Documentation of indigenous methods for solid waste management in uThweba Village, Kwaximba Tribal Authority, Republic of South Africa

by

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ABSTRACT

Globally, inadequate solid waste management is a significant environmental and public health challenge, especially in rural and marginalised communities where municipal services are limited or absent. Poor waste management contributes to land degradation, water contamination, greenhouse gas emissions, and higher health risks. While modern waste management systems are prominent in policy frameworks worldwide, Indigenous knowledge systems have historically provided sustainable, low-cost, and culturally rooted waste solutions cantered on reuse, repurposing, and resource efficiency.

In South Africa, waste collection services are still inadequate despite progressive environmental laws. Many rural areas are excluded from formal municipal waste management, resulting in illegal dumping, open burning, and environmental pollution. Although the literature highlights the potential of Indigenous waste practices to assist in reducing solid waste risks, there is however limited documentation on how these systems work today in rural areas or how they can support formal municipal services.

This study documents Indigenous solid waste management methods practiced in uThweba Village, Cato Ridge, located in the Outer West of Durban under the KwaXimba Tribal Authority within the eThekwini Metropolitan Municipality, KwaZulu-Natal Province. Using uThweba as a case study. The research aimed to describe the waste types produced, record existing Indigenous waste management practices, evaluate their impact on the accessibility and affordability of waste services, and develop a practical Indigenous waste management model for similar rural communities without municipal waste collection.

A qualitative research approach was used, including household questionnaires and field observations. Data were coded and analysed with descriptive statistics, and results were shown in tables and graphs. Findings show that, due to the lack of consistent municipal waste collection, households depend on Indigenous practices passed down through generations. These practices focus on reuse and repurposing of materials and are part of the community's cultural heritage. However, problems arise with non-biodegradable waste like cans, glass, and tins that cannot be reused. This

waste ends up in yards and pits and often scattered by animals, creating environmental and health hazards. The community expressed a need for municipal help, especially in establishing recycling facilities for non-reusable waste. The study concludes that combining Indigenous waste management practices with targeted municipal support could offer a sustainable and culturally suitable solution for rural waste management in South Africa.

Keywords: Indigenous knowledge, cultural practice, community, society, traditional practice,

DEDICATION

Special dedication to my intellectual soulmate husband Khehla Shange, who fought a 2-year battle with cancer (who passed this earth on the 10th March 2023) and whose spirit and intellectual mindset lives through me. He has been a great motivation in convincing me to register for my master's programme. He uplifted me and acknowledged the potential within me. My husband further engaged with the tribal authorities in the village of uThweba to request a site where waste management will be implemented, should my dissertation be approved. That is how much he believed in my capabilities. For that, you will forever be my king Khehla Shange. Thanks to my 13- and 14-year-old children, Ayanda and Mawande Shange, for allowing me, as their mom, to occasionally disengage from family for a few hours to focus on my academic studies. My children are still young, but they understand the concept and the importance of education, and they respect the decisions made by their academic mother. My gratitude also goes to my late, brave mother, Nokwethemba Mantombi Elizabeth Zondi, who passed away in May 2024 after battling dementia for many years. She raised four children and three grandchildren as a single mom. Above all, I thank God, the Almighty, who has been the pillar of strength for me to persist in completing my dissertation despite the hardships I have faced over the past four years.

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DECLARATION

Name: _ Monica Thokozani Shange

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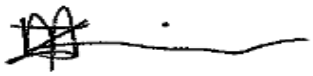
I declare that the above dissertation is my work and that all the sources I have used or quoted have been indicated and acknowledged using complete references.

I further declare that I submitted the dissertation to originality-checking software, and it meets the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.



_____ April 2026

SIGNATURE **DATE**

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ACRONYMS

DFFE	Department of Fisheries, Forestry, and Environmental
DRDLR	Department of Rural Development and Land Reform
EIWMP	eThekwini Integrated Waste Management Plan
IDPs	Integrated Development Plans
IK	Indigenous Knowledge
IKS	Indigenous Knowledge Practices
ITB	Ingonyama Trust Board
IWMP	Integrated Waste Management Plan
LINKS	Local and iIndigenous Knowledge Systems
MSK	Modern scientific knowledge
MSWM	Municipal Solid Waste Management
NGOs	Non-governmental organisation
MSW	Municipal solid waste
NWMS	National Waste Management Strategy
SWM	Solid Waste Management
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
SPSS	Statistical Package for Social Sciences

1 CHAPTER 1: INTRODUCTION

1.1 Background

Solid waste management is a universal challenge (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018). This challenge affects both developed and developing countries in distinct ways (Lotus, 2014). Generally, rapid population growth, industrialization, shifts in consumption patterns, and consumer behaviour are recognised as drivers of high waste generation rates and volumes (McAllister, 2015). According to Cobbinah, Addaney, and Agyeman (2017), developing countries face greater difficulties in managing solid waste compared to their developed counterparts. In this context, Machete (2019) criticises the failure of many African governments to dismantle the historical legacy of colonial service delivery systems, which continue to let down indigenous African communities.

Subsequent studies by Famo and Machete (2023:77-86) and Madonsela and Machete (2023) build on Machete (2019) and conclude that the indigenization of governance, including solid waste management systems, has the potential to improve the dire state of solid waste management worldwide. These studies also suggest that indigenisation can unlock the potential for effective governance in African countries, further supporting Machete's (2019) earlier claims.

Semenya and Machete (2019:10) concluded that “African communities hold a rich history of undocumented knowledge systems that have survived colonialism and modernization, conveyed mainly through oral accounts." This knowledge system is valuable to the livelihoods of African communities. It is often used to sustain them, including self-provisioning services such as waste removal when the government does not provide them. Semenya and Machete (2019) also assert that this knowledge system is remarkably resilient, as it has largely endured the brutal regimes of colonialism, apartheid, and other historical oppressions.

According to Goduka (2005), as cited in Famo and Machete (2023:77–86), the concept of "indigenous" originates from the Latin words "indigenus “(noun) and "indigene” (adjective). The Word Hippo (2021) states that the term "indigenous" is an adjective synonymous with (1) native, (2) indigenous, (3) aboriginal, and (4) born within. A similar

understanding of the concept of "indigenous" was found in Amaro and Watson (2016), who confirmed that in Latin, the word "Indigena" means native. The word was used in the early 1640s. Amaro and Watson (2016) note that "indigena" translates to "natural occurrence," originating from the old Latin term "indu", which itself derives from the ancient "endo". The latter shares a similar meaning with the Greek "endina" (Amaro & Watson, 2016). Consequently, UNEP (2018) asserts that indigenous knowledge, encompassing the information and technology developed and continuously evolved by a community, is essential for preserving both the community and its culture, as well as for safeguarding the community's inherited resources.

Famo and Machete (2023:77) states, “there is a gap in the literature linking waste management practices to indigenous knowledge.” She further emphasises that her study aims to bridge this gap by examining waste management practices in the Chief Albert Luthuli municipality, South Africa. The current study shares similar characteristics to the work of Famo and Machete (2023:77). The main difference between these two studies lies in the geographic locations and cultural groups of the communities being investigated, as well as their respective dynamics.

Another South African study, conducted by Madonsela *et al.* (2024), comprehensively examined indigenous practices and methods of solid waste management, unravelling the complexities of indigenous waste management practices. The latter study, conducted in Bushbuckridge Local Municipality, resulted in at least three peer-reviewed journal articles, which are referenced in the current study. In Madonsela and Machete (2023), the authors analysed and systematically critiqued the concept of indigenous knowledge in a global context. The latter study examined the evolution of the concept and the historical shifts in how societies lived their lives, addressing several societal issues, including solid waste management, to date. One of the critical lessons drawn from the latter study is that as communities evolve, the quality and quantity of their waste change, and so should the management of that waste. Space – delete all large spaces.

The village of uThweba is one of many South African rural communities that have no access to municipal waste collection services. As defined earlier, the community of uThweba is indigenous, showing a greater degree of uniformity in their daily practices and shared approaches to handling their daily livelihood. Thus, this community is a suitable society from which to document solid waste management practices, as was

the case in the earlier studies of Famo and Machete (2023) and Madonsela *et al.* (2024).

Cobbinah, Addaney, and Agyeman (2017) reported that developing countries frequently face more challenges in managing solid waste. Machete (2019) attributes the persistence of colonial waste management systems in many African and historically oppressed countries as a key factor contributing to the ongoing difficulties these nations face in effectively managing their solid waste (Machete, 2019). In this discussion, Machete (2019) criticises the failure of numerous African governments to reverse the historical legacy of colonial production and service delivery systems, which continue to disadvantage indigenous African communities (Machete, 2019).

The village of uThweba is among many rural areas in South Africa that lack proper municipal waste collection services. Given the extensive research on successful indigenous waste management methods in reducing solid waste-related environmental health risks, documenting and implementing these techniques could greatly enhance living conditions in South African villages without adequate waste collection. In uThweba, illegal dumping of solid waste in open areas and household pits is widespread. These illegal dumpsites often become breeding grounds for vectors and pests, including flies, rodents, and other animals (Babayemi and Dauda, 2009). According to Babayemi and Dauda (2009), waste discarded near streams, stormwater gutters, and drains negatively impacts nearby water sources and the environment, creating health hazards for the local community.

1.2 Documentation of Indigenous Knowledge Systems (IKS)

In response to persistent environmental challenges and service delivery gaps, increasing attention has turned to Indigenous Knowledge Systems (IKS), which refer to locally developed, culturally embedded bodies of knowledge, practices, and belief systems that are passed down through generations and guide communities in managing their natural resources sustainably. IKS refer to locally developed knowledge and practices passed down through generations, guiding communities in the sustainable management of their environment and resources.

IKS is locally developed knowledge and practices, considered as a cultural practice that is passed down through generations, that guide communities in sustainably managing their environment and resources at a given time. Oral tradition is the strongest method for propagating and perpetuating IKS (Tharakan, 2017). The other form of transmission identified by Tharakan (2017) is practical application and mimicry. There is generally no written record of IKS from the societal level, as the practice is considered a cultural activity. IKS suffered an existential threat when Modern Scientific Knowledge (MSK) was introduced through colonization and globalization (Moahi, 2007). The threat still lingers as most IKS depend on human memory for their existence. (Adeyemo and Adebayo, 2017). Thus, documenting IKS to preserve their intellectual knowledge is essential.

1.2.1 Benefits of documenting IKS

Moahi (2007) emphasised the significance of documenting IKS, arguing that Western civilizations are appropriating the intellectual property of knowledge from indigenous societies. This appropriation benefits the nations where it is implemented, while the original creators of that knowledge gain nothing in return. A notable example is the use and dissemination of acupuncture. (Tharakan, 2017). In South Africa, indigenous cultural heritage is frequently incorporated into tourism development. In KwaZulu-Natal, Zulu traditions, history, and cultural performances have become key attractions for tourists, although the economic benefits often do not fully reach the local communities whose culture is being commodified (Xulu, 2005; Xulu, 2007).

Cultural tourism in South Africa generates substantial revenue; however, the economic benefits are often unevenly distributed. In KwaZulu-Natal, tourism promotion frequently relies on the branding of the Zulu Kingdom and indigenous cultural heritage, yet community participation and ownership remain limited (Xulu, 2007). Consequently, many rural communities associated with cultural heritage tourism continue to experience poverty and unemployment despite the presence of tourism opportunities (Nkwanyana & Nzama, 2023). Furthermore, research indicates that local ownership of tourism enterprises is often minimal, with many businesses controlled by external investors, resulting in unequal benefit distribution within host communities (Mthembu, 2019).

1.2.2 Hindrances to IKS Documentation

Documentation enables knowledge creators to benefit when outsiders appropriate it for profit. Documenting indigenous Knowledge Systems also promotes knowledge diversity (Yunnus, 2017). Without diverse knowledge, finding alternative solutions to everyday problems is difficult (Yunnus, 2017). Knowledge diversity offers different perspectives, providing decision-makers with various solutions to consider. . Documenting IKS ensures easier access to diverse cultural ideas and practices. Proper documentation also promotes transparency and enables the original knowledge holders to benefit from their intellectual contributions while allowing other communities to learn from different cultural practices (Sillitoe, 1998; UNESCO, 2017). The sharing of indigenous knowledge, therefore, promotes intercultural learning and strengthens knowledge exchange. However, one of the major barriers to documenting IKS is the legacy of colonial education systems, which historically prioritised Western knowledge and marginalised indigenous ways of knowing (Odora Hoppers, 2002; Smith, 2012).

The system is still riddled with hegemonic notions that elevate Western methods above the traditional practices of indigenous peoples. This is also evident in some research institutions dedicated to documenting, processing, and disseminating IKS (Moahi, 2007). With the few established research institutions dedicated to documenting IKS, Adeyemo, and Adebayo (2017) pointed out that there is a lack of seriousness in the research institutions about disseminating documented IKS, if there is any.

The other challenge facing the documentation of IKS is the belief that “knowledge is incomplete and is produced by people of questionable understanding or skill” (Osman-Elasha, 2009:16). This belief is established because of the comparison between IKS and MSK. Where MSK is considered structured and rigorous knowledge that came about as a result of scientific inquiry, which is based on facts that can be tested to be true (Tharakan, 2017). Opponents of IKS believe that it is knowledge based on people's assumptions and opinions, with little or no reference to truth or justification (Osman-Elasha, 2009). The propagation of this belief results in many people seeing no value in documenting IKS. Osman-Elasha's (2009) statement above that IKS is based on assumptions and opinions that are not considered truthful and thus hold no value is questionable based on what is defined as truth/justification and what is legitimately regarded as a test.

Osman-Elasha (2009) also identified the issue of ethnicity as a barrier to the proper documentation of IKS. Osman-Elasha (2009) pointed out that people have divided themselves along ethnic lines (in a social context), resulting in secrecy about sharing knowledge between ethnic groups. Ethnicity is belonging to a social group with a common national or cultural tradition. Therefore, it does not necessarily dwell on secrecy but rather on the belief in different methods that particular ethnic groups have been practicing as part of their culture, which may be different methods used. An example is a tummy ache medication treatment, which is used differently in different ethnic groups, not because they disagree or are meant to keep secret from each other, but rather because they both have different effective methods used to treat tummy aches. Perhaps the barrier to IKS, which may be perceived as secrecy, is that different ethnic indigenous medical methods have not been adequately documented or publicised for other ethnic groups to know of the diversity of different indigenous medical treatments available, thus not bringing transparency. The assumption of secrecy is perhaps a myth that can be eliminated should IKS be dominantly documented.

1.3 Characterization of waste streams

Any waste that is not in the form of a gas or liquid is classified as solid waste (Dumlao and Halog, 2017). Solid waste is the type of waste that society rejects (Dumlao and Halog, 2017). This waste originates from human and animal activities and is typically discarded as useless or unwanted (Dumlao and Halog, 2017). Solid waste is well-defined as organic and inorganic materials produced from various societal activities (Dumlao and Halog, 2017). Depending on their source, solid wastes can be classified into different categories, such as household waste, commonly classified as municipal waste, industrial waste, hazardous waste, biomedical or hospital waste, which have lost their value after the first user (Dumlao and Halog, 2017).

Waste streams are flows of specific waste, from their source to recovery, recycling, or disposal (Bourguignon, 2015). Waste streams are divided into two broad categories: material-type waste streams, such as plastic, glass, paper, cardboard, and wood; and product-type waste streams, which include electronic, mining, construction, demolition waste, or waste from vehicles that are no longer considered useful (Bourguignon,

2015). Each waste stream has specific characteristics and applicable legislation regarding its treatment methods and recycling possibilities (Bourguignon, 2015). The principles of 'waste management hierarchy' and 'polluter pays' apply to all waste streams (Bourguignon, 2015). Waste streams are also characterised according to their physical, chemical, biological, toxicological, and ecotoxicological properties (Bourguignon, 2015).

Characterization and classification of waste can serve various purposes, and the material is subject to different rules and regulations (DHI Solution, 2013). This waste material can be categorised as either non-hazardous or hazardous, thus determining its suitability for recycling or landfilling (DHI Solution, 2013). Waste materials originate from manufactured packaging or container materials and organic or vegetable sources (Dumlao and Halog, 2017). The origins and manufacturers of the various packaging materials, who are indirectly responsible for a significant portion of waste production, are also very important (Dumlao and Halog,2017).

Underprivileged communities tend to produce more organic material. In contrast, affluent communities generate large amounts of pure recyclables and potentially fewer organic materials because food is often sourced from packaged or canned products rather than directly from agricultural markets (Dumlao and Halog, 2017). The study by Dumlao and Halog (2017) on municipal solid waste management concepts and practices indicated that approximately 25% to 30% of general waste material is recyclable (Dumlao and Halog, 2017). Additionally, not all paper and cardboard materials are separated at the source (Dumlao and Halog, 2017).

1.3.1 Characteristics of waste streams generated in non-urban communities

In Southeast Nigeria, waste is not seen as unwanted or valueless material but as byproducts of human activities, stemming from farming, construction, and food processing (Izubara and Umoh, 2004). Depending on the type of waste, various indigenous waste management techniques can be applied; for example, animal bones can be placed in pit latrines and buried to gradually enrich the soil with nutrients such as iron, nitrogen, and phosphate (Izubara and Umoh, 2004). Most agricultural waste is organic and can be used as fertilizers, while some is utilised for renewable energy

(DRDLR, 2015). The marula fruit is one identified agricultural waste incorporating indigenous knowledge and technology. The fruit is used to make juices and coffee (when the peels are burned), the shell is used for energy, and nuts are produced from the fruit (DRDLR, 2015). Agricultural waste is composted by burying it, and wastewater is directed to these areas (Izubara and Umoh, 2004). Subsequently, that soil can be used as fertilizer (Izubara and Umoh, 2004).

Wastewater can be preserved and used for watering gardens and for household livestock consumption (Izubara and Umoh, 2004). Tonga's agricultural practices serve as its primary source of livelihood; therefore, sustaining soil fertility is a significant priority for producing high-quality agrarian products (Aremu and Vijay, 2015). Rags and fibre sacks are other types of waste that can be incinerated (Izubara and Umoh, 2004). The burning repels mosquitoes and unwanted animals (Izubara and Umoh, 2004). Non-degradable waste can be transformed into useful items, such as decorations (Izubara and Umoh, 2004). Leftover food can be used for baiting activities like catching birds (Izubara and Umoh, 2004). Old clothes are also valuable in gardens, as they can be repurposed as scarecrows to deter harmful birds from gardens (Izubara and Umoh, 2004).

Recycling is a form of indigenous knowledge where metals are returned to the local communities and repurposed into valuable items (Izubara and Umoh, 2004). An article by Binda (2014) mentions that the process of recycling is as old as humanity, with evidence dating back to 400 BC. Recycling has evolved from a household practice to an industrial-scale operation (Binda, 2014). Metal is the oldest recycled material (Binda, 2014). Many Malays live in the country's rural areas and engage in agricultural activities to support their livelihoods. They are highly skilled in arts and crafts, using wood, bamboo, pottery, and metal in their creations (Yang *et al.*, 2018). As previously mentioned by Binda (2014), the recycling process is ancient, with evidence dating back to 400 BC. Additionally, Izubara and Umoh (2004) affirm that recycling is part of the indigenous knowledge related to reusing materials rather than discarding them as waste.

1.3.2 Classification of solid waste management practices.

Advanced waste management practices, whereas developing and underdeveloped countries continue to rely on solid waste management, involve the systematic control

of waste from its generation to its final disposal. This process encompasses activities such as storage, collection, transportation, processing, and disposal of waste in a manner that considers public health, environmental protection, economic efficiency, engineering standards, and social attitudes (Dumlao and Halog, 2017). Effective solid waste management requires coordinated efforts among households, communities, private sector entities, and municipal authorities. The process begins when waste is generated, triggering the need for proper management practices. Waste management systems vary across countries, with developed nations typically implementing more advanced and regulated methods, while many developing countries still rely on traditional or locally adapted waste management approaches (Dumlao and Halog, 2017).

Unlike more structured systems in developed regions, many developing countries in Asia and Africa face significant infrastructure, financial, and public behaviour challenges that affect effective municipal solid waste management (Zhang *et al*., 2024). A 2025 literature review by Hariyani *et al.* (2025) on waste management methods worldwide emphasises significant inequalities between developed and developing nations in both technology adoption and control procedures (Hariyani *et al.,* 2025). The different types of methods for solid waste management include landfills, sanitary landfills, incineration plants, composting, source segregation, and waste reduction through the 3Rs (Reduce-Reuse-Recycle) method, as well as energy recovery (Dumlao and Halog, 2017).

Landfills, sanitary landfills, incineration plants, composting, and other waste management methods are traditional disposal methods used in developing and underdeveloped countries (Dumlao and Halog, 2017). In contrast, developed countries have adopted waste diversion strategies, including reducing waste as a resource to generate energy, creating fertilizer through composting, and recycling separated recyclable materials (Dumlao and Halog, 2017). According to Dumlao and Halog (2017), developing countries often lack innovation in waste management because they still rely on landfills and traditional methods, while developed countries have implemented advanced and innovative techniques for converting waste into energy and other resources. Despite variations in drivers and needs across regions, nations in both the Global North and South need to improve WH and CE compliance, and enhance

stakeholder partnership, awareness, and participation throughout the SWM process (Awino & Apitz, 2023).

1.3.3 The efficacy of solid waste management practices

A case study in Gweru, Zimbabwe, examined how the informal sector helps manage solid waste and turns discarded materials into reusable resources (Jerie & Tevera, 2014). Managing municipal solid waste is a persistent challenge in many developing countries. Rapid population growth puts pressure on already-strained waste systems, causing service inefficiencies. As a result, large amounts of waste stay uncollected, creating serious environmental and health risks (Jerie & Tevera, 2014). The study found that informal enterprises in Gweru generate significant waste, demonstrating low material efficiency. Food markets are most affected, producing large amounts of biodegradable waste that is often improperly disposed of. The authors emphasize that waste management should address the entire lifecycle: waste generation, collection, storage, transport, treatment, and resource recovery, to reduce pollution and health risks (Jerie & Tevera, 2014).

In many developing countries, waste is ideal for conversion into organic fertilizer, and economic factors favour composting in regions where food production is of great importance (Jerie and Tevera, 2014). Waste composting transforms the fermentable organic content of waste into a soil conditioner (Jerie and Tevera, 2014). The study by Jerie and Tevera (2014) reveals that there is an inadequacy in the waste collection fleet in Gweru, as the waste collection trucks in the area are unable to service all the settlements, considering the increasing population of Gweru and the expanding informal sector (Jerie and Tevera, 2014). There are high rates of vehicle breakdowns due to poor road conditions and inadequate maintenance of vehicles (Jerie and Tevera, 2014). Additionally, there is a lack of financial resources within the municipality to support efficient vehicle waste collection. Some vehicles used for waste removal are old and frequently break down (Jerie and Tevera, 2014). The council does not have enough waste collection and disposal facilities, including skips and metal or plastic bins (Jerie and Tevera, 2014). Areas such as the Kudzanai market generate large amounts of waste in a single day, and the waste receptacles are insufficient to match the amount

of waste disposed of, as few bins have been provided for collection (Jerie and Tevera, 2014).

In addition to insufficient financial resources, there is an absence of a waste policy that establishes a framework for planning and organizing waste management activities, along with weak enforcement of existing legislation related to environmental management and solid waste management in the city (Jerie and Tevera, 2014). Moreover, there is a lack of public education regarding environmental management from various institutions (Jerie and Tevera, 2014). In most developing countries, 50% to 70% of municipal solid waste comprises organic materials suitable for composting (Manea *et al.*, 2024). The composting process can occur through source separation (UNEP, 2015). This process involves microorganisms that fall into three main categories: bacteria, fungi, and actinomycetes (George and Natalia, 2016). Currently, waste continues to rise, and our world can no longer sustain the uncontrolled disposal of waste (George and Natalia, 2016).

According to the United Nations Environment Programme (UNEP) Global Waste Outlook (2024) assessment, global municipal solid waste is projected to increase from approximately 2.3 billion tonnes in 2023 to 3.8 billion tonnes by 2050 if current practices persist. This growth is expected to result in heightened environmental, health, and economic burdens (UNEP, 2024). The World Bank has reported that the world currently generates over 2 billion tonnes of municipal waste annually, with this figure anticipated to rise by nearly 73% by 2050. A significant portion of this waste remains uncollected or is openly dumped, particularly in low-income countries.

The World Health Organization's most recent report notes that solid waste volumes are increasing at an unprecedented rate and that much of this waste continues to be inadequately managed or disposed of in uncontrolled ways, such as open dumping and burning. These practices pose risks to ecosystems, human health, and climate objectives. A global assessment found that more than 40% of households worldwide dispose of their waste in unsafe or uncontrolled ways, such as open burning or dumping, contributing directly to pollution and health hazards. To address this urgent issue, communities and policymakers must take immediate action and implement safer waste management practices.

1.4 Motivation of the Study

Modern waste-handling strategies, including recycling, composting, and waste separation, are widely recognised as effective approaches to reducing pollution and promoting resource recovery. These methods are generally implemented within formal municipal waste treatment systems, particularly in urban areas with established infrastructure and institutional support. In contrast, many rural communities lack access to formal waste collection and disposal services. Consequently, these communities frequently rely on local knowledge. In these contexts, indigenous knowledge systems play a significant role in environmental management.

Indigenous waste-handling techniques have evolved through sustained interactions between communities and their natural environments, enabling effective waste management using locally available resources and culturally embedded practices. These approaches frequently emphasize waste minimization, material reuse, and environmentally responsible disposal methods, aligning with contemporary sustainability principles. Despite their potential benefits, indigenous waste-handling systems are frequently excluded from formal waste management planning and policy discussions.

A primary reason for this exclusion is that indigenous knowledge is predominantly transmitted through oral traditions and experiential learning rather than written documentation. As a result, many indigenous waste-handling practices remain undocumented and are often perceived as informal or unstructured, despite their effectiveness within practicing communities. The limited documentation of indigenous waste-handling techniques has resulted in a scarcity of recent academic literature. Due to the fact that indigenous knowledge has historically been preserved through oral traditions rather than formal research, several seminal studies from previous decades continue to serve as key references for understanding these systems and their application in environmental management.

The reliance on older literature in this study is therefore justified, as these works provide a foundational baseline of knowledge regarding indigenous practices that have historically been under documented. Concurrently, recent studies, including those by Machete (2019), Famo and Machete (2023), and Madonsela *et al.* (2024), illustrate the growing recognition of indigenous knowledge systems in supporting sustainable environmental management. These contemporary studies supplement earlier foundational research. Documenting indigenous waste management practices can expand the existing body of knowledge and introduce locally appropriate, cost-effective strategies. Such documentation may also foster greater appreciation of indigenous knowledge systems within environmental management discourse and facilitate the integration of indigenous practices into environmental education and policy development into environmental education and policy development.

1.5 Problem Statement

Many rural South African communities generate household waste without formal municipal collection, instead using indigenous methods to manage waste locally. UThweba Village lacks formal municipal waste services, compelling households to rely on undocumented indigenous methods. Due to these methods not being formally recorded, there is little understanding of their effectiveness, sustainability, or risks. This absence of documentation on indigenous waste management practices reveals a key knowledge gap. Without analysis, it remains unclear whether these practices are sustainable or need improvement.

This study aims to address that gap by documenting and analysing the indigenous waste management practices in uThweba Village. Evaluating their social, economic, and environmental impacts will help determine whether these practices are sustainable and identify strengths and gaps. The results will inform more inclusive and effective waste strategies in similar rural areas.

Older references were deliberately chosen because the foundational and intergenerational nature of Indigenous waste management makes these studies essential for explaining core principles and traditional applications. This study demonstrates that incorporating both older and recent literature is essential for a

comprehensive understanding of indigenous waste management practices. This dual approach directly addresses gaps and uneven documentation in research on indigenous knowledge systems, especially in the context of waste management. Older literature is essential, as many indigenous practices are historically rooted and transmitted through cultural traditions and oral knowledge rather than formal documentation. Early academic works provide foundational insights into traditional knowledge and environmental practices, contextualizing the evolution of indigenous waste management.

Recent literature links indigenous waste management to contemporary concerns, such as sustainability and the circular economy, demonstrating its ongoing relevance and widening the study's scope beyond the historical. The limited availability of recent literature on indigenous waste management underscores the value of earlier sources documenting traditional practices before the effects of modernisation and urbanisation. These works offer important historical evidence that continues to inform current practices. By integrating older and recent literature, this study not only contextualises indigenous waste management historically but also firmly establishes its continued relevance within current academic discussion. This approach underpins the central argument for documenting the Indigenous Waste Management System (IWMS) in uThweba Village.

1.6 Research aims and objectives

The study aimed to document indigenous solid waste management methods practiced in uThweba Village, South Africa. To achieve this research goal, the following objectives were examined:

1.6.1 To examine the types of household waste generated in the study area.

1.6.2 To document waste management practices common in uThweba Village.

1.6.3 To evaluate the influence of indigenous systems on the accessibility and affordability of waste disposal services in uThweba Village.

1.6.4 Recommend an appropriate indigenous solid waste management model for uThweba Village, considering the gaps and findings from.

1.7 Breakdown of remaining chapters

Chapter 2: An overview of current literature on indigenous solid waste management methods. The literature was reviewed to identify gaps in knowledge that need to be addressed.

Chapter 3: This chapter discusses the steps and methods used to document the indigenous solid waste management practices in uThweba Village, KwaZulu-Natal, South Africa.

Chapter 4: This chapter discusses the results of the data analysis processes conducted and reported. It discusses each theme regarding the research objectives, continuously referring to the literature.

Chapter 5: The summary of findings and conclusions is presented in Chapter 5.

Chapter 6: This chapter provides recommendations based on the results and conclusions obtained.

1.8 Conclusion

This chapter provided background on the definition of indigenous Waste Management in relation to the Indigenous Knowledge System and outlines the objectives and goals of the study. It also explains the rationale and benefits of documenting indigenous waste management practices across various regions in both developed and underdeveloped countries. This chapter discusses the challenges and gaps in the practice of indigenous waste management, using the case study of uThweba Village in Cato Ridge, west of Durban, within eThekwini municipality

2 CHAPTER 2: INDIGENOUS METHODS OF SOLID WASTE

2.1 Introduction

Indigenous knowledge (IK) is a body of understanding developed by indigenous societies prior to the introduction of modern scientific knowledge (Tharakan, 2017). This knowledge serves as the foundation and template for how societies address local challenges, including resource utilisation and conservation, agriculture, and public health (Tharakan, 2017). The United Nations Educational, Scientific and Cultural Organisation (UNESCO) recognises this as knowledge woven into a complex culture encompassing language, social interaction, and practices for resource allocation and utilisation (Nakashima & Rubis, 2017).

Indigenous knowledge does not rely on established laws of applying scientific methods but rather on the knowledge that society has adopted (Nakashima & Rubis, 2017). It is a network of knowledge and beliefs and is considered a tradition meant to preserve and sustain the livelihood of the society (Nakashima & Rubis, 2017). Indigenous knowledge does not depend on formal scientific methods; instead, it is rooted in the knowledge and practices that communities develop and adopt through long-term interaction with their environment. It consists of a network of knowledge, beliefs, and traditions transmitted across generations that play an important role in sustaining community livelihoods and cultural practices (Sinthumule, 2023; Obi *et al*., 2021).

The acquisition of indigenous knowledge does not require any formal qualification, but rather experience and practical knowledge. Tharakan (2017) and Nakashima and Rubis (2017) acknowledge that indigenous methods are locally based and have track records of being feasible and proven to sustain livelihoods in societies for many years with minimal flaws. Mapira and Mazambara (2013) argue that Indigenous knowledge systems were marginalised in an attempt to replace them with Western views, which led to the destruction of values and cultural norms. In support of the earlier argument, Semenya and Machete (2019: 719-729) infer that many of these knowledge systems are prevalent and continue to be practiced in non-urban areas of South Africa as the ultimate means of securing a livelihood for rural communities.

The significance of these knowledge systems in South African communities, particularly amongst the rural (non-urban) segment of the country's population, elevates the need for urgent documentation, which can also help preserve them, through the acknowledgment of their value. These knowledge systems in the livelihoods of vulnerable and historically oppressed populations, the urgency and essentiality of this study are unearthed. It should be acknowledged, however, that while these knowledge systems have survived colonialism, a reasonable amount of their content, richness, principles, and opportunities have already been lost along the way (Semenya & Machete, 2019). This acknowledgment further justifies the urgency to prevent further losses associated with the lack of documentation of IKS. A further observation by Lindh and Haider (2010) is that many indigenous knowledge systems remain unnamed, poorly defined, and largely undocumented.

According to these authors, three key characteristics of indigenous knowledge systems are: they are often undocumented, primarily transmitted through oral traditions, and closely linked to the livelihoods of rural communities. These characteristics have been widely recognised and are used to distinguish such knowledge from formal scientific knowledge systems. Although the work of Lindh and Haider (2010) is not recent, it remains a foundational study in documenting and understanding indigenous knowledge systems. More recent studies continue to support these observations, confirming that indigenous knowledge is largely transmitted orally and remains insufficiently documented despite its importance for community livelihoods and environmental management (Madonsela *et al*., 2024; Famo and Machete, 2023). These studies reinforce the relevance of Lindh and Haider's observations in contemporary research on indigenous knowledge systems.

An in-depth analysis of international literature on the characteristics of IKS by Moahi (2006) and Lindh and Hiader (2010) compares well with Semenya and Machete (2019). Figure 2.1 below presents several characteristics of IKS found in Madonsela and Machete (2023) and Famo and Machete (2023). The studies by Moahi (2006), Lindh and Haider (2010), and Semenya and Machete (2019) share similar perspectives on the characteristics of IKS. Their literature compares well as they all describe IKS as community-based, culturally embedded, and transmitted across generations. However, each author focuses on specific aspects: Moahi stresses knowledge transmission,

Lindh and Haider explore its cultural depth, and Semenya and Machete highlight its community foundations. According to Fabiyi and Oloukoi (2013), indigenous knowledge focuses on conservative and sustainable management of natural resources (Fabiyi & Oloukoi, 2013). Indigenous knowledge appears as fixed communication with experiential training and learning processes, while scientific knowledge depends on tests (Fabiyi & Oloukoi, 2013).

Indigenous knowledge in itself is scientific knowledge that is merely not documented. Both types of knowledge are not perfect, but are extremely useful (Bi Che Soh & Omar, 2011). The indigenous knowledge of homemakers in rural and urban areas varies significantly due to various aspects of resource management (Bi Che Soh & Omar, 2011). Indigenous waste management systems have been deployed in countries like Nigeria and have proven effective with similar impacts to those regarded as westernised knowledge systems (Ajibade, 2007). The term indigenous system is commonly used to refer to the health and agriculture sectors, as local communities are known for developing their traditional medicines for various ailments (Ajibade, 2007).

Specific techniques used in agriculture have proven to be effective (Ajibade, 2007). Little information is, however, passed on or documented about indigenous knowledge applicable to waste management in South Africa (Tharak, 2017). While Western knowledge was seen as modern, IKS is regarded as a traditional and backward way of life (Risiro *et al*., 2013). Figure 2.1 below displays the most and least frequently used characteristics from the reviewed studies. It uses descriptive statistics to characterize indigenous knowledge based on its high scores. From the 38 examined articles and their definitions of IK, 26 unique elements were identified (see Figure 2.1). The components used to characterize IK ranged from 1 to 13 among different authors. This descriptive statistical analysis reached a consensus, suggesting that a median of ten elements could be considered the ideal number for representing the core of IK, namely:

- Local/originated locally
- Unique to a society or culture
- Of the indigenous people of particular geographical areas
- Bodies/ forms/complex set of knowledge/wisdom/
- Embedded in the cultural traditions of regional and local communities

- Basis for local decision-making in agriculture, health, food education, and environmental management
- Practiced for generations/ transmitted from one generation to another
- Developed around specific conditions of populations and communities
- Traditional/traditional wisdom/science

Figure 2.1: Characteristics of indigenous knowledge systems-studies

Source: Madonsela and Machete (2023), and Famo and Machete (2023)

While myriad characteristics determine whether knowledge systems practiced in communities are Indigenous or foreign, no records exist of the prevailing characteristics in South Africa, particularly in Cato Ridge, uThweba. Understanding these characteristics is significant for several reasons: first, to identify the variables that drive service delivery in the study area; second, to understand the factors influencing solid waste management practices in the region; and lastly, and most importantly, to recognise the factors that affect the state of environmental health in Cato Ridge uThweba, as solid waste management is a key determinant of environmental health.

2.2 Indigenous systems of solid waste management

Given the repeated failures in waste management and the limited financial resources for delivering these services to communities, Machete (2019) argues that waste should be managed indigenously. The prevalent practice known as the “task force approach," which required all residents to participate in a mandatory clean-up service, involved collecting waste and placing it along the roadside rather than disposing it in dumpsites, as noted by Izubara and Umoh (2004). This approach has faced criticism for sustainability concerns from Madonsela and Machete (2023) and Famo and Machete (2023). Some studies indicate that waste left behind is either consumed by scavenging animals, allowed to decompose, or washed away by floods (Izubara and Umoh, 2004).

According to Izubara and Umoh (2004), the primary indigenous practice of waste management involves segregating waste into biodegradable and non-biodegradable categories. Waste segregation at the source is rooted in indigenous African and Western traditions, ensuring effective waste disposal is adequately achieved (Izubara & Umoh, 2004). After waste segregation, Tharak (2017) notes that Indigenous communities would either bury, burn, compost, convert, bait, mulch, or recycle the separated waste. These techniques are applied to different waste streams (Izubara & Umoh, 2004). Solid waste generation is a global environmental and public health issue, especially in rural areas with poor waste management infrastructure and services (Vinti & Vaccari, 2022; Zondi *et al*., 2023). It is essential to examine how these challenges are handled in regions without strong waste management support.

While it has been shown that indigenous knowledge-based waste management techniques enable waste to be handled and disposed of in an environmentally friendly and beneficial way, there is rarely research on how these techniques can be implemented to address current waste management challenges (Izugbara and Umoh, 2004). Historically, these techniques have been utilised to manage various waste streams, including human waste, agricultural waste, household waste, and others. These methods tend to be overlooked because academics perceive them as primitive, backward, and associated with superstitious communities (Madonsela and Machete, 2023). The existing literature highlights several common indigenous solid waste management methods practiced in different communities worldwide (see below Table 2.1).

Table 2-1: Known indigenous methods of waste management

Author	Type of waste	IKS processing methods	End products produced
Madonsela and Machete (2023)	Combustible contents	Reused	Fuel
	Organic constituents	Reused Composted	Animal feed Manure
Eyong (2007)	Crop residue (Millet and sorghum)	Reused	Trash lines on farms impede the runoff of water.
	Rice husk	Reused	Fuel and animal food
	Coffee peeling	Reused	Fuel, compost material, and stable material.
	Tree trunks	Reused	Log lines
	Fiber bags	Reused	Storage for solid waste, food items, and farm tool bags
	Charcoal	Sold and reused	Fuel
	Bread waste	Reused	Animal feed
	Saw dust	Reused	Fuel, animal stable litter, and for cleaning newly laid tiles
	Waste from grinding mills and palm kernel factories	Reused	Animal feed
	Animal droppings	Reused	Direct fertilizer
		Composted	Manure
	Blood and bones from abattoirs	Reused	Animal feed
	Animal horns	Reused	Cups and decorative items
	Rice husk	Reused	Fuel, animal feed, mulch, and stable litter
Achankeng (2004)	Coffee peelings	Reused	Fuel, stable litter, and compost materials
	Old tires	Repaired and transformed into:	Flower vases, ropes, slippers, shoes, wires
	Aluminum waste	Recycled and transformed	pots, boxes, buckets, watering cans, cake pans, charcoal cookers, sawdust stoves, knives, hoes, cutlasses, spears, spades, masks, tourist articles

	Paper and plastic	Recycled and transformed	Tourist articles
Kanene (2016)	Human Waste	Buried	Fertilizer
	Grass and crop residues	Added in cattle kraals to add bulk to the amount of organic remains and used as	Manure
Lwasa (2012)	Metals	Recycled into other forms	
Birhanu (2015)	Plant remains	Reused Dried	Manure Fuel
	Animal remains (Meat and bones)	Reused	Animal feed
	Recyclables (glass, plastic, tin cans, metals, etc.)	Sold to individuals called Korales,	Korales sold these items to small recyclers and industries
	Clothing Items	These were exchanged with individuals called Liwach for new household utensils.	Resold by Liwach to low-income earners
Demanya (2017)	Solid waste	solid waste was dealt with through two traditional composting methods called 'tomo' and 'prokan'. 1. Tomo is a place where every locally generated waste is deposited. At a point in time, 'Tomo' was dug out as compost or manure. 2. Prokan- involved dropping organic wastes on backyard gardens to rot and compost	
Izugbara and Umoh (2004) and Ajibade (2014)	Agricultural Waste	Composted (buried in shallow pits)	Economically valued trees such as banana, raffia palm, and coconut plantain were planted on top of these pits.

	Food remains	Reused	➢ Baits for household and home garden rodents and pests. ➢ Animal feed and ➢ Processed into other forms of food e.g yam peels were used to make elubo(a traditional yam flour.
		Composted	➢ Manure
	Animal droppings	Composted and dried	Used as manure
	Animal parts (bones, horns and tusks, cow tail)	Recycled	Plates, cutlasses, flutes, ivories, decorative items, and as ingredients in local medicine.
	Fiber sacks, rags, old clothes	Burnt Reused in;	Mulching, construction of scarecrows, bedding/sleeping mats for livestock and domestic animals
	Bottles	Reused	➢ Decorating graces ➢ Storage for plant seeds ➢ hooks and trinkets.
	Ash	Reused	Cleaning Agent Ingredients in preparing black soap
	Plantain bark, banana, and cocoa pods	Reused	Ingredients in making black soap
	Coconut shells and palm extracts	Reused	Fuel for cooking
	Weeds	Reused	Mulch
	Guinea corn Stalk	Reused	Malaria medicine
	Metal waste	Recycled and forged into;	Hunting daggers, bullets, spears, arrows, garden diggers, traps, kitchen and carving knives, cutlass, hoe, axe, jewelry, necklaces, rings, bangles, tipped iron-tipped pegs, hooks, etc.

2.2.1 Existing indigenous practices of solid waste management

In southern Nigeria, some organic and agricultural waste is recycled for animal feed (Izubara & Umoh, 2004). The food is collected and dried to slow or stop decomposition before feeding animals (Izubara & Umoh, 2004). Organic waste from farms, such as food and animal faeces, is reused as fertilizer (Izubara & Umoh, 2004). Ash is another waste product generated from wood and coal when making fuel (Izubara & Umoh, 2004). This substance has previously been used for various purposes, including teeth whitening, soap, and cleaning black smoke stains from cooking pots (Izubara & Umoh, 2004).

Rural people practice the tradition of animal slaughtering for cultural beliefs, and some slaughter simply because they own farms (Izubara & Umoh, 2004). The leftover animal parts from slaughtering are repurposed into useful plates, cutlery, and decorative materials (Izubara & Umoh, 2004). Metals are another type of waste produced in these communities. In the past, these metals were melted down and used to construct new desired tools (Izubara & Umoh, 2004). Cans commonly used in households can be repurposed to create funnel gallons and bread-baking pans (Izubara & Umoh, 2004). Old tires are another waste produced in rural communities; they can be reused to make sandals and ropes for drawing water from wells (Izubara & Umoh, 2004).

South Nigeria is another typical example of a region implementing indigenous waste management, as Izubara and Umoh (2004) noted. Additionally, there are technology projects involving waste management aspects, such as urine diversion systems, glass recycling, waste tire depolarization, waste tires for paving internal streets in rural areas, and using plastics to manufacture other products (DRDLR, 2015). Urine diversion toilets were piloted in Gauteng Province, Eastern Cape, North-West, Limpopo, and Mpumalanga provinces, where urine and faecal matter are separated at the source (DRDLR, 2015).

This separation occurs as urine flows through a separate pipeline, while faeces (solid waste) are captured in a vault and dried through solar-powered insulation plates; urine and solid waste can be used for composting (DRDLR, 2015). Waste bottles can be transformed into beads, creating income at markets (DRDLR, 2015). The waste

management technology projects were piloted in South Africa, but there is limited knowledge regarding the continued use of such technologies across various provinces. This approach should be considered for future waste management to reduce pressure on landfill sites. A study conducted in Guyana, South America, reveals that cultivating sugarcane and rice shows that recycling organic waste through bio-dung composting and vermicomposting is an effective method for producing fertilizer (Ansari, 2010). Vermicomposting involves the biological breakdown of organic matter using earthworms and microorganisms to create vermicompost (Ansari, 2010). This process helps maintain soil fertility as a bio-fertilizer in agricultural activities (Ansari, 2010). Over centuries, indigenous peoples have sustainably managed the land and soil for agriculture using indigenous knowledge (Pushpanjali *et al*., 2013).

A study conducted in an Australian abattoir reveals that paunch is another form of waste produced during animal slaughter, mixed with other bulk agents and sold as bagged compost, which is then used as fertilizer in crop production for domestic gardens. Livestock manure can sustain soil health by combining grass and crop residues in the cattle kraals and subsequently adding the mixture to the organic remains present. This process helps maintain soil texture and restore the soil's nutrients (Aremu & Vijay, 2016). Crop residues are not burned or discarded as unwanted waste but are reused to enhance soil fertility and provide essential nutrition, thus supporting agricultural practices (Aremu & Vijay, 2016). In India, most plant waste is burned or left to decay in public places, contributing to pollution (Siindhu, 2012).

Kosoe, Darko, and Osumanu (2019) studied how residents of the Jaman Municipality in Ghana manage household waste. They found that Indigenous Knowledge Practices (IKPs) are central to rural waste management where formal services are limited. A key practice is converting or recycling certain waste materials into useful products. This process depends on the skills of local artisans who repurpose discarded materials into items of economic and functional value. For example, blacksmiths repurpose scrap metal into household tools such as knives, axes, machetes, and spoons, which are then used locally or sold within the community. According to a study by Masila Joshua Masipa and Madimabe Geoff Mapaya (2025), indigenous waste management systems focus on resource recovery and reuse rather than disposal, effectively reducing the amount of waste that needs to be finally discarded. However, the study primarily

documented the repurposing of metal materials, while the reuse or recycling of other non-biodegradable materials, such as plastics and glass, was not extensively discussed. This suggests that although certain materials can be effectively repurposed within indigenous waste management systems, other waste streams may remain inadequately addressed.

The findings of Kosoe *et al*. (2019) therefore highlight both the strengths and limitations of indigenous waste management practices. While these practices contribute to waste reduction and local economic activities, there may still be gaps in managing certain types of waste. Understanding these dynamics is important when examining indigenous waste management practices in other rural contexts. Consequently, the present study seeks to document similar practices in uThweba Village to determine how indigenous waste management systems operate and whether they address different categories of waste generated within the community.

For biodegradable waste, Kosoe, Issaka, and Osumanu (2019) reported that residents of the Jaman Municipality convert this waste into animal feed or processed food. Examples of such waste used to feed domestic animals include cassava and yam peels, leftover fruits from the market, and farm weeds.

Research conducted in Maseru, Lesotho, shows that ash is commonly applied as a pest control method in both household gardens and agricultural fields (Senekane *et al*., 2022). The study also notes that ash serves several other functions, including its use in treating certain unexplained illnesses within the community (Senekane *et al*., 2022). In addition, households in Maseru maintain ash heaps that often contain a forked copper pole, which is traditionally believed to protect the homestead from lightning strikes (Senekane *et al*., 2022). The findings of this study align with the existing literature, which highlights the widespread use of ash in home gardening and farming practices (Senekane *et al*., 2022).

Similar practices have been reported in other regions. For example, in the United Kingdom, wood ash has been documented as a pest-repelling substance used in home gardens (McCoid & Hainey, 2019). In Zimbabwe and Ghana, farmers mix wood ash with maize kernels to protect stored maize from pest infestations (Ndlovu & Sprickerhoff, 2017). Furthermore, research from India indicates that ash derived from

the stem juice of Musa paradisiaca Linn is applied for wound healing (Bharathi *et al*., 2012). Collectively, these studies demonstrate that ash has diverse applications across different regions, particularly in pest control and in certain traditional medicinal practices.

Impact of indigenous waste management practice on Innovation and job creation

Various benefits are associated with processing waste into valuable items that can be reused. According to the Department of Rural Development and Agrarian Reform's Final Annual Performance Plan for 2015/16, several initiatives were introduced to promote rural development and environmental sustainability in South Africa, even though specific waste beneficiation programs are not mentioned in the report. According to a recent study by Rampedi, Schoeman, and Kwenda (2024), only a small percentage of small businesses in Gauteng townships actually practiced recycling or reuse of waste, with most relying on municipal waste collection, and 10 to 20 percent giving recyclables to informal waste reclaimers.

Building on this, research conducted in India by Pushpanjali *et al*. (2013) assessed the impact of soil nutrients and manure on crop yields. Their field experiments compared crops with and without nutrient inputs, revealing that the absence of manure or fertilizer led to significantly lower yields. According to a study by Rameshwar Hiranmai Yadav and Anteneh Argaw (2016), recycling agricultural waste such as post-harvest crop residues and cattle shed manure through methods like vermicomposting provides a useful approach to soil fertility and resource recovery.

The study converted these wastes into compost using biological methods and applied the compost to crops. Results showed improved plant growth, increased soil fertility, and greater biomass. Furthermore, the research emphasised that turning agricultural waste into products such as compost, bioenergy, and animal feed supports environmental health and creates income opportunities for farmers. Thus, agricultural waste should be repurposed to boost environmental sustainability, increase crop productivity, and reduce poverty in rural areas.

2.2.2 The practice of indigenous waste management in developed countries

Culture influences various management practices across societies, and these practices are often shaped by socio-political and socio-economic conditions (Thomas & Schonken, 1998; Edoho, 2001). One of the indigenous groups studied by Olga Siragusa and Dmitry Arzyutov (2020) is the Veps people who live in northwest Russia. The researchers used qualitative ethnographic methods, including field observations, interviews with community members, and documentation of everyday household practices, to understand how indigenous knowledge influences waste use and resource management.

Their findings revealed that the Veps engage in recycling and reuse practices, in which materials that have reached the end of their initial useful life are “given a new life” through repurposing. For instance, used tyres are transformed into garden decorations, while empty oil cans and drums are reused as containers for collecting and storing water. Fabric off-cuts are also utilised to create carpets, pillows, doll fillings, and clothing. Furthermore, the researchers observed that the doll-making process is connected to traditional beliefs, where leftover threads from the process are burned as part of cultural practices (Siragusa and Arzyutov, 2020).

2.2.3 The practice of indigenous waste management in developing countries

Poor waste management and excellent waste management in urban and rural areas plague most developing countries (Adebayo Bello and Bin Ismail, 2016). In support of the above statement, poor waste management remains a major challenge in both urban and rural areas of developing countries, driven by rapid population growth, urbanization, and limited waste management infrastructure. Many municipalities struggle with inadequate waste collection and disposal systems, resulting in open dumping, environmental pollution, and health risks (Mngomezulu *et al*., 2024; Nyathi, 2025; World Bank, 2019. Studies show that a significant portion of waste generated in low-income countries is either not collected or is improperly disposed of, particularly

in informal settlements and rural communities where access to waste services is limited.

Thus, this research focuses on identifying the most effective approach to Solid Waste Management (SWM) in developing countries, an ongoing concern for researchers and policymakers (Amuda *et al*., 2014). This need is underscored by a World Bank report, which indicated that Sub-Saharan Africa generated about 174 million tonnes of Municipal Solid Waste (MSW) in 2016 (World Bank, 2019). Furthermore, more recent studies suggest that waste generation in the region is expected to increase to approximately 269 million tonnes by 2030 and could exceed 500 million tonnes by 2050, highlighting the urgent need for improved waste management systems (Adedara *et al*., 2023; IFRI, 2025).

Municipal solid waste management is, in theory, the responsibility of local authorities, who are expected to collect, transport, and properly dispose of waste within their jurisdictions. However, many municipalities face significant challenges in fulfilling these responsibilities due to limited resources and organizational constraints. Studies indicate that waste management systems in developing countries are often hindered by inadequate funding, insufficient infrastructure, limited technical expertise, and staff shortages (Maalouf et al., 2025; Jagun *et al*., 2023). These limitations impede effective waste collection, transport, and disposal, resulting in inefficient services and environmental problems. Furthermore, increasing urbanization exacerbates these challenges for municipal authorities.

Research in South African municipalities demonstrates that increased waste generation, driven by urbanization and population growth, places additional strain on already limited municipal waste management resources. Consequently, many local authorities are unable to provide consistent and efficient waste services, especially in low-income and informal settlements (Mngomezulu *et al*., 2024).

Composting represents a predominant Indigenous Knowledge Practice (IKP) for managing biodegradable solid waste in many African communities (Ajibade, 2007). This approach utilises animal excreta, plant leaves, farm residues, and household food waste to produce organic fertilizer on a small scale. The process typically involves burying these materials in shallow pits or wet containers for a period of time (Ajibade,

2007). Once matured, the compost is applied as organic fertilizer in subsistence farming, thereby recycling nutrients (Ajibade, 2007). Currently, compost is used in various subsistence farming activities, contributing to nutrient recycling and improved soil fertility (Vinti & Vaccari, 2022; Tadesse *et al*., 2025).

Historically, management education and scholarship relating to Africa have been dominated by Western theories introduced during the colonial period, which limited the development of indigenous African management thought and created a perceived dichotomy between “developed” Western management paradigms and “underdeveloped” African management ideas (Inyang, 2009). In recent years, however, contemporary scholarship has increasingly challenged this perspective, advocating the recognition and integration of indigenous African management philosophies, such as Ubuntu, alongside other culturally grounded organizational practices. This evolving scholarship sets the stage for a deeper exploration of African-rooted management approaches.

Recent studies unequivocally demonstrate a strong shift towards the development of African management philosophies rooted in indigenous knowledge systems and cultural values, eschewing exclusive reliance on Western theories from the colonial and globalization eras. Scholars maintain that African management, anchored in local traditions, especially Ubuntu, distinctly emphasises communal relationships, collective responsibility, human dignity, and shared leadership. For example, research by Joyce Toendepi and Khanyisile Cele (2024) establishes the rising prominence of Afrocentric leadership models cantered on collective wisdom, collaboration, spirituality, and interconnectedness in organizational management. Their study confirms that responsible leadership in African contexts reflects the enduring principle of '*I am because we are,' prioritiz*ing community-oriented decision-making and deep respect for human dignity.

*Comparison of the practice of indigenous waste management methods between developed and developing countrie*s

Indigenous systems hold a wealth of knowledge that could enhance municipal solid waste management (MSWM). However, their value is often overlooked because most management models have tended to favour Western approaches due to colonization and its ongoing legacy ref. According to reports, significant positive gains can be achieved when traditional and modern MSWM methods are integrated. SWM methods are blended ref. In literature, emphasis is frequently placed on Western waste management methods at the expense of African practices, resulting in limited development of African management theories (Inyang, 2009).

Western management approaches, therefore, dominate in Africa, with minimal attention paid to their cultural implications for African managerial contexts. Nevertheless, research on the Indigenous practices of the Ndigbo people in Nigeria suggests that certain Indigenous management principles are compatible with, or comparable to, aspects of Western management paradigms (Oghojafor et al., 2013; Iguisi, 2014). Recent studies further emphasize the importance of integrating indigenous African knowledge systems into management frameworks, arguing that culturally grounded philosophies such as Ubuntu and communal leadership can enhance organizational effectiveness when combined with contemporary management approaches (Ibeh, Eyong & Amaeshi, 2022).

2.2.4 Indigenous waste management practice in South Africa

There is minimal emphasis on or literature regarding South African indigenous waste management methods; however, more literature discusses the country's commitment to sustainable development. Instead, South African literature focuses on economic development in a growing population experiencing increasing urbanization rates. As expected, this growth is accompanied by a rise in waste generation, necessitating the establishment and implementation of effective waste management policies and programs (Mngomezulu, Mbanga & Adeniran, 2024; UNEP, 2023; Madonsela *et al*., 2024)

The waste hierarchy (Figure 2.2 below) informs and influences waste management legislation in South Africa. This hierarchy forms the foundation of the National Waste Management Strategy (NWMS), which guides waste management practices and policy implementation in the country (DFFE, 2020). The hierarchy prioritises waste reduction and avoidance, emphasizing the implementation of engineering and design measures to ensure products do not generate unnecessary waste at the point of use (DFFE, 2020). This includes minimizing the use of potentially waste-generating materials during manufacturing and packaging processes.

The reuse stage encourages identifying secondary uses for materials and products after they reach the end of their initial life cycle. Recycling involves removing particular materials from the waste stream and converting them into raw materials that can be used to manufacture similar or new products. A common example of this process is plastic recycling. Recovery generally applies to waste that can be incinerated to generate energy for other applications, such as boilers or steam generators. The final option in the hierarchy is disposal or treatment. When all other waste management options have been exhausted or are not feasible, these methods are considered. Treatment aims to reduce the environmental and health impacts of waste, while disposal involves safely placing waste in controlled facilities, such as landfills. Both approaches are intended to prevent harm to human health and the environment (DFFE, 2020).

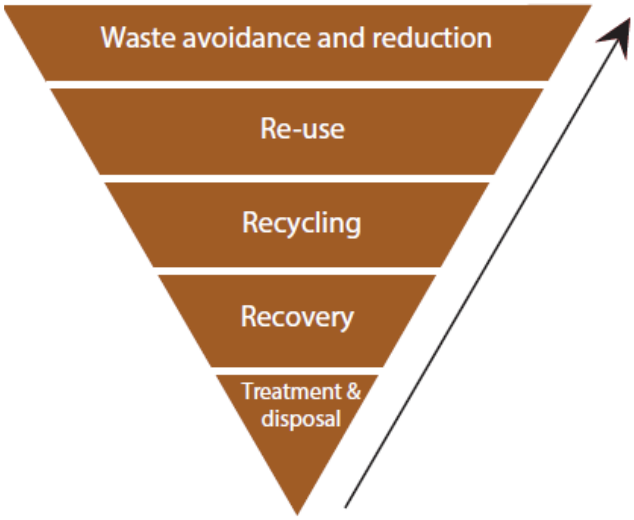

Figure 2.2: Waste management hierarchy as per the National Waste Management Strategy. Source: DEA (2020).

2.2.4.1 Legislative framework: waste management laws in South Africa

Numerous legislative guidelines regulate the management of waste produced by households. The following sections examine the existing frameworks designed for waste management in South Africa:

Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996).

The South African Constitution, enacted through Act No. 108 of 1996, establishes the Bill of Rights. By affirming democratic values such as human dignity, equality, and freedom, it underscores the protection of individual rights. Section 24 further guarantees everyone the right to an environment that is not harmful to their health or well-being. This right extends to having the environment protected for both present and future generations through reasonable legislative and other measures.

As a result, this constitutional provision serves as the foundation for environmental governance and waste management legislation in South Africa. Within the context of indigenous waste management, the Constitution supports the recognition of sustainable environmental practices that have historically been embedded within indigenous communities. These practices, such as the use of natural materials for everyday items and the careful management of resources, emphasize resource conservation, reuse, and environmental stewardship. This alignment directly supports the constitutional principle of protecting the environment for future generations, highlighting how traditional methods can inform modern approaches to environmental protection.

Health Act, 1977 (Act No. 63 of 1977)

The Health Act of 1977 provides guidelines to protect public health through environmental sanitation and waste control measures. Section 20 of the Act grants local municipalities the authority to maintain hygienic environments that promote residents' health. This includes responsibilities related to waste removal, proper waste disposal, licensing of waste collection and treatment services, and monitoring waste processing facilities. In relation to indigenous waste management practices, the Act

underscores the importance of maintaining clean, healthy environments. Traditional community-based approaches to waste management, such as composting organic waste or reusing materials, contribute to environmental hygiene and align with the Act's objectives of promoting public health.

National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) Act, 1998 (Act No. 107 of 1998) serves as the overarching framework for environmental governance in South Africa. Through its principles, the Act promotes integrated environmental management, sustainable development, and environmental protection. Among the key principles are waste avoidance, minimisation of environmental impacts, and responsible resource management.

In the context of indigenous waste management, NEMA recognises the importance of sustainable resource use and environmental stewardship, values that are deeply rooted in indigenous knowledge systems. For example, indigenous waste management practices might include prioritizing reduced waste generation, repurpose biodegradable materials, and use traditional ecological knowledge to sustainably manage local environments, all of which support the broader goals of sustainable development promoted by NEMA.

National Environmental Management: Waste Act 59 of 2008

The National Environmental Management: Waste Act 59 of 2008 serves as the primary legislative framework governing waste management in South Africa. The Act aims to protect both health and the environment by regulating waste management practices. Promoting waste minimisation, reuse, recycling, and recovery introduces the waste management hierarchy as a guiding principle for waste management activities nationwide. The Waste Act aligns with the constitutional mandate to ensure a clean and healthy environment and to encourage sustainable waste management practices. Indigenous waste management practices, which traditionally emphasise waste reduction, material reuse, and responsible resource use, reflect the principles embedded in the waste hierarchy promoted by this Act.

EThekwini Municipality Refuse Removal Bylaws, 2016

The eThekwini Municipality Refuse Removal By-laws provide local regulatory guidelines for the collection, storage, and disposal of solid waste within the municipality. These by-laws define the responsibilities of both the municipality and waste generators in ensuring proper waste handling and disposal. The municipality is responsible for providing waste receptacles and ensuring regular waste collection services, while residents and businesses must store waste appropriately prior to collection. From an indigenous perspective on waste management, these by-laws create opportunities to incorporate community-based initiatives. Indigenous practices such as separating organic waste, reusing materials, and community participation in environmental management can complement municipal waste management systems and improve local waste management outcomes.

Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000)

The Municipal Systems Act governs municipalities and ensures alignment between national legislation and municipal governance structures. The Act outlines procedures for developing Integrated Development Plans (IDPs) that guide municipal planning and service delivery, including waste management. In relation to waste management, municipalities are responsible for developing strategies that promote efficient resource use, waste reduction, and recycling initiatives. By engaging with indigenous waste management practices, such as collective community action, creative reuse of discarded items, and the transfer of traditional environmental knowledge, municipalities can integrate sustainable waste-handling methods rooted in community participation into formal policies.

EThekwini Integrated Waste Management Plan 2016–2021

The eThekwini Integrated Waste Management Plan (EIWMP) was developed in accordance with the Waste Act, which requires municipalities to formulate strategies for managing waste effectively. The EIWMP outlines waste management objectives, targets for waste collection and diversion, and strategies aimed at waste minimisation, reuse, and recycling. It also includes plans to develop new waste disposal facilities

and decommission existing ones. In the context of indigenous waste management, the IWMP provides a framework for incorporating traditional practices into formal systems. Community-based waste management approaches and indigenous environmental knowledge can support municipal efforts to reduce waste generation and promote sustainable waste management practices. Additional Waste Management Policies in South Africa.

National Waste Management Strategy 2020

The NWMS 2020 provides the national strategic framework for implementing the objectives of the National Environmental Management: Waste Act 59 of 2008. Through this strategy, waste avoidance, reduction, reuse, recycling, and recovery are prioritised, operating in accordance with the waste management hierarchy. The NWMS also outlines national targets for landfill diversion, improved collection services, and the development of sustainable waste management infrastructure.
In the context of indigenous waste management, the NWMS encourages community participation and sustainable resource use, which are key principles embedded in many indigenous environmental practices. Traditional practices such as the reuse of materials, composting of organic waste, and community-based resource management align with the strategy's goals of reducing waste generation and promoting environmentally sustainable waste management practices.

White Paper on Integrated Pollution and Waste Management for South Africa 2000

The White Paper on Integrated Pollution and Waste Management established the policy foundation for waste management in South Africa. It introduced the concept of integrated waste management, a holistic approach that encompasses waste prevention, minimization, reuse, recycling, and safe disposal. The policy also emphasises sustainable development and environmental protection while addressing the social and economic impacts of waste. Within the context of indigenous waste management, the White Paper acknowledges the need for inclusive and community-based environmental management approaches. Examples of indigenous knowledge

systems contributing to integrated waste management include the communal organization of clean-up efforts, the application of resource-conservation practices passed down through generations, and traditional education on responsible waste handling. These methods promote environmentally responsible behaviour, resource conservation, and community participation in waste management activities.

2.3 Conclusion

Recent scholarship shows that research on indigenous knowledge systems, defined as a community's traditional practices, skills, and understandings developed over generations, is gaining recognition in academic discourse and development policy. Scholars argue that indigenous knowledge offers valuable insights into sustainable environmental management (the responsible use and protection of the environment through conservation and sustainable practices) and community-based service delivery (services designed and managed by local communities), especially in rural areas with limited formal infrastructure.

As a result, indigenous practices are now being explored as complementary approaches to address local development challenges, such as waste management and environmental sustainability. This analysis is informed by a postcolonial theoretical framework, which emphasises the critical examination of knowledge production and values the significance of local and historically marginalised voices. Applying this lens highlights the importance of recognizing indigenous perspectives and challenging dominant narratives within environmental sustainability and development policy.

Despite this growing body of research, significant gaps remain in documenting indigenous waste management practices across many developing regions. In South Africa, although some recent studies have begun to examine indigenous environmental knowledge and community-based waste management approaches, the literature remains limited in scope and geographical coverage. Specifically, among the studies reviewed in this chapter, none were conducted in the KwaZulu-Natal Province, and there is no documented evidence of research focusing on indigenous waste management practices in the uThweba village community.

This gap highlights the need for further empirical investigation into indigenous waste management practices within this local context. To address this, the intended research will employ a qualitative approach, including semi-structured interviews and ethnographic fieldwork with community members in uThweba village. This methodology will allow for an in-depth understanding of local indigenous waste

management practices, as well as the cultural beliefs and knowledge systems that inform them.

A review of the literature on indigenous knowledge and waste management practices indicates that although some studies exist, the body of literature remains limited, particularly within developing countries. For example, studies conducted by Benedict Machete and Kgaugelo Semenya have examined indigenous environmental knowledge and waste management practices within rural South African communities. Their research, conducted in rural areas of Limpopo Province, explored how communities traditionally manage waste through practices such as reusing organic materials (using plant and food scraps for other purposes), composting (breaking down organic waste for use as natural fertilizer), and repurposing household items (finding new uses for items rather than discarding them).

Using qualitative research approaches, methods that collect non-numerical data, such as interviews and community observations, the studies documented how indigenous knowledge systems contribute to environmental sustainability and local resource management. The findings of these studies revealed that indigenous waste management practices play an important role in reducing waste generation and promoting environmentally responsible behaviour within communities. However, the studies also highlighted that such practices are often informal and poorly documented in academic literature. While these studies contribute valuable insights into indigenous waste management systems in South Africa, their geographical focus remains limited.

In particular, little or no documented research has examined indigenous waste management practices within the KwaZulu-Natal Province, and no studies were found that specifically investigate these practices in the uThweba village community. This gap underscores the need for further research to document and analyse indigenous waste management practices in this region. The literature reviewed in this chapter indicates that indigenous knowledge systems have historically contributed to environmental management practices in many communities.

Several scholars argue that practices such as reuse, reduction, and recycling have long existed within indigenous societies as part of traditional resource management systems. These practices were often embedded in cultural norms that encouraged

resource conservation and reduced waste. For example, Tharak (2015; 2017) highlights that waste minimisation practices observed in modern waste management frameworks are comparable to traditional practices historically used in local communities. This suggests that contemporary waste management principles may share similarities with indigenous resource management practices that have been applied for generations.

Furthermore, Binda (2014) states that the process of recycling is as old as humanity, with evidence dating back to 400 BC. Izubara and Umoh (2004) further support the view that recycling was rooted in indigenous knowledge of reusing materials rather than treating them as waste. Therefore, recycling is not a Western concept but rather originates in indigenous Knowledge Systems (IKS), which have not been acknowledged or referenced in the literature. The authors Izubara and Umoh (2004) and Tharak (2015) all share a common perception regarding the principles of reduce, reuse, and recycle. These are the three essential components of environmentally responsible consumer behaviour: "reduce" means minimizing waste; "reuse" means finding new uses for items instead of discarding them; and "recycle" means processing used materials into new products.

According to the Waste Management Hierarchy outlined in the National Waste Management Strategy (DEA, 2020), these principles represent the top priorities in waste management, and indigenous people also practiced them as part of their waste management practices. These waste management methods were self-taught techniques for reducing household waste. Therefore, this concept has always been a part of the indigenous knowledge system, if not originating from it.

Izubara and Umoh (2004) and the DRDLR (2015) article provide various methods that diverse societies can adopt to reduce waste through reuse. Specifically, reuse practices in Southeastern Nigeria have proven effective, with positive outcomes from reusing waste materials. Notably, these waste-reuse methods were practiced by local people before being documented. This pattern suggests that indigenous knowledge is documented only after it has been “tested” for many years and then passed on orally to the next generation. Osman-Elasha (2009) and Tharakan (2017) argue that Indigenous Knowledge Systems (IKS) are often seen as incomplete or as based on individual assumptions rather than formal scientific documentation. Such views have

marginalised indigenous knowledge in academic discourse. However, several empirical studies challenge this view by showing that indigenous knowledge effectively addresses community challenges. It is important to note that the existing literature on indigenous knowledge systems is itself subject to certain limitations and potential biases.

Much of the literature is drawn from specific regional case studies and may underrepresent voices from less-studied communities. Additionally, indigenous practices are sometimes documented retrospectively or through the lens of external researchers, which can result in partial interpretations or omissions. Acknowledging these limitations is important for critically engaging with the literature and for understanding the broader context in which indigenous knowledge is represented.

For example, Izubara and Umoh (2004) conducted a study in South-Eastern Nigeria. They examined how indigenous knowledge systems contribute to local environmental management and resource utilisation. The study used qualitative methods, such as community observations and interviews with local residents, to document traditional practices in waste management and resource reuse. Findings showed community members could convert waste materials into usable items with local techniques. This reduced waste generation and supported household livelihoods.

Aremu and Vijay (2015) also examined indigenous waste management practices in Nigerian communities. They explored the role of traditional knowledge in sustainable resource use. The research found that local communities use indigenous skills to transform waste into useful products. This shows that indigenous knowledge is important for waste minimisation and environmental sustainability. The findings counter the idea that developing countries cannot convert waste into valuable resources.

The studies conducted in Nigeria, therefore, demonstrate that indigenous waste management practices can provide effective and sustainable solutions at the community level. Notably, Nigerian communities often employ methods such as transforming organic waste into compost and creatively reusing various household materials, drawing on long-standing cultural traditions and communal participation. In comparison, South African indigenous waste management practices, as observed in

regions like Limpopo Province, also incorporate the reuse of organic materials and repurposing of household items as integral elements of daily life. Both contexts emphasize the adaptation of local practices to meet environmental and household needs, although regional differences in materials used, cultural practices, and the extent of formal documentation exist.

These comparisons illustrate that, while indigenous approaches to waste management are shaped by specific regional needs and resources, there are significant commonalities in their focus on sustainability, resourcefulness, and community knowledge. However, while these practices have been documented in some regions, there remains limited research documenting similar indigenous waste management practices in other developing countries, including South Africa, particularly in areas such as KwaZulu-Natal. This highlights the need to document indigenous knowledge systems to promote transparency, preserve cultural knowledge, and explore their potential contributions to contemporary waste management strategies.

3 CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

Leedy and Ormrod (2010:407) define research methodology as “comprising the conceptual analysis of the body of methods and principles associated with a branch of knowledge.” They further state that research methodology is “the systematic, conceptual analysis of the methods applied to a field of study” (2010:401). The objective of this chapter is to provide a clear rationale for the chosen study design, selection of study area, population, and sample criteria, data collection tools, relevance of data, analysis and presentation strategies, as well as considerations of data validity and limitations.

This will guide the reader in understanding the methodological model adopted for this research. To achieve the goals of any investigation, logical steps and guidelines are established. Building from this foundation, this chapter focuses on the methods used to document indigenous solid waste management practices in uThweba Village, located in the outer west of Durban under the KwaXimba Tribal Authority in KwaZulu-Natal, South Africa.

3.2 Research design

Creswell (2014) defined research design as “a step-by-step approach used by a researcher to conduct a scientific study.” Agreement among leading authors indicates that the research problem shapes the research design. For example, Boru (2018) and Ubisi *et al. (*2019) specifically support the view that the nature of the research problem determines the research design, research methods, and data collection and data analysis approaches. Building on this idea, Creswell (2014) explains that the step-by-step approach includes research methods and techniques for effectively and efficiently addressing the research question. Similarly, Saunders *et al.* (2009) describe research

designs as general plans for conducting research, particularly for answering research questions. To elaborate, Babbie (2014) adds that a research design should state who or what will be studied, when, how, and for what purpose.

Finally, Creswell and Creswell (2018) and Asenahabi (2019) conclude that there are generally three research designs: quantitative, qualitative, and mixed methods. For instance, a quantitative research design might involve conducting a survey to measure customer satisfaction using numerical data. In contrast, a qualitative research design could include in-depth interviews to explore participants' experiences and perspectives. A mixed methods design may combine both approaches, such as using surveys to collect quantitative data and follow-up interviews to gain qualitative insights.

3.2.1 Quantitative design

Quantitative research design systematically collects and analyses numerical data to generate quantifiable or discrete values and to test hypotheses and examine relationships between variables (Creswell, 2014; Babbie, 2021).

3.2.2 Qualitative design

Qualitative research designs differ from quantitative research approaches. The latter emphasises exploring and understanding the meaning that a person or group of people attributes to a social or human problem with minimal generalization (Alharahsheh & Pius, 2020).

3.2.3 Mixed methods design

The mixed-methods approach, as described by Johnson *et al.* (2007) and Creswell & Creswell (2018), allows for the concurrent or sequential collection and analysis of data, which may be qualitative, quantitative, or both, and for the utilization of data analysis methods that can be one or both (qualitative and quantitative). This mixed-methods study requires collecting qualitative and quantitative data and integrating them to answer the research question. This research employed a mixed-methods design, combining qualitative and quantitative approaches, and used a survey to collect data from sampled individuals (see the questionnaire template used in Appendix A).

3.3 Data Collection Method

3.3.1 Structured Interviews Using a Questionnaire

Structured interviews were conducted with willing uThweba residents experienced in indigenous solid waste management. Household heads responded on behalf of their families. The researcher administered questionnaires during interviews, clarifying questions as needed to ensure understanding. The questionnaire included closed-ended questions for quantifiable data and open-ended questions for detailed insights into waste management practices. In-person interviews were conducted because they are essential for gathering complex information (Scheuren, 2004). A key advantage of research surveys is that they generate cost-effective empirical data based on real-world observations (Kelly *et al.,* 2003).

This approach allows researchers to set a clear project timeframe, which aids in planning and delivering results (Kelly *et al*., 2003). However, research surveys may overlook the significance of the data if they place too much emphasis on coverage, leading to insufficient depth in the topic (Kelly *et al*., 2003). The survey used a face-to-face interview as an effective data collection method. Face-to-face interview surveys provide distinct advantages, as the presence of the interviewer increases cooperation and allows respondents to receive immediate clarification if needed (Scheuren, 2004). Both open-ended and closed-ended questions were utilised to gather the necessary information.

3.3.2 Field Observations

Field observations took place during interviews, allowing the researcher to observe actual waste management practices and verify responses. This enabled capturing details that participants might omit or consider unimportant. Observation methods help identify behaviours not easily revealed through interviews (Swinburne, 2012). The leading researcher completed the questionnaires, assisted by research assistants who posed the questions to the respondents. Although each participant received a copy, interviews were based on their questionnaire data.

Over four weeks, 316 questionnaires were gathered. Individual interviews clarified any ambiguities regarding the research objectives. Questionnaires were distributed to all participants, and the researcher entered responses to ensure accurate recording. Transportation to households was not an issue; the principal researcher delivered research assistants to each study area, from which they walked to the assigned households. Before the study, Professor Machete trained the lead researcher and assistant for effective study execution. He also monitored survey progress on-site during the initial days of data collection.

3.4 Study area

The study area is situated in uThweba village, located in the outer western region of Durban under the jurisdiction of the KwaXimba Tribal Authority within the eThekwini municipality, KwaZulu-Natal Province (see Figure 3.1). According to the 2023 Statistics SA census, uThweba comprises approximately 3,874 residents and 1,500 households. As is common among rural villages within the eThekwini municipality, uThweba does not receive municipal waste management services

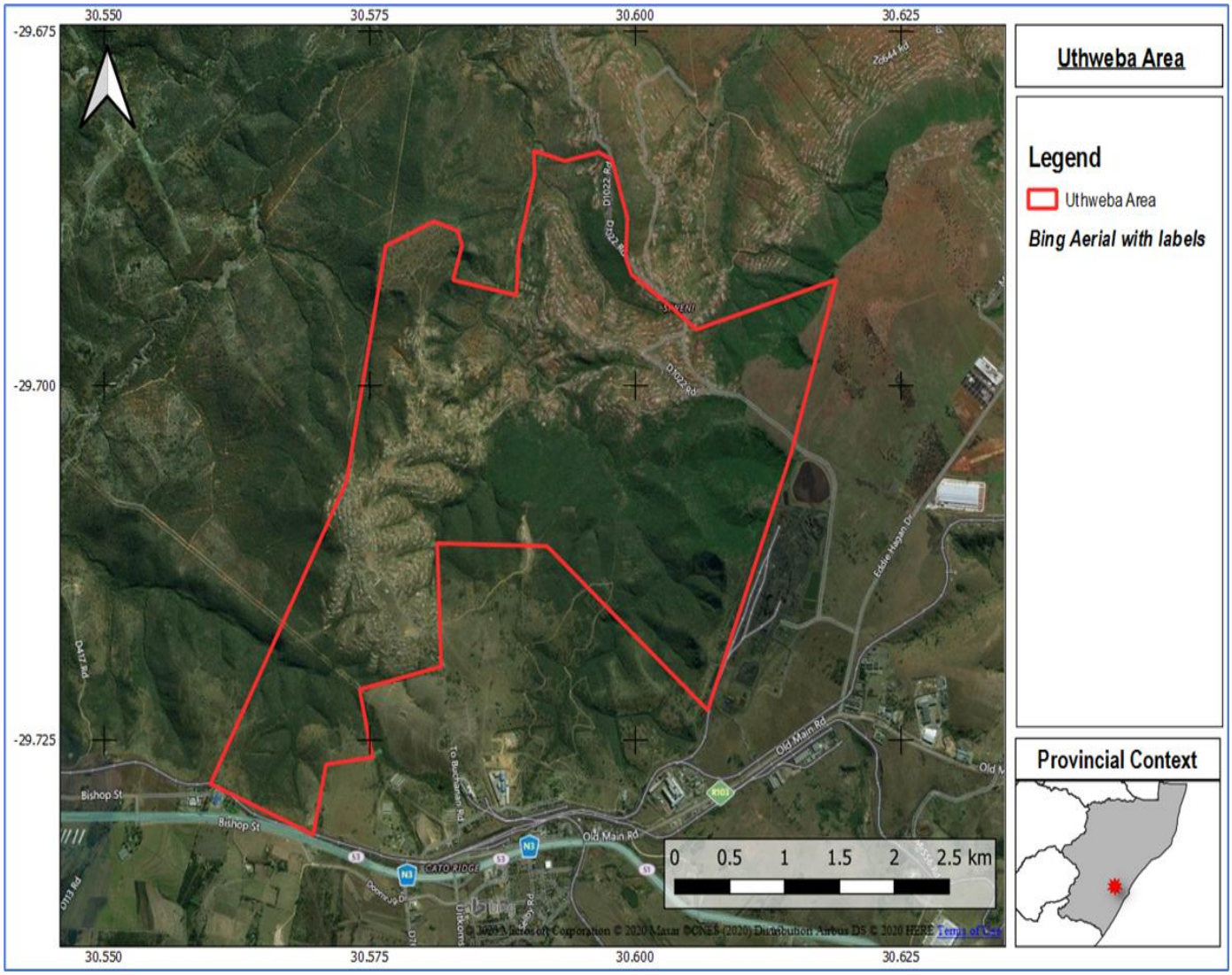

Figure 3.1 Study area – uThweba village under kwaXimba tribal authority, eThekwini local municipality

3.5 Population and Sampling

A convenient sampling approach was used to draw a representative sample as recommended by Noor (2008). The study adopted the formula by Yamane (1967) for calculating the sample size (total number of households) that were sampled:

$$n = \frac{N}{1 + N(e)^2} \quad \text{.....(1)}$$

Where, N = Total population

e = 5 % of standard error

n = Sample size

For a total population of 1,500 households, the value of n is:

$$n = \frac{1500}{1 + 1500(0.05)^2}$$

n = 315.789 respondents

According to the formula, 316 households were sampled, with only one respondent per household. This number was necessary to gather reliable information on indigenous systems of general solid waste management in uThweba Village. From each sampled household, an adult aged 18 or older, preferably the household head, was selected to participate in the study. The sampled individuals represented a portion of the population being studied. The survey employed a systematic approach to gather data from a set of elements, enabling the creation of quantitative descriptions of the attributes of the larger population to which these sampled elements belong.

The survey aimed to produce statistical estimates of the characteristics of the targeted population. Scheuren (2004) further explains that a study seeks to merge population profiles. The researcher had to identify a subset of the population, a sample from which they sought to collect information (Floyd, 2014). The survey collected data from part of the target population (Scheuren, 2004), employing three methods in the sample survey: sampling, question design, and data collection (Floyd, 2014).

3.6 Research tool/Method

The questionnaire survey was administered to 316 households. One respondent per household completed a single questionnaire (see attached in appendix A) on indigenous waste management practices within uThweba Village. All participants were willing; none were hesitant. The questionnaires allowed the researcher to collect data from a large, diverse sample, providing a broader representation of the target population (Lindemann, 2023).

The questionnaire enabled the researcher to identify variations and provide accurate interpretations (Lindemann, 2023) while addressing complex questions. Closed-ended questions were easier and quicker for respondents. Even if some questions were unclear, the answer options provided clarity (Bryman, 2016)). Fixed options streamlined respondents' assessments (Bryman, 2016). When only open-ended questions are asked, the likelihood of receiving irrelevant answers increases, making it more challenging to gather and analyse feedback data (Bryman, 2016).

The two primary survey types used in the research study are questionnaires and interviews. The questionnaires were analysed using quantitative social science statistical methods. Additionally, the researcher conducted interviews to investigate and confirm household activities related to indigenous waste management practices and to determine whether respondents' information correlates with field observations.

The questionnaire included scales to determine community members' attitudes, abilities, and opinions. The survey questions provided insights into respondents' perceptions, attitudes, and beliefs. Some questions overlapped to enable the researcher to verify the information in the questionnaires, while others aimed to explore further relevant items identified in the literature review (Noor, 2008). The survey included rating and multiple-choice questions to simplify the process for the researcher and the respondent (Noor, 2008). The main advantage of these questions is that they are easy to complete, and the answers can be checked easily and quantitatively, which is beneficial for large sample groups (Noor, 2008).

Fixed-response questions were also included in the survey, as they guide respondents and make it easier for them to answer. Additionally, the responses are easier to analyse and interpret since they can be categorised into limited sets (Noor, 2008).

However, the drawback of fixed responses is that they lack the detail, richness, and personal insights that open-ended questions can provide (Noor, 2008). This limitation was addressed through interviews, which allowed participants to provide more detailed explanations, opinions, and contextual insights that could not be captured by fixed-response survey questions.

3.6.1 Field observation

Field observations were conducted alongside the survey to assess the credibility of participants' information. These observations confirmed the participants' responses (see the checklist in Appendix E). Together, field observations and interview surveys formed an integrated approach. Field observations helped the investigator interpret non-verbal communication and map participant interactions and relationships (Schmuck, 1997). They also alerted the researcher to distortions or inaccuracies in respondents' information (Marshall & Rossman, 1995). An observation schedule was used to collect field data on indigenous waste management practices. All observations were conducted with household participants' consent.

3.6.2 Transparency of Questionnaires

Before distributing the questionnaires, they were translated into isiZulu (see Appendix B). This ensured transparency about the research topic and gave respondents a clear understanding of the study's objective. UThweba village comprises mainly Zulu-speaking residents. Therefore, isiZulu was chosen for the interviews. The leading researcher and four research assistants were fluent in isiZulu.

3.6.3 Primary data collection

The study collected nominal, ordinal, and interval data through structured interviews and indigenous waste disposal practices that will be documented in photos.

3.6.4 Presentation of the results and analysis

Data were presented using bar and pie charts, among other visualisations. The presented data were systematically discussed after each illustration. This study collected both qualitative and quantitative (mixed) data sets. All collected data were first summarised and categorised according to their characteristics and frequencies. Descriptive statistics were used to summarise the data. The collected data were transcribed and entered into MS Excel spreadsheets.

The Statistical Package for Social Sciences (SPSS) version 28 was utilised for data analysis. The survey data were entered into the SPSS from a coded structured interview questionnaire for statistical analysis and were presented using figures and other graphics. Descriptive and correlational statistical analyses were conducted across variables, examining data types, preferred presentation methods, and relationships.

The collected data were primarily mixed (qualitative and quantitative) and aligned with the expected analyses and relationships tested among the variables. Ultimately, frequencies of different management practices (categories) were counted, and both open-ended and closed-ended questions were analysed to draw inferences from the conclusions in each study data set. Qualitative data were analysed through content analysis by grouping responses according to themes (thematic analysis).

The sampled individuals represented a portion of the population being studied. The survey employed a systematic approach to gather data from a set of elements, enabling the creation of quantitative descriptions of the attributes of the larger population to which these sampled elements belong. The survey aimed to produce statistical estimates of the characteristics of the targeted population. Scheuren (2004) further explains that a study seeks to merge population profiles. The researcher had to identify a subset of the population, a sample from which they sought to collect information (Floyd, 2014).

The survey collected information from only a portion of the target population (Scheuren, 2004). The sample survey utilised three methodologies: sampling, question design, and data collection (Floyd, 2014). Information was gathered using a

standardised procedure to ensure everyone received the same questions (Scheuren, 2004). Subsequently, the survey results were summarised in statistical graphs (Scheuren, 2004).

Data analysis was utilised to extract meaning from raw, unprocessed data (Braun & Clarke, 2006). The process involved labelling and categorising data and information to recognise similarities and differences. Descriptive qualitative data analysis was performed using thematic analysis. The data were sorted into different themes based on the research objectives, and content analysis was applied to examine the data through these themes, addressing the research objectives (Braun & Clarke, 2006). According to Braun and Clarke (2006), this is the ideal method for qualitative data analysis since it cannot be statistically analysed. The researcher coded all questionnaire responses, including open- and closed-ended questions. Frequency graphs were used to present the data. Data were interpreted using percentages.

3.6.5 Data validity

Validity refers to the extent to which a research instrument measures what it is intended to measure (Leedy and Ormrod, 2010). Several steps were taken to ensure validity. The questionnaire for structured interviews was designed to align with the research objectives, ensuring the questions addressed key aspects of indigenous solid waste management practices.

To improve validity, the questionnaire used closed- and open-ended questions. Closed-ended questions let the researcher collect measurable data. Open-ended questions let respondents explain their waste management practices and experiences. This combination captured both quantitative and qualitative data for the study. I also observed waste management practices during interviews. By visiting respondents' premises, I verified the information they provided. This process confirmed the credibility of my findings, as I could compare interview responses with actual practices seen in households.

3.6.6 Secondary data for validation and background

UThweba village is a rural area with limited secondary data available due to the lack of infrastructure development in the region. No secondary data that references waste management or other relevant information could be sourced. However, some data containing minimal information about rural waste management was obtained from the eThekwini Integrated Development Plan (IDP, 2023/24 to 2027/28) and the Integrated Waste Management Plan (2016-2021), though it is not specific to the study area.

3.7 Ethical issues

Consent was obtained from potential participants both verbally and in writing for the study. The researcher emphasised that participation was voluntary and that individuals could withdraw at any time. Participants were assured their responses would remain confidential and anonymous, and that they would not be exposed to harm. The study followed the four primary research ethics principles outlined in relevant guidelines. i.e., respect for persons (autonomy), beneficence, non-maleficence, and justice. These principles ensured the respectful and dignified treatment of participants, the maximization of potential benefits and minimization of harm, and the fair selection and treatment of all participants throughout the study.

The study's purpose was clearly communicated before the interviews, along with participants' rights, including safety and the right to withdraw without consequences. Permission was obtained from the municipality, as detailed in Appendix C, and participation was explicitly stated to be voluntary, with no financial incentives. Confidentiality was observed to protect participants' identities and any sensitive information related to the organizations.

3.8 Limitations

The study encountered no challenges during the data collection process, as participants were generally cooperative and willing to provide the required information.

3.9 Conclusion

This chapter systematically outlines the structure, design, research methods, and tools employed in the current study. It also justifies the selection of each approach and clarifies its relevance to the study's objectives. The chapter cites previous studies employing similar methodologies. Finally, it specifies the types of data collected, sample size, analytical techniques, and the framework for presenting results.

4 CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the results obtained from the fieldwork conducted in uThweba Village. The data presented in this chapter were obtained through structured interviews using a questionnaire administered to household heads. The results are analysed in relation to the objectives of the study. The findings are presented thematically according to the four research objectives. Each section introduces the relevant questionnaire question, explains the purpose of the question, and interprets the results obtained from the respondents. Where respondents were allowed to select more than one option, the percentages represent the proportion of respondents who indicated a particular response, and therefore the totals do not necessarily equal 100%.

Recycling jobs are stable and rapidly growing, as waste generation continues to increase with population growth. The recycling industry is attractive and lucrative because it enables the recovery of rare and valuable materials. Recycling facilities are located approximately 20 to 40 kilometres away in central areas of Durban, posing a financial challenge for locals to access. The eThekwini municipality has implemented various recycling initiatives within the city; however, there is no evidence of similar facilities in rural areas where waste collection is absent. This raises questions about the municipality's objectives concerning the recycling process, as rural areas are consistently marginalised, particularly in terms of access to recycling facilities, which are recognised globally as a key aspect of waste management.

It is acknowledged that recycling facilities are established in urban areas where waste collection is already provided due to the municipality's bylaws concerning rate payments. This presents a contradiction regarding the objectives of the recycling process, as recycling is another waste management system designed to minimize waste in landfill sites. Waste collection services are linked to rate payments as part of the municipality's bylaws. Land ownership in rural villages in KwaZulu-Natal, such as uThweba village, falls under the authority of the Ingonyama Trust Board but is managed by the eThekwini municipality; thus, rates are not paid in such areas.

Consequently, waste collection services from these households are not offered by the municipality. Pollution is a global crisis that conveys various adverse environmental impacts if not managed efficiently.

The eThekwini Integrated Waste Management Plan (2016-2021) indicates the challenges and impracticality of establishing municipal waste collection services in rural areas. However, it fails to provide clear reasons for these limitations (eThekwini Municipality, 2016). This situation leaves households in rural communities to make their own decisions regarding waste management. The documents from the eThekwini Municipality, including the Integrated Development Plan (IDP) and IWMP (2016-2021), reveal that waste collection in rural villages continues to pose significant challenges.

4.2 Results

4.2.1 Objective 1: To examine the types of household waste generated in the study area.

Question 19 of the questionnaire sought to identify the types of waste generated by households in uThweba Village, how they are collected and stored before being reused or discarded. It further investigates the type of disposal used for each identified waste type.

Types of Waste Generated

Respondents were instructed that they could tick more than one option, as households may generate several types of waste simultaneously. Therefore, the percentages presented represent the proportion of respondents who indicated that they generate each type of waste, rather than the volume or weight of waste produced. Understanding the types of waste generated within households is important because it provides insight into the composition of the waste stream and assists in identifying appropriate waste management strategies.

Figure 4.1 illustrates the different types of waste generated in the village. All respondents (100%) indicated that their households generate paper, glass, cans and tins, and plastics. These waste materials are primarily derived from packaging associated with groceries and household products purchased for daily consumption. In addition, 90% of respondents indicated that sanitary pads are generated as household waste. Building rubble and animal waste were reported by 70% of respondents, which reflects the presence of construction activities and livestock ownership within the village.

Other types of waste identified include electronic waste (44%), which consists of discarded electrical appliances such as radios and televisions. Garden waste accounted for 42%, while ash waste accounted for 30%, mainly resulting from cooking and heating activities using wood or coal. Only 2% of respondents reported generating other types of waste, including medical-related waste. These findings indicate that household waste in uThweba Village largely consists of packaging materials, organic waste, and by-products of daily household activities.

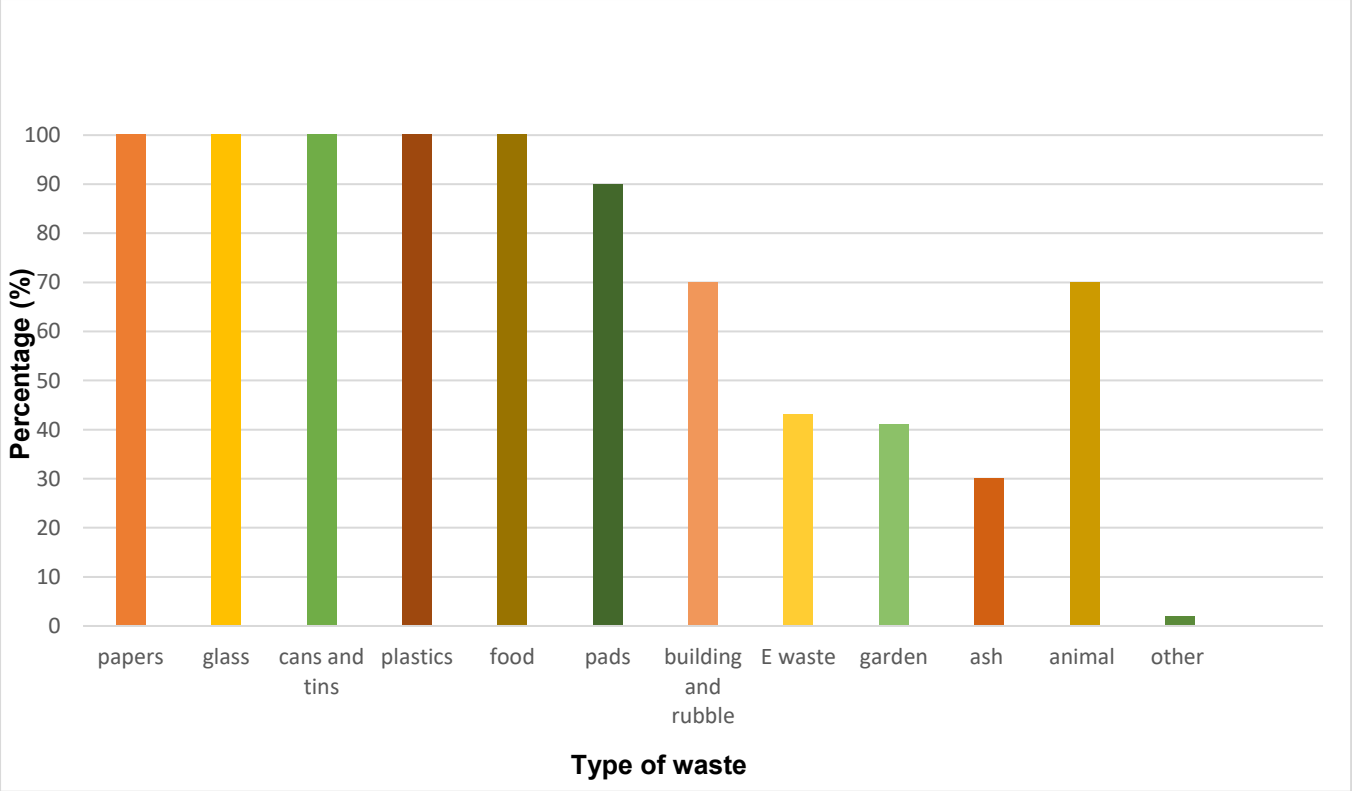

Figure 4.1: Type of waste produced within uThweba Village

Waste Collection Practices

After waste is generated, it must be collected before it can be stored or disposed of. Waste collection in this context refers to the method used by households to gather waste materials within their household premises before further management. Figure 4.2 illustrates the different methods used by households to collect waste.

The majority of households collect most waste types by hand. For example:

- Paper waste: 100% collected by hand
- Plastic waste: 90% collected by hand
- Glass waste: 85% collected by hand
- Cans and tins: 87% collected by hand

Some households use wheelbarrows, particularly when collecting heavier waste types such as garden waste or rubble.

For instance:

- Garden waste: 25% collected using wheelbarrows
- Animal waste: 10% collected using wheelbarrows

A small number of respondents reported collecting waste directly into pits or vehicles, particularly for heavier or bulk waste materials such as building rubble or e-waste. These results indicate that waste collection within households is largely manual and labour-intensive, reflecting the rural context of the community.

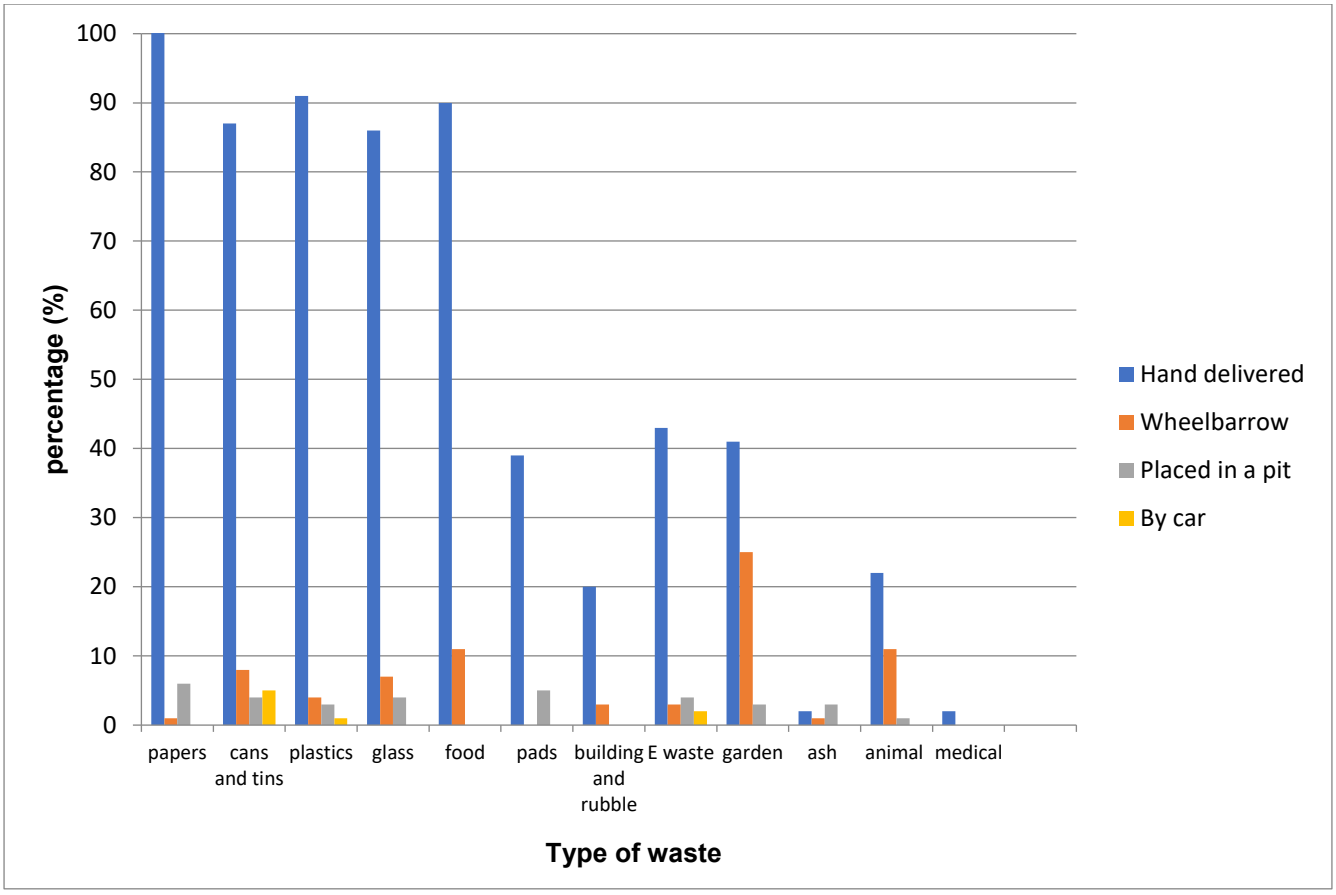

Figure 4.2: Method of Waste collection in uThweba village

Waste Storage Practices

Waste storage refers to the temporary holding of waste materials within the household before disposal or reuse. Proper storage is important because it prevents waste from spreading across the household environment and reduces health and environmental risks. Figure 4.3 shows the different storage methods used by households in the village. The results indicate that most households store waste in plastic bags or containers.

For example:

- Paper waste: 54% stored in plastic bags
- Plastic waste: 58% stored in plastic bags
- Glass waste: 56% stored in plastic bags

Buckets are also commonly used for storing waste, particularly food waste, where 50% of households reported using buckets. Some households store waste in skip bins, while others store certain waste types directly in pits within their household yards. In some cases, waste is not stored, particularly building rubble, garden waste, and ash, which may be disposed of immediately after being generated. These findings suggest that households rely mainly on informal storage systems, reflecting limited access to formal waste storage infrastructure.

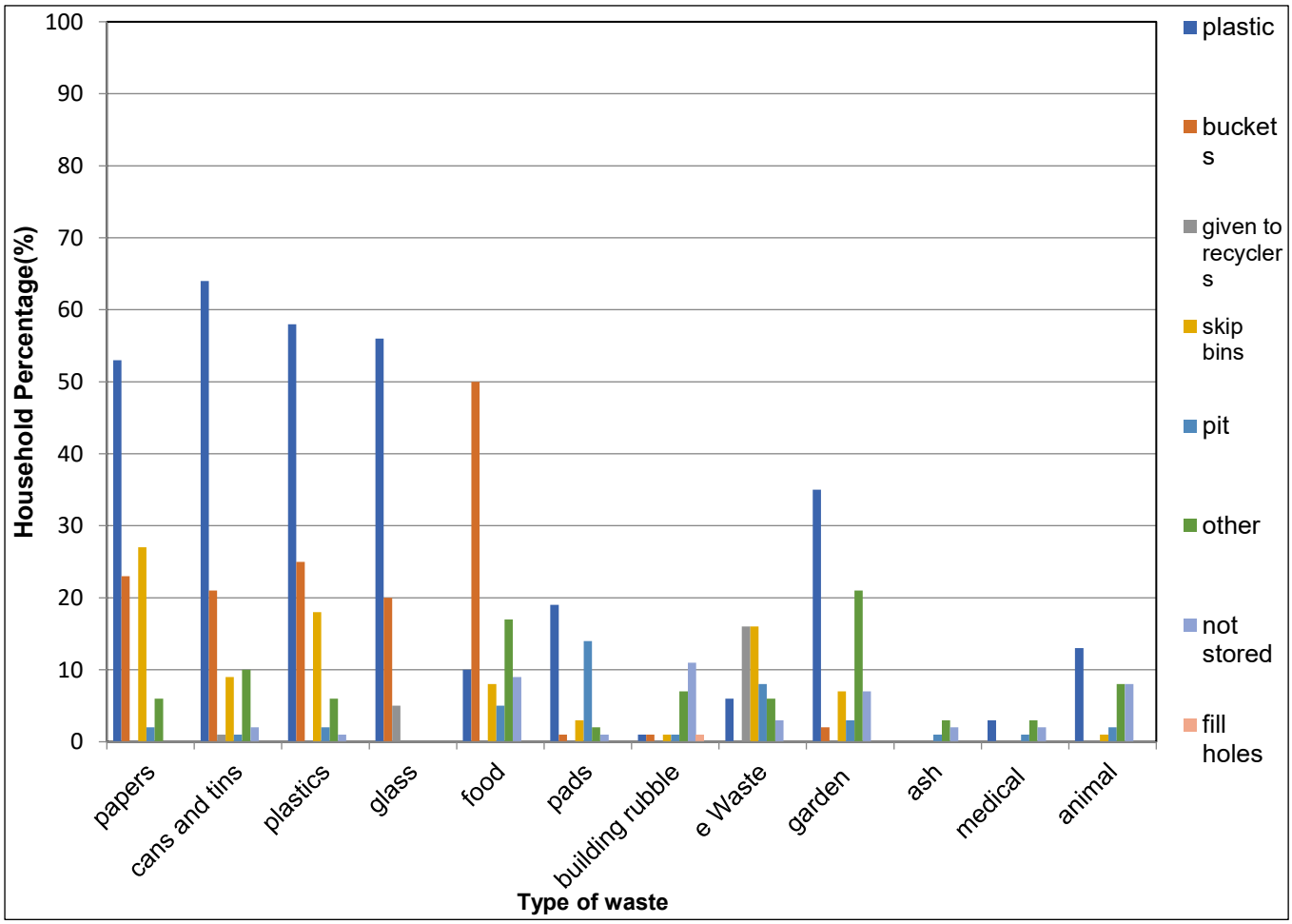

Figure 4.3: Waste storage method

Waste Disposal Practices

Waste disposal refers to the final method used by households to discard or manage waste materials that cannot be reused. Figure 4.4 illustrates the different waste

disposal methods practiced within the village. The results indicate that several disposal methods are used, including:

- Disposal in pits
- Burning
- Feeding waste to livestock
- Giving waste away
- Recycling
- Disposal in streams
- Using waste for agricultural purposes

Burning is a common disposal method for materials such as paper, plastics, and garden waste. Disposal in pits is also frequently practiced for waste types such as paper, plastics, and ash. Food waste is commonly reused as livestock feed, with 56% of respondents reporting feeding leftover food to animals. Animal waste is frequently used in kraals or as fertiliser, while some construction materials are reused for erosion control or structural purposes. A small proportion of waste, particularly e-waste, is given away to recyclers or collected by waste pickers.

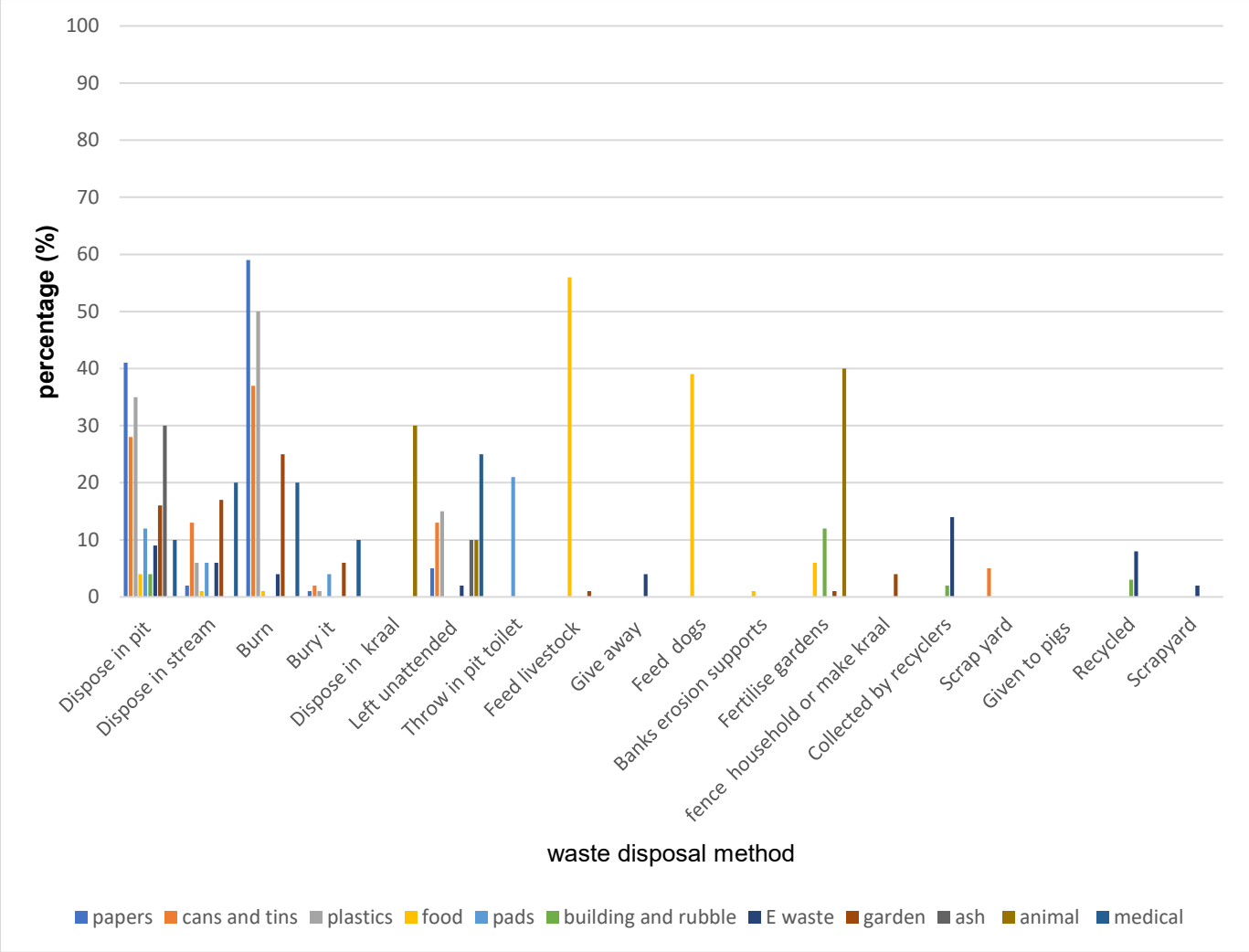

Figure 4.4: Waste disposal methods practiced in the village

Table 4.1 below presents an interpretation of the waste disposal method, as illustrated in Figure 4.4, above. This interpretation aims to clarify the type of waste disposal method employed by the community in the village. It is evident from the results that paper, cans, tins, plastic, and ash are significant types of waste that are disposed of in pits if unused. Simultaneously, waste that cannot be reused is burned, including paper, cans, tins, plastic, and garden waste. The only type of waste disposed in kraals is animal waste, originating from livestock such as cows, goats, and sheep. Thus 30% of animal waste is used for such purposes. 25% of waste is unattended, particularly medical waste. The only waste disposed in pit toilets is pads. Approximately 56% of food waste is fed to livestock, primarily as leftover food.

The only waste product that is given away is e-waste, which includes electrical appliances, and that alone constitutes only 3%. 5% of building rubble material is used for bank erosion control in some households. Only 4% garden waste is used to fence properties or to feed livestock. Recyclers collect 7% of e-waste, while only 8% of e-waste is recycled by the community themselves. Recyclers collect 1% of building rubble waste. Only 5% of tins and cans are taken to the nearby scrapyards. At the same time, only 4% of building rubble is taken to relevant facilities.

Table 4-1: Interpretation of the waste disposal method, Figure 4.4 above

Waste type	Waste disposal method																
	Dispose in a pit	Dispose in the stream	Burn	Bury it	Dispose in the kraal	Left unattended	Throw in a pit toilet	Feed lives tock	Give away	Feed dogs	Bank erosion supports	Fertilise gardens	fence a household or make a kraal	Collected by recyclers	Scrap yard	Given to pigs	Recycled
Papers	41%	2%	59 %	1 %	-	5%	-	-	-	-	-	-	-	-	-	-	
Cans and tins	28%	12%	38 %	2 %	-	14%	-	-	-	-	-	-	-	-	5%	-	-
Plastics	37%	6%	50 %	1 %	-	15%	-	-	-	-	-	-	-	-	-	-	-
Food	4%	1%	1%	-	-	-	-	56 %	-	39 %	-		-	-	-	-	-
Pads	12%	6%	-	4 %	-	-	21%	-	-	-	-	-	-	-	-	-	-
Building and rubble	4%	-	-	-	-	-	-	-	-	-	5%	-	-	1%	-	-	4%
E waste	9%	6%	4%	-	-	2%	-	-	3%	-	-	-	-	7%	-	-	8%
Garden	18%	18%	25 %	6 %	-	-	-	1%	-	-	-	-	4%	-	-	-	-
Ash	30%	-	-	-	-	10%	-	-	-	-	-	-	-	-	-	-	-
animal	0%	-	-	-	30%	10%	-	-	-	-	-	40%	-	-	-	-	-
Medical	10%	20%	20 %	10 %	-	25%	-	-	-	-	-	-	-	-	-	-	-

4.2.2 Objective 2: To document indigenous methods of solid waste management used in uThweba Village

Sections 14, 18, 19, 20, and 21 of the questionnaire assess the average number of years households have used indigenous waste-disposal methods, identify the types of waste reused in the village, examine how indigenous waste-management knowledge is transmitted, and measure community participation in environmental clubs.

Figure 4.5 below represents the question on how long you have been using the current waste management method and shows that some households have lived in the village for nearly 80 years and have been using indigenous waste management methods. This indicates how long the residents have practiced these methods in the village. This must be compared with the number of respondents per age to have any value. Figure 4.5 illustrates the number of years households have practiced indigenous waste management methods. The results indicate that many households have practiced these methods for several decades, with some respondents reporting up to 80 years of experience with indigenous waste management practices. This finding suggests that indigenous waste management knowledge has been transferred across generations within the community.

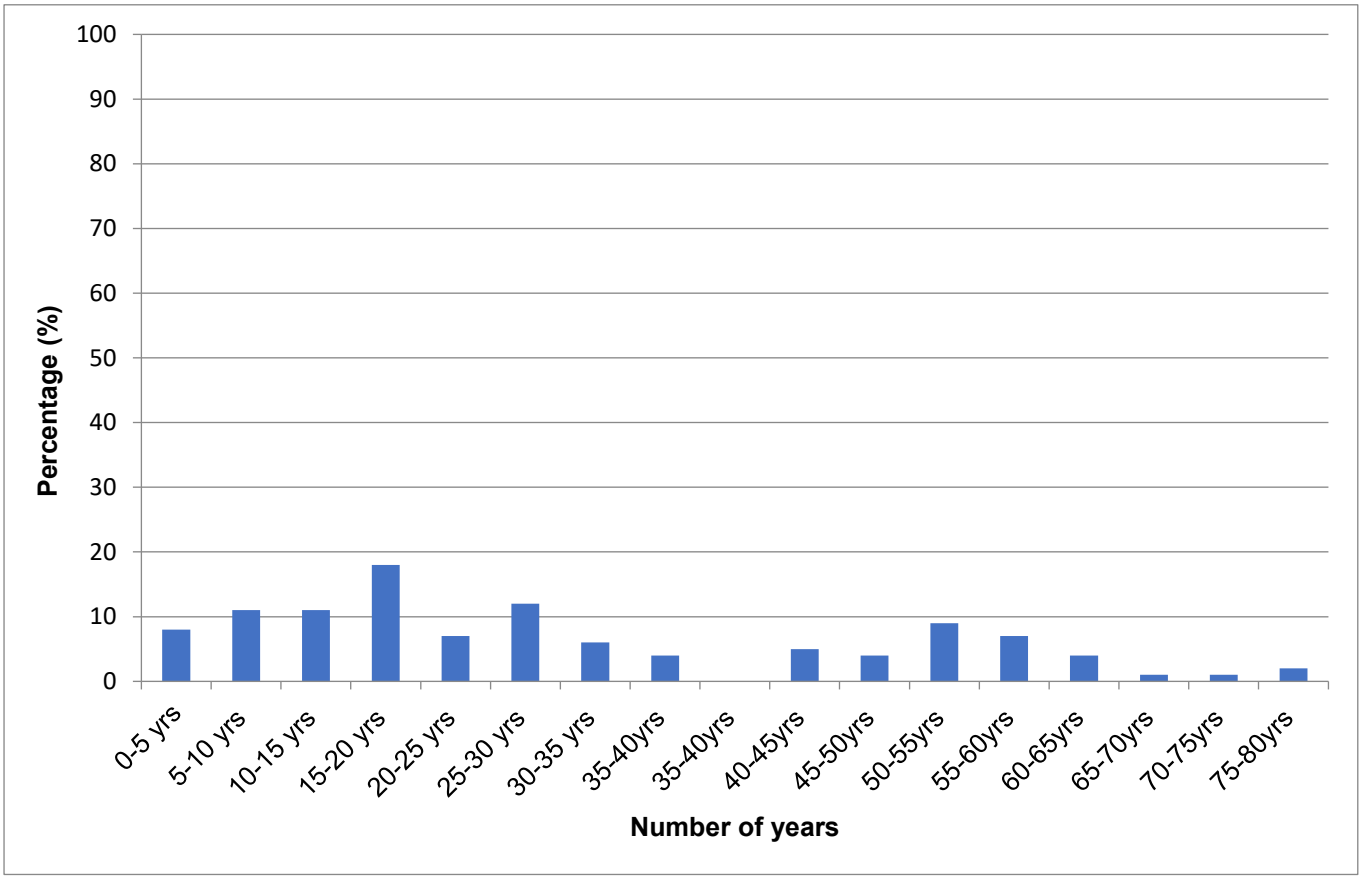

Figure 4.5: Average Number of years the household has been using the indigenous waste disposal method

Figure 4.6 shows the types of waste that are reused within the village. Food waste accounts for 24% of reused materials, as it is commonly fed to livestock. Garden waste and building rubble each account for 19% of reused materials, often used for fencing, kraal construction, or erosion control. Plastic waste accounts for 14% of reused materials, as plastic bags are commonly reused for carrying goods or storing other waste. Animal waste accounts for 8% of reused materials, particularly for fertilising gardens or household floor polishing. Other reusable materials include cans, tins, and glass containers (7%), which are often reused for storing household items. E-waste represents the least reused category (2%), as these items are usually collected by waste pickers for recycling.

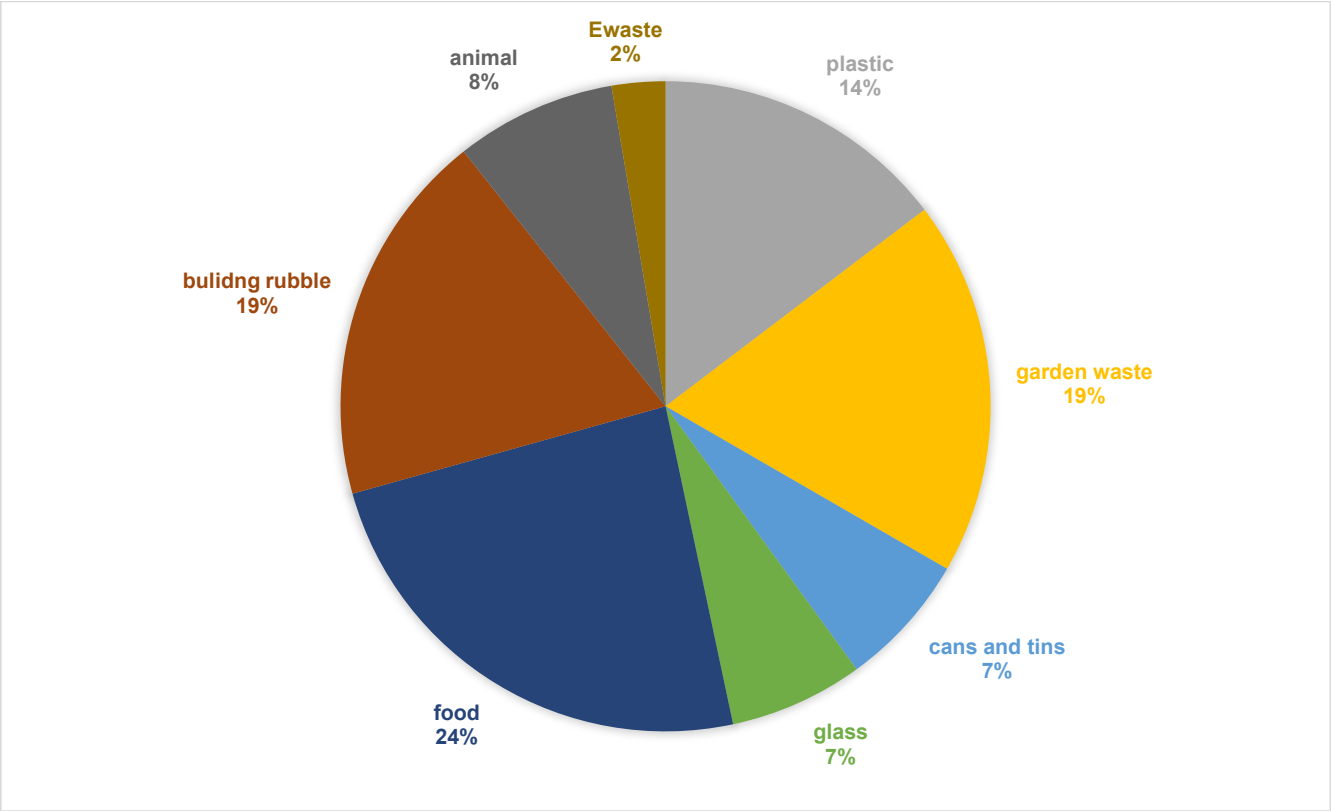

Figure 4.6: Type of waste reused within the village

Figure 4.7 further indicates that 64% of respondents reported that indigenous waste management knowledge is passed down orally from generation to generation, while 27% indicated that this knowledge is shared within the community. Only 9% of respondents indicated that their practices originate from cultural traditions developed during their upbringing. These findings demonstrate that indigenous waste management practices in uThweba Village are largely knowledge systems maintained through community traditions and intergenerational learning.

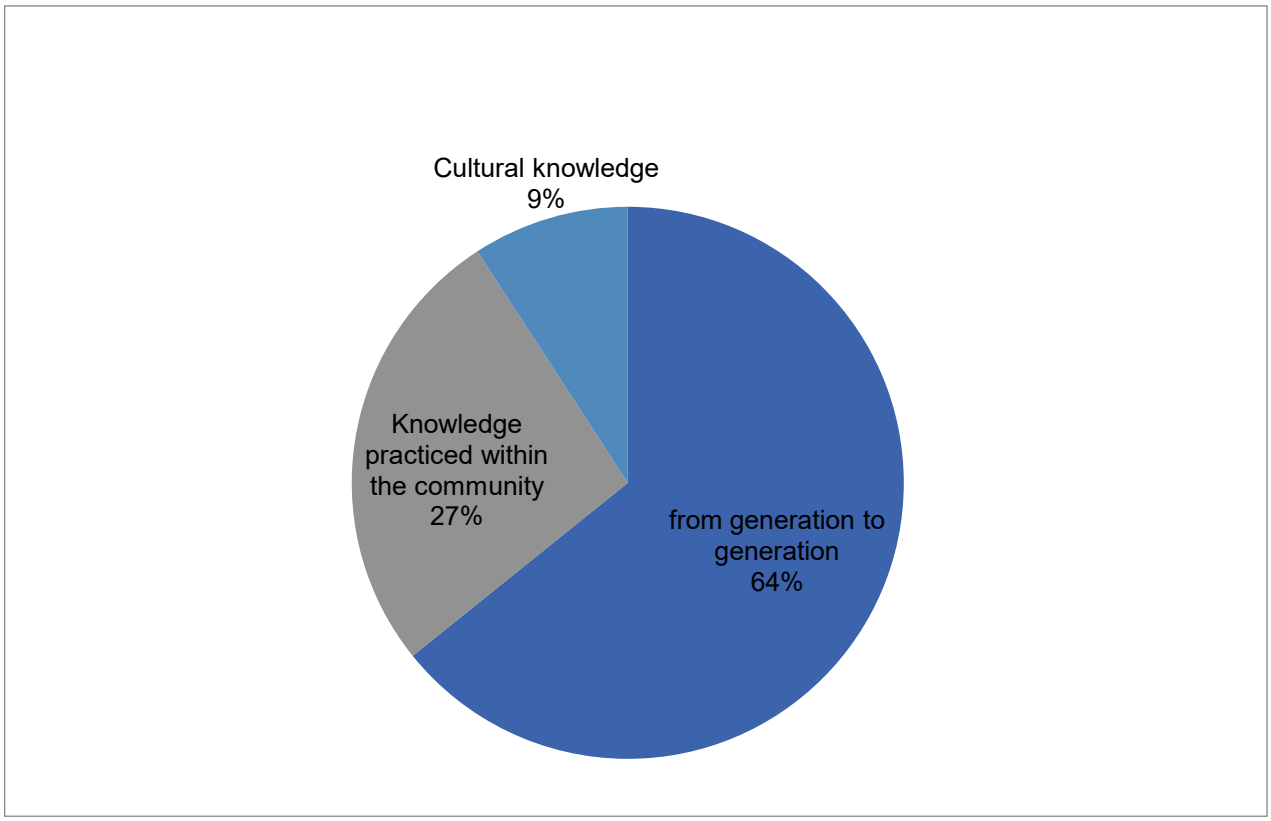

Figure 4.7: How the indigenous waste management knowledge was taught to the households

Figure 4.8 below demonstrates that 95% of community members do not participate in any environmental clubs, while only 5% of the population participates. Therefore, this is an indication that indigenous waste management practiced by the community is not taught but rather transfer of knowledge within the community.

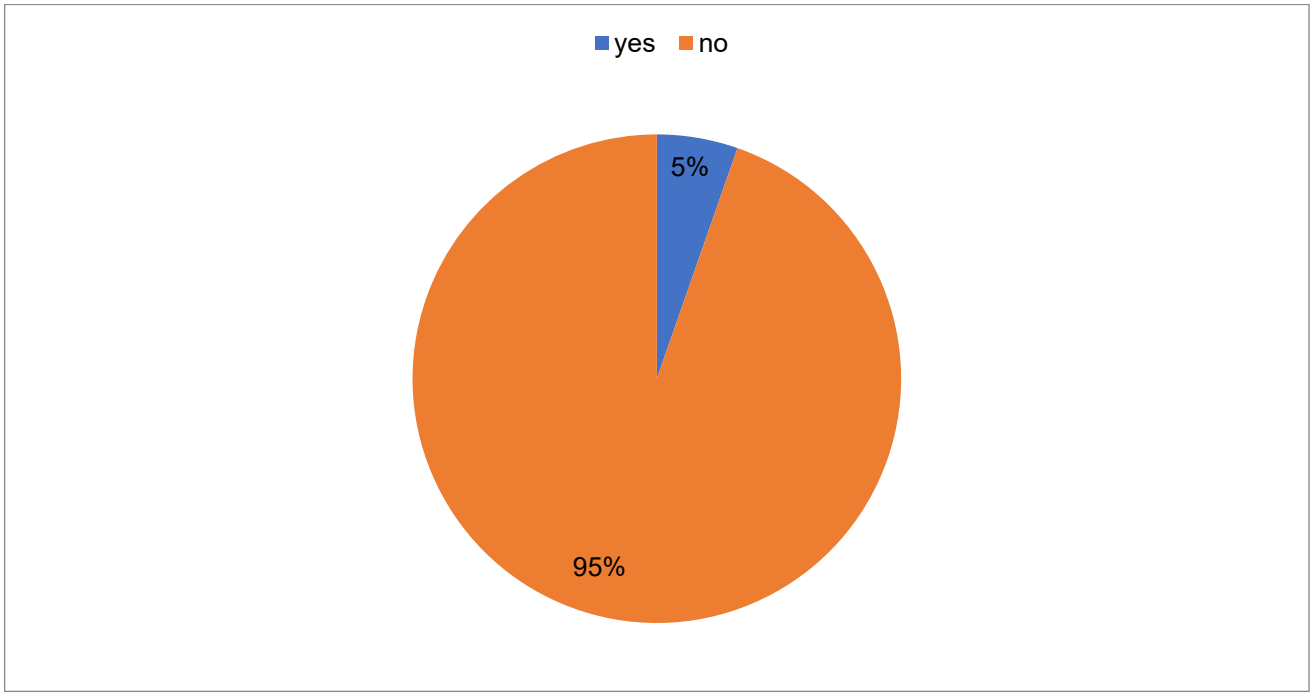

Figure 4.8: Community participation in environmental clubs

The images below, taken by the researcher (Photo 4.1 – Photo 4.9), illustrate how tins, cans, and bottles that are not reused reduce the lifespan of household pits, as they are non-biodegradable and cannot be burned. The images further demonstrate the types of indigenous practices employed by the community, such as using garden waste for constructing kraals and fencing household premises. Boulders from construction activities are reused to demarcate and retain specific household areas, minimising soil erosion.

Photo 4.1 Surplus and unused cans, steel, and tins discarded in the household pits

Photo 4.2 Surplus and unused cardboard and bottles are discarded in the household

Photo 4.3 Boulders reused as retainers along the household fence

Photo 4.4 Boulders emanating from construction activity are stockpiled for reuse within the household

Photo 4.5 Household pits dug for surplus material to be burnt

Photo 4.6 Construction cement stockpiled to be reused within household premises

Photo 4.7 Tree branches and boulders reused to fence the household premises

Photo 4.8 Tree branches are reused to demarcate garden areas within household premises

Photo 4.9 Tree branches reused for livestock kraals

4.2.3 Objective 3: To evaluate the influence of indigenous waste management systems on the affordability of waste disposal services in uThweba Village

Section 10 of the questionnaire sought to identify the income profile of residents of uThweba Village. Figure 4.9 presents the income profile of residents in uThweba Village. The results show that 80% of respondents earn between R1000 and R5000 per month, mainly from government social grants and limited employment income. A smaller proportion of respondents (11%) earn between R5000 and R10 000, while 9% earn less than R1000 per month. These results indicate that most households in the village operate within low-income conditions, which limits their ability to pay for private waste collection services. As a result, many households rely on indigenous waste management practices, such as reuse, burning, and disposal in household pits.

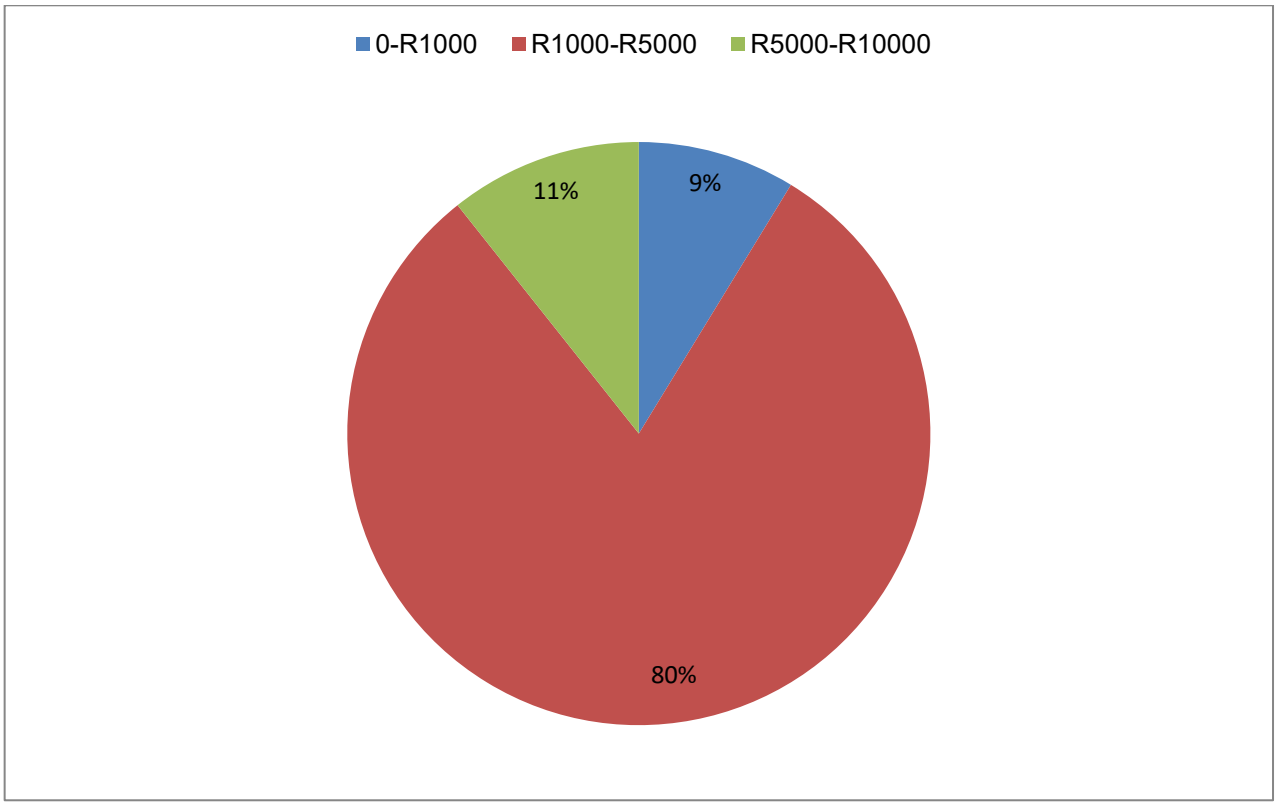

Figure 4.9 Income profile of uThweba village residents

4.2.4 Objective 4: Recommend an appropriate indigenous solid waste management model for uThweba Village, considering the gaps and findings from this study.

Section 21 of the questionnaire was intended to identify the preferred methods of waste disposal among residents of uThweba Village. Figure 4.10 illustrates that 48% of respondents prefer municipal waste collection services, as they experience difficulties managing certain waste materials such as plastics, cans, and sanitary waste. However, 34% of respondents indicated that they prefer continuing with indigenous waste management practices, as these methods have been used for many years and remain practical in the absence of municipal services. Approximately 10% of respondents suggested establishing a communal waste disposal pit, while 4% preferred burning waste within household premises. A small proportion of respondents suggested establishing recycling facilities (3%) or community waste collection centres (1%). These findings highlight the need for improved waste management infrastructure while recognising the role of indigenous waste management practices within the community.

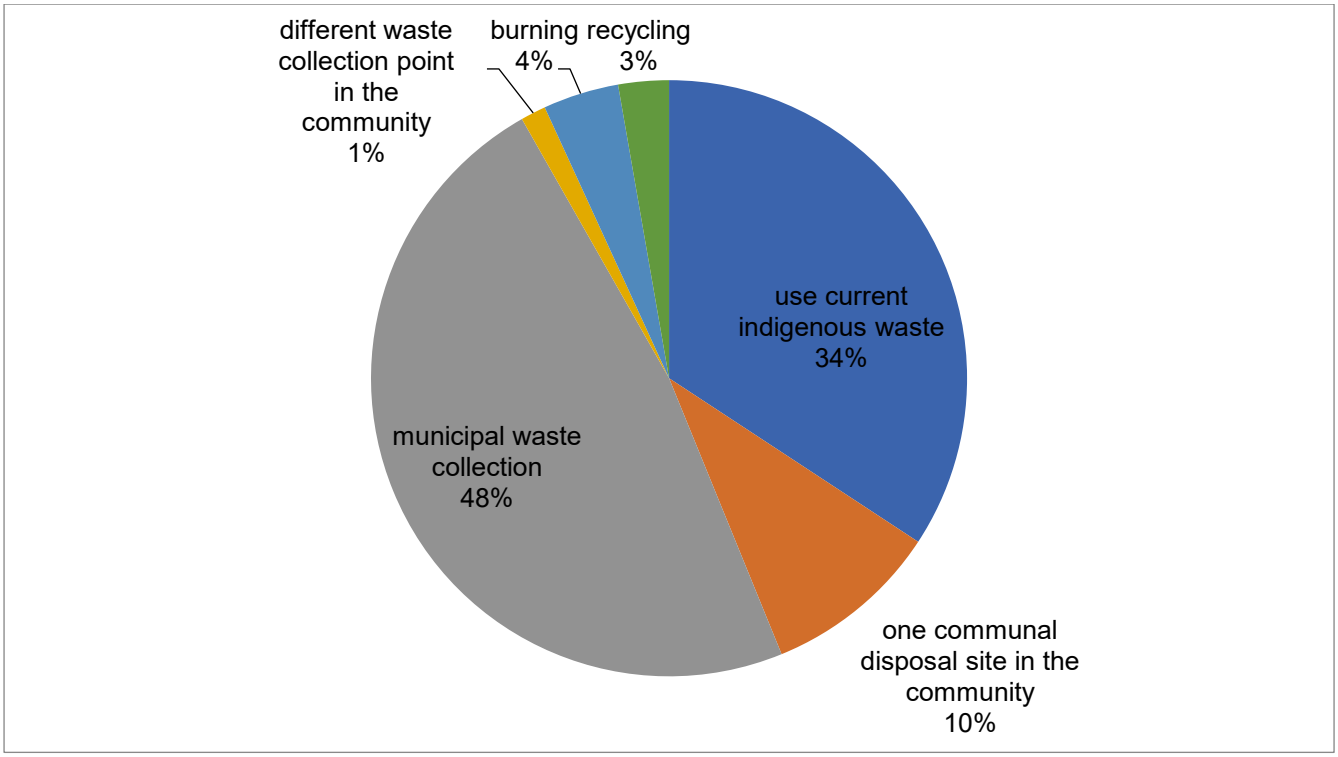

Figure 4.10: **The preferred method of waste disposal by uThweba village residents**

4.3 Conclusion

The results presented in this chapter indicate that residents of uThweba Village continue to rely heavily on indigenous waste management practices. The main waste management practices identified include collection, storage, reuse, and disposal through burning or pits. Many of these practices are rooted in traditional knowledge systems passed down across generations. The findings also demonstrate that reuse plays a significant role in the community, as many waste materials are repurposed for agricultural, domestic, or structural purposes. However, the study also highlights challenges related to limited waste management infrastructure and low household income levels, which restrict access to formal waste collection services.

5 CHAPTER 5: CONCLUSION

5.1. Conclusion

This chapter presents the conclusions derived from the investigation of indigenous solid waste management practices in uThweba Village. It synthesises the key findings from Chapter 4 and evaluates the extent to which the study's aim and objectives were achieved. The discussion is organised according to the research objectives outlined in Section 1.5 of Chapter 1. The primary aim of this study was to examine indigenous solid waste management practices in uThweba Village and assess their role in household waste management within a rural context.

The specific objectives of the study were:

Objective 1: To examine the types of household waste generated in the study area.

Objective 2: To document waste management practices prevalent in uThweba Village.

Objective 3: To evaluate the influence of indigenous waste management systems on the affordability of waste disposal services in uThweba Village.

Objective 4: To recommend an appropriate indigenous solid waste management model for uThweba Village based on the gaps identified in the study.

Chapter 4 addressed each objective by analysing questionnaire responses, field observations, and visual assessments collected during the survey. Section 5.2 provides a synthesis of the major findings for each objective.

5.2. Major Findings of the Study

Objective 1: Types of Household Waste Generated in the Study Area

The findings indicate that households in uThweba Village generate two primary categories of waste: biodegradable and non-biodegradable. Biodegradable waste consists mainly of food waste, animal waste, crop residues, and garden waste generated through subsistence farming. Non-biodegradable waste includes plastic bags, glass bottles, tins and cans, paper products, electronic waste, and construction debris. The study found that households frequently separate waste into functional categories, including disposable, burnable, compostable, reusable waste, and materials designated for redistribution.

Field observations indicated that most households engage in subsistence farming, generating significant organic waste, including vegetable peelings, crop residues, and garden trimmings. However, this organic waste is rarely discarded. Instead, it is reused in various ways within the household. Food leftovers are typically fed to livestock, including chickens, pigs, dogs, and cats. Animal waste, particularly cow dung, is commonly used as organic fertilizer for household gardens. Vegetable peelings are often temporarily stored and later applied to gardens as compost. Garden and construction waste are stored outdoors before reuse. Construction materials are repurposed for housing, erosion control, or filling potholes. Tree branches and garden waste are used for kraal fencing or as firewood.

Objective 2: Waste Management Practices in uThweba Village

The community in uThweba Village has employed indigenous waste management methods for several decades. These methods have developed organically and constitute local knowledge transmitted across generations. Unlike formal urban systems, these indigenous practices originate in practical community knowledge and the use of local resources, rather than in government or educational institutions. Within households, waste is typically stored in plastic bags or buckets prior to reuse or disposal. Recyclable materials, including cans, plastics, and paper, are stored

separately before reuse or disposal. composed of. Waste collection is predominantly manual, with household members transporting waste by hand to designated areas within the yard. Garden and animal waste are moved using wheelbarrows as necessary.

In the absence of municipal waste collection, households employ indigenous disposal methods. Most households dig waste pits for excess waste, which is disposed of in these pits when it cannot be reused for agricultural purposes. However, certain waste materials, such as paper and plastics, are occasionally burned in the pits to reduce the volume of accumulated waste on household premises. The study found that recycling primarily occurs through informal reuse rather than formal recycling systems. For example, glass bottles are reused for household purposes or landscaping, construction stones are repurposed as fencing, and garden branches are used to construct kraals or fences. Surplus food is fed to livestock. These practices demonstrate that the community's indigenous waste management systems prioritise reuse, resource recovery, and minimal waste generation. Community members frequently regard discarded materials as resources that can be repurposed for practical household or community uses.

Objective 3: To evaluate the influence of indigenous waste management systems on the affordability of waste disposal services in uThweba Village.

Indigenous waste management systems help maintain accessible, affordable waste management for households in uThweba Village. Survey results indicated that approximately 80% of households earn between R1000 and R5000 per month, reflecting relatively low household incomes. These income levels limit residents' ability to afford formal waste disposal services, even if such services were available. Municipal waste removal services are typically provided to communities that pay municipal rates.

These rates help fund essential municipal services, including water supply, electricity, road maintenance, public safety, and waste collection. Because residents do not pay municipal rates, they do not receive formal waste collection services and therefore rely

on indigenous waste management practices. Despite the effectiveness of indigenous practices, community members expressed a desire for municipal assistance, particularly in managing surplus non-biodegradable waste that cannot be reused within households.

Objective 4: Recommended Indigenous Solid Waste Management Model for uThweba Village

The findings suggest that although indigenous waste management practices are effective for biodegradable waste, significant challenges persist in managing non-biodegradable waste. Plastics, glass, tins, cans, sanitary pads, and diapers are not easily reused and, in the absence of local recycling facilities, are frequently disposed of in household pits. Although residents are aware of the negative environmental impacts of burning waste, they continue to burn certain materials because there are no alternative disposal methods. Burning waste releases harmful pollutants into the atmosphere, contaminates air, soil, and water resources, and poses potential health risks to humans and animals.

The study also found that certain waste products, such as diapers and sanitary pads, cannot be burned effectively. These materials often remain in household waste pits, where they may be scattered by animals, thereby contributing to environmental pollution within the community. The absence of a recycling facility represents a significant challenge. Establishing a small community-based recycling centre could enhance the management of non-biodegradable waste, including plastics, glass, tins, paper, and sanitary products. Such a facility would complement existing indigenous waste management practices and reduce the environmental impacts associated with burning and uncontrolled waste disposal.

5.3. Conclusion

Indigenous waste management practices are essential for managing household waste in uThweba Village. In the absence of formal municipal services, the community relies

on local resources to manage waste effectively. These practices emphasize waste reuse, resource recovery, and minimizing waste generation, particularly for biodegradable waste generated by subsistence farming. Indigenous knowledge systems have thus contributed significantly to maintaining environmental cleanliness within the community. However, the study identified several limitations in the management of non-biodegradable waste. The absence of recycling facilities and municipal waste services presents challenges for the proper disposal of plastics, glass, tins, and sanitary products.

Consequently, some waste is burned or disposed of in household pits, which may lead to negative environmental and health impacts. address these challenges, a community-based recycling facility is needed to enable residents to safely dispose of non-biodegradable waste while supporting existing indigenous waste management practices. Furthermore, indigenous knowledge related to waste management should be documented, preserved, and integrated into broader environmental management strategies within rural South Africa. Recognizing and incorporating indigenous waste management practices into policy frameworks could yield more sustainable, culturally appropriate solutions to address waste challenges in rural communities.

6 CHAPTER 6: RECOMMENDATIONS

This study provides valuable insights for developing programs to improve indigenous waste management by addressing the cultural values and beliefs that sustain traditional practices within uThweba. The data collected can assist eThekwini policymakers in determining the most suitable solid waste management systems and practices to enhance current waste management. Furthermore, the findings indicate a strong need for a village recycling centre to process waste. The recycling centre would also bring socio-economic and ecological benefits.

The researcher proposes an indigenous solid waste management model based on the findings above. Figure 6.1 below illustrates this proposed model for the residents of uThweba village. This model will ensure effective waste handling, including source segregation in accordance with relevant waste classifications, preventing general waste from mixing with hazardous waste. Reusable and non-reusable waste should be separated at the source. Likewise, compostable and non-compostable waste should also be distinguished. Reusable but non-biodegradable waste should be kept separately. Building rubble should be stockpiled and segregated for reuse. Similarly, biodegradable waste, including garden, food, and animal waste, should be sorted accordingly.

Non-biodegradable waste that cannot be reused should be considered for recycling, such as glass, paper, plastic, tins, and cans. However, a challenge remains due to the lack of recycling facilities near the village. A recycling facility will provide socio-economic benefits to the community and positively impact the environment. Recycling will also create jobs, as employees will be needed to operate the facility. Therefore, the Indigenous solid waste management model detailed below is significant for ensuring that indigenous waste management practices are consistently applied, as they have proven effective in minimizing waste within the community while enhancing environmental and socio-economic outcomes in the village.

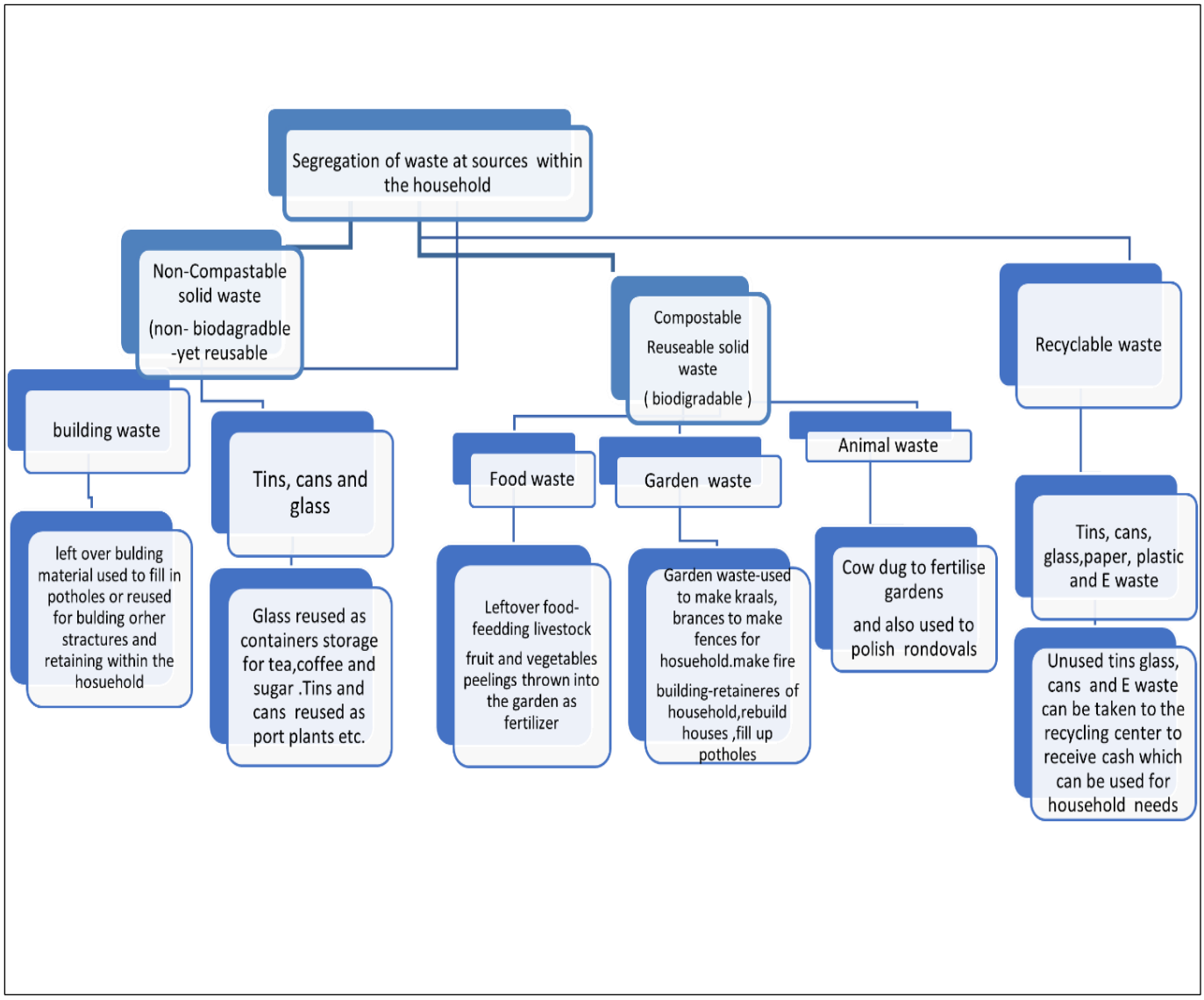

Figure 6.1:Proposed uThweba village indigenous solid waste management model.

Indigenous knowledge on waste management should be documented and implemented across relevant sectors, including government, the private sector, and educational institutions. The only practical solution to poor waste management in rural South Africa is to adopt indigenous systems. Some practical initiatives that can be implemented in the village of uThweba to enhance the current indigenous waste practices can also be drawn from the initiatives undertaken in Maseru, Lesotho, in 2023, where the following are encouraged:

Composting kitchen waste provides several benefits, such as reducing unwanted garbage and producing fertiliser for gardens. Therefore, before discarding food

leftovers and other remnants, households should first determine whether they can be reused as compost material. Rubble generated from construction does not have to be discarded; instead, it can be reused to fill potholes and for other rebuilding purposes, as well as serving as retainers to minimize soil erosion on properties. The uThweba village community has demonstrated that building rubble resulting from the construction of their houses is repurposed for other building needs. Therefore, the distribution of recycling facilities should not be limited to urban areas, as waste is generated by every society worldwide, leading to cumulative negative effects that affect us all.

6.1 Clean-up campaigns

Clean-up campaigns can also be implemented in rural areas like uThweba to raise awareness of the importance of indigenous waste management and environmental protection through cleanliness, thereby creating a positive impact on the village. These campaigns can be initiated with assistance from non-governmental organizations (NGOs), the Ingonyama Trust Board (ITB), and eThekwini municipal officials who are willing to contribute resources such as waste bags. Local tribal authorities should be involved in the campaign to help engage the community. NGOs, ITB, and government officials can be invited to donate waste bins and other valuable materials that can help alleviate pollution. These efforts can raise awareness about keeping the community clean and improve indigenous waste management practices in uThweba. Additionally, such initiatives could provide an opportunity to discuss recycling methods for unused waste items in the village.

6.2 Education

Educating and raising awareness among children in the village about waste management is crucial to preserving traditional practices. Instilling this knowledge in young minds is crucial to maintaining clean communities, protecting the environment, and preserving traditional waste management practices. Raising awareness and educating children about these practices is a crucial component of the waste management hierarchy, which aligns with the 3 Rs (Reduce, Reuse, Recycle). This education and awareness will highlight the benefits of indigenous waste management

methods across socio-economic and ecological aspects. It is also essential for children to take pride in the waste management systems developed by their ancestors. This pride will help them retain their cultural beliefs and waste management practices, thereby ensuring sustainability for future generations.

Waste management awareness workshops in communities are recommended as valuable tools for sharing and addressing waste management issues within the social footprint. These workshops enable communities to express their understanding of indigenous solid waste practices among all age groups. Participants can reference cultural mores, traditions, and practices as essential elements throughout the waste management process in their areas. A study in Maseru illustrates that such workshops provide benefits and can be effectively implemented when community members, guided by their respected leaders (headmen), listen and follow their example during cleaning campaigns. This engagement can also lead to methods for communities to explore indigenous waste management strategies for socio-economic benefits; for instance, some waste products can be transformed into useful items sold at flea markets for profit.

6.3 Conclusion

The survey results show that uThweba residents rely on indigenous waste management methods in their village. Therefore, it is recommended that they address the identified gaps by learning from successful case studies in other countries, such as the Lesotho Maseru study (2023), which introduced various initiatives to improve indigenous waste management. Recycling facilities for unused waste, such as tins, cans, and glass items that often end up as litter across the village, could be established. Achieving the above recommendations will require collaboration among various stakeholders, including NGOs, municipalities, and tribal authorities, to strengthen and promote indigenous waste management practices passed down through generations. Considering the current situation, where municipalities are unable to provide waste collection services in the village, indigenous waste management remains a crucial area for improvement.

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APPENDIX A: ENGLISH QUESTIONNAIRE

STRUCTURED INTERVIEW QUESTIONNAIRE FOR UTHWEBA COMMUNITY

Indigenous methods of solid waste management practiced in uThweba Village, South Africa

STRUCTURED INTERVIEW QUESTIONNAIRE

Demographics of the household	
1. Gender of household head	
2. Age of household head	
3. Highest level of education completed by the household head	
4. Employment status of household head	
5. Language spoken by respondent household head	
6. Household head (state his status in the household, e.g. father)	
7. Number of household members	
8. Number of household members completed grade 12	
9. Number of household members with post-matric qualifications (high education qualifications)	
10. Total combined monthly household income	
11. Language spoken generally in the household (state if language changed over years), from which language to which language, and why did the change happen	
12. Household culture (specify specific cultural activities that are practiced by the household)	
13. Household religion (state how long has this religion been practiced by the family)	
14. How long has this household existed in its current location?	
15. Where did this household been before its current location (state years in previous location)	
16. Has this household originated from another country (especially the household head(s), state the country of origin and the years. Give some ancestral history as far back as you possible can, with ages included.	

17. Does any household member participate in any cultural activities?	Y / N	If yes, specify the cultural activities: *you may tick more than one* a) Local Festival b) Volunteer activity for a charitable organization c) Traditional Dance and Festivities d) Local sporting event e) Poetry and show business f) Other, specify…….
18. Does any household member participate in any environmental club?	Y / N	If yes, specify the ecological or conservation clubs:

19. How does your household manage different waste materials (specify each waste type and how it is managed), i.e. food, garden, animal dung, builder's rubble, medical, diapers, household hazardous, e-waste (cell phones, ashes and etc)

Waste types	*How do you store?*	*How is it collected?*	*How is it processed or disposed?*
a)			
b)			

c)			
d)			
e)			
f)			
g)			
h)			
i)			

Please answer the following questions regarding the management of your waste

Item	Food Waste	Garden Waste	Animal Waste	Building Waste	Medical Waste including	Household Hazardous Waste	Plastic and rubber waste products	E-Waste	Ash	Other, specify……
1. How long have you been using the waste management methods specified above?										

20. Other than through municipal collection, how could you prefer to management your waste as a community collectively

Type of waste	*Storage*	*Collection*	*Disposal/treatment/recycling*
a)			
b)			
c)			
d)			
e)			

21. How did you learn this waste management methods mentioned above (chose the best in each)

(a) Accumulated experience of life	
(b) Transferred orally	
(c) From generation-to-generation	
(d) Knowledge practiced within local community	
(e) Traits from religious practices	
(f) Cultural knowledge	
(g) Local initiation schools	
(h) Formal education	
(i) Other (specify)	

22. Any additional comments or inputs you would like to say in relation to the topic of this study

Thank you for your participation

9 APPENDIX B: ISIZULU QUESTIONNAIRE

Ukunakelwa kwadoti endaweni yaso uThweba

South Africa.

Izibalo zabantu bomndeni	
1. Ubulili benhloko yekhaya	
2. Iminyaka yenhloko yekhaya	
3. Izinga lemfundo yenhlokoo	
4. Isimo sokuqashwa kwenhloko yekhaya	
5. Ulimu olukhunyulwa inhloko yekhaya	
6. Inhloko yomndeni (chaza isimo sayo ekhaya, isib. ubaba)	
7. Mangaki amalunga ahlala ekhaya	
8. Inani lamalungu omndeni aqede ibanga le-12	
9. Inombolo yamalungu omndeni aneziqu ze-post matric (iziqu zemfundo ephakeme)	
10. Isamba semali engenayo yanyanga zonke ehlanganisiwe	
11. Ulimi olukhulunywa ngokujwayelekile ekhaya (chaza uma ulimi lwashintsha ngokuhamba kweminyaka), lusuka kuluphi ulimi luye kuluphi ulimi futhi kungani lolu shintsho lwenzekile	
12. Isiko lasekhaya (chaza imisebenzi ethile yamasiko eyenziwa yikhaya)	
13. Inkolo yasekhaya (chaza ukuthi le nkolo inesikhathi esingakanani isenziwa ngumndeni)	
14. Sekuyisikhathi esingakanani lo mndeni ukhona endaweni okuyo njengamanje?	
15. Ubukuphi lo mndeni ngaphambi kwendawo okuyo (iminyaka yesifunda endaweni edlule)	
16. Ingabe lo mndeni usuka kwelinye izwe (ikakhulukazi inhloko yomndeni), isho izwe lendabuko kanye neminyaka. Nikeza umlando wokhokho kakhulu ngangokunokwenzeka, uhlanganisa iminyaka.	

17. Ingabe likhona ilungu lomndeni elibamba iqhaza kunoma yimiphi imicimbi yamasiko?	Y / N	Uma kunjalo, cacisa imisebenzi yamasiko: ungamaka ngaphezu kokukodwa a) Umkhosi Wasekhaya b) Umsebenzi wokuzithandela wenhlangano esiza abantulayo c) Umdanso Wesintu Nemikhosi d) Umcimbi wezemidlalo wendawo e) Izinkondlo kanye nebhizinisi lokubonisa f) Okunye, cacisa…….
18. Ingabe likhona ilungu lomndeni elibamba iqhaza kunoma iyiphi iklabhu yezemvelo?	Y / N	Uma Yebo, cacisa amakilabhu emvelo noma okongiwa kwemvelo:

19. Umndeni wakho uziphatha kanjani izinto ezilahlwayo ezahlukene (chaza uhlobo ngalunye lwemfucuza nokuthi luphathwa kanjani),i.e. ukudla, ingadi, ubulongwe bezilwane, imfucumfucu kamakhi, ezempilo, amanabukeni, okuyingozi kwasendlini, imfucuza ye-e (amaselula, umlotha nokunye)

Izinhlobo zikadoti	*Ugcina kanjani?*	*Iqoqwa kanjani?*	*Icutshungulwa noma ilahlwa kanjani?*
a)			
b)			
c)			
d)			
e)			
f)			
g)			

h)			
i)			

Sicela uphendule imibuzo elandelayo mayelana nokuphathwa kwemfucuza yakho

Izinto	Udoti Wokudla	Imfucuza Yengadi	Imfucuza Yezilwane	Udoti Wokwakha	Udoti Wezokwelapha ohlanganisa amanabukeni Alahlwayo kanye nama-	Imfucumfucu Eyingozi Yasekhaya (ama-aerosol, upende,	Imikhiqizo yemfucuza yepulasitiki nenjoloba	Ugesi-Imfucuza	umlotha	Okunye, cacisa.
1.Unesikhathi esingakanani usebenzisa imfucuza izindlela zokuphatha eshiwo ngenhla?										

20. Ngaphandle kokuqoqwa kukamasipala, ungakhetha kanjani ukuphatha imfucuza yakho njengomphakathi ngokuhlanganyela

Uhlobo lwemfucuza	*Isitoreji*	*Iqoqo*	*Ukulahlwa/ukwelashwa/ukugaywa kabusha*
a)			
b)			
c)			
d)			
e)			

21. Uzifunde kanjani lezi zindlela zokulawula udoti ezibalwe ngenhla (ukhethe ezingcono kakhulu kuzo zonke)

a) Isipiliyoni sokuphila esinqwabelene	
b) Kudluliswe ngomlomo	
c) Kusukela esizukulwaneni kuya kwesinye	
d) Ulwazi olwenziwa emphakathini wendawo	
e) Izici zemikhuba yenkolo	
f) Ulwazi lwamasiko	
g) Izikole zokusoka zasendaweni	
h) Imfundo ehlelekile	
i) Okunye (chaza)	
22. Noma yikuphi ukuphawula okwengeziwe noma imibono ongathanda ukuyisho mayelana nesihloko salolu cwaningo	

Siyabonga ngokubamba kwakho iqhaza

APPENDIX C: ETHICS CLEARANCE

UNISA university of south africa

CAES HEALTH RESEARCH ETHICS COMMITTEE

Date: 08/04/2019

NHREC Registration # : REC-170616-051
REC Reference # : 2019/CAES/067
Name : Ms MT Shange
Student #: 42921929

Dear Ms Shange

Decision: Ethics Approval from 04/04/2019 to 31/03/2020

Researcher(s): Ms MT Shange
shangen@iceboenviro.co.za

Supervisor (s): Dr F Machete
machef@unisa.ac.za; 011-471-2075

Working title of research:

Documentation of indigenous methods of solid waste management practiced in uThweba village, KwaZulu-Natal, Republic of South Africa

Qualification: MSc Environmental Management

Thank you for the application for research ethics clearance by the CAES Health Research Ethics Committee for the above mentioned research. Ethics approval is granted for a one-year period. After one year the researcher is required to submit a progress report, upon which the ethics clearance may be renewed for another year.

Due date for progress report: 31 March 2020

Please note the points below for further action:

1. The researcher should describe the process that will be followed to develop the proposed model, as stipulated in the last research objective.

*The **low risk application** was **reviewed** by the CAES Health Research Ethics Committee on 04 April 2019 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
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The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No field work activities may continue after the expiry date. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number ***2019/CAES/067*** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Prof EL Kempen
Chair of CAES Health REC
E-mail: kempeel@unisa.ac.za
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Prof MJ Linington
Executive Dean : CAES
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APPENDIX D: CONSENT LETTER FROM THE COUNCILLOR

ETHEKWINI MUNICIPALITY

Councillor

Mezzanine Floor Shell House
Cnr. Anton Lembede & Samora Michell Street, Durban, 4001
P O Box 1014, Durban, 4000
Tel: 031 322 7030, Fax: 031 311 3827
www.durban.gov.za

Our Ref: CLLR B.A MKHIZE
Your Ref: 078 121 5642
Enquiries: CLLR B.A MKHIZE

Consent letter for Monica Shange student number 42921929 to conduct the research "Documentation of indigenous methods of solid waste management practiced in uThweba Village, Kwa-Zulu Natal, Republic of South Africa".

This letter serves to confirms that Monica shange student number 42921929 who is currently enrolled for a Master of Science in Environmental science at the University of South Africa (UNISA) has been granted access by the local councillor to conduct her research titled "Documentation of indigenous methods of solid waste management practiced in uThweba Village, Kwa-Zulu Natal, Republic of South Africa". The research will involve taking pictures of waste disposal sites households within uThweba, and conducting one on one interview with selected participants in the area. It has been indicate that all ethnical issued will be handles appropriately. A written consent will be requested from all potential participants through giving them brief information about the study, the benefits and risks associated with their participation and the aim of the study. Potential participants will also be informed about their rights to give or refuse consent and to withdraw from the study at any given point.

Councillor Bongumusa Anthony Mkhize

COMMISSIONER OF OATHS
ETHEKWINI MUNICIPALITY
EX OFFICIO DISTRICT OF DURBAN IN
TERMS OF SECTION 6 OF ACT 16 OF 1963
Dr Pixley Ka Seme Street, Durban, 4001

12 APPENDIX E: FIELD OBSERVATION CHECKLIST

1. Is there a household pit for waste disposal within the premises?

Yes	No

1. Type of waste identified within the household

General waste		
	Steel	
	Animal bones	
	Human faecal	
	Food residues	
	Vegetable products	
	Agricultural waste	
	Animal waste	
	Rags and fibre sacks	

	bottles	
	Electronic	
	Rubber	
	Glass	
	clothes	
	Paper	
	wood	
	Pottery	
	Plastic	
	Tyres	
	Sanitation waste	
	Building Waste- demolition waste not containing hazardous waste or hazardous chemicals	
Hazardous waste	**Household Hazardous Waste (aerosols, paint, paraffin, thinners, batteries)**	
	Medical waste	

	Rags and fibre sacks		
	bottles		
	Electronic		
	Rubber		
	Glass		
	clothes		
	Paper		
	wood		
	Pottery		
	Plastic		
	Tyres		
	Sanitation waste		
	Building Waste- demolition waste **not containing hazardous**		
	Medical waste		

2. Are there any signs that waste is being burnt on the premises

Yes	No

3. Is there any reused waste identified within the premise

Yes	No

Specify and take picture

…….

……
……
……

4. Are there crops within the homestead?

Yes	No

5. Are there any of the crop waste reused within the homestead
   Specify……
   ……

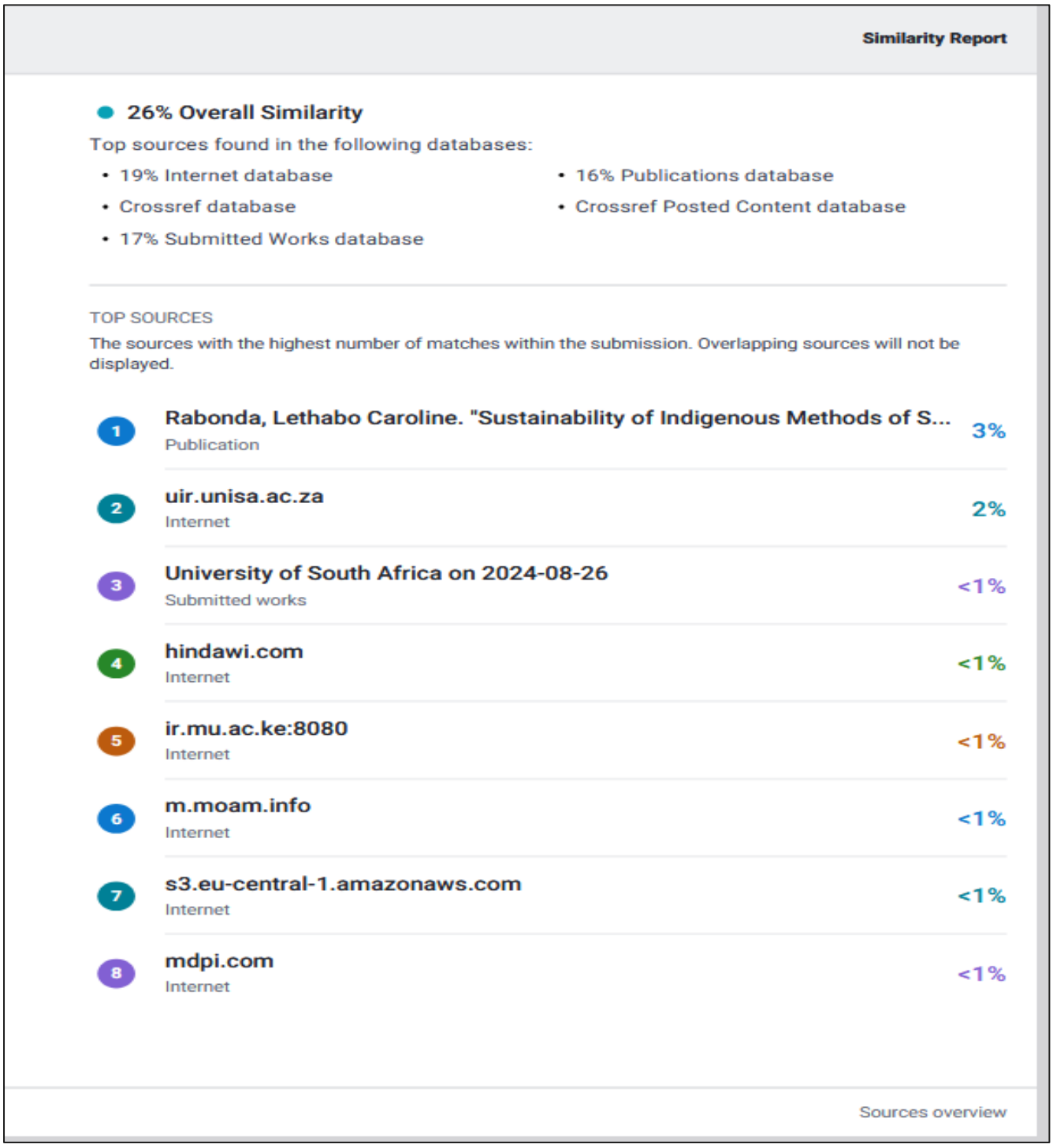
6. Are there excessive rats mosquitoes, and flies within the homestead?

Yes	
No	

7. Visual observation of waste disposed within the illegal dump sites

General waste		
	Steel	
	Animal bones	
	Human faecal	
	Food residues	
	Vegetable products	
	Agricultural waste	
	Animal waste	
	Rags and fibre sacks	
	bottles	
	Electronic	
	Rubber	
	Glass	
	clothes	
	Paper	
	wood	
	Pottery	
	Plastic	
	Tyres	
	Sanitation waste	
	Building Waste- demolition waste not containing hazardous waste or hazardous chemicals	
Hazardous waste	**Household Hazardous Waste (aerosols, paint, paraffin, thinners, batteries)**	
	Medical waste	

APPENDIX F: TURNITIN REPORT



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