid Waste Management framework

According to Wilson (2007), around 1990, some international agencies and non-governmental organisations (NGOs) became disappointed with the failure of ‘technical fix’ approaches in developing countries, and this led to the conceptual framework for integrated municipal SWM in low-income countries (Schübeler et al., 1996; Awino & Apitz, 2023), after a collaborative programme on municipal solid waste management in low-income countries. Thus, it was developed out of experience to address certain common problems with municipal waste management in low- and middle-income countries.

Arnold van der Klundert of the Dutch institute-type NGO WASTE contributed to the integrated municipal SWM to be termed integrated sustainable waste management as both an analytical tool and a development framework (Van der Klundert & Anschütz, 2001; Salman, Long, Wang & Zha, 2022). The ISWM has three dimensions in waste management: namely, stakeholders, waste system elements, and sustainable aspects. The waste management hierarchy is also a cornerstone of the ISWM. Stakeholders are people, communities, or organisations that have an interest in or benefit from waste management. The roles of interested parties may not be the same. The elements refer to the collection, transfer, disposal, or treatment. Waste reduction, reuse, recycling, and composting are also part of the elements. Aspects assist in assessing, studying and creating measures to ensure sustainability. It has financial and economic aspects, environmental aspects, political/ legal aspects, institutional aspects, and socio-cultural aspects. The DSIR framework indicates that there is a connection between waste, the environment, health, and the community (Salman, Long, Wang & Zha, 2022).

ISWM emerges as a solution to address the growing challenge of managing waste (Batisca *et al.*, 2021) as it addresses all three aspects of the triple bottom line interpretation of sustainability (environmental, social, and economic). It also addresses the question of who (the stakeholders), what (scope), and how (strategic aspects: technical, economic, social, financial, institutional, and political). The ISWM, which is three-dimensional, can be adapted for the purposes of a systematic comparison into overlapping triangles in which waste management exists (Wilson *et al.*, 2013; Iyamu, Anda & Ho, 2022). It deals with the physical elements and the governance strategies. Physical elements include public health, environmental protection, and 3Rs while governance strategies include inclusivity, financial sustainability, and sound institutions and policies.

2.25 Chapter summary

Waste-related challenges are not something new to humankind. Human beings have been struggling to manage waste for many centuries. At first, waste management was not organised, but outbreaks of waste-related epidemics led to organised forms of

waste management. Developed countries have always been ahead of developing countries as far as the management of waste is concerned. Waste management in countries that are emerging fails to be on par with developed countries due to capacity constraints, which are financial and human resources. The drivers of waste management are public health and environmental protection. These drivers led to the international environmental agreements on waste management that helped in controlling waste management on land and in the ocean. The challenge with them is that they are full of compromises, and this creates loopholes for some states to continue to dump waste. Another challenge is that states can withdraw from the agreements with impunity. There is also a need for parties to the agreement to strengthen implementation mechanisms, compliance mechanisms, and enforcement mechanisms. However, there are successes gained from international environmental agreements in developing countries that help protect people's health and nature. These successes are evident in the formation of institutions and the enactment of laws that will protect public health and the environment.

There is a high need for environmental justice to address environmental injustices. The major cause of environmental injustice is inequality. The challenge in addressing inequality is found in power relations. Those in power maintain the situation so that it can remain as it is. Power relations ensure that developed countries dominate developing countries and urban areas dominate rural areas. This is also demonstrated by gender perspectives on waste management. Power is gendered and masculinised, and this perpetuates an unequal power relationship between different genders.

South Africa, too, has experienced waste-related challenges. These challenges led to the introduction of waste-related legislation, the main one being NEMWA (Act No. 8 of 2008). But irrespective of these good pieces of legislation, South Africa is still struggling with waste management, especially in rural municipalities.

There is a need for ethics in waste management so that rational beings can know what to do and not what to do, what is right and what is wrong in the management of waste. The traditional ethical theories fail to address the issue of waste management properly as they fail to cater to other species, which are important for the sound biological functioning of rational beings. This failure calls for a new waste management ethic that will not be anthropocentric.

African countries have adopted a Eurocentric type of waste management in their management of waste policies, with the perception that successful waste management policies in developed countries will guarantee success in developing countries. But this did not materialise as developed countries' context is different from developing countries context. The literature has evidence of the existence of indigenous management of solid waste, which is generally acceptable to the local populations, especially in rural establishments. But the indigenous management of solid waste practices, like other waste practices, has strong and weak points. However, these practices enjoy legitimacy among their users, as such, they can be employed to change the management of waste service provision. More research needs to be conducted to establish how municipalities, as waste management service providers, can tap into this knowledge and how the weakness of indigenous solid waste management can be improved to align them with the current trends in waste management.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Chapter two reviewed the literature related to the management of solid waste worldwide. It identified the need to advance the management of waste for a sustainable environment. It also highlighted that fruitful management of the solid waste system in first-world countries will not necessarily be fruitful in emerging countries due to differences in contexts. These contexts relate to economic, capacity, governance, history, and technical issues. It was also established that rural municipalities have problems meeting the set standards for solid waste management, and these work against a sustainable environment. This necessitates indigenous management of solid waste for a sustainable environment.

This chapter outlines the research methodology developed to collect data from primary and secondary sources. An approach is required to study any type of situation (Creswell, 2003); hence, the research methodology. The research design and methodology are explained and their use justified, intending to answer the research questions and have appropriate data collection and analysis methods.

3.2 Area of study

The study focused on Thalahane village. This village is found in the Maleboho area of Bochum, in the Province of Limpopo, South Africa. Thalahane village is under the municipality of Blouberg in the Capricorn District municipality. Thalahane village was the seat of Chief N. Maleboho's royal office. The village of Thalahane is at the centre of all of Chief N. Maleboho's villages in Blouberg. Chief N. Maleboho's villages make up almost 80% of Blouberg municipality.

The nearest city is Polokwane. The travelling distance from Polokwane is 117 km via R521 or 125 km via R567. The time taken from Polokwane to Thalahane village can be 1 hour 42 minutes. The geographical coordinates are 23, 1342° South, 28,9616° East. Thalahane was its original name. That rural area is at the base of Blouberg Mountain and is under the control of Chief Ngoako Maleboho. The population is sparse and largely made up of self-employed people and a few professionals. It suffers from

a significant drain as people with skills leave the area for other places. Grants play an important role in the livelihood of the village. The road network is not good, which makes it difficult to access some of the streets in the village.

3.3 Research design

The study is qualitative, with a case study design and a phenomenological approach. The design was selected to achieve the research objectives. Qualitative research is done to assist the researcher in understanding the phenomenon by engaging with the participants (Densin & Lincoln, 2005). Thereby, it assists the researcher in giving a detailed explanation of the phenomenon as it happens in its real environment. This is confirmed by Newman and Benz (1998), who assert that qualitative research enables researchers to understand phenomena with the help of the lived experiences of people in their natural environment. Babbie and Mouton (2001) think that qualitative designs emphasise in-depth understanding and attempt to seek deeper meanings of human experiences. In so doing, these experiences are not reduced to numbers. According to Creswell (2016) and Creswell (2018), the qualitative researcher keeps their attention on what the participants bring and attach to the issue under investigation and not the meanings that the researcher brings to the research. The strength of qualitative research is that it has the potential to generate rich descriptions of the participants' meanings of their lived experiences from a relatively small sample (Creswell, 2003).

Phenomenological research is an inquiry design where the researcher describes the meanings of what has been experienced by the participants about the phenomenon, and this is done to come up with the essence of lived experience about a phenomenon (Creswell, 2014). Thereby assisting in making available a rich and full description of people's experiences and interpretations of phenomena. The phenomenon in this study is indigenous solid waste management.

A case study is an inquiry design in which the researcher produces an in-depth analysis of a case. It is an in-depth inquiry of a phenomenon, an individual, or a group within its real-life context (Sjöberg *et al.*, 2007). In-depth investigation implies not only an intensive study of a phenomenon, but also the acquisition of detailed and rich knowledge about the phenomenon (Singh, 2006). The Merriam Webster's Dictionary

(2009) regards it as “an intensive analysis of an individual unit (a person or community) stressing developmental factors in relation to the environment”. According to Woodside (2010), a case study is an investigation that is concerned with understanding, describing, and foreseeing. The strength of a case study is that it allows richer and more in-depth data to be collected, thereby increasing the trustworthiness of the findings. The case study concentrates on the experiential knowledge of the case and pays close attention to the influence of its social, political, and historical context. A case study is depicted as a phenomenon of some sort occurring in a bounded context (Miles and Huberman, 1994). “A case is a choice of the object to be studied” (Stake, 1994). The case in this study is Thalahane village, and thus, the case study is necessitated by the specificity of the case under investigation which is formed by its boundedness. The focus on Thalahane village, which is a unit, is evidently a trait of a case study.

White (1992) regards a case as intrinsic when it is zealously focused on a unit, person, or community, or institution and relies exclusively on the living account of the group. Intrinsic case is resorted to when one wants a better understanding of a particular case and that is, within all its particularity and ordinariness, a case of interest. Baxter and Jack (2008) recommend binding the case to avoid making the scope of research too broad, and most importantly, binding the case avoids the ambiguity of ‘biting too much’ and the difficulty of concentrating and analysing large areas and volumes of information, hence binding it to Thalahane village. Binding a case study is the demarcation of a group, area, or situation for the purpose of concentrating intrinsically on it. Hence, the issue of binding this case is important in that it helps to put parameters to the case, which enables the type of focus needed to bring to light the issue of indigenous solid waste management practices that are at play within most rural areas.

3.4 Study population

The population of the study consists of all the community members of Thalahane village. The study population can be described as all subjects that are the focal point of research (Weiss, 1998). For Welman *et al.* (2005), the study population comprises individuals, groups, and organisations from which the researcher can draw conclusions. It is a subset of the target population available for the study.

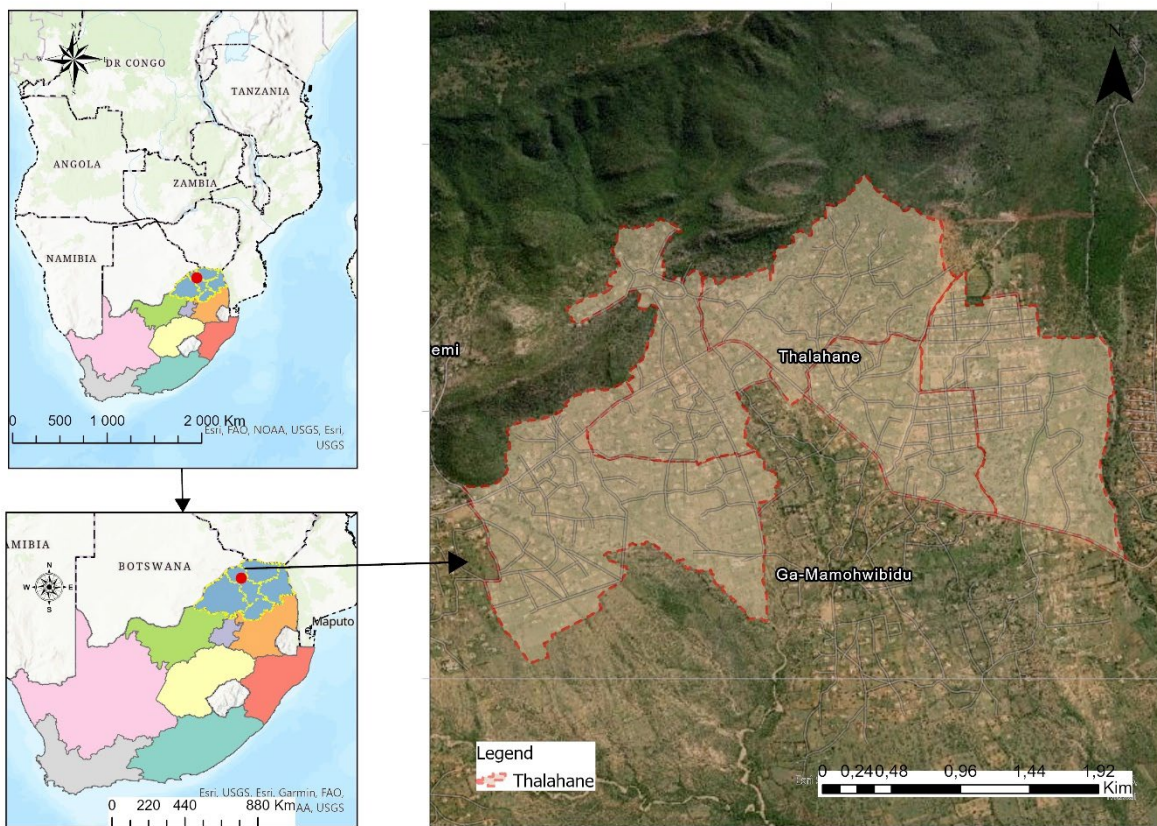


Figure 3. 3: Map of Thalahane Village (Masiya & Masipa, 2021)

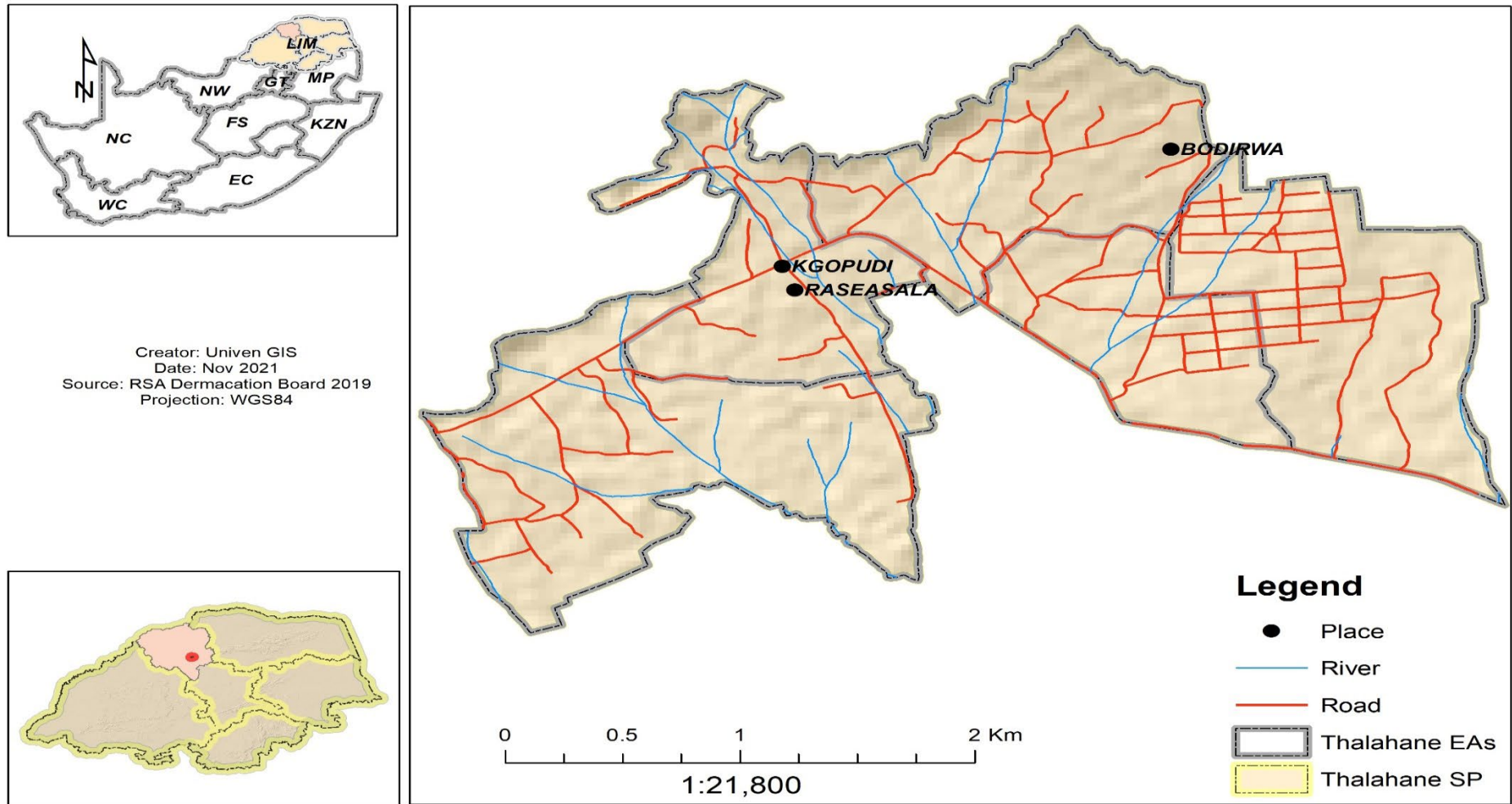


Figure 3. 4: Map of Thalahane Village (Masiya & Masipa, 2021)

3.5 Gaining community entry.

The first point of contact in Thalahane village was the local chief. The researcher explained to the local chief the purpose of the research. The researcher provided evidence that he was a student at the University of Venda, indicating that he was interested in researching indigenous solid waste management practices in Thalahane. The chief gave permission and even provided the researcher with a community member to guide him through the village. This community member (guide) also acted as proof to the community members that the researcher had permission from the chief to conduct a study. Thus, the guide assisted the researcher in being warmly accepted in the households, as he is well known in the community. In addition to the guide, the chief provided the researcher with an updated list of all the households in Thalahane village. Through the list, the researcher indicated to the guide which households he wanted to visit. The researcher collected data at Thalahane village, where the participants are living. The researcher had face-to-face interviews with the people of Thalahane village in their contexts for four weeks.

3.6 Sampling

The researcher could not interview all the individuals in Thalahane village due to time and financial constraints. Hence a sample. The section of the population that is selected for enquiry is called a sample (Bryman *et al.*, 2014). In qualitative research, the notion of sampling to be engaged is determined by the type of information the researcher wishes to obtain and which category of people and documents or which area(s) would be the most suited to obtain it from (Schreiber & Asner-Self, 2011). The size of the sample is not an important issue (Schreiber & Asner-Self, 2011) and is overbearingly focused on. An essential interest in qualitative research is the revelation of meaning buried in reality as understood and interpreted by people (Njie & Asimiran, 2014). Kruger (1988) and Morse (1994) proposed at least one individual in a case study; however, due to the quest for rich data from units within the framework of the individual, unit, or institution to be studied, more than one individual could be used as the researchers deem fit.

Households were sampled using purposive sampling, which is a non-probability type of sampling technique. This sampling method is based on the judgment of the

researcher. Purposive sampling was appropriate for the study. Purposive sampling was chosen because it is practicable in the context of the funds and time available for the research study and it helps to avoid unnecessary and irrelevant items entering the sample by chance. The researcher judged what was relevant for the study by looking at the aim and objectives of this research. Thalahane village has a detailed and well-maintained list of households. Each time there is a new household, it is updated. It is compulsory for a member of the society to go and register at the chief's place before he or she can be given a site to start a new household. The researcher purposefully selected sixty (60) households from the village list. This made it easy for him to tell the guide which households he intended to visit.

Members of the same household would naturally use the same indigenous solid waste management practices, as indigenous knowledge is passed orally in the family through word of mouth and actions. Each household provided one member to be a participant in the study. This means that all in all, there were sixty (60) participants. The researcher requested that members of the households who were conveniently available for the research be the participants. In households where more than one person was available to be a participant, the researcher used that opportunity to make a purposeful selection with a view to balancing gender. The sixty participants selected were divided into those who took part in the one-on-one interview and the focus group discussion. Forty-six participants were allocated to be part of the interviews, and the other fourteen participants were divided into two groups of seven and were allocated for focus group discussions.

Table 3.1 provides a full description of participants in terms of gender, age, and educational level.

Table 3. 1: Table 3.1 Description of participants

Age in years	Gender		Educational level			
	M	F	Preschool	Primary	Secondary	Postsecondary
18-35	9	11		3	13	4
36-60	8	12		4	14	2
Above 60	8	12	3	8	8	1

	25	35				
	N = 60					

The intended number of Municipal staff members to be interviewed was ten, but only five members were willing and available for the interviews.

3.7 Data collection instruments

For data to be collected from the participants or objects of study, appropriate data collection techniques are necessary. The data collection tools assist the researchers in getting data from the participants or objects of study. If the way in which data is collected is inappropriate, it will lead to inaccurate replies to the research questions. This means the data collection tools should be in line with the research design. This study opted to collect data from primary sources through interviews, focus group discussions, observation, and a review of official municipal reports relevant to waste management. Qualitative data collected provides the researcher with a detailed analysis of solid waste management in Thalahane village.

3.7.1 Unstructured interviews with members of Thalahane village

This researcher selected unstructured one-on-one interviews. Unstructured can be described as in-depth interviews with the main aim of getting to know the experiences of the participants and the interpretations they flexibly attach to their experiences (De Vos *et al.*, 2018). This technique enabled the researcher to explore indigenous solid waste management for a sustainable environment with complete freedom to ask questions in a format relevant to the situation (Kumar, 2014). The flexibility that goes with this technique allows the researcher to ask questions on indigenous management of solid waste, looking at the context of the situation and the discussion at hand. What was significant when using unstructured interviews was achieving an understanding of the participant's view of indigenous solid waste management practices in a fluid social relationship, as well as engaging the researcher and the participants (Collins, 1998). The advantages of unstructured interviews are that the method is flexible, as

the questions are not fixed, and this gives room to the researcher to probe what is relevant and interesting at the time, which assists the researcher in being exposed to new ideas. It allows for checking if the interviewer and the interviewee understand each other's meanings, and if the interviewee needs clarity where there is no correct understanding, the question can be asked again or rephrased to better suit the interviewee's understanding. The same thing applies to the interviewer; if the interviewer has a misunderstanding of the meanings of the interviewee, a follow-up question can be asked. These advantages of unstructured interviews enable rich information to be unlocked, thereby making in-depth knowledge on waste management available to be tapped. Unstructured interviews were more suitable for this study as they allowed the interview to be flexible and also allowed probing, prompting, and follow-up questions on any relevant issue during interviews. This provided the researcher with a way of understanding solid waste management by engaging with the subject through how the participants understand the phenomenon, thereby helping the researcher generate a rich description of the management of solid waste as it takes place in the real world of Thalahane people. The unstructured interviews were guided by the following research objectives:

- To investigate indigenous waste management, which the Thalahane local community uses to manage solid waste.
- To analyse the implementation of a waste management system by Blouberg Local Municipality in Thalahane village.
- To develop an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.

There were two main questions, followed by probing and follow-up questions. The two main questions were planned to minimise the possibility of getting irrelevant information in the interview. Annexure A has the interview guide. These two main questions were worded in such a manner that they will not be answered by 'yes' or 'no' but by explanation. The other questions flowed from "within a clue-and-cue-taking process after the initial meaning or analogy question had been asked" (De Vos *et al.*, 2018). Unstructured interviews enabled the researcher to probe the participants until more light was shed.

The language that was used was Northern Sotho. The two main questions were translated into Northern Sotho, as it is the dominant language of the local people and the researcher, to enable smooth communication and the better release of in-depth, rich information. The researcher took the opportunity to learn how the participants wanted to be addressed. Some preferred their surnames, some their first names, some their clan names (e.g., Mokgalaka), others their praise names (e.g., Tshwene), while others preferred to be addressed as mothers to their firstborns (e.g., Mma-Matome). This was key to a good conversation and to letting the participants feel at home with the researcher. This made the researcher one with the participants and not a stranger. The researcher was at all times mindful that participants are customers that bring information to him and that without them, the business of conducting research would be in vain. The voice tone of the researcher was kept friendly and acceptable, as the researcher was aware that the first meeting was key to establishing a lasting, good, and warm relationship with the participants that would deliver appropriate information.

The interview meeting started with the Northern Sotho formalities of greeting, as the interview was going to be conducted in Northern Sotho. The participants were reminded of the purpose of the meeting. Once that was done, they signed the consent forms, which were first interpreted for them in Northern Sotho. The researcher also asked for consent to audio record the interview and to take notes when the interview was in session. This was granted.

Once the participants had provided adequate information on how waste is managed, the researcher did some probing, prompting, and follow-up questions on the information provided until he had obtained in-depth knowledge and understanding of how solid waste is managed.

Fortunately, the participants, especially the older ones, enjoyed relating how they managed solid waste. They shared their experiences of solid waste management, while the researcher audio recorded the interview and took notes of areas where probing, prompting, and follow-up questions would be made. The researcher also noted the pitch, tone, pauses, and gestures during interviews.

The non-verbal cues showed that the participants were passionate about having someone listen to what they knew about solid waste management. The way they

answered questions showed that they were knowledgeable about how they managed solid waste and that they were experts in their application of the management of solid waste. As management of solid waste is not something personal, they provided detailed information. They were willing to show the researcher that even though he is at the university level, they knew more than he does about solid waste management. The researcher allowed the participants to speak as they pleased, which shed more light on how they managed solid waste.

Once the participant was done responding to the main question, the researcher would check the notes and start prompting, asking follow-up questions, and probing. Even during follow-up questions, probing, and prompting, the participants would still provide detailed information. The researcher allowed the participants to provide as much information as possible on their solid waste management practices. Thus, the interviews took a long time.

After the interview session was concluded, participants took the researcher to their solid waste management site so that he could observe what they were talking about during the interviews. The researcher saw backyard pits for solid waste management and composting places where solid waste was burned and repurposed items made from solid waste. The visit to these places assisted in validating the information gathered during the interviews. The researcher transcribed the recordings and translated them into English with the help of a translator. The process was revised so that there is no loss of information due to translation.

3.7.2 Interviews of the Municipality waste management staff

The researcher used unstructured interviews to get to know how the municipality manages solid waste and how to develop an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management practices. The intended number of municipal staff to be sampled for interviews was twenty, but only five were available for interviews. The date, time, and place of the interviews were set depending on the availability of staff members. The interview was guided by the following objectives:

- To analyse the implementation of a waste management system by Blouberg Local Municipality in Thalahane village.

- To develop an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.

It was a face-to-face interview. The interview guide has been provided in annexure A.

The face-to-face interview was done with municipal staff members. Five members were willing and available for the interviews. The interviews were conducted when the participants were conveniently available. The interviews were conducted in English.

3.7.3 Observation as data gathering technique

Once the process of interviewing was done, the researcher embarked on observation as a way of gathering data by watching events and behaviour in the natural setting (Marshall & Rosman, 1989). The observation was overt and direct; that is, the Thalahane people were aware that they were being watched. The researcher watched without interacting with the people of Thalahane village. This was done for ethical reasons, as the arrangement for entering the research site was that data gathering would be done with participants knowledge. The observation period lasted for four weeks.

The observation guide was drawn before starting with observation, and the information was collected in the form of field notes. The analysis was done thematically. This method assisted the researcher in understanding the indigenous solid waste management practices from the perspective of the Thalahane village community and verifying the information from the interviews.

3.7.4 Focus group discussion

The researcher used two focus group discussions, and each had seven members. Kruger (1994) and Prince and Davies (2001) recommend between 3 and 12 members per group. Focus group discussion is a research technique used to collect data through group interaction (Gundumogula, 2020). The group was selected from Thalahane village considering the objectives of the study. The focus group discussion was used because it is employed to gather an in-depth understanding of indigenous

solid waste management as a societal issue. The focus group discussion was conducted after the unstructured interviews. It was given direction by the interviews and these objectives:

- To investigate indigenous waste management, which the Thalahane local community uses to manage solid waste.
- To analyse the implementation of a waste management system by Blouberg Local Municipality in Thalahane village.
- To develop an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.

The researcher as moderator determined the time, place, and duration of the discussion. The researcher determined the focus group questions by considering the research question. The moderator started by announcing the rules and regulations of the discussion (Gundumolula, 2020), then guided the conversations, asked questions and encouraged the participants to share their opinions, experiences, and feelings with the intention of generating rich and diverse insights into indigenous solid waste management practices.

The researcher asked to audio record the discussion and take notes, and the participants granted permission. The focus group discussion lasted about an hour and a half. Greenbaum (2003) recommends a duration of between one and a half and two hours. The researcher acted as moderator of the focus group discussion. The discussion flowed from the questions used during interviews captured in Annexure A. These questions assisted in generating conversation between group members.

The focus group discussion was done in Northern Sotho, as it is the dominant language in the area and is the language through which the participants can better provide in-depth knowledge about waste management. During discussions, the researcher would time and again, when necessary, ask probing questions, follow-up questions, and exit questions. These allowed the participants to feel at home sharing their opinions with the group, to continue to discuss indigenous solid waste management further, and to assist the researcher in checking if he did not miss anything.

3.7.5 Review of Blouberg municipality waste management-related official documents

Blouberg municipality has the following official documents relating to the management of solid waste:

Integrated Development Plan (IDP) and Solid Waste Management Plan (ISWP).

The following research objectives guided the researcher to generate rich, in-depth knowledge from the documents:

- To analyse the implementation of a waste management system by Blouberg Local Municipality in Thalahane village.
- To develop an integrated sustainable solid management plan for Thalahane village that accounts for indigenous solid waste management.

The researcher collected rich and in-depth data from the Blouberg waste-related documents. These documents are the official documents of the municipality and therefore, primary sources of information.

3.8 Data analysis

The data that was gathered through interviews, focus group discussions and a review of municipal waste-related documents was analysed. Thematic data analysis was used. According to Bryman *et al.* (2014),

“thematic analysis is a flexible method that is not tied to a specific philosophical orientation. The goal of thematic analysis is to identify, analyse, and describe patterns, or themes, across the data set”.

Thematic data analysis was useful because it enabled the researcher to examine the interpretations that Thalahane people attach to solid waste management and how and why they manage solid waste the way they do, thereby helping to generate meanings and useful information that provided in-depth knowledge about Thalahane solid waste

management to answer the research questions. It also assisted in providing accurate and trustworthy data.

The researcher went through all the data and took out common issues that appeared more often. This was possible through thematic analysis. The thematic analysis used the phase process by Braun and Clarke (2006), which is as follows: the researcher makes himself familiar with the data, thereafter, generates initial codes, searches for themes, defines and names themes, and, finally, answers research questions. The researcher read through the collected data, coded the data, searched for themes in the data, and then interpreted the meaning of the themes. While the researcher was engaging with thematic data analysis, he also validated the accuracy of the information through triangulation. Data from the municipal documents, visits to the solid waste management sites, focus group discussions, and unstructured interviews were compared for inconsistencies.

Step 1: Generating codes

The data collected through interviews and focus group discussions was translated from Northern Sotho into English with the help of a professional translator. The researcher went through the data to have a thorough and thoughtful knowledge of the data. To do this, he read the data several times to get a deeper understanding of the data. The ideas that emanated from the data were listed. These ideas helped the researcher understand the participants' understanding of indigenous solid waste disposal practices. Coding is about organising the data collected during the data gathering process into categories from which themes will emerge.

“Codes are tags or labels for assigning units of meaning and are usually attached to ‘chunks’ of varying sizes. Those might be words, phrases, sentences or even the whole paragraph” (Miles and Huberman, 1994).

Therefore, codes assist in taking out data that is of interest and managing the data. Before the researcher could do the coding, he familiarised himself again with the data and listed them. Furthermore, the researcher allowed the codes to emerge from the collected data. Once the data had been displayed, the researcher dug out the lessons learned (Lincoln & Guba, 1990). This was done considering the research questions.

Then the categories were given a title by which they would be known. To achieve that, the researcher read all the transcribed data, segregated it into groups of sentences that had enough meaningful information and assigned codes to them. This happened until all the data had been coded. The sentences that could not be grouped were put aside but were later revisited and helped provide further information on indigenous solid waste disposal practices (Creswell *et al.*, 2016). The process of coding was completed and reviewed to ensure the qualitative trustworthiness of the data analysis.

Step 2: Searching for themes

The researcher developed themes from the coded data of focus group discussions and interviews. There were no discrepancies between themes developed from focus group discussions and interviews. But what is interesting is that the themes of the interviews and focus group discussions were similar. The researcher achieved that by sorting the different codes into themes. A table of the recurring themes was drawn, in which the themes were ranked. A theme that appears more than once is deemed important. This resulted in seven themes that were used as the major findings of the study. The themes appear in the next chapter.

Step 3: Reviewing the themes

The researcher went through the themes again, checking whether some could be joined or separated. The researcher went back to refine the themes, ensuring that he was left with themes that adequately represented the data.

Step 4: Definition and naming of themes

The researcher defined and named themes before presenting them for qualitative analysis. He also looked at interrelated themes and came up with how the description was done. He also indicated what each theme was about.

Step 5: Answering research questions

This involved advancing a qualitative narrative of themes and coming up with an interpretation of the findings. The researcher described how the qualitative narrative of themes is comparable to the literature using a theoretical lens. Under that step, the researcher was able to advance the lessons learned (Lincoln & Guba, 1990). In this way, the research questions were answered in chapters four, five, and six. In those chapters, the results were put into a synthesised pattern, which helped reveal the

essence of indigenous solid waste disposal practices and answer the research questions.

3.9 Trustworthiness

According to DeVos *et al.* (2011), important aspects related to trustworthiness are in the qualitative approach. They are dependability, confirmability, credibility, and transferability. These four aspects were all used to ensure that the study could be trusted. The researcher ensured that there was quality assurance in the study by addressing issues related to data trustworthiness. The researcher used strategies to deal with threats to trustworthiness and to increase the credibility of the findings. These strategies include, among others, triangulation, extensive field notes, member checks, a peer review, an audit trail, and spending four weeks in the field. Triangulation was applied by using data collected from unstructured interviews, focus group discussions, and visits to solid waste management sites. In triangulation, more than one method is used to avoid personal bias. By using different investigator methods in the same study, investigators can partially overcome the weaknesses that flow from the one-investigator method (Denzin, 2001). The researcher triangulated data from observation of the solid waste site, focus group discussions, documents, and unstructured interviews to justify the themes. The themes established in this data added to the trustworthiness of this study (Creswell, 2014); hence, the study was quality assured. Triangulation assisted towards confirmability, that is, the extent to which the results of the research project are moulded by the subjects of investigation. Triangulation obstructed research unfairness and led to the participants' voices being heard in the research results.

Triangulation is also a strategy for enhancing credibility. Credibility is about having trust in the truth of the results of the study. The researcher engaged with the participants long enough to ensure that there was credibility. Furthermore, the field data were collected from in-depth, unstructured interviews with the participants until saturation of the data was reached. During that engagement, one of the things the researcher did was do a member check. "Member checks" (Lincoln & Guba, 1990) or respondent validation (Maxwell, 2012) is about taking the final report to the participants to get feedback on the accuracy of what has been observed to avoid bias and misunderstandings. Member checking was done when the researcher checked,

verified, and made clear the interpretations with the participants. The researcher gave the participants the report to get feedback from them. In addition, the researcher made available some parts of the raw material for others to analyse and use as “member checks”, in which Thalahane village participants were asked to corroborate the findings (Lincoln & Guba, 1990). The results were described in full, with supporting quotations from the subjects of investigation also provided, and a relevant literature review was done. Member check was also done under supervision. There was a constant conversation that took place with the supervisor and co-supervisors during the study process to ensure credibility.

The two strategies- triangulation and member checking played a role in ensuring that there was dependability. Dependability is about the consistency and repeatability of the results. Besides triangulation and member checking strategies, the study also used code and re-code, prolonged engagement in the field, and persistent visits to solid waste sites to ensure the dependability of the results. The researcher coded the data, and after two weeks, re-coded the data to make sure there was correctness. The researcher was in the field of study for four weeks when collecting data to get a thorough knowledge of the indigenous solid waste disposal practices of Thalahane. This enabled the enhancement of not only dependability but also credibility (Polit & Beck, 2010). Persistent visits to the solid waste management sites were also made to ensure trustworthiness. “Persistent observation refers to the researcher’s focus on the aspects of a situation that are relevant to the phenomenon being studied” (Polit & Beck, 2010). The phenomenon relevant to the study was indigenous solid waste disposal practices. The researcher carefully checked the participants as they were being interviewed, checking even their non-verbal communication. That enabled an appropriate interpretation of their experiences with indigenous solid waste disposal practices. The researcher also probed for clarity on the issues they were raising regarding indigenous solid waste disposal practices, asking questions and focusing on issues that were relevant to the problem. The researcher kept the following documents for the audit track: Field notes on the solid waste management site, transcribed in-depth interviews, and audiotapes of interviews.

Comprehensive field notes are defined by Creswell (2014) “as a rich, thick description” of data. Comprehensive field notes add to the validity of the findings, as they paint a good picture of what is observed. They also clarify the bias and deal with discrepant

information. The researcher spent four weeks in the field to get comprehensive field notes on solid waste management sites. Comprehensive field notes facilitated the data analysis process and provided evidence that linked research questions to the research protocol and the research report (Yin, 2000). It also enabled the researcher to leave a trail to enable auditors to check if the interpretations, conclusions, and recommendations could be tracked to Thalahane participants and Blouberg municipality sources (Lincoln & Guba, 1990).

Confirmability is “concerned with establishing that data and interpretations of the findings are not figments of the inquirer’s imagination but are clearly derived from data” (Tobin & Begley, 2004). Studies suggest that triangulation can be used to achieve the confirmability of qualitative enquiry (Bones, 2009; Kock, 2006; Lincoln & Guba, 1985). Triangulation has already been discussed, and it was used to achieve confirmability as part of trustworthiness. Triangulation assists to ensure that there is no researcher or participant bias, thereby ensuring the integrity of inquiry findings. The researcher overcame misinformation, evasions, and lies by being sceptical of information that might not be correct. The researcher cross-checked the data and writing of the final report.

Bitsch (2005) indicates that the “researcher facilitates the transferability judgement by a potential user through ‘thick description’ and purposeful sampling. The researcher provided a rich and extensive set of details concerning the methodology and context. According to Li (2004), “to enable judgements about how well the research context fits with other contexts, thick descriptive data, that is, a rich and extensive set of details concerning methodology and content, should be included in the report. This can help the researcher replicate the report using similar conditions in other settings (Anney, 2012). The researcher also used purposive sampling to focus on key participants who are particularly knowledgeable about indigenous solid waste practices (Schutt, 2006). Purposive sampling provided in-depth findings (Cohen *et al.*, 2011). Therefore, purposive sampling helped maximise the information uncovered by the few participants.

With credibility, dependability, transferability, and confirmability, the researcher ensured that there was trustworthiness in the study; that is, “the findings of an inquiry are worth paying attention to or taking account of” (Babbie & Mouton, 2010). To

achieve this, the researcher used quality assurance strategies. When there is trustworthiness, the study is worth paying attention to and is credible and reliable.

3.10 Study delimitations and limitations

Delimitations are the limitations consciously set by the authors (Theofanidis et al., 2019). The study was limited to the case of Thalahane village and not extended to all the villages in the Blouberg municipality due to financial and time constraints. Baxter and Jack (2008) recommend binding the case to avoid making the scope of research too broad. Limiting the study to Thalahane village helped the researcher not to 'bite too much'. The delimitation was also extended to the sampling of participants in Thalahane village. Sixty participants were sampled to take part in the study, as the sample size is considered less important than the depth and richness of the research (Schreiber & Asner-self, 2011). Kruger (1998) and Morse (1994) proposed at least one individual in a case study but went on to indicate that due to the quest for rich data from the unit, in this case Thalahane village, more than one individual could be used as the researcher deems fit. So, the researcher deemed it fit to sample sixty participants.

Limitations concern potential weaknesses that, in most cases, cannot be controlled by the researcher. "A limitation is a factor that may or will affect the study but is not under the control of the researcher (Miles, 2019). There were only five participants available to be interviewed from the municipality. It would have been more beneficial if there were more than five participants. The researcher used overt observation as one of the data collection techniques. Time constraints allowed only four weeks of observation. It would have been more beneficial if the observation had lasted for twelve months. Another challenge with overt observation is the Hawthorne effect, that is the tendency to modify an aspect of behaviour when participants are aware that they are being observed.

3.11 Ethical Considerations

The researcher applied for ethical clearance from the University of Venda Research Ethics Committee and was granted permission. The number was SHSS/19/AS.02/1906. Written permission was also granted by both Blouberg Municipality and Maleboho Royal Office after a formal request. When selecting participants, the researcher prevented cultural, social, racial, and sexual biases in society (Grove *et al.*, 2012). He selected participants based on the research problem, research questions, and purpose of the study, thereby ensuring respect for the principle of justice.

When the study was conducted, harm and discomfort of the participants were avoided. This was done by asking questions that would not bring harm or discomfort to the participants, thereby ensuring respect for the principle of beneficence. The participants were also given the freedom to choose whether to be part of the study or not. Furthermore, they were allowed to make an informed decision before signing the consent form. Even after they had given consent to be part of the study, they were still given the freedom to continue or withdraw from it whenever they felt like doing so during the study, thereby showing respect for the principle of autonomy. Their confidentiality was also respected throughout the research process (Miles & Huberman, 1994) by not exposing their names. Concerning non-maleficence, the researcher ensured that the study did not harm the participants during the study.

The preceding shows that the fundamental principles of respect for autonomy, the principle of beneficence, the principle of non-maleficence, and the principle of justice (Dhai & McQuoid-Mason, 2011) were taken into consideration throughout the study.

The study did not harm the participants. Instead, it made sure that the participants' dignity and identities were protected. The study was conducted with the consent of the participants and relevant institutions. Miles and Huberman (1994) advocate for the following ethics to be addressed: honesty and trust, privacy, harm, and risk, confidentiality, informed consent, and anonymity. The researcher ensured that these ethical considerations were implemented.

The researcher selected a topic that respects research ethics and ensures that the study benefits the participants by bringing solutions to their real-life situations. The researcher explained the purpose of the study to the participants and indicated to them that they were not compelled to sign the consent forms if they did not wish to do so.

When collecting data, the researcher made sure that participants were treated with respect and that they were not given incorrect information on how the data would be used. The researcher additionally avoided disclosing sensitive information about the participants. When reporting about the findings, the researcher did not falsify the evidence, data, findings, or conclusions. Finally, the work of other scholars that the researcher used was acknowledged.

3.12 The researcher's role

The researcher was the key instrument in the collection of data. He took steps to obtain permission to conduct the research. That he did by applying for ethical clearance. The researcher was given ethical clearance by the University of Venda, which was used to apply to the Thalahane Local chief and the Blouberg Municipality to get permission to conduct the study. Thalahane village falls under Blouberg Municipality. The two role players gave consent for the study to be carried out. That enabled the researcher to enter the research site.

Another role that the researcher played was to interview the participants. The researcher used purposive sampling to choose the right participants. Furthermore, he was transparent to all the role players about the purpose of the study. Transparency and warmth towards the participants ensured a good atmosphere and let the participants share their experiences freely. The researcher was a leader and a guide during the interviews, making sure that he planned the schedules of interviews to accommodate who, what, when, and where questions. He also planned appropriate interview questions, which helped to uncover the experiences of participants in solid waste management practices.

3.13 Chapter summary

The area of study is Thalahane Village chosen on the basis that it will assist in answering the research questions and based on its accessibility, in terms of finances and time, to the researcher. A qualitative study with a phenomenology approach and case study design was used as it was found to be the best way to answer the research questions and also on the basis that the researcher has a strong belief that reality is socially constructed. The population of the study was composed of all community

members of Thalahane village. The participants were selected using purposive sampling. Thirty participants were selected for unstructured interviews and focus group discussions. Indigenous solid waste management sites were visited to confirm the information coming from unstructured interviews and focus group discussions. Blouberg municipality documents relating to waste management were read and analysed to collect data on how the municipality implements waste management in Thalahane village.

The data was analysed thematically. Measures were taken to ensure that the study is trusted by applying validity, reliability, and trustworthiness. Throughout the study, ethical considerations were respected.

CHAPTER 4: THE STATE OF INDIGENOUS WASTE MANAGEMENT IN THALAHANE VILLAGE

4.1 Introduction

Chapter Three was about research methodology. This chapter outlines the findings of this research on the state of indigenous management of waste in Thalahane village. The findings were the results of the interviews with the participants and observations on the existence of backyard pits, composting and repurposing of waste, and dumping places in the community. These findings are discussed as follows:

4.2 Indigenous solid waste management practices by the Thalahane community

The management of waste is about the prevention and reduction of waste. If the two options do not succeed, waste is processed for reuse and recycling and ultimately disposed of in a sustainable, environment friendly manner. Central to the management of waste is the hierarchy of waste, which is about a hierarchy of priorities for managing waste in the order of preferences and in terms of what is best to sustain the environment. It assists in the evaluation process that protects the environment. The sustainable, environment friendly waste hierarchy is as follows:

- Avoidance – focuses on ways to prevent the creation of waste.
- Reduction – to take steps to lower the quantity of waste created.
- Reuse – to prevent solid waste from entering the landfills by repurposing it, thereby reducing the waste produced as an end product.
- Recycle – it is about using solid waste materials to manufacture new products, thereby reducing the waste produced.
- Energy recovery – is about producing energy from waste.
- Disposal – to get rid of waste in a sustainable, environment friendly manner.

The depiction of the waste hierarchy as sustainable environmentally friendly is attached below.

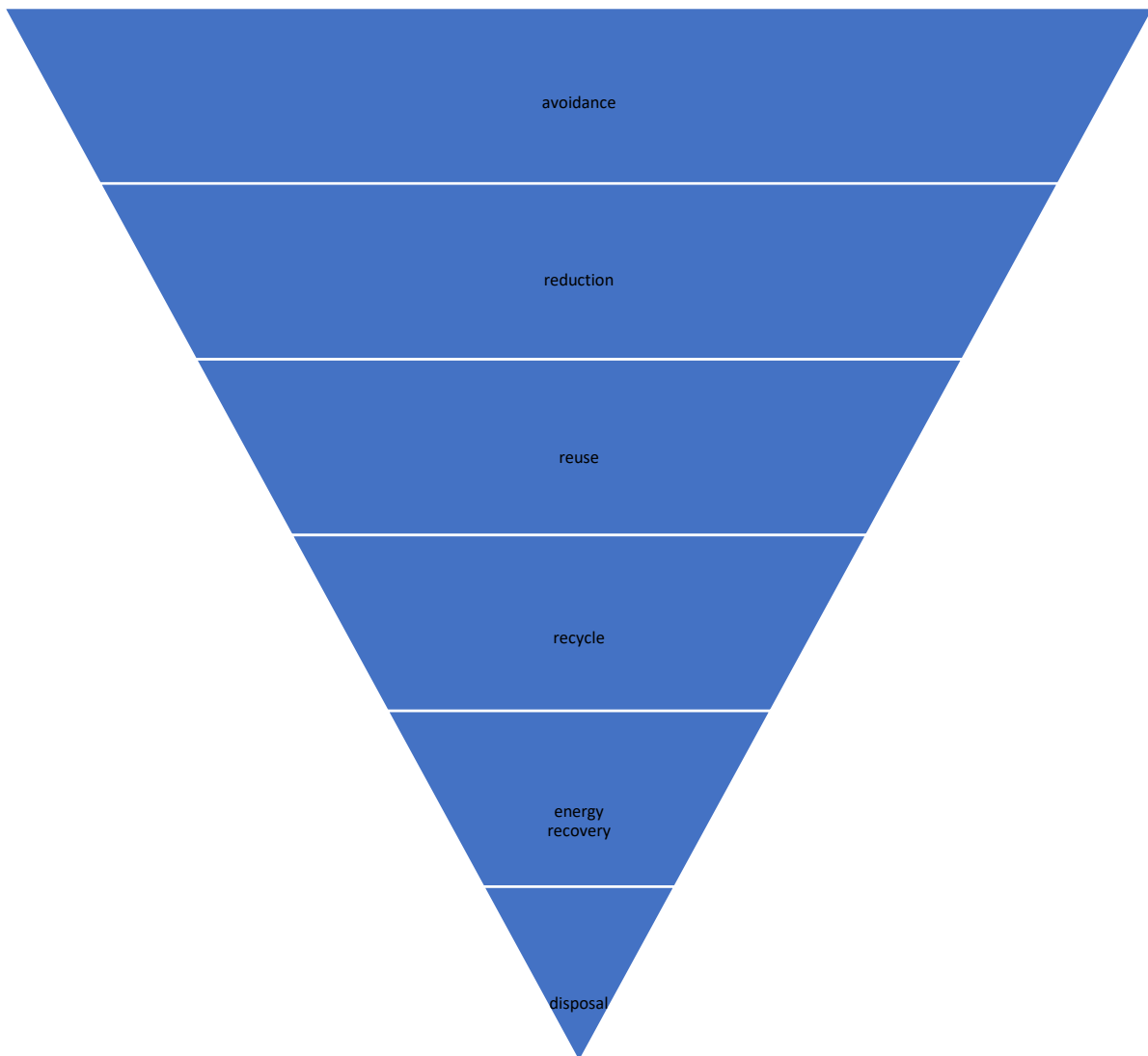


Figure 4. 8: Environment-friendly waste management hierarchy

The community of Thalahane, too, has preferences of priorities on the waste hierarchy, from the best preferred to the least preferred, according to the effects on the environment. This is evident from the themes developed while studying waste management in Thalahane village. They were developed as follows: the Thalahane community practiced separation of waste, burying waste underground, turning waste into compost, burning waste, repurposing potential waste into something useful, using waste for trapping and scaring birds and animals, storing metal and glass for waste pickers, using back yard pit for waste disposal, taking waste out of their yard to manage it, and their methods of managing waste are affordable. The community's waste hierarchy is shown below.

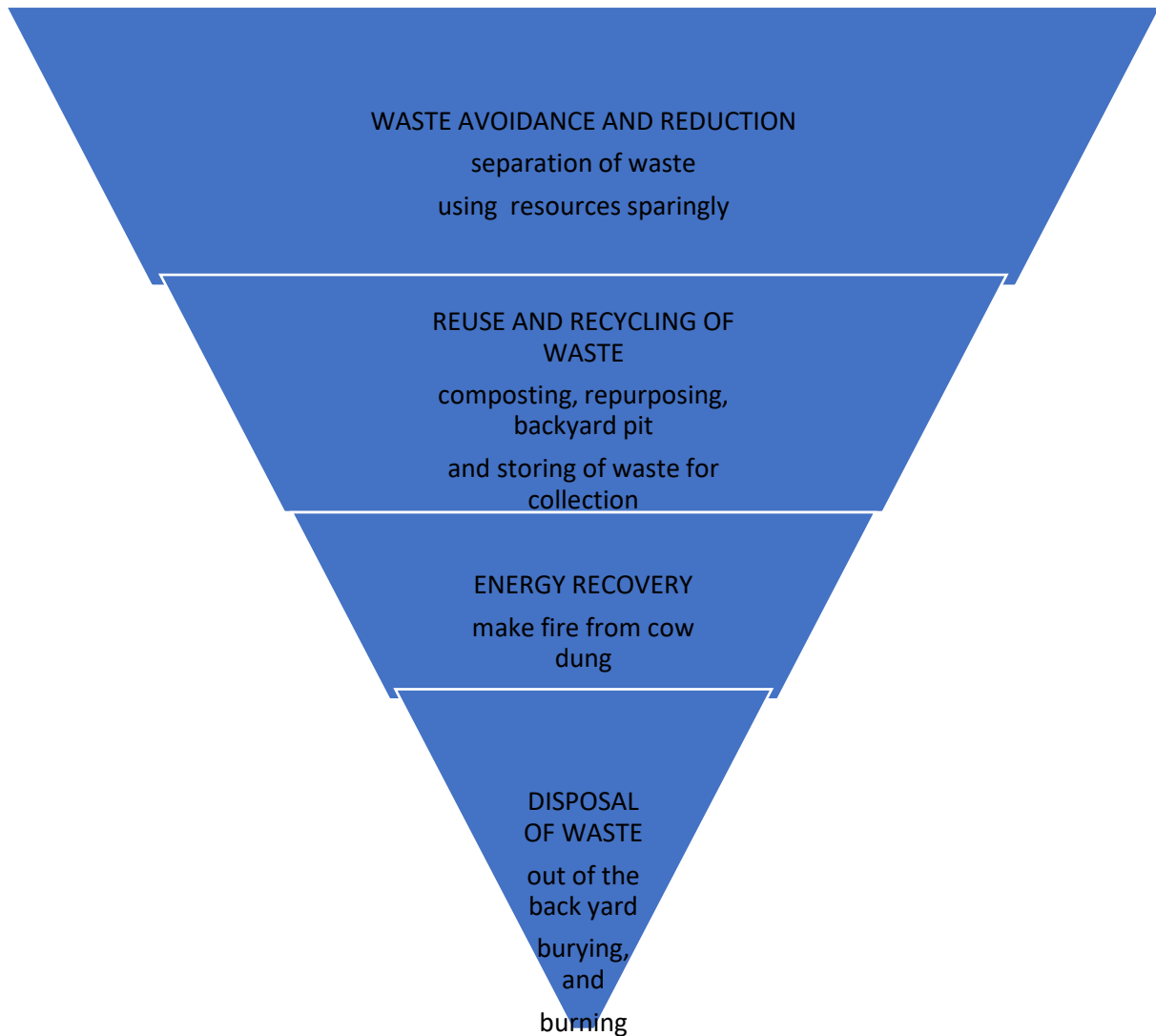


Figure 4. 9: Thalahane village solid waste management hierarchy

4.2.1 Waste avoidance and reduction

- **Separation at source**

Separation is a way of managing waste in ways that ensure that different types of waste are not mixed. During the investigation, it was found that, as a way of managing waste, the community engages in the separation of waste. One of the participants said:

“At home, we do not mix left-over food with things like glasses and metals, as we give leftovers to our domestic animals”.

This separation happened at the household level. This separation of waste as an indigenous practice has also been confirmed by Machete (2018) in the indigenization

of improved access to affordable household refuse disposal in South Africa. Waste glass, waste metal, and waste food are not mixed. Rather, they are separated. The reason given was that left overs are given to dogs, pigs, and chickens, and as such, they cannot be mixed with other waste. The same thing applies to glass and metal. Waste metal is picked for recycling and, as such, is not mixed with other waste. Waste separation is convenient for recycling, composting, and reuse, helps reduce the use of raw materials, and keeps recyclable and reusable materials out of landfills. Separation of waste also assists in keeping hazardous waste separate from non-hazardous waste so that it can be managed separately.

This practice was found to be a good indigenous practice for waste management. This kind of waste management practice was found to contribute to sustainability and was also in line with international waste management practices. This meant that the practice could be used at the municipal level to assist in bringing about sustainable waste management practices, as it was expected that the municipalities should engage in waste management practices that bring about sustainability. This is also in line with international practices.

4.2.2 Basis for sustainable waste management

- **Reuse**

Waste from food was also used as bait. They used it to bait birds and animals for meat. In some cases, it was used to bait animals like baboons and monkeys that troubled them during the farming season. However, not all respondents were using this kind of waste management, but it contributed to the reduction of waste.

There was even mention of scarecrows by some participants. These were figures put in the fields to scare off birds, baboons, and monkeys. They used old clothes and caricatures of human beings to scare off birds, baboons, and monkeys from plundering the fields. Trapping and scaring off birds and animals has been confirmed by Machete (2018) in his “Indigenization for improved access to affordable household refuse disposal in South Africa”. That was regarded as the reuse of waste and contributed to the reduction of waste being transported to landfills.

- **Recycle**

There were community members who collected metals separately so that those involved in recycling could come and collect them easily. The same thing applies to glass materials. That kind of waste management practice contributes to sustainable waste management. Recycling is a good way of managing waste, as it keeps waste away from landfills and reduces transport costs to landfills. Recycling is an internationally recommended practice of waste management after reduction and reuse.

The study also found that the community used composting. Composting is the process of putting organic waste material in the soil until it decomposes. In this study, the community used biodegradable materials for composting. These materials were put in a pit, and then the soil was used to close the pit. When the time was right, it was used as fertilizer. Sometimes these materials were put in holes for some time until the time was right, that is, they decomposed. Then fruit trees would be planted in those holes. Compost has adequate plant nutrients and is beneficial as fertilizer, vital humus, and a natural pesticide. Furthermore, compost does not temper the ecosystem. Organic waste material is the most commonly produced waste in South Africa (Machete *et al.*, 2015). Proper management of organic waste material is paramount, as it can cause smelly households and leachate content that can lead to soil degradation. A study by Kosoe *et al.* (2019) indicated that household composting is also practiced in Ghana. According to Ajibade (2007), composting is done with organic wastes such as animal faeces, farm residue, food, and dead plants. For Izugbara and Umoh (2004), it also involves burying or leaving wet organic waste for a while to decompose. According to Izugbara and Umoh (2004), composting is practiced in Nigeria. From the participants, it was established that back-yard pits were dug for waste management purposes. They said that it was a general way of handling waste. They added that this happens especially if there is a wedding or funeral. During that week, a pit would be dug to be used to manage waste. The waste that was managed in this pit during funerals and weddings was mainly food waste. The backyard pit contributed to the reduction of waste to be taken to landfills in cases where the waste was ultimately used as animal food or as compost. The challenge with that kind of waste management was that it could contribute to the pollution of underground water. During rainy periods, the water from the pit can sink and pollute underground water. Sometimes waste in the pit causes a bad smell if it is kept for a long time. Back-yard pits are open-air dumps.

Open dumping is a poor solid waste management strategy. Mismanagement of solid squander is a world concern in terms of pollutants to the environment, economic sustainability, and social inclusion (Gupta *et al.*, 2015; Vitorino de Souza Melaré *et al.*, 2017).

4.2.3 Energy recovery method

The community indicated that they use cow dung as fuel for cooking, home brewing, baking, and boiling water for a bath. This was done to save on electricity. However, with beer brewing, electricity cannot be used; only firewood or fire from cow dung is used.



Picture 4. 9: Fireplace for bread baking and beer brewing

4.2.4 Waste disposal methods

Another form of managing waste is burying it. Burying refers to the hiding of waste in the ground so that it cannot be seen. One of the participants said:

“We bury unwanted things like used nappies, rotten pumpkins, and rotten watermelons”.

However, not all the participants were using this method of waste management. Others did not mention the practice of burying waste. Burying was used for organic waste like rotten pumpkins and rotten watermelon. They said it was meant to keep smells and insects away from the public. In certain instances, disposable nappies were buried. However, the practice may lead to environmental contamination, which is a hazard to public health. The burying of waste may also affect the water bodies.

Another form of waste management is burning. This kind of practice involved items made from cloth, paper, and wool. Waste made from these materials is burned. They said that burning reduced the amount of waste to be thrown away. They also said that they do it in such a way that it does not result in conflict with the neighbours. As a result, burning was mostly conducted at night when people were in their houses.

The burning of waste can decrease the amount of waste to be discarded and it is also cost-effective. But this kind of practice can bring about air pollution, which is not good for public health. However, polluted air can bring about breathing diseases. Burning should therefore be done under highly controlled conditions to prevent air pollution. Burning waste is also an environmentally poor waste management practice. Recycling materials like paper and plastic can be lost due to fire and it can also cause air pollution. It can also be a health risk, as many harmful and poisonous chemicals can be released into the air that people and animals breathe, resulting in respiratory diseases. According to scientific literature, open burning causes the release of pollutants like sulphur dioxide, carbon monoxide, carbon dioxide, and many others, which affect the atmosphere negatively (Wiedinmyer *et al.*, 2014). Therefore, it will retard the realisation of the SDGs, and it is not a good practice for sustainable solid waste management.

It was established by the researchers from the participants that community members disposed of waste in empty spaces. They said this type of disposal was the last resort after they had tried all other indigenous waste management strategies. It was also established that there were no landfills around the area of Thalahane. The nearest landfill was about thirty kilometers away. The participants made it clear during interviews that they did not have transport to take their solid waste to the landfill. This resulted in the out of backyard strategy, and it was the main cause of uncontrolled dumping, which was a cause for concern for community members. The practice of

solid waste management resulted in indiscriminate dumping. Furthermore, it increased environmental and health risks for people and animals. It also increased environmental risk as it ultimately caused environmental degradation. In addition, it posed health risks as some of the chemicals from waste can ultimately be found in human bodies through the terrestrial food chain and drinking water. Terrestrial food chain refers to network feeding relationships among different species; for example, grasshoppers eat grass, snakes eat grasshoppers, mangooses eat snakes, and mangooses die and provide organic materials to grass.



Picture 4. 10: Life stock feeding from a waste dump

Dumping waste in open spaces is called open air dumping. Open air dumping, in addition to causing environmental concerns such as air contamination, emissions of greenhouse gases (GHG), pollution of surface water, and underground pollution, leads to marine littering. Marine littering affects seas and oceans and results mainly from plastic waste (Derraik, 2002; Iñiguez *et al.*, 2016). This type of littering results in environmental damage and economic loss and endangers public safety (Cheshire *et al.*, 2009). The main cause of marine littering is uncontrolled dumping, which results in waste being washed by rivers into the sea or ocean.



Picture 4. 11: Disposable nappies waste trapped in a dry stream

4.2.5 The existence of indigenous practices for solid waste management

There was evidence that there were indigenous solid disposal practices in Thalahane village. These practices were not taught in schools but were shared by word of mouth and by doing from one generation to the next. The drivers of these practices were good public health, good animal health, cleanliness, environmental care, recycling of waste, reduction of waste, reuse of waste, and good neighbourliness. Where there are conflicts, the local traditional leader steps in to resolve the conflict. In his study, Ibodje (2017) concluded that where there are “stronger traditional institutions in enforcing and monitoring cultural norms on domestic waste management activities, there is less indiscriminate domestic waste management”. The out of the yard strategy was used as a last resort when the community did not have any other option left to deal with

waste. In many instances, it was discovered that the indigenous waste practices used were good indigenous solid waste practices.

From the interviews, it was also established that indigenous waste practices were affordable. From the participants, it was also found that community members could afford it, irrespective of class. That meant that even the poorest of the poor could afford it. Therefore, it was cost-effective; that is, it was produced and delivered on waste management without being expensive to the community; hence, it was sustained from generation to generation and therefore sustainable. One of the main challenges in the management of solid waste in emerging countries is the unwillingness of service beneficiaries to pay for the services (Sujauddin *et al.*, 2008). This is in part, because of the question of affordability. Management of solid waste systems that are commonly used in developing countries has been copied from developed countries, where economic conditions allow for maximum applicability.

Repurposing is about changing from its original usage to a new way of using it. It also means the use of waste as a basic material. The participants said:

“I am a good traditional dancer (mmini wa dinaka). The music drums that we use are made from old metal water drums and cow hide”.

Metal water drums that were leaking were repurposed into traditional music drums. The same thing applied to small metal pipes and animal horns. These were repurposed into traditional music pipes. Another participant said:

“The plastics that we get from the shops, we use them to weave mats”.

Shopping plastics bags were used to make floor mats. An 80-kg maize meal bag was repurposed as a signpost to indicate that traditional beer was available. The 80-kg maize meal bag was tied to a pole and put in the street near the place where the traditional beer has been brewed. The traditional signpost was put where it would be seen from a distance. When traditional beer drinkers see the sign, they know that there is traditional beer in that place.



Picture 4. 12: Traditional beer place signposts

Goat hides were also used as floor mats or as home decor. Cow hides were used in the making of music drums and as leather ropes.



Picture 4. 13: Repurposed goat skin for home decor

Another participant said:

“At home, when there is too much porridge, we turn it into a drink called maheu”.

Unwanted porridge waste was turned into maheu for drinking when it was hot. Metal drums were turned into waste bins; bones were turned into traditional healing bones (dihlako or ditaola or thangu), and animal skins were turned into clothes for traditional dances.

Another participant said:

“At home, we use old plastic buckets to fetch and store water”.

Five-liter plastic buckets of paint and cooking oil were used to fetch water. Wood was used to make cattle kraals and firewood. Most participants said that this form of waste management was popular among community members.



Picture 4. 14: Community street water tank



Picture 4. 15: Pictures of containers repurposed to store and fetch water

Kosoe *et al.* (2019) found that waste can also be converted into useful items like knives, cutlasses, hoes, and axes. Similar findings were found in the Ngwa of southern Nigeria (Izubara & Umoh, 2004).

Repurposing waste contributes to the reuse and decreasing of squander, thereby reducing the amount of waste to be taken to landfills. Landfills in the Blouberg municipalities are open air dumps. Open dumping impacts the environment by contaminating the air through odours and greenhouse gases (GHG), vectors of diseases, groundwater contamination, and surface water contamination (Ferronato & Torreta, 2019). Repurposing waste contributes to sustainability and is also in line with international waste management trends. It was also found to be cost-effective in that even the poorest community members could afford it.

Another participant said:

“What is left after we have eaten is given to our domestic animals. That also includes what is left after beer-making”.

Feeding food waste to animals was another form of waste management. They said that waste from porridge, vegetables, meat, and fruits was used to feed animals like

dogs, pigs, goats, sheep, cats, and cattle. Waste from porridge and meat was given to dogs and cats. On the other hand, waste from porridge, vegetables, and fruits was given to pigs, while goats, sheep, and cattle were given vegetable waste and other waste from the field. By-products of traditional beer making and mealie meal making were also fed to pigs, goats, cattle, and chickens. This kind of waste management practice was effective in the reduction of waste, something which is key to waste management's sustainability. The less waste, the better for people's health and nature. The study by Kosoe *et al.* (2019) found that in the Jaman South District, community members recycled food like farm weeds, cassava peels, yan, and leftover fruits to feed domestic animals.

They said that rain usually damages their street roads. To repair these roads, they used demolition waste. They also used to put the waste where the road was muddy and slippery to enable cars and carts to pass with ease. That helped to deal with demolition waste. That was another way of reducing waste.



Picture 4. 16: Road repaired using rubble

From the interviews, it was learned that old clothes were used as bedding for cats and dogs. The same materials were also put in the nests of laying chickens to keep the eggs warm so that they could hatch at the appropriate time. Potato chip plastics and

shopping plastic bags were weaved into decorating ornaments. Similarly, some wire was turned into bracelets. That was the reuse of waste.

Making a new product requires raw materials that must be extracted from the earth. There is also a need for labour, transportation, and energy. The best way to save natural resources is to repurpose them. Repurposing is one way to reuse. Repurposing can save natural resources for this generation as well as future generations, thereby promoting sustainability. The added benefit is that money can be saved. Other than saving money, it mitigates land, air, and water pollution. Finally, it contributes to the reduction of greenhouse gas emissions that contribute to global climate change.

Out of the interviewers' description of on how indigenous solid waste management is conducted in Thalahane village, one realises that there are internal attributes that support the success of indigenous solid waste management, internal attributes that work against the success of indigenous solid waste management, external factors that can be taken advantage of to assist in the success of indigenous solid waste management, and external factors that are a danger to the success of indigenous solid waste management.

- Internal attributes that support the success of indigenous solid waste management.

The way indigenous waste management transfer takes place enhances a buy-in from members of the community. Community members are not pushed to play a role in indigenous waste management; it happens spontaneously. In every family, there are knowledge holders who act as evaluators, monitor, and provide support. Members of the society are provided with practical knowledge and wisdom, which enable them to deal with conflict situations in waste management. Everyone is a right holder and almost everyone is a duty bearer in waste management as right holders and duty bearers, find themselves with one choice which is to manage waste. This gives the community resilience for the challenges of waste management.

By using avoidance, reduction, reuse, and recycling, indigenous solid waste management contributes to and acts as a preventative measure to the reduction of vulnerability and minimising health risk factors, environmental risk factors, and

community risk factors. One of the major threats to these risk factors is air pollution, but avoidance, reduction, reuse, and recycling contribute to the reduction of pollution and the emission of GHGs that contribute to environmental insecurity.

Involving everyone in the practice offers little to no discrimination or exclusion and, as such, allows most of the community members to enjoy freedom from indignity. The involvement of the community assists in the sharing of waste management responsibilities. The people, as right holders and duty bearers, have a responsibility towards the community (public), animal life, and the environment. The responsibility is shared amongst the individual members of the households, among different households in the community, with traditional authorities, and in all community structures. The whole village is like a big institution that specialises in waste management, as what is taught in the family matches what is taught in the community. It offers little room for dissension, thereby making indigenous waste management acceptable. In addition, indigenous solid waste management is affordable, as all the participants indicated that it does not cost them a lot.

Members of the community, as major stakeholders in waste management, are involved. They promote “nothing about us without us”. So, indigenous solid waste management promotes popular participation and social integration. This also helps to increase the legitimacy and acceptability of indigenous solid waste management. Indigenous solid waste management has a governance structure. The individual as part of the household, the household, the community as a whole, and the traditional authority form part of the governance structure in that order. The customary laws play a role in determining who, what, and when.

- Internal attributes that work against the success of indigenous solid waste management.

Disposal practices like taking waste out of the yard displace waste problems from one area to another. As it solves a waste problem in one area but takes it to another area or creates it in another area. These disposal practices also lack adequate means to dispose of waste in an environmentally friendly manner.

- External factors can be taken advantage of to assist in the success of indigenous solid waste management.

The non-interference by the local municipalities in the practice of indigenous solid waste management can assist in strengthening it further as it is not competing with other forms of waste management.

- External factors are a danger to the success of indigenous solid waste management.

The education system provided by the local school does not condone indigenous practices. Exposure to media that promotes Eurocentric practices and culture. The death of knowledge holders robs society of a valuable knowledge source since indigenous practice is, in most cases, in oral form. The challenges posed by e-waste (electronic waste) are also a threat to indigenous solid waste management.

4.3 DPSIR and Thalahane village indigenous solid waste management

The concept of “system drivers” is defined as an event that changes the status quo of the existing waste management system (in either a positive or negative direction), be it legislation that encourages an integrated approach to waste management or a change in public perception of a management system. In most cases, the responses act as “system drivers” as they change the status quo of an existing waste management system in a positive direction. Thereby, we can address the pressures, state, and impact of waste through the recovery, recycling, and reuse of resources, the minimisation of waste streams, and the elimination of negative system drivers. Thereby put in the process of achieving human development in an inclusive, connected, equitable, prudent, and secure manner.

From the data gathered during interviews, it is evident that the motive force behind the development of indigenous solid waste management in Thalahane village is public health, cleanliness, environmental protection, animal health, resource value of waste, and public awareness. While the community engages in livelihood activities, which are social and economic, it produces waste that has a bearing on the environment. The driving force for livelihood activities is the need for food, the need for shelter, the need for mobility, the need for water, the need for goods and services, the need for clothes, the need for education, the need for hygiene, and the need for safety.

These needs lead to human activities that result in meeting needs like cooking, construction, buying, farming, manufacturing, and packaging. These human activities, coupled with population growth, changing lifestyles, and increasing demand for resources, put pressure on the environment. The pressure comes in the form of waste. The pressure results in the state of the environment being affected. That is the state of water, the state of air, and the state of the soil. This refers to the quality of air, water, soil, and ecosystem. The affected quality of air, water, quality of soil, and ecosystem result in social and economic impacts.

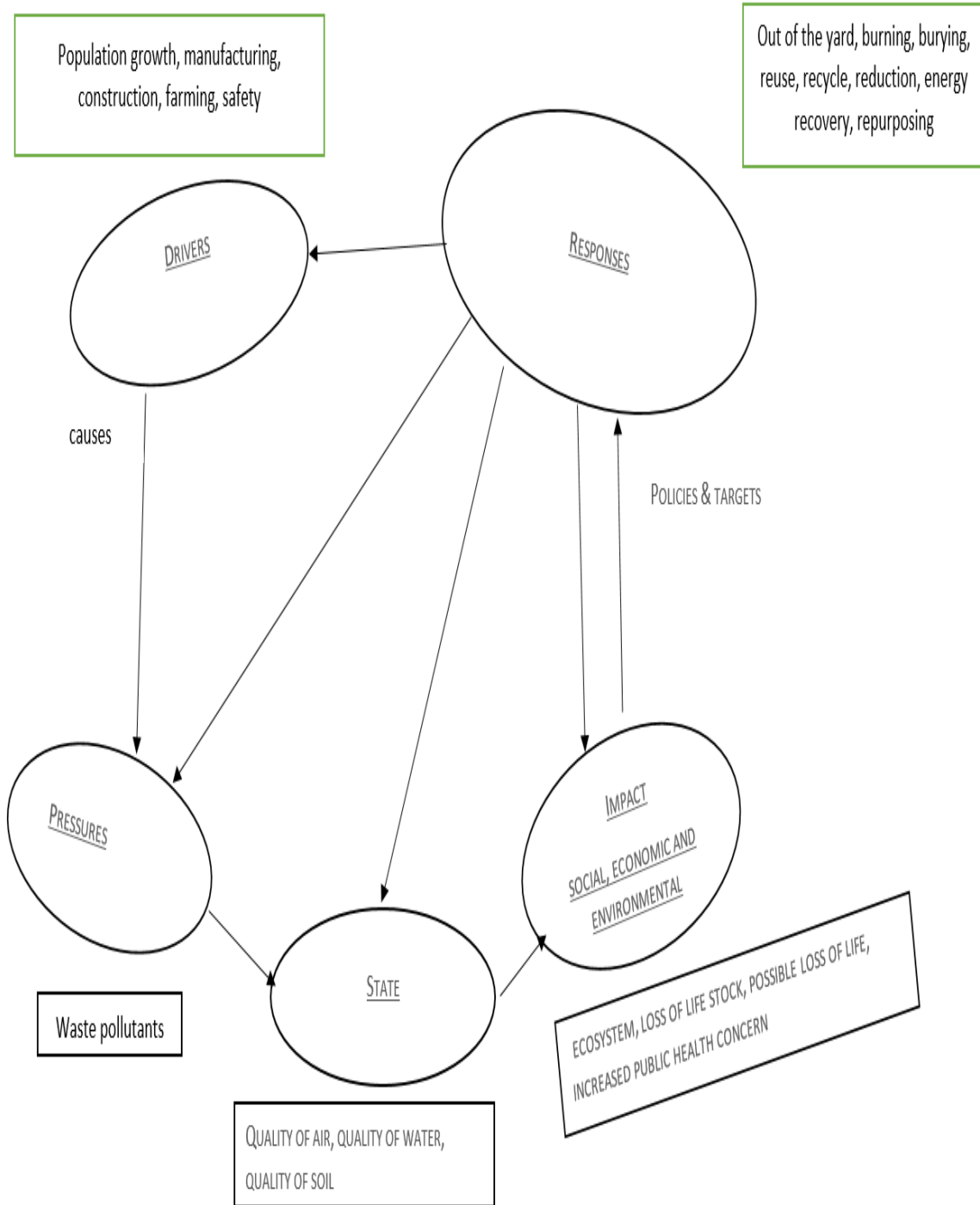


Figure 4. 10: Thalahane waste DPSIR

A response to waste by society comes because of an undesired outcome and can affect the driving forces, pressures, states, and impacts (Kristensen, 2004). There are two major types of responses to human activities (drivers): technological responses and regulations (Abalansa *et al.*, 2020). There are no noticeable technological responses to human activities by the local community. The regulations that are in place are from the national and local governments but are not being enforced. However, indigenous waste management knowledge is passed orally from parents to children throughout the community on how to reduce waste. The community farms just enough food for consumption; they avoid cooking too much food; and they preserve food to avoid waste.

Responses to pressures

Pressures are the results of human activities when there are no relevant responses to those activities (Abalansa *et al.*, 2020). Responses to pressures, in most cases, result in a reduction of the quantity of waste that reaches the environment. As a response, the community uses eco-friendly products like grass-woven mats and leather mats made from slaughtered animals. These responses help reduce pressure on the environment. The reuse of food as bait for birds, baboons, and monkeys and the reuse of old clothes as caricatures of human beings to scare off birds, baboons, and monkeys contribute towards the alleviation of pressures. Storing metals helps separate waste collectors and reduces pressures on the environment.

Responses to state change and impacts on human and animal life.

The community still relies on its basis for decision-making, and knowledge of know-how practices gained from their experience in waste management as they interact with the environment. The knowledge covers aspects such as agriculture, preparation, conservation, distribution of food, construction and maintenance of shelters, and management between ecological relations of society and nature (ICSU, 2002). The adult population responds by disseminating information to the young population, which creates awareness and attitudinal change. The creation of awareness and attitudinal change assist in reducing the state of change and its impact on human and animal life.

The effectiveness of responses

The response is meant to reduce or alleviate drivers, pressures, states, and impacts. How society responds depends on how it perceives and evaluates the drivers, pressures, states, and impacts. The drivers, pressures, states, and impacts that are perceived and evaluated as a threat to human welfare, animal life, and the environment are given high priority responses. The effectiveness of responses is judged on whether they can deal with the threat as perceived and evaluated by the community and on the basis that they can change the status quo of the existing drivers, pressures, states, and impacts to address them through recovery, recycling, and reuse of resources, minimization of waste streams, and avoiding negative system drivers, thereby promoting the process of achieving human development.

Thalahane solid waste management responses are as follows: they buried waste underground, turned waste into compost, burned waste, stored metal and glass waste separately for waste pickers, disposed of waste in the pit yards, and disposed of their waste in open spaces. The community perceives unmanaged waste as a threat to public health, animal life, cleanliness, and the environment. Hence, their response. But not all their responses contribute to altering the existing pressures, states, and impacts positively.

Repurposing potential waste involved reuse, recycling, and reduction of waste. It limits the amount of waste to be disposed of. Repurposing of potential waste, thereby alleviating pressures, states, and impacts on the environment. It also contributes to good public health and animal life, cleanliness, and avoiding environmental degradation. It promotes the process of achieving human development.

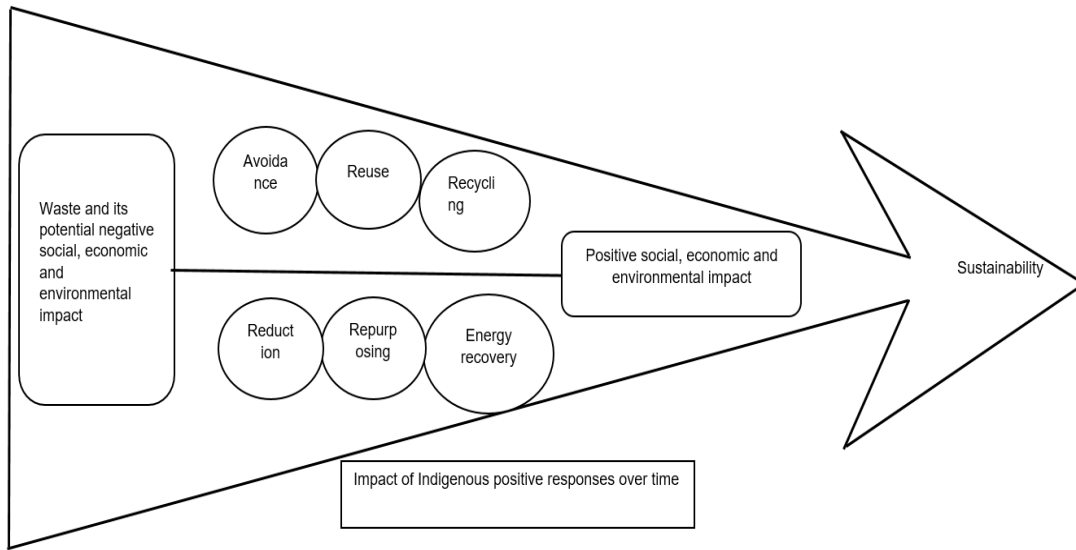


Figure 4. 11: Thalahane Indigenous positive responses

But the burning of waste, burying of waste, and disposal of waste in pit yards and open fields do not alleviate the pressures, states, and impacts on the environment, as they are a threat to public health, animal health, cleanliness, and environmental degradation. These waste practices rob the community of clean water, fresh air, and a clean environment. These waste practices can lead to the possible loss of human and animal life and increase people's health concerns. Responses to the burning of waste, burying of waste, and disposal of waste in pits and open fields tend to have a ripple effect on the local solid waste management system. That is, these waste practices harm the promotion of sustainable development goals and ultimately livelihood.

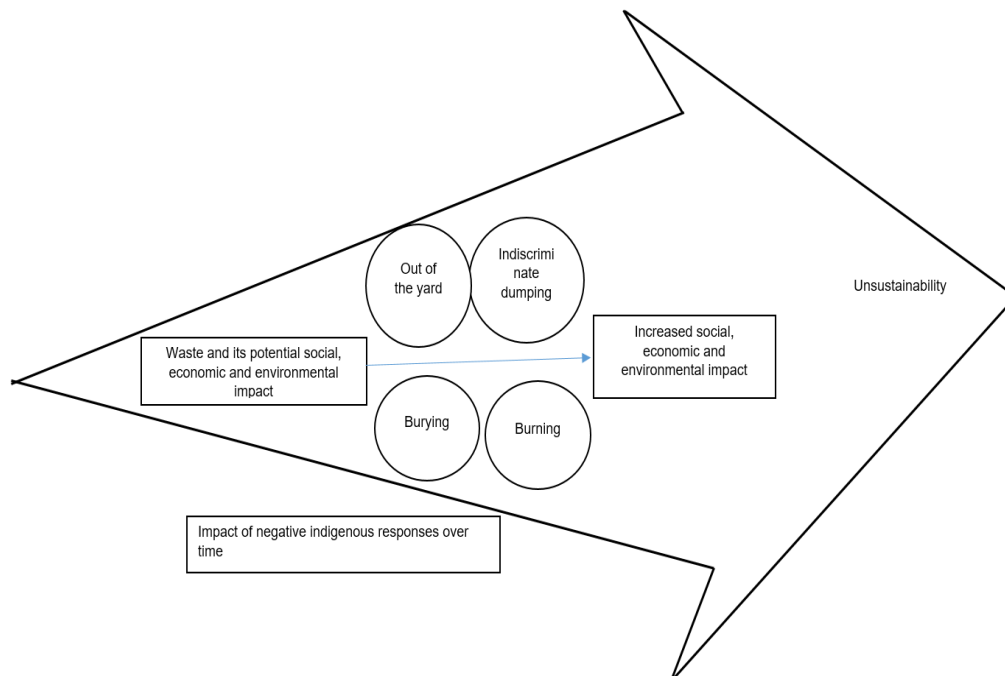


Figure 4. 12: Thalahane Indigenous negative responses

4.4 Transfer of indigenous waste management knowledge

From the interviews, what is evident is that indigenous waste management is learned through experience. It is practiced repeatedly until it is mastered. This means it is developed through habituation. If one practices indigenous waste management over and over again, it will eventually become part of the character.

Indigenous solid waste management transfer is a process by which solid waste management exemplars share their waste management knowledge, skills, and

behaviours with inexperienced members of the community. In most cases, the adult population acts as indigenous solid waste management exemplars, as they are the knowledge holders. The young ones in the community are the ones receiving knowledge, as they are inexperienced.

Indigenous solid waste management exemplar



transfer

Unexperienced member of the community

The indigenous solid waste management holder is identified as the one from whom the community looks to gain indigenous solid waste management knowledge. The holders share the valuable information that is captured by the inexperienced members of the community. Information on waste management is shared through doing and talking. In this way, waste management knowledge transfer is executed. Learning and doing are key to the transfer of indigenous waste management. The young ones gain by observing, listening, and doing. Doing is a way of practicing what has been shared. As they practice, evaluation and monitoring take place based on the knowledge exemplars.

The transfer enables inexperienced members of the community to master waste management knowledge and skills and enables them to solve waste management challenges in a different context. The knowledge learned covers factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge (Krathwohl, 2002).

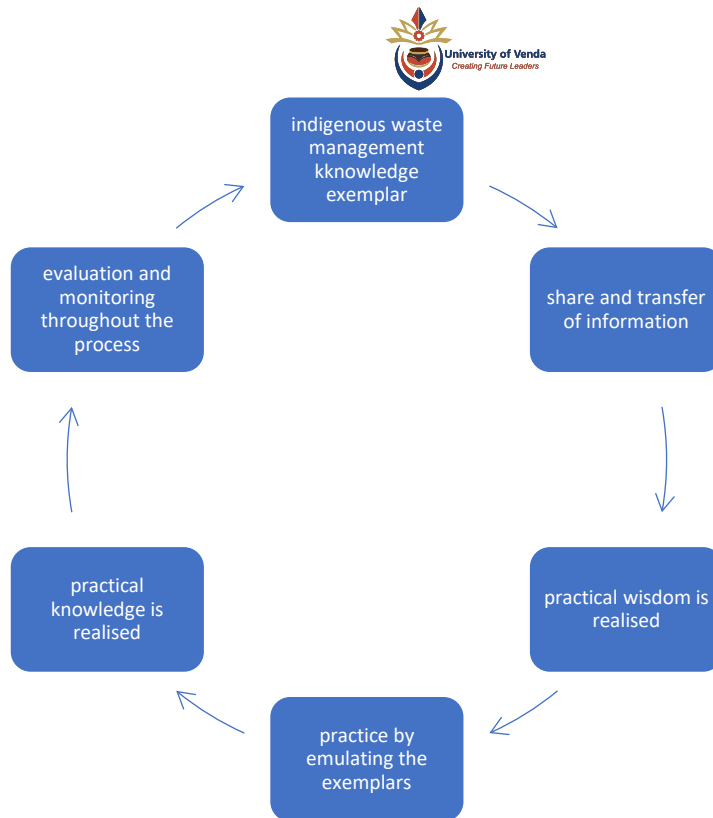


Figure 4. 13:Depiction of Thalahane indigenous waste management knowledge transfer

The transfer of indigenous solid waste management takes place until an individual has proper functioning in waste management. The benefit of indigenous waste management transfer is that the community can build collective knowledge on waste management, and retain it, and share it with the incoming generation of the community. The family structure, as the basic unit of the community, is key in the transfer of waste management knowledge from the experienced members of the community to the inexperienced members of the community. But this does not mean indigenous waste management transfer is limited to the family structure alone. During community gatherings, rituals, funerals, festivities, and knowledge transfer do take place.

4.5 The application of “Hohfeldian incidents” to Thalahane indigenous solid waste management

The “Hohfeldian incidents” are four basic elements. They are the privilege, the claim, the power, and the immunity. What is notable in Thalahane village is that individuals,

household communities, and traditional authorities have the privilege and the claim. In the case of “Hohfeldian incidents”, if X has a claim, then Y has a duty; that is, a right holder is a different person from the duty bearer. In the case of the Thalahane community, all members of the society are right holders and duty bearers. The indigenous solid waste management calls everyone to duty. So, the claim and the duty reside with the same people.

Power resides in traditional authority, but it is a limited power as the traditional authority should dance to the tune of customary laws and religious beliefs. These customary laws and religious beliefs are a form of the indigenous legal system. The community can caution the traditional authority on matters of the indigenous legal system. So, the community has limited access to the power of traditional authority on matters of waste management. This means the traditional authority has limited immunity and limited liability.

4.6 Integrated indigenous solid waste management framework

From the interviews and discussions, a picture emerges of indigenous solid waste management as having stakeholders, governance, response mechanisms, and drivers. The stakeholders included the traditional authority, the community, the household, and individuals, and governance included the customary laws of traditional authority, community, household, and individuals. The response mechanisms included avoidance, reduction, reuse, recycling, repurposing, burning, burying, and out of yard, disposal means. The main drivers of indigenous solid waste management are environmental protection; human and animal health and cleanliness and beliefs. The stakeholders, governance, response mechanisms, and drives work in an integrated manner, and if integrated solid waste management is a system that is occupied with the reduction, collection, recycling, and disposal of solid waste, then Thalahane indigenous solid waste management has an integrated framework, which can be depicted as follows:

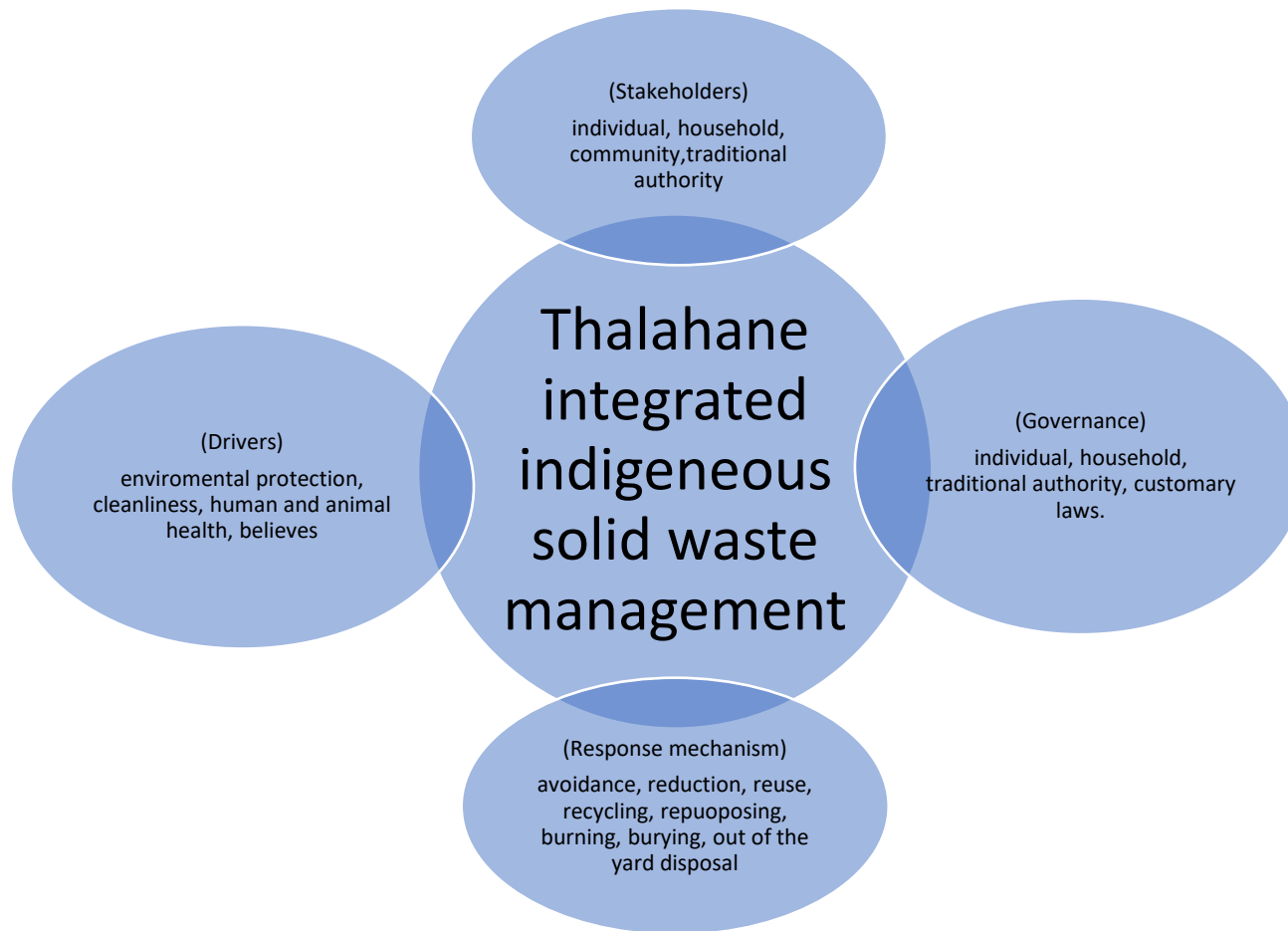


Figure 4. 14: Thalahane Integrated indigenous solid waste management framework

4.7 The Precautionary Principle, Prevention Principle, Rectification Principle, and the Principle of Sustainable Development in Thalahane village

These Principles are derived from International environmental law. They are useful in ensuring the protection of the environment and public health. The question is : Does the Thalahane indigenous solid waste management align itself to these principles? Subsections 4.7.1, 4.7.2, 4.7.3, and 4.7.4 deal with this question.

4.7.1 The Precautionary principle and indigenous solid waste management

Precautionary measures are necessary for solid waste management to prevent the degradation of the environment and to protect public health. These measures apply when there are serious threats to environmental protection and public health and there is a lack of full scientific certainty.

The 1992 Rio conference says:

“In order to protect the environment, the precautionary approach shall be widely applied by states according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (Rio Declaration, 1992).

There is no evidence to suggest that Thalahane indigenous solid waste management has precautionary measures. Thus, the precautionary principle is not applied in Thalahane village. Indigenous knowledge refers to

“cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with natural environment. These sophisticated sets of

understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview” (UNESCO, 2002).

As such, the measures that are used in Thalahane village to manage waste are based on the lived experiences of the members of society.

4.7.2 The Prevention principle and indigenous solid waste management

Prevention is better than cure. This is the case with environmental harm. It is cheaper and easier to prevent environmental harm and ill health due to waste than to react after environmental harm and ill health have happened. Thalahane village's solid waste management hierarchy, as captured in Figure 4.2, indicates that there is waste avoidance and reduction; reuse and recycling of waste; energy recovery; and disposal of waste.

Waste avoidance and reduction in Thalahane village is conducted through the separation of waste and using resources sparingly. Using resources sparingly assists in preventing more waste. Thus, it is a preventative measure. Reuse and recycling of waste are done through composting, repurposing, a backyard pit, and storing of waste for collection. All these measures of reuse and recycling of waste, except backyard pits, are preventative measures.

The measures discussed under this subsection (4.7.2) are compelling evidence that Thalahane indigenous solid waste management has preventative measures. Believing that preventative measures prevent environmental harm and public ill-health due to waste, we therefore resolve that Thalahane indigenous solid waste management applies the Prevention Principle.

4.7.3 Rectification principle and indigenous solid waste management

The rectification principle is

“focused on the prevention at the source of environmental pollution by obliging the potential polluter or polluting activity to make use of the best available techniques in order to prevent the pollution in the first place” (Wibisana, 2006).

The rectification principle is not applied in Thalahane indigenous solid waste management.

4.7.4 Sustainable Development principle and indigenous solid waste management

Under the Sustainable Development Principle, the environment matters, society matters, and the economy matters for now and for the future. The Sustainable Development Principle creates a balance between these three pillars. The community of Thalahane, while engaging in livelihood activities which are social and economic, produces waste that has a bearing on the environment. The driving force for livelihood activities is the need for food, the need for shelter, the need for mobility, the need for water, the need for goods and services, the need for clothes, the need for education, the need for hygiene, and the need for safety. These needs are socioeconomic, and for these needs to be met for the present generation and the future generation, the protection of the environment and public health are key.

In Thalahane village, for each driver of pressure, state, and impact, the community responds to create a balance between the three pillars of sustainable development. This is demonstrated by Figure: 4.2, which is about Thalahane DPSIR. This is also confirmed by Thalahane Integrated Indigenous Solid Waste Management (Figure: 4.6). It is evident enough that the Sustainable Development Principle is being applied.

Having noted the positive and negative responses of the community in dealing with the drivers, pressures, states, and impacts while engaging with the livelihood activities and believing in the positive responses of the community, one resolves that the Sustainable Development Principle is applied in Thalahane village.

4.8 Thalahane indigenous solid waste management and Extended Producer Responsibility

The Extended Producer Responsibility came into effect on the 5th of May 2021. This research work could not find evidence to suggest that it has an impact on the Thalahane indigenous solid waste management practices. But extended producer responsibility is an environmental policy in which the producer takes responsibility for the product even after it becomes waste. That is, the producer takes responsibility for the management of the product even during the waste stage of the product. This way, it contributes positively to the circular economy. The circular economy intends to design out waste by maintaining the value of waste material at the highest level.

Extended producer responsibility (EPR), in waste management, focuses on putting the responsibility of the product on the producer throughout its entire life cycle. The primary aim of extended producer responsibility (EPR) is to minimise the environmental impact of waste materials through increased product recovery, recycling, take back, and final disposal. The focus of EPR is on upstream and downstream interventions. Research has shown that extended producer responsibility (EPR) has economic, social, and environmental benefits. Extended producer responsibility (EPR) is an environmental policy in which the producer takes responsibility for the management even during the waste stage of the product. In this way, we contribute positively to the circular economy. The circular economy intends to design out waste by maintaining the value of waste material at the highest level.

One can assume that the good implementation of the EPR policies will help alleviate the negative waste management responses in Thalahane village, especially when it comes to e-waste that cannot be dealt with properly through indigenous solid waste management practices, as the polluter pays principle will apply.

4.9 Chapter summary

The chapter answered the question of which indigenous solid waste management practices the Thalahane local community uses to manage waste. The community uses

separation of waste, using the resources sparingly, composting, repurposing, backyard pit disposal, storing waste for collection, making cooking fire from cow dung, burying waste, burning waste, and taking waste out of the yard as indigenous solid waste management.

These indigenous waste management practices are classified into waste avoidance and reduction, reuse and recycling of waste, energy recovery, and disposal of waste. This classification is according to the most preferred to the least preferred practices. The most preferred practices fall under waste avoidance and reduction, followed by reuse and recycling of waste, and then energy recovery. The least preferred is the disposal of waste.

The preferred waste management practices are aligned with international environmental law and NEMWA (Act No. 59 of 2008). They contribute to the achievement of SDGs relating to waste management. These indigenous solid waste management practices can help transition the linear economy to the circular economy; they make waste valuable and preventative in its application.

The least preferred indigenous solid waste disposal practices, on the other hand, do not comply with international environmental law and NEMWA (Act No. 59 of 2008). These practices do not accommodate the precautionary principle, prevention principle, rectification principle, or principle of sustainable development. They have negative responses to drivers, pressures, states, and impacts.

Indigenous management of solid waste is learned through observing and doing until it becomes part of the character. Its transfer is linear, and mostly from the waste management exemplars to the inexperienced members of society. Indigenous solid waste management practices are a response to drivers, pressures, states, and impacts. There is an integration of indigenous solid waste management between stakeholders, governance, response mechanisms, and drivers.

CHAPTER 5: MUNICIPAL WASTE MANAGEMENT IN THALAHANE VILLAGE

5.1 Introduction

The previous chapter was about the state of indigenous waste management in Thalahane village. This chapter outlines the research findings on municipal waste management in Thalahane village. The findings came from interviews with the participants, visits at the household level, and document analyses of the Integrated Development Plan and Waste Management Plan for Blouberg Municipality. These findings are discussed theme by theme under the following research objective:

5.2 An analysis of the implementation of waste management system by Blouberg local municipality in Thalahane village

The themes were developed from interviews and document analyses of the Blouberg Integrated Waste Management Plan and the Blouberg Integrated Development Plan. The number of themes was developed as follows: The Thalahane community is too far from the landfill, and the Thalahane community lacks waste transport equipment to transport waste to the landfill. The themes discussed are as follows:

5.2.1 Long distance of Thalahane community from the landfills of Blouberg Municipality

The municipal participants indicated that the municipality relies mainly on collecting waste and transporting it to the landfills, and that they have two landfills which are far from Thalahane village. A landfill or rubbish dump is a legal site chosen to dispose of waste that cannot be reused, recycled, or recovered. From the document analysis of the Blouberg Integrated Waste Management Plan, it was also established that Blouberg Municipality has two landfill sites. One is in Alldays, and the other is in Senwabarwana. According to the municipality's Integrated Waste Management Plan, waste

“has to be transported to its landfill sites in distances of over 100 km return trips, and this has a huge overhead cost for the municipality”.

That the landfills were too far from Thalahane village was also confirmed by one of the participants when he said:

“The place chosen for us to go and dump our waste is too far away; that is why there are illegal dumping areas in the village”.

That statement accounted for the uncontrolled dumps in that area. That statement also accounted for the ‘out of the yard’ strategy of waste management by the community.

Even though landfilling and refuse removal are key in the Blouberg Municipality, South Africa’s National Waste Management Strategy says otherwise. South Africa’s National Waste Management Strategy seeks to ensure that the waste management hierarchy is carried out (DEA, 2012). In terms of waste management hierarchy, reduce, reuse, and recycle are to be prioritised. However, landfilling is prioritised by the Blouberg Municipality in Thalahane village. According to Machete and Shale (2015), during implementation, landfilling is prioritised, defeating the goal of South Africa’s National Waste Management Strategy of recycling. This is supported by DEA (2012) and Tirado-Soto and Zamberlan (2013). According to the DEA (2012), ninety (90) percent of the waste generated is destined for landfills. The landfills in the Blouberg Municipality are open-air dumps. Open-air dumps are associated with major environmental risks. In addition, they lead to major health risks. Furthermore, landfilling has a seriously high expenditure on solid waste management services for the municipality and their local communities (Catherina, Phillip & Jacoba, 2016; D’Onza *et al.*, 2016). This causes budgetary constraints and financial unsustainability in municipalities.

5.2.2 Thalahane community’s lack of waste plants and equipment

Waste plants and equipment refer to waste compactors, tractors, X-chasis and industrial bins, and home-use bins meant for the transportation and storage of waste. It is the competence of the Blouberg Municipality to provide waste plants and equipment to assist

in the management of waste in Thalahane village. However, it is not feasible in terms of the municipality's budgetary constraints and the geographical and spatial character of the municipality. According to the Blouberg Integrated Waste Management Plan,

“The backlog is 24139. Challenges are funding for the rollout of refuse services to all settlements”.

There was no equipment from the municipality to assist in the village, and this was supported by one of the participants when he said:

“We do not have cars to transport waste to where it was supposed to be dropped; that is why the things we do want in our yards are thrown out of our yards”.

The provision of waste bins is the competence of the municipality. In this case, Blouberg municipality. The Blouberg Integrated Waste Management Plan indicated that the municipality has about seven thousand and five hundred (+7500) waste bins, and according to Statistics South Africa (Census, 2011), the Blouberg Municipality has forty-one thousand, one hundred and ninety-two (41192) households. The difference between the stock on hand of waste bins and the number of households is about thirty-three thousand and six hundred and ninety-two (33692). This means there is a shortage of about three hundred thousand, six hundred and ninety-two (33692) waste bins. There is a significant shortage of waste bins. The Blouberg Integrated Waste Management Plan indicated the list of villages covered when it comes to the supply of waste bins. The list is as follows:

Senwabarwana, Dilaeneng, Puraspan, Avon, Indermark, Kromhoek, Devrede, Taaibosch, Alldays, Longden, Grootpan, Burgerrecht and Motlana. Thalahane village was not included on the list of villages that were provided with waste bins. This attests to the fact that there were no waste bins in Thalahane village. This fact was also confirmed by the participants.

5.2.3 Waste services in Thalahane village

The fact that Thalahane village was not provided with waste bins and that they did not have the equipment to transport waste to the landfill, which was too far away from them, and that the provision of those necessities was the competence of the Blouberg Municipality, led to the conclusion that Thalahane community lacked waste removal services and that the Blouberg Municipality was not successful in conducting solid waste management services in Thalahane village. The Blouberg Integrated Waste Management Plan summarises waste management challenges as follows:

“Capacity constraints: this involves a lack of resources (financial and human) to roll out the service to the entire municipal area. The available plant and personnel are not enough to render the service in all areas. For the past two financial years, the municipality could not purchase plant and refuse bins due to budgetary constraints. The two landfill sites available are not licenced since they don’t comply with legal requirements for proper landfill sites.”

The lack of enough financial and human resources makes it difficult for the municipality to provide proper waste management services in Thalahane village. This was confirmed by the municipal staff members during interviews. The municipal participants indicated that the municipality’s waste management finds its basis of existence in terms of Section 15(1)(a) of the Constitution of the Republic of South Africa read with Schedule 5 and the National Waste Management Strategy 2020, but the major function in complying fully with their function is a lack of enough funding. Lack of enough funding, according to the municipal participants, affects the procurement of waste service equipment and the hiring of enough staff, thereby making it difficult for them to extend the waste service to all the villages under their care, Thalahane village being one of them. The municipality is expected to prioritise the 3 Rs in waste operations, but a lack of funds poses a problem.

5.2.4 Lack of enough public participation in matters relating to waste

The municipal participants, when asked about public participation in matters relating to waste, indicated that the participation was not satisfactory; that is, most village members

did not turn up. This, according to them, affects the IDP and Municipal Waste Management Plan. The municipality is willing to listen to the voices of villagers in the municipality in matters relating to waste management, but a lack of enough participation is a stumbling block to the integration of the people's views. This is the case even when the municipality intends to integrate the informal waste pickers into the municipality system. The integration of informal waste practices and formal waste practices lacks a framework.

5.2.5 Lack of implementation of EPR

The municipal participants, when asked about the implementation of EPR, indicated that EPR has not yet taken off the ground in their municipality.

5.2.6 Blouberg municipality waste management and DPSIR

In Chapter Four, it was noticed that the Thalahane community experienced drivers, pressures, states, and impacts that triggered a response from them. In this section, the Blouberg Integrated Waste Management Plan and Blouberg Integrated Development Plan were analysed to check how the municipality responds to the challenges of waste management in their locality.

Response 1: Two landfills were built to assist the local communities. The landfills are far from Thalahane village. Hence, the community cannot use it. Therefore, this response is not effective for the community of Thalahane. The burning of waste, burying of waste, and disposal of waste in pit yards and open fields are unsustainable waste management practices that are encouraged by landfills that are inaccessible to society due to a lack of transport.

Response 2: The municipality bought equipment like waste compactors, tractors, X-Chasis, industrial bins, and home use bins. The list of areas earmarked to be serviced by this equipment excludes Thalahane village. Therefore, this response is not effective in Thalahane village as it does not bring relief to pressures, states, and impacts.

Response 3: The municipality has wide priorities. Priority number 09 is 'Healthy and Safer Environment and Waste Management. The ineffectiveness of responses 1 and 2, makes this response unattainable.

Effective responses, in most cases, act as “system drivers” as they change the status quo of an existing waste management system in a positive direction as they address the pressures, states, and impacts of waste through the recovery, recycling, and reuse of resources, the minimization of waste streams and the alleviation of negative system drivers. The three responses from the municipality do not act as system drivers because they do not change the status quo of existing waste management problems like the burning of waste, burying of waste, and disposal of waste in pit yards and open fields, nor they alleviate the pressures, states, and impacts on the environment. The threat to public health, animal health, cleanliness, and environmental degradation continues. Generally, the responses of the municipality have little effect on the drivers, pressures, states, and impacts experienced in Thalahane village.

5.3 Blouberg municipality waste management and Extended Producer Responsibility

The Extended Producer Responsibility came into force on the 5th of May 2021. There is no visible impact of Extended Producer Responsibility in Blouberg municipality. But in terms of the EPR regulations, the responsibility for the effective and efficient management of end-of-life products lies with the producer. If the EPR is well implemented, then this will assist the Blouberg municipality to respond positively to the drivers, pressures, states, and impacts.

5.4 Chapter summary

This chapter answered the question of how Blouberg municipality implements solid waste management in Thalahane village. The municipality does not have enough waste management plants and types of equipment to cater to all the villages in the municipality. It has a waste management backlog of 24 139. This is coupled with capacity constraints

in terms of financial and human resources to roll out the waste service to the entire municipality. Capacity constraints negatively affect how the municipality responds to the drivers, pressures, states, and impacts in Thalahane village. Thus, we cannot address the threats to environmental protection and public health. Thalahane village is one of the villages in which municipal waste management is almost nonexistent.

CHAPTER 6: FRAMEWORK INCORPORATING INDIGENOUS WASTE MANAGEMENT PRACTICES IN MUNICIPAL INTEGRATED PLAN (IWMP)

6.1 Introduction

The previous chapter was about municipal waste management in Thalahane village. This chapter is about a framework incorporating indigenous waste management practices into the municipal integrated waste management plan (IWMP). The findings were the result of interviews with the participants, visits to households' waste management sites, and document analysis of the Integrated Development Plan and Waste Management Plan of Blouberg municipality. The guidelines for the development of integrated waste management plans (IWMPs) by the Department of Environmental Affairs were also used to assist in drawing an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste practices. These findings are discussed per theme under the following research objective:

6.2 Development of an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.

This section aims to develop an integrated, sustainable solid waste management plan for Thalahane village that accounts for indigenous knowledge. The first step was to develop a framework for how to draw an integrated sustainable solid waste management plan that accounts for indigenous knowledge. At present, there is no known framework to achieve that. The framework that attempts this is the Modernised Mixture Approach (MMA). The challenge with the Modernised Mixture Approach is that indigenous waste management systems are used in 'small-scale decentralised systems' (Kosoe *et al.*, 2019). With the developed framework, there is a move away from 'experts' coming up with solutions for the local people (Sillitoe & Bicker, 2004; Ross, 2018) to a situation where the local people are an important stakeholder in matters that affect them (Ojolowo & Wahab, 2017). In this case, solid waste management matters. The use of indigenous solid waste practices in solid waste management is encouraged by UNEP (2015) and Hammed *et al.* (2016). Akpabio & Subramanian (2012) asserted that "programme intervention will have to

depend on available local institutions and groups in a manner that utilises dialogue and information dissemination practices to succeed”. Successful solid waste management systems in developed countries have limited applicability in developing countries because they immobilise indigenous solid waste management systems and disregard indigenous context and conditions. What follows is a diagrammatic representation of the developed Indigenised Integrated Sustainable Solid Waste Management framework.

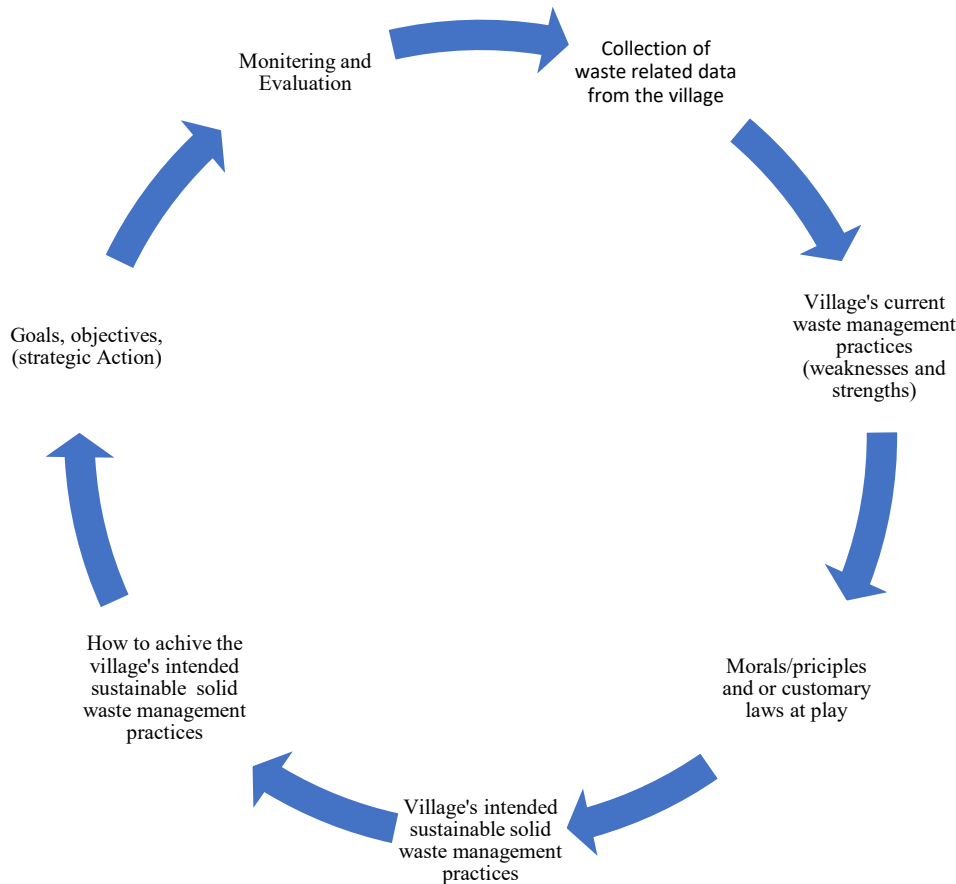


Figure 6. 2: Indigenised Integrated Sustainable Solid Waste Management framework

The framework covers the following: a collection of waste-related data from the village; the village’s current waste management practices (weaknesses and strengths); morals, principles and/or customary laws at play; the village’s intended sustainable solid waste management practices; how to achieve the village’s intended sustainable solid waste management practices; goals and objectives (strategic action); monitoring and evaluation.

The collection of waste-related data should be done using relevant data collection methods. It can be interviews, focus groups, or any data collection method that is appropriate to the situation. The village's current waste management practices (weaknesses and strengths) look at what was practiced in waste management during that period. It arises from the data collected. Then the practices are looked into in terms of their strengths and weaknesses. The strengths are built upon, and the weaknesses are discontinued. Morals, principles, and/or customary laws at play have to do with values. A village's intended sustainable solid waste management practices have to do with where the community wants to go in terms of waste management, or their aspirations. How do the village's intended sustainable solid waste management practices deal with the ways and means to achieve the aspirations of the community in terms of waste management practices? The goals and objectives should be what to achieve in the long run and what to achieve in the short term. It will also carry the specific tasks, what will be done, and by whom. Monitoring and evaluation are about supervising, observing, and checking the progress and quality of progress and assessing and making judgements about the goals and objectives. Once the framework was in place, then an integrated sustainable solid waste management plan was drawn as follows:

Collection of waste related data from the village

The collected data led to the following themes: the Thalahane community practiced the separation of waste and the burial of waste underground. In addition, the Thalahane community turned waste into compost, reduced waste by burning it, reused potential waste into something useful, used waste for trapping and scaring birds and animals, stored metal and glass for waste pickers, used backyard pits for waste disposal, took waste out of their yard to manage it, and the methods of managing waste were affordable. Furthermore, the Thalahane community was too far away from the landfills and lacked waste plants and waste equipment to transport waste to the landfills. These themes were discussed in detail in 4.2 and 4.3. The collected data assisted in establishing the current state of waste in Kgatalala village.

The village's current state of waste management practices

From the collected data, it was also established that the village has both good and poor practices of solid waste management. The judgement is made in terms of public health and the environment. Solid waste practices that promote good public health and environmental protection are regarded as good practices, while those that inhibit good public health and environmental protection are regarded as poor practices. In addition, practices that promote good public health and environmental protection are regarded as representing the strength of the practices, and those that do the opposite are regarded as representing the weakness of the system.

The strengths of the village's solid waste management are drawn from the following list: the Thalahane community practiced separation of waste, turning waste into compost, repurposing potential waste into something useful, using waste for trapping and scaring birds and animals, and separating metal and glass for waste pickers. Their methods of managing waste were affordable. These are the practices that represent the strength of the practices, as they bring the added benefit of ensuring the achievement of the sustainable development goals (SDGs) for the village. For the village's solid waste practices to improve, these practices should be used as building blocks.

The following is a list of practices that represent the weaknesses of their practices: the Thalahane community is far away from the landfills and lacks waste plants, waste equipment to transport waste to the landfills, and the burial of waste underground. As a result, the Thalahane community reduced waste by burning it, using back-yard pits for waste disposal, or taking waste out of their yard to manage it. These practices were found to contribute to odours, indiscriminate dumping, littering, environmental degradation, and sickness in people and animals. Therefore, these practices should be discouraged.

The community has an added advantage in that they can work communally. For example, they can offer communal labour when it comes to community activities, such as the digging of graves. This can be regarded as an opportunity that can be exploited for the benefit of solid waste management in the area. Community members can also team up to remove and clean dumping areas and deal with littering. Furthermore, respect for one another and traditional leadership can be used to monitor the situation.

Morals, values, and customary laws at play

At the household level, parents are regarded as waste management exemplars and the custodians of morals and customary laws. However, at the village level, the local traditional leaders are regarded as the custodians of morals and customary laws. What runs through the village is respect. It is respected in families between the young and the old, between families, and for traditional leadership. Anyone who is seen as lacking respect is regarded as an outcast. Taboos also play a role in ensuring what ought to be done and what ought not to be done. Some of the taboos that were highlighted by the participants were that one cannot take the waste out of the yard at night; one cannot sweep the yard at night; and one cannot sweep the house at night.

The village's intended sustainable solid waste management practices

To achieve this, the participants indicated what they liked and disliked about the current waste management practices. Most participants disliked indiscriminate dumping. One participant complained that he was living next to a dumping place and that it brought bad smells during rainy seasons. Even those who were not living next to the dumping site shared the same sentiment but added that their animals fed from those dumping places. One participant also reported that he no longer eats the intestines of animals that have been slaughtered locally because of what the local domestic animals feed on. Others complained about backyard pits. They were saying the backyard pits are dug at the corner of the yard because no one wants them next to his house, as they tend to attract flies and produce bad smells. Reducing waste by burning it was also a problem for them, as it produces bad smells.

The participants did not have a problem with composting solid waste, repurposing solid waste, or separating solid waste. All of them liked those practices, as they were benefiting from them in one way or another. With the composting of waste, the added benefit was that the compost would be used as fertiliser for their plants. With the repurposing of waste, according to the participants, they were able to create things they did not have without buying them. They were also able to feed their animals with waste food materials.

Besides what they liked and disliked, they also indicated that there are things they would like to see happen to assist in solid waste management. For example, they wanted the municipality to assist them with refuse removal. They also wanted to improve the enforcement of their good solid waste management. They also wanted enforcement to stop the practices that they disliked.

Goals and objectives

From the interviews, the researcher was able to separate things that the community wanted to be done urgently and those that could be done in the long run into objectives and goals. The objectives were found to be the following: minimising exposure of solid waste to human beings and animals; minimising exposure of solid waste to air, water and soil; and minimising disposal of solid waste generated. The goals were as follows: reduce

the risk of public health, animal health, and environmental degradation; reduce uncontrolled dumping; improve waste education awareness and promote cleaning campaigns; and build on the best practices of local indigenous solid waste disposal practices.

Monitoring and evaluation

Most participants wanted parents to provide monitoring at the household level. Regarding this, one participant said that every house should be policed by the parents. They also extended monitoring to include local traditional leadership at the village level. The evaluation was left to the parents and the local leadership.

Thalahane village's integrated sustainable solid waste management plan that accounts for indigenous solid waste management practices

The researcher used the preceding information, collected from the participants, to draw an integrated sustainable solid waste management plan that accounts for indigenous solid waste disposal practices. The plan is as follows:

6.4.1 Part 1 – Introduction

This integrated sustainable solid waste management plan was developed for Thalahane village in Blouberg Municipality, Limpopo. It was done to improve solid waste management in the area through the use of effective and sustainable indigenous practices. Data was collected from the community and through the Indigenized Integrated Sustainable Solid Waste Management (IISWF) Framework. It was turned into the Integrated Sustainable Solid Waste Management Plan, which accounts for indigenous solid waste practices. Based on that information, the village's intended sustainable solid waste management and how to achieve it, as well as the goals, and objectives of the ISSWM, were drawn.

Thalahane village's intended waste management practices: To create an environmentally friendly, sustainable solid waste management system for good public health that accommodates indigenous disposal practices.

How to achieve Thalahane village’s intended waste management practice: To use partnerships with the Blouberg Municipality, Thalahane village’s waste disposal practices, waste education awareness and promotion of cleaning campaigns, available resources, the 3Rs initiative, assessment, and development to achieve excellence in waste management in Thalahane Village.

Goals

1. Reduce the risk to public health, animal health, and the environment
2. Reduction of indiscriminate dumping
3. Improving waste education and awareness and promoting campaigns
4. To build on the best practices of indigenous solid waste disposal practices

Table 6. 4: Goals and objectives of Thalahane waste management

	Goal1	Goal 2	Goal 3	Goal 4
	Reduce the risk to people’s health and animal health	Reduction of indiscriminate dumping	Improving waste education awareness and promoting cleaning campaigns	To build on the best practices of Thalahane indigenous solid waste disposal practices.

Objective 1	Minimise the exposure of solid waste to human beings and animals	Minimise places of illegal dumping	Reach out to more community waste management. Educate the community about waste	To identify effective Thalahane indigenous solid waste management practices
Objective 2	Minimize exposure of solid waste to the air, water, and soil	Clean up places of illegal dumping	Create awareness about waste	To examine Thalahane's indigenous solid waste management practice
Objective 3	Minimise the disposal of solid waste generated	Minimise the solid waste generated	Promote effective waste management and good practices	To implement the best Thalahane indigenous solid waste practices

Benefits

The benefits are the following: To assist the community of Thalahane village in realizing their intended sustainable solid waste management plan that accounts for indigenous solid waste management practices. To improve the level of waste management in Thalahane village to be in line with the national policy on waste in South Africa, specifically South Africa's National Waste Management Strategy. To make sustainable development goals (SDGs) realisable in Thalahane village, especially the ones on climate change, clean water, and sanitation.

Methodology

The Integrated Sustainable Solid Waste Management (ISSWM) plan for Thalahane was drawn using the Indigenized Integrated Sustainable Solid Waste Management framework, adapted from the Strategic Planning (SP) process. Preparation was done through the collection of data from the participants. The data was collected through unstructured interviews, visits at household-level waste management sites, and document analysis. What was observed is that dumping in backyards does exist; composting is happening, and there are dumping sites in the village. The document that was analysed is the Blouberg Municipality Waste Management Plan. The SWOT analysis was done to establish the current situation of waste management. The morals and customary laws at play were established. The intended waste management practices were established to determine where the village should be in terms of the waste management of Thalahane village. Then it looked at how to achieve the intended waste management practice, relating to ways to get to the intended waste management practices. To enable the intended waste management practice to be realisable, goals and objectives, and strategic action plans, were drawn. Furthermore, the strengths were identified, and waste management was built upon them. The weaknesses were also identified, and measures were taken to eliminate them. Finally, opportunities were identified and exploited for the improvement of waste management. Threats were identified, and measures were taken to defend against them. The goals and objectives were set using information from the participants. Then mechanisms were put in place to ensure that there is monitoring and evaluation. All these formed parts of the integrated sustainable waste management plan that accounts for indigenous solid waste practices.

Challenges identified from the collected data

- Insufficient plant and equipment for waste management
- Insufficient human resources for waste management
- Landfills that were too far from communities
- Poor solid waste management practices
- Unsafe disposal facilities

- Lack of enforcement of good practices

Section 1

General Goals Statement

This integrated sustainable waste management plan was developed by the researcher to provide the Thalahane community with a set of goals that include indigenous waste practices to implement and monitor. Based on the challenges identified during the interviews with participants, the following goals for the ISSWM (Integrated Sustainable Solid Waste Management Plan) plan were drawn:

Table 6. 5: Thalahane village's goals for the integrated sustainable solid waste management plan

Goal1	Goal 2	Goal 3	Goal 4
Reduce the risk to public health and animal health	Reduction of uncontrolled dumping	Improving waste education awareness and promotion campaigns	To build on best practices of Thalahane indigenous solid waste disposal practices

Section 2

General Description

Thalahane village is found within the Blouberg Municipality of Limpopo Province, South Africa. It is at the base of Blouberg Mountain. It is rural, with no industrial activities taking place. It has a population of about four hundred and fifty-three households, with many members not economically active.

6.4.2 PART 2 - Solid Waste Generated

The waste generated is household waste and demolition waste consisting mainly of paper, glass, metals, plastics, yard debris, rubble, and very little e-waste (electronic waste) like radios, TV, and cellphones.

6.4.3 PART 3 - Existing Solid Waste System

It is an indigenous way of disposing of waste. The means employed to deal with waste were as follows: Thalahane community practiced separation of waste, burying of waste underground, turning waste into compost, reducing waste by burning it, repurposing potential waste to something useful using waste for trapping and scaring off birds and animals. The Thalahane community also stored metal and glass for waste pickers, used back-yard pits for waste disposal, and took waste out of their yards to manage it. Lastly, their waste management was affordable. Every household had to decide which way was suitable for the generated waste. The landfill was about thirty kilometers away from the village. However, there was no transport to take waste to the landfill. As such, the out-of-the-back-yard strategy was used to deal with waste that could not be dealt with through other indigenous waste strategies, which resulted in uncontrolled dumping.

6.4.3.1 Solid waste system needs

There was a need for the community to improve on the out-of-the-back-yard strategy. This necessitated rubbish bins and controlled dumping sites. There was also a need for transport, to transport waste to landfills. Uncontrolled dumping sites had to be cleaned and eliminated through cleaning campaigns in the community. There was also a need to improve on burning, burying, and back-yard pit waste management strategies, as they contributed to air, soil, and water pollution.

6.4.4 PART 4 - Special Waste

The waste that required special attention was the following: construction and demolition waste, electronic waste (E-waste), tyres, and medical waste. Most of these were dealt with using the out-of-my-place strategy.

6.4.5 PART 5 - Waste Education and Awareness Campaign

Indigenous waste practices were transmitted to others orally and through action from the parents. It was done at home through talking and doing. This covered the following:

There was a need to make it more formal, concentrating on the 3 Rs (reduce, reuse, and recycle). That should be done through a door-to-door campaigns and school outreach. However, the door-to-door campaigns, though effective, are time-consuming and expensive. The cheapest method is outreach at special events like community meetings, funerals, and weddings.

6.4.6 PART 6 – Implementation

The Thalahane parents and community leaders will be responsible for the implementation of the ISSWM plan, in consultation with a solid waste manager from the Blouberg Municipality. At the household level, each household member should take charge of waste. Monitoring will be done by the parents, the community leadership, and the solid waste manager from the Blouberg Municipality.

Table 6. 6: Thalahane village integrated sustainable solid waste management activity plan

What?	Who?	When?	How much?
<ul style="list-style-type: none"> • Reducing generated waste • Reuse of 	Household members	Everyday	N/A
		Everyday	N/A

<p>generated waste</p> <ul style="list-style-type: none"> • Recycling of generated waste 	Household members	Monthly	N/A
<ul style="list-style-type: none"> • Transportation of waste to landfills 	Community and municipal waste official	Once a week	R300 per load.
<ul style="list-style-type: none"> • Cleaning campaign 	Municipal waste officer, community, schools, and municipal waste officials	Once a quarter	N/A
<ul style="list-style-type: none"> • Waste education and awareness campaign 	Community waste official and household	Once a quarter	N/A
<ul style="list-style-type: none"> • Monitoring uncontrolled dumping 	Community and household members and the municipality	Everyday	N/A
<ul style="list-style-type: none"> • Monitoring targets 	Municipal waste officials, and	Once a month	N/A

	community members	Once a month	N/A
	Municipal waste officials and community leadership		

6.5 Key observations at the household waste management sites and document analysis

Visits to solid waste management sites were also used as a data collection method. It was done not only to collect data but also to verify the data that was collected during interviews. Participants mentioned back-yard pits, composting of solid waste, and burying of waste as their waste management practices. The researcher went and visited the actual waste management sites to bring synergy between what the participants said and what was happening at the household level. The researcher also went and visited the dumping places, where the community dumped waste when using the out-of-the-yard strategy of disposing of waste. Through these visitations, the researcher confirmed that there is composting of solid waste, repurposing of solid waste, burying of solid waste, back-yard pits for solid waste, and dumping places due to the out-of-the-yard strategy of disposing of solid waste. Observation assisted with the validation of the findings. These findings were discussed under 4.2.

Document analysis was done on the following Blouberg Municipality documents: the Integrated Waste Management Plan and the Integrated Development Plan. The key findings from the two documents were as follows: The Blouberg Municipality does not have enough plants and equipment to cater to all the villages under its authority. Furthermore, Thalahane village is one of the affected villages. The municipality has two landfills, which are both open-air dumps. The municipality does not have enough human resources for solid waste management. The challenges of plants, equipment, and human

resources are due to the financial constraints that the municipality is experiencing. The municipality has a backlog in terms of solid waste management services, which is attributed to the historical standing of the municipality. The municipality was under the former homeland of Lebowa, which did not prioritise issues of solid waste management. A detailed discussion of document analysis was presented in 4.3 (to investigate how the Blouberg Municipality conducts solid waste management services in Thalahane village).

6.6 Discussion

After interacting with the participants and having gone through the IDP (Integrated Development Plan) and IWM (Integrated Waste Management Plan) of the Blouberg Municipality, the researcher believes there is enough evidence to prove the existence of indigenous disposal practices in Thalahane village. These practices were transmitted orally from generation to generation. These practices provided important social benefits, and improved public health, increased tolerance, and opportunities for the community to have a clean environment, thereby enhancing the quality of life and the well-being or welfare of both individuals and communities. There was a cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, social habits, meanings, and language associated with waste practices. These know-how practices for waste management were developed and maintained by the community members as they interacted with their natural settings.

Some of these practices tended to falter with the advent of new waste materials, such as e-waste and other non-biodegradable waste materials. However, some of those practices were found to be in line with the 3 Rs (reduce, reuse, and recycle). This meant that they were in line with international trends and also complied with NWMS (National Waste Management Strategy) and NEMA (National Environment Management Act). What was beneficial about them was that they were found to be cost-effective in the sense that even the poor could afford to implement them. Such waste practices can be implemented by municipalities to close the gap created by human and financial resource challenges. What was also interesting was that the ISSWM plan for the Thalahane village could be drawn,

which accounts for the indigenous waste practice. Therefore, sustainable indigenous solid waste practices were useful for the ISSWM plan.

6.7 Chapter summary

The findings showed that the local community at Thalahane village used the following indigenous solid waste disposal practices to deal with solid waste: the community practiced separation of waste, burying of waste, turning waste into compost, reducing waste by burning it, and repurposing of potential waste to something useful. The Thalahane community also used waste for trapping and scaring off birds and animals. Furthermore, the Thalahane community separated metal and glass waste for waste pickers. The Thalahane community used back-yard pits for waste disposal and took waste out of their yards, to manage it, and these methods of managing waste are affordable.

The practices are divided into good practices and poor practices. The implication is that good practices are effective, irrespective of their origin. The good practices from Thalahane village, therefore, can contribute to the solutions to the challenges faced by developing countries in solid waste management. What is even an added benefit is that the practices are affordable. From the literature review, it has been established that one weakness of the systems that have been successful in developed countries is that they are too expensive for developing countries to have and maintain. Hence, the unwillingness on the part of the service beneficiaries to pay for the services.

The study outlined the indigenous solid waste practices in Thalahane village and went a step further by creating an indigenised integrated sustainable solid waste management framework that can help account for the indigenous solid waste disposal practices. It went on to use the framework in practice by using it to draw a Thalahane integrated sustainable solid waste management plan that can account for indigenous solid waste disposal practices. The framework is flexible, as it is adaptable to different contexts and conditions.

The study confirmed that the history of waste management in developing countries, with Thalahane as a case, is as old as humankind. The study also provided a solution to the challenge of the limited applicability of the successful experience of solid waste management in developed countries when it is directly transplanted to developing

countries. The solution lies in an integrated sustainable solid waste management plan that accounts for indigenous solid waste disposal practices. This legitimises the plan and renders it acceptable to the community. Then the community will take ownership of the plan and run with it.

CHAPTER 7: DISCUSSION OF FINDINGS

7.1 Introduction

This chapter covers the restated research questions, a summary of the findings, interpretation of the findings, implications of the findings, and conclusion.

The research questions are as follows:

- Which indigenous solid waste management practices does the Thalahane local community use to manage solid waste?
- How does Blouberg municipality implement solid waste management in Thalahane village?
- How can an integrated sustainable solid waste management plan for Thalahane village be developed that accounts for indigenous solid waste management?

7.2 Summary of findings

The findings of the study suggest that the community of Thalahane village lacks formal solid waste management but has informal solid waste management practices based on indigenous knowledge. These indigenous solid waste management practices are learned at home and then from the rest of the community. This form of solid waste management is affordable to the local community. The strategies used in managing waste included prevention, repurposing, reuse, recycling, burning waste, burying waste, discarding waste out of the yard, making fire from waste, feeding domestic animals with left-overs, using residue from ploughing fields as feed, and Ubuntu/ Botho assists the community to comply with their own indigenous solid waste management practices.

The findings also indicated that Blouberg Municipality's waste management finds its basis of existence in terms of Section 156(1)(a) of the Constitution of the Republic of South Africa, read with Schedule 5. Its waste management strategy rests on the National Waste Management Strategy 2020. The municipality recognises the waste theory of 3 Rs (reduce, reuse, and recycle), and it is working towards contributing to the achievement of

the National Development Plan. The municipality communicates with the people in the villages through ward committees, councillors, and IDP meetings, but there is not enough public participation. The municipality has municipal solid waste management plan, but there is a challenge of a lack of funds, waste management equipment, and staff. The municipality is not able to deliver waste services across all its villages, Thalahane included. The municipality has two landfills and relies mainly on collection-based waste management services. There is also a challenge with the implementation of EPR in the municipality. The municipality is willing to accommodate indigenous solid waste practices that comply with the 3Rs. The municipality is willing to work with indigenous solid waste management holders as stakeholders in waste management. The municipality indicated the need for a framework to incorporate informal waste sector into the MSW plan.

7.3 Findings in the context of literature

There is a lack of formal solid waste management in Thalahane village, but there are informal waste practices based on IK. These waste practices are indigenous to the Thalahane community. UNESCO (2006) and Hadlos, Opdyke and Hadigheh (2022) assert that IK is about practices that are commonly practised in the communities that are indigenous to a specific place. The specific place in the study is Thalahane village. Nicky *et al.* (2013) see IK “as a large body of knowledge and skills that are developed outside the formal educational system, and is embedded in culture, and is unique to a given location or society” Warren (1991) and Mohoang (2022) add that IK is dynamic. Thalahane indigenous solid waste management practices were developed by past generations through their experience with waste challenges, and they have stood the test of time (BHAT *et al.*, 2018; Holtorf and Högberg, 2022). Therefore, the indigenous solid waste management practices of Thalahane village are a product of lived experience. The knowledge is informal as it ‘comes outside the formal educational system’. Therefore, the knowledge is experiential rather than theoretical.

The indigenous solid waste management practices of Thalahane village are dynamic (Nicky *et al.*, 2013; Mohoang, 2022). That is, knowledge is not static but evolves over time to respond to changing times and to new challenges posed by waste. Therefore, the knowledge can be adaptable to different conditions and context, as such, it can contribute

towards resolving the challenges facing rural municipalities where services are not able to reach villages. The dynamic nature of knowledge makes it easy to adapt to the current era of Agenda 2030.

Ross (2018) is lobbying for a departure from the development model of 'experts' designing and implementing solutions for local communities that have been transplanted to another place. Wilson et al. (2013) call for the tailoring of services to local conditions. Keita *et al.* (2010) emphasise inclusivity in the provision of waste services as important to beef up where municipalities lack capacity to provide full service to poor communities and informal settlements. Thalahane indigenous solid waste management practices are a support to this call by Ross (2018) to a state where local conditions and factors, including indigenous waste management practices and traditional beliefs (Ojolowo & Wahab, 2017; Sono *et al.*, 2022). IK is the foundation of decisions taken by the Thalahane community when it comes to solid waste management practices. IK in Thalahane village is rich with human-environment interaction (Wahab & Ogunlola, 2014; Patel & Patel, 2022); as such, it is the cornerstone of that community when it comes to human-environment interaction. Scheinberg et al.'s (2011) research work indicates that many municipalities have an active informal sector, which has been shown to save municipalities around 20% or more of their waste management budget, but Velis *et al.* (2012) indicated the challenge of integrating the informal sector with the formal sector. This is the case in Blouberg municipalities. One of the findings is that the municipality does not have an integrated solid waste management plan for Thalahane village that accounts for indigenous solid waste management, and this led to the municipality failing to have a community-based waste management plan for Thalahane village. Hence the call by Memon (2010) for inclusive plans prepared in a participatory manner to serve without discrimination all parts of the user community (Bullu, 2022).

The Blouberg municipality faces the challenge of a lack of funds to deliver waste services to all its villages. This is supported by Chen *et al.* (2010) and Batista et al. (2021) when they say that developing countries have significant problems managing solid waste due to limited resources (financial and social). This situation is made worse by the 'copy and paste' that is applied by developing countries from developed economies without regard

to their context and situation (Topić & Biedermann, 2015; Zhang & Liu, 2022), and they go on to indicate that it is necessary that areas develop ways of thinking to develop individual solutions to solid waste management challenges that are appropriate to their own specific history, economy, demography, and culture in accordance with their unique institutional, environmental, and financial resources. This is supported by Chand Malav *et al.* (2020) when they raise the need to identify the ISWM alternatives available that must be the most effective, attainable alternatives adapted to society to reduce environmental damage caused by municipal solid waste. Wilson *et al.* (2013) propose that,

“...solutions need to be developed locally and tailored specifically to local needs and conditions. Users and potential users need to be involved in designing their own services, which in turn need to be delivered by a diversity of types of service providers. Critically, those services must be provided at a cost that is locally affordable”.

Indigenous solid waste management practices have always been found to be locally relevant, and Ajibade (2007) and Wang *et al.* (2022) made the call that indigenous solid waste management should be developed and improved where necessary for the good of society as they are affordable and cut across all the classes in Thalahane village.

The strategies used in Thalahane to manage waste in an indigenous way included reuse, repurposing, recycling, and energy recovery. The objective of solid waste management is to defeat waste accumulation. Abbasi (2018) and Mohoang (2022) advance reuse, recycling, and recovery as strategies to conquer waste accumulation. These strategies are in line with the National Waste Management Strategy (2020) and have been found to be sustainable. This means reuse, repurposing, recycling, and energy recovery as used by Thalahane people, can also be used at the municipal level to defeat waste accumulation. Currently, Blouberg municipality mainly relies on waste collection services to avoid waste accumulation. The waste collection service deports the waste problem from the settlements and creates it at the landfills. Landfills in Blouberg municipality are open-air, and as such, release greenhouse gas emissions. According to Caiado *et al.* (2017), the main contributor to global warming is greenhouse gas emissions related to

waste. The afore-mentioned indigenous waste of Thalahane village defeats waste accumulation, and at the same time, diverts waste away from the landfill. The Thalahane indigenous solid waste management strategies, like using waste as manure or composting and feeding domestic animals with left-over foods, defeat the accumulation of waste and divert waste from the landfill. Composting has adequate plant nutrients and is beneficial as fertiliser as it does not temper with the ecosystem. It is done from organic wastes such animal faeces, farm residue, food, and dead plants (Ajibade, 2007). Machete *et al.* (2015) indicated that organic waste material is the most commonly produced waste in South Africa; therefore, composting can be a relevant strategy to deal with waste in South Africa.

Reuse, repurposing, recycling, energy recovery, composting, and feeding of domestic animals with leftover food, as well as turning waste from the ploughing fields into animal feeds, assist in preventing waste (Khan *et al.*, 2022). This means these strategies are in line with the Prevention Principle 21 of the Stockholm Declaration. In terms of this environmental principle, restricting environmental degradation is better than repairing environmental damage. These indigenous strategies also comply with the sustainable development principle, which is mainly about environmental protection. These indigenous solid waste management strategies also comply with international environmental standards, which are the basis of environmental multilateral agreements. According to the international environmental law, nations must control the Anthropocene by resolving the most damaging environmental challenges.

The findings indicated that the municipality is willing to accommodate indigenous solid waste management practices that comply with the 3Rs and is also willing to work with indigenous solid waste management holders as stakeholders in waste service. There are indigenous solid waste management strategies that comply with the 3Rs. These strategies will assist to smoothen the engagement between the municipality and the indigenous solid waste management holders and assist to integrate the appropriate strategies into the MSW services. This necessitates a framework to integrate indigenous solid waste management practices into MSW.

Some indigenous solid waste management strategies, like burning waste, burying waste, and discarding waste outside the yard, have been found not to be environmentally friendly as they cause pollution to the air, water, soil, and ecosystem (UN-HABITAT, 2010; Saha & Handique, 2023). One of the findings is that Ubuntu/ Botho are at the heart of indigenous solid waste management practices. The participants indicated that the community complies with indigenous solid waste management practices outside of Ubuntu. Ubuntu is about collective existence; hence, it is translated as “a person is a person because of or through others” (Moloketi, 2009; Aharimpisya *et al.*, 2023). Ubuntu brings with it a sense of solidarity, compassion, reciprocity, humility, justice, mutual caring, oneness, and communality (Mandela, 2006; Haaga, 2022). Oneness brings an element of doing to others what you want done to you. Ubuntu minimises solid waste-related conflicts and moves the people of Thalahane towards a common goal of implanting indigenous solid waste management practices with almost zero enforcement. But in the formal MSW, the enforcement of relevant regulations is a must-have (Chan *et al.*, 2010; Hossain *et al.*, 2022). Cost recovery by the users is a great challenge in Blouberg municipality. The integration of indigenous solid waste management practices into the MSW can bring with it an element of Ubuntu, which can assist in recovering waste-related costs due by the users in Blouberg, thereby injecting cash that is needed by the municipality to run MSW services. The municipality has a challenge with public participation, especially in matters relating to solid waste management. The use of solid waste management as the starting point of public participation in MSW can encourage the community to develop an interest in matters pertaining to MSW and to own up to MSW and not view it as foreign to them.

The data indicates that Blouberg municipality has executive authority in terms of Section 156 (1) of the Constitution of South Africa.

‘A municipality has executive authority in respect of and has the right to administer (a) the local government matters listed in Part B of Schedule 5; and (b) any other matter assigned to it by national or provincial legislation’. The municipality is expected to manage solid waste in line with the National Waste Management Strategy 2020, and to move in this direction, the Blouberg municipality has developed its own Municipal Solid Waste

Management plan but has challenges in meeting the three pillars of NWMS, which are (1) waste minimisation; (2) effective and sustainable waste services and compliance; and (3) enforcement and awareness due to a lack of financial muscle (Azevedo *et al.*, 2019; Rondón Toro *et al.*, 2023). Lack of funds affects the procurement of waste management equipment and the hiring of enough staff. This also forces the municipality to treat different areas in the municipality in the same way, irrespective of the differing challenges (Hoorweg & Bhada-Tata, 2012). The financial challenge is also an impediment to the implantation of Extended Producer Responsibility (EPR) in the municipality.

7.4 Theoretical frameworks in the study

Two theoretical frameworks have been used in this study, namely, the DPSIR framework and the Integrated Sustainable Waste Management framework. DPSIR relates human activities to the environment. Drivers are socio-economic sectors in Thalahane village that fulfil human needs for water, shelter, food, security, health, transport, education, culture, entertainment, and employment (Tscherning *et al.*, 2012; Fu & Shi, 2022). These human activities in Thalahane village intentionally or unintentionally exert pressure on the environment, which is evident through the release of solid waste. The pressures exerted by the Thalahane community lead to intentional or unintentional changes in the state of air, water, and soil. Changes in the quality of water, air, and soil impact the ecosystem and well-being of the people in Thalahane village. The ecosystem process benefits the community through the provisioning of food, water, timber, and regulation of air quality, water quality, or disease.

Responses are decisions that can be taken by the Thalahane community, and or Blouberg municipality to the drivers, pressures, state, and or the impacts. The community of Thalahane responds through reuse, repurposing, recycling, energy recovery, and composting at the drivers' level. Other strategies, like the burning of waste, the backyard pit for waste, the burying of waste, and the discarding of waste outside the yard, continues to exert pressure on the environment and ultimately, the state of the ecosystem. The Blouberg municipality responds to the drivers, pressures, state, and or impact silently in Thalahane village but actively in other villages. According to Gabrielsen and Bosch (2003), deliberately doing nothing is a response.

The Integrated Sustainable Waste Management Framework was developed out of experience to address common problems with municipal waste management challenges in the developing world (Batisca *et al.*, 2021). ISWM has three dimensions, namely stakeholders, waste system elements, and sustainable aspects. The stakeholders in Thalahane village are community members and the municipality. The two stakeholders have an interest in waste management, even though their roles are different. The elements include the waste management strategies used in Thalahane village, namely reuse, repurposing, recycling, energy recovery, composting, and feeding of domestic animals with leftover food. Turning of waste from the ploughing fields into animal feeds assists in preventing waste. The aspects are lenses through which existing waste management can be assessed, and they are the financial and economic aspects, environmental aspects, political and legal aspects, institutional aspects and socio-cultural aspects.

7.5 Conclusion

What is evident from the study is that the Thalahane local community uses indigenous solid waste management practices that are based on the waste strategies of the 3Rs and that there are others which are not based on the 3Rs. This means the waste management system has both strengths and weaknesses. The municipality can take advantage of the strengths of indigenous solid waste management practices and integrate those good indigenous solid waste practices to resolve the waste challenges that are faced by the municipality. Indigenous solid waste management practices have weaknesses that can be improved.

Blouberg municipality has plans in place to discharge its waste management obligations, but financial challenges make it difficult for the municipality to comply fully with the National Waste Management Strategy 2020. The municipality is willing to have home-grown sustainable municipal waste management that integrates sustainable informal practices but lacks a framework that can help the municipality achieve that objective. This study developed a framework that can improve and integrate informal waste practices with formal waste practices. There is a high need to move away from transplanting waste

management practices from developed countries into South African rural municipalities like Blouberg. Waste management systems need to be tailored for local conditions, and different areas, formal and informal, need different waste management strategies as they have different waste management challenges.

CHAPTER 8: EVALUATION, JUSTIFICATION, CONCLUSION, AND RECOMMENDATIONS

8.1 Introduction

The purpose of this chapter is to review the entire study and establish whether the objectives of the study have been met. This chapter brings the study to a conclusion. It provides conclusions and recommendations, justifications for the study, an evaluation, and the limitations of the study.

8.2 Evaluation of the study

The purpose of this study was to examine indigenous waste disposal practices in Thalahane village as well as establish how they can be applied in the current municipal's waste systems. The study sought to achieve the following objectives:

1. To investigate indigenous waste management that the Thalahane local community uses to manage solid waste.
2. To analyse the implementation of a waste management system by the Blouberg Local Municipality in Thalahane village
3. To develop an integrated sustainable solid management plan for Thalahane village that accounts for indigenous solid waste management.

To accomplish the study objectives, a qualitative methodology consisting of a phenomenological approach and a case study design was followed. The design was appropriate for this study and helped to answer the research questions. The design did not show signs of shortcomings. The participants were selected purposefully, in line with the appropriate criteria of getting participants who have rich knowledge and experience of waste management in Thalahane village. Thirty participants were purposefully selected from the households.

Participants with rich knowledge and experience of that phenomenon were selected so that they could bring to light what they were being asked. For the participants to qualify for selection, they had to indicate that they had some knowledge of indigenous solid waste

disposal practices. The sample was suitable and acceptable in that the research questions were comprehensively answered.

8.2.1 Summary of key findings and critique

The research questions for the study were as follows:

- Which indigenous solid waste management method does the Thalahane local community use to manage solid waste?
- How does the Blouberg Municipality implement solid waste management in Thalahane village?
- How can an integrated sustainable solid waste management plan for Thalahane village be developed that accounts for indigenous solid waste management?

Out of the research questions came the research findings. The key findings were outlined according to the objectives, as follows:

8.2.1.1 Investigating the indigenous waste management which the Thalahane local community uses to manage solid waste.

Indigenous waste disposal practices are used in Thalahane. The community used the following ways to manage solid waste: separation of solid waste, burying of solid waste underground, composting of solid waste, burning of solid waste, repurposing of potential solid waste into something useful, using waste to trap and scare away birds and animals, storing metal and glass waste separately for the waste pickers to collect, using back-yard pits to dispose of waste, and taking waste out of their yard. All of them were found to be affordable to the community; however, not all of them were good for human and animal health, and not all of them were found to promote environmental sustainability.

Those that promoted good health and environmental sustainability were as follows: the practicing of separating waste, the composting of waste, the repurposing of potential waste into something useful, and the sorting of metal and glass waste for waste pickers. These methods were also found to be in line with the 3Rs (reduction, reuse, and recycling). These methods also contributed to the achievement of South Africa's national

policy on waste. By promoting the 3Rs (reduce, reuse and recycle), they are promoting South Africa's National Waste Management Strategy, whose first strategy is to

“promote minimisation, reuse, recycling and recovery”
(NWMS, 2011).

Indigenous solid waste practices also delivered the constitutional rights of the people of Thalahane village; namely,

“a right to an environment that is not harmful to their health or well-being; and to have the environment protected for the benefit of the present and future generations”.

The indigenous solid waste practices were also giving the people of Thalahane village multiple benefits from sustainable development goals (SDGs). These practices will help to reverse the current trend in South Africa, where ninety (90) percent of the waste generated is destined for landfills (DEA, 2012). When one compares this percentage with one percent of solid waste in Germany, which ends up in landfills, South Africa's percentage is significantly higher. Furthermore, taking solid waste to landfills is expensive; therefore, reducing the amount of waste to be taken to landfills will reduce the number of costs involved in moving the waste to landfills.

Among the indigenous solid waste practices, some represent poor solid waste management practices. The poor practices are the following: Thalahane community is burying solid waste underground, reducing waste by burning it, using back-yard pits for waste disposal, and taking waste out of their yards to manage it. The poor indigenous solid waste management practices do not promote the South African national policy on waste, specifically South Africa's National Waste Management Strategy. Instead, they infringe on the constitutional rights of the people, of Thalahane village, as they are creating an environment that is not conducive to the health or well-being of the people, for the present and future generations. In other words, the bad practices make the realisation of sustainable development goals (SDGs) not possible because they promote

open-air dumping, marine littering, and open burning of solid waste. These are the major causes of pollution of the air, water, and soil. The consequences of bad practices are environmental degradation, climate change, and poor public health.

8.2.1.2 Analysing the implementation of a waste management system by the Blouberg Local Municipality in Thalahane village.

The Blouberg Municipality was found to have an integrated waste management plan for the whole municipality. However, due to financial constraints and the geographical and spatial character of the municipality, it could not provide waste management services to all its villages. Thalahane village was one of the villages not receiving waste management service. Therefore, the Blouberg Municipality does not conduct waste management services in Thalahane village. This shows that the constitutional rights of the people of Thalahane village are being violated, and the municipality is shunning away from its constitutional obligations.

8.2.1.3 Development of an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous solid waste management.

It was established that for an integrated sustainable solid waste management plan for Thalahane village that accounts for indigenous knowledge to be drawn, there was a need for a framework to be developed. The schematic representation of the framework is as follows:

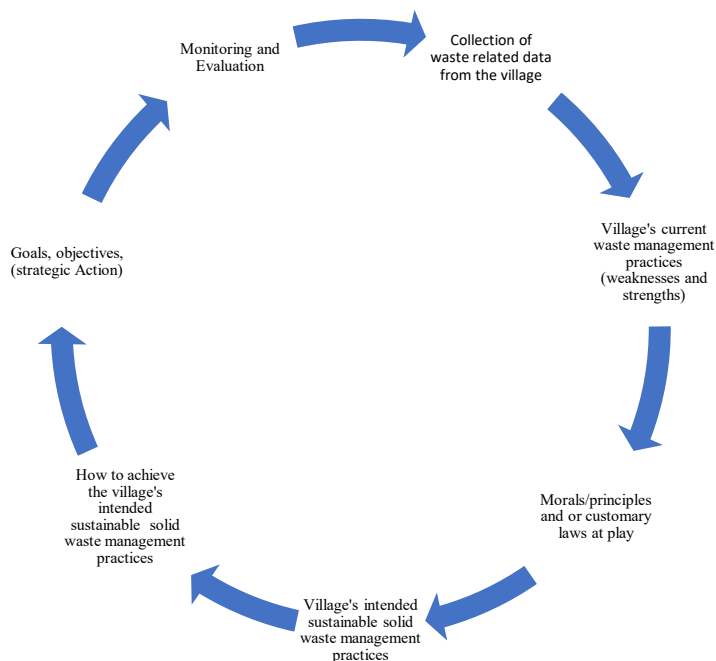


Figure 8. 2: Indigenised Sustainable Solid Waste Management Framework

From the framework, the Integrated Sustainable Waste Solid Management Plan for Thalahane that accounts for indigenous knowledge has been represented. The plan is under 4.5. Good indigenous solid waste disposal practices in Thalahane village can be used to improve the solid waste management system of the Blouberg Municipality. What is important is to get the local people involved in the drawing of the plan. This is a move away from the municipality's practice of using consultants to develop an integrated solid waste management plan, which in most cases becomes difficult to implement.

8.3 Justification of the study

The study will assist researchers, scholars, and students who are conducting research in the same or related fields. It has shown the indigenous perspective on waste management. That perspective can be put to good use by rural municipalities. Furthermore, the study has developed an integrated sustainable solid waste management plan framework that can account for Thalahane's indigenous waste disposal practices. The study has used that framework to draw an integrated sustainable solid waste management plan for Thalahane. Rural municipalities will benefit from this study.

8.4 Limitations of the study

Most of the participants could not communicate in English. As a result, they were interviewed in Northern Sotho, and then an English translation was made. However, some of the words they used could not be directly translated into English. Words like ditaola (divine bones) are not easy to translate to English; therefore, the translation to English may not be hundred percent correct. However, care was taken to ensure that the meaning was not lost by using language experts. As an added advantage, the researcher speaks Northern Sotho as a home language, and he has specialised in Northern Sotho at the undergraduate level. He was also a Deputy Chief Marker of Grade 12 (twelve) Northern Sotho first language for ten years. In addition, the use of multi-data collection quality assured the quality of the data collected.

8.5 Conclusion

From the evidence gathered and the preceding discussions, the study concluded that there were good and bad indigenous waste disposal practices in Thalahane village. The good indigenous disposal practices can be exploited to the benefit of the Blouberg Municipality, while the bad ones should be discouraged. The Blouberg Municipality struggled to provide proper waste management services to Thalahane village, and that partially contributed to uncontrolled dumping sites. The study, through the evidence gathered, proved that an integrated sustainable solid waste management plan for a village can be drawn by drawing an integrated sustainable solid waste management plan for Thalahane that accounts for indigenous knowledge. To facilitate the drawing of the plan for the village, the study created a village-integrated sustainable solid waste management planning framework.

8.6 Recommendations

The recommendations are as follows:

8.6.1 Indigenous waste practices that promote good health and environmental sustainability

Some indigenous solid disposal practices promote good health and environmental sustainability. When providing waste services to the villages, municipalities should use those practices as steppingstones and use them to get buy-in from the villages. A total disregard for indigenous waste disposal practices may confuse the community. Furthermore, the community may lose track of where it is coming from, thereby having nothing to build on.

8.6.2 Waste management education and cleaning campaigns

There is a need for waste management education in the villages. This type of education can be conducted in short sessions at community gatherings in the form of announcements. Formally, it can be done during community meetings and in schools. This will assist the community in becoming aware of the good and bad practices of waste management. Cleaning campaigns can be conducted once every three months to remove uncontrolled dumping sites.

8.6.3 Municipalities that control villages should have an integrated sustainable solid waste management plan that accounts for indigenous knowledge.

Steps should be taken to develop a village-to-village integrated sustainable solid waste management plan, as the challenges of waste vary from village to village. In such endeavours, good indigenous practices should be accommodated so that the plan can get buy-in from the community. The accommodation of such indigenous practices will make the community embrace the plan.

8.6.4 Budget for waste management should be increased in municipalities.

Municipal budgets for waste management services of municipalities controlling villages should be increased. This will enable the municipalities to buy enough waste plants and waste equipment for the entire municipality. It would also make it easy for the municipality

to have adequate human resources for waste management. Lack of these items may lead to uncontrolled dumping and, ultimately, to the spread of preventable diseases, as well as environmental degradation.

8.6.5 Integrated sustainable solid waste management planning framework be adopted by municipalities controlling villages.

An integrated sustainable solid waste management planning framework developed in the study for village use is recommended to draw better waste management plans for the villages. The framework is adaptable to most village waste management situations.

8.6.6 Village system of leadership be used in solid waste management enforcement.

Few waste officers in rural municipalities can enforce proper waste management practices in all villages under the municipality. This is due to financial constraints. The leadership of each village can therefore be used to enforce proper waste management practices in their villages. This will cost the municipality almost nothing.

8.6.7 Specific community based sustainable waste management in rural municipalities

Municipalities have formal and informal settlements. The waste challenges in formal and informal settlements differ, and as such, the waste management plan for these areas should not be the same. This is the same for urban and rural settlements.

8.6.8 The integration of Ubuntu and environmental ethics knowledge to bring change of behaviour to households' waste management.

Ubuntu and environmental ethics knowledge can instill a sense of respect for nature, people, animals, plants, and other communities of species. This sense of respect will stop improper solid waste management. Households will see the need to pay for the waste services, thereby contributing to municipality waste service cost recovery.

8.6.9 The extended producer responsibility be speedily implemented in municipalities

The EPR should be implemented to reduce costs incurred by households' waste, basically produced by the manufacturers. Producers, in terms of EPR regulations, should carry the costs of their produce at the end of their life span, not households.

8.6.10 Communities in rural areas should be supplied with 8-yard dumpsters.

The 8-yard dumpsters will be used by the communities to dispose of waste that cannot be properly managed at the household level. This will discourage illegal dumping, which, in most cases, takes the form of out-of-my-back-yard strategy.

8.6.11 The integration of informal recyclers into the municipal waste management systems

Recycling is a good waste management strategy. Informal recyclers contribute towards the achievement of zero waste and a circular economy. Therefore, they can be an important part of the municipal waste system because they divert waste from landfills which are in some cases open-air, and cut transport waste costs to landfills.

8.6.12 Facilitation of cheap, effective, and sustainable community environmental cleanliness

The use of indigenous sustainable practices can be used to facilitate cheap, effective, and sustainable community environmental cleanliness by the municipality, as they are affordable, easy to use, and acceptable in the community.

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ANNEXURE A

Interview and observation guide

Code name..... (for anonymity)

Age (in year)

Highest Qualification.....

Introduction

Greet the participants to establish rapport with them.

My name is Masila Joshua Masipa (student number 16023623) in the Department of Art and Social Sciences at the University of Venda. I am conducting a study on:

Indigenous Solid Waste Management Practices for sustainable Environment. A Case of Thalahane Village, Limpopo Province South Africa

It is my hope that the answers you will provide me with will help me understand solid waste management as it happens in Thalahane village. Participation in this interview is voluntary and confidential. Should you feel uncomfortable continuing with the interview at any point, you are free to withdraw, and there will be no negative consequences. The interview will take approximately 30-45 minutes of your time.

Thank you for agreeing to take part in this interview with me. I request that you read the consent form before we begin with the interview. If you are willing to sign, please sign to confirm your participation at your own free will.

Data collection guiding questions

Interview guide

Thalahane village participants interview guiding questions.

How do you use indigenous solid practices to manage waste in Thalahane village?

What are your perceptions regarding indigenous waste practices?

What are different indigenous solid waste practices established that you use?

Which rules have been established to manage waste?

How did you learn how to manage waste?

Indicate how people in other areas can afford to manage waste as it is done in this area/

Focus group discussion guiding questions.

What ways are used to manage waste?

What role does the municipality play in how you manage waste?

What are the waste challenges that are in Thalahane village and how would you like to be assisted?

Which ways of managing waste are most preferred and which ones are least preferred?

How do you reuse and/ or repurpose waste in Thalahane?

How does Botho (Ubuntu) feature in the way you manage waste?

How can indigenous solid waste management practices be improved for municipal use?

Municipality waste management staff interview guiding questions.

How is waste managed in Blouberg municipality?

How does the municipality communicate with the villages to plan for waste management?

What is your perception of indigenous solid waste system?

How is your waste management service in Thalahane village?

What are the challenges that are experienced by the municipality pertaining to waste management service?

What are the challenges of delivering waste services in the villages?

How can indigenous solid waste practices be incorporated in the municipal waste management system?

Question 1	Comments and observation of non-verbal cues
❖ How is solid waste managed in Thalahane Village?	
Questions for clarification	
Probing Questions	
Follow-up Questions	
Exit Questions	
Question 2	
❖ Which solid waste management practices are preferred in Thalahane Village?	
Questions for clarification	
Probing Questions	
Follow-up Questions	
Exit Questions	
❖ Request to view evidence from solid waste management sites from the participants	

Observation guide

Observer:

Date:

Time	Activity	Possible questions	Behaviour	Action
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	Evidence of formal solid waste management in Thalahane village. Formal form of waste management from the Municipality.	In what way does the Municipality assist with waste management?		
	Waste avoidance, reduction, reuse, and recycling at household level. Relevance of indigenous solid waste practices for the conservation and sustainable use of natural resources. Converting waste into useful items. Facilitation of cheap, effective, and sustainable community environmental cleanliness	In what way do you avoid waste, reduce waste, reuse waste, and recycle waste?		
	Landfills sites view.	How do you manage landfills?		
	Evidence of Thalahane village dumping places.	Why do you dump waste in these places?		
	Evidence of back yard pits for waste. Managing kitchen waste. Managing of food from waste.	What do use this pit for, and do you manage it?		
	Evidence of energy recovery at household level.	How do you recover energy from waste?		

ANNEXURE B

Approval from the municipality to conduct the study

Blouberg Municipality



P.O. Box 1593
SENWABARWANA 0790
Tel: No.: 015 505 7100
Fax: No.: 015 505 0568 / 0296
E-mail: sebolav@blouberg.gov.za

Sebola HV
015 505 7100

27 JULY 2023

Att: Municipal Manager

Re: REQUEST FOR THE APPROVAL OF ACEDMIC RESEARCH

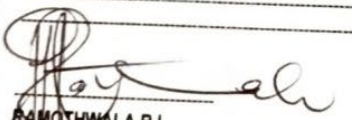
We received a request letter from University of Venda lecture who is requesting for space to do his academic research at Kgatalala Village/ Thalane within Blouberg Municipality.

Attached please receive the student s request letter

Surname & Initials	Field of study	Student No.	Gender
1. Masipa MJ	School of Human and Social Science	16023623	Male

We therefore request Municipal Manager to approve the research request for Mr Masipa MJ

Approved / ~~Not Approved~~


RAMOTHWALA RJ
MUNICIPAL MANAGER

ANNEXTURE C

Approval from the Thalahani Village Chief


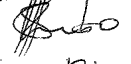
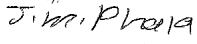


MOLEBO TRADITIONAL AUTHORITY
BUFFELSHOEK-THALAANE No. 78
SEMWABARWANA - CAMALEBOHO

DEAR SIR/MADAM

THIS IS TO CERTIFY THAT WE AS TRADITIONAL AUTHORITY HAS MET WITH MR MASILA MASIPA TO CONDUCT THE ENVIRONMENTAL RESEARCH AS WE AGREED

THE AUTHORITY IS ALWAYS AVAILABLE TO ASSIST ALL MEMBERS OF THE COMMUNITY AT LARGE; IF THEY WISH TO DO PROJECT WITHIN THE ABOVE-MENTIONED TRADITIONAL COMMUNITY.

REGARDS:

SENIOR HEADMAN: J. MOLEBO 
A. MOLEBO 
J. PHALA 
J. HODD - SECRETARY 
M. MASIPA - VISITOR 

SENIOR HEADMAN
MOLEBO
2019 -11- 21
UNDER KGOSHI KGOLO
N.I. LEBHO

ANNEXURE D
Ethical Clearance

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:

Mr MJ Masipa

Student No:

16023623

PROJECT TITLE: Indigenous solid waste disposal practices for sustainable solid waste management: A case of Kgatalala village, Limpopo Province.

PROJECT NO: **SHSS/19/AS/02/1906**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

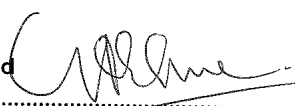
NAME	INSTITUTION & DEPARTMENT	ROLE
Dr Adv. PE Matshidze	University of Venda	Promoter
Prof VO Netshandama	University of Venda	Co - Promoter
Dr NV Mudau	University of Venda	Co - Promoter
Mr MJ Masipa	University of Venda	Investigator - Student

ISSUED BY:

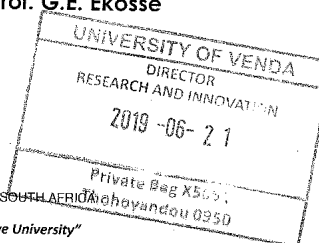
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: June 2019

Decision by Ethical Clearance Committee Granted

Signature of Chairperson of the Committee: 

Name of the Chairperson of the Committee: Senior Prof. **G.E. Ekosse**



University of Venda
PRIVATE BAG X569, THOHOYANDOU, 0950, LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9080
"A quality driven financially sustainable, rural-based Comprehensive University"

ANNEXURE E

Similarity index

Mr

ORIGINALITY REPORT

2%	1%	2%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1 Veronica Frank. "The European Community and Marine Environmental Protection in the International Law of the Sea", Brill, 2007
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ANNEXURE F

Editor's letter

Office No. 06
Department of English, Media Studies and Linguistics
University of Venda
P/Bag X 5050
Thohoyandou
0950

30 October 2023

To Whom It May Concern

This serves to confirm that I proof-read and edited the thesis titled "Indigenous Solid Waste Management Practices for Sustainable Environment: A Case of Thalahane Village, Limpopo Province, South Africa" by Masipa M.J, student number:16023623.

Regards

Vincent N. Demana



University of Venda
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Website: <http://www.univen.ac.za/>
A quality driven, financially sustainable, rural-based comprehensive university