DOCUMENTATION OF INDIGENOUS METHODS OF WASTE MANAGEMENT IN CHIEF ALBERT LUTHULI MUNICIPALITY, REPUBLIC OF SOUTH AFRICA

by

MATLHODI FAMO

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at the

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Supervisor

Prof Machete Machete

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Declaration

I declare that documenting indigenous waste management practices that are prevalent in the Chief Albert Luthuli Municipality, RSA is my own unaided work and that all the sources that I have quoted have been indicated and acknowledged by means of complete references. I further declare that I have not previously submitted this work, or part of it for examination at any other institution of learning or at the University of South Africa for another qualification.

29 August 2023

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Signature   Date

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Disclaimer

This dissertation is made-up of four chapters (1-4). Chapters 2 and 3 are peer reviewed and published in accredited journals. Thus, each chapter in this dissertation is cited and referenced according to the standard of the Journal in which it is accepted or published (see annexure C). Hence forth, this is a publication-based dissertation submitted for an MSc in Environmental Management at the University of South Africa.

Abstract

There is an observed proliferation of studies around indigenous knowledge (IK). However, the definition of indigenous knowledge remains ambiguous from several studies. Some inconsistencies in what some international studies define as indigenous knowledge leave the IK concept fluid. To put the discourse on what IK is, the current study examined the priority elements that can be used to characterize knowledge as being indigenous or foreign to a defined community. In unravelling the discourse, the study examined the influence the demographics of Chief Albert Luthuli municipality on knowledge that is indigenous to this community. Results showed a link (nexus) between common spoken language, cultural, ritual practice, beliefs, and IK practices of communities in general. The study also showed the influence of economics such as employment, levels of education and household income on IK. The ultimate finding was that these variables proved association with the adoption of IK practice as means of survival as alternatives to lack of income or sustainable income in households.

Indigenous methods emerge from language, culture, place, and customs. Indigenous methods were mostly practiced in developing countries, which included social, economic, and environmental activities practiced by the community for survival. Indigenous methods have been observed since time immemorial and have been effective in waste management within households in rural communities. Fewer studies were documented in relation to the waste management methods which were practiced indigenously by the communities in South Africa. Hence the study will explore the skills and practices acquired by the local community of Chief Albert Luthuli in relation to waste management. 398 respondents from the age 18 years and above participated in the study. Microsoft Excel and Statistical Package for Social Science (SPSS) were used for data capturing and analysis. Samples were collected in certain areas of the study area by means of simple random sampling technique. Mixed method which consisted of questionnaires was

selected for the purpose of the study. Waste management has been a major challenge for the community that led to indiscriminate waste disposal, hence indigenous waste management should be revisited to curb the challenge. Categories of waste streams were identified during the study and methods how they were indigenously managed by the local community within the study area of Chief Albert Luthuli municipality were also identified. Furthermore, the lack of formal waste management systems in the rural areas of Chief Albert Luthuli have resulted in different indigenous systems and practices of solid waste management.

Key words: indigenous knowledge, cultures, African cultures, African philosophy, decolonization, indigenous waste management methods, indigenous practices, indigenous methods, waste stream, indigenous knowledge, waste management

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CHAPTER 1:

BACKGROUND AND JUSTIFICATION OF THE STUDY

1.1. BACKGROUND OF THE STUDY

Indigenous Knowledge Practices (IKPs) are local knowledge developed by ancestors through centuries of experimentation and are passed orally from generation to generation (Barnhardt & Kawagley, 2005).

Indigenous Knowledge (IK) is defined as local knowledge specific to a particular culture or society (Warren & Rajasekaran, 1993). Indigenous Knowledge facilitates the understanding of population trends and their behaviour (Ziker *et al.*, 2016). Furthermore, Berkes (2018) defines the concept indigenous knowledge as the accumulation of local community knowledge, practices, and beliefs and the co-existence in a particular geographical area. Indigenous Knowledge is primarily communicated orally and typically used to facilitate resolutions and cultural practices within a community as well as societal interaction. Most of the knowledge of the Indigenous people, especially in developing countries, is undocumented and only passed down orally from generation to generation

The lack of formal documentation increases the risk of IK loss across generations (Chiwanza *et al.*, 2013). Documentation is pivotal to safeguard IK so that it continues to provide local solutions or alternatives to Western knowledge and create gratification in rural communities about their IK (Kihwelo, 2005). IK is lively, but gets neglected as innovations and adaptation of practices emerge. The increasing rate of loss of IK due to rapid population growth, changes in the environment, and lifestyle changes due to development processes, modernisation and cross-cultural interaction is as major cause of concern (International Institute of Rural Reconstruction, 1996). Indigenous people around the world have developed, maintained, and evolved knowledge systems by means of direct experience and interacting with the biophysical environment over millennia (Atleo, 2011). Indigenous knowledge explains the evolution of customs that are

derived from the effort taken to adjust to the surrounding environment. IK evolution is lively and influenced by the inner-most avant-garde experimentation and contact with external structures (Flavier *et al.*, 1995). Indigenous knowledge is evolving, and encompasses both the observable and the practicable.

According to the Mpumalanga Provincial Government (2022), South Africa was formed by the amalgation of four formerly self-governing British dependencies, which are the Cape, Natal, Orange Free State, and Transvaal provinces. Mpumalanga was formed in 1994 when the region formerly known as the Eastern Transvaal was merged with the former native land of KaNgwane, KwaNdebele and parts of Lebowa and Gazankulu (Mpumalanga Provincial Government, 2022). Archaeological sites in the Mpumalanga region indicate settlement by humans and ancestral habitation dating back to 1.7 million years (South Africa Yearbook, 2001/02). The Nguni tribe arrived in the province in the 1400s, the Ndebele ethnic group arrived in the 1600s and the Swazi arrived in the 1700s. The settlement by these tribes shaped the demographical setting of the area. The population of Chief Albert Luthuli Municipality (the study area) is mostly dominated by these tribal groups (Statistics South Africa, 2011).

The academic community has explored the concept IK, however prior studies have failed to address the exploration and documentation of indigenous knowledge with regards to waste management practices. The study was motivated by the need to deal with the indiscriminate dumping of waste in open spaces which was observed to be more prevalent in areas that receive waste collection services from the local municipality as compared to areas where waste is not collected by the local municipality. Indiscriminate dumping of waste in open spaces was observed to be more dominant in areas such as Carolina (Silobela Township), Elukwatini as compared to rural areas such as Dundonald and Diepdale. Dundonald and Diepdale are cleaner communities that are using indigenous knowledge practices acquired/learned from their forefathers.

1.1.1. Importance of Indigenous knowledge

According to Mwantimwa (2008), indigenous knowledge is the pillar of a set of shared values and norms amongst indigenous people. It has the capacity of being converted into commercial benefits in which it can provide hints that can help human beings with development. Indigenous knowledge also helps in production and ensuring that there is growth in the economy in which the environment is not harmed and using knowledge as an important development resource. It has been seen in the past that IK is a useful environmental management resource for the poor in which activities like recycling were adopted (Angioni, 2003).

The indigenous connoisseurs realized that when using the Western systems alone to solve challenges faced by the society, they encounter failure. IK can complement western knowledge systems (Gwaravanda & Ndofirepi, 2020). South Africa's drive for the evolution and protection of indigenous knowledge within communities have a long history. The African Renaissance, as a concept, has captured the imagination of many South Africans and IK has been practiced before and after colonialism (Ntuli, 2002).

1.1.2. Importance of indigenous waste management methods

The practice of indigenous knowledge goes beyond all human activities, including waste management to preserve the environment for future generations (Ajibade, 2007). Waste management in certain countries is guided by certain local or cultural norms. Indigenous waste management practices have long been in existence before the introduction of the current western system of waste management (Senekane *et al.,* 2022). The absence of formal refuse collection systems made communities to rely on waste management practices that seem to solve their challenges. Indigenous waste management practices have been in existence way before colonialism.

Developed countries have been using the best methods of waste handling and disposal since time immemorial (Ajibade, 2007). Waste management methods used in Nigerian cities were described as ineffective (Ajibade, 2007). Ajibade (2007) observed that integrated waste management can bring solutions as the alternative management concept. Communities in Nigeria have been using local methods whereby solid waste has been reused and recycled (Ajibade, 2007). Food and yard waste are recycled through feeding animals, organic waste is used for composting, ash is recycled through making black soap, and other waste such as old tyres are recycled to make slippers and garden chairs (Ajibade, 2007; Senekane *et al.*, 2022). Orang Asli in the Jempol district of Negeri Sembilan, do not have waste bins or disposal pits and waste was either incinerated or fed to the animals (Ling *et al.*, 2010). There are no waste collection services, but the storage of recyclables was observed as the Orang Asli sell recyclable items to agents who come to their village to collect them (Ling *et al.*, 2010). Furthermore, the locals in Kenya reuse animal dung and vegetable waste to enhance the richness their lands through composting (George, 2015).

The Ngwa community in Nigeria uses indigenous solid waste techniques to manage their waste (Izugbara & Umoh, 2004). The members of the community were either burying, composting, burning, recycling or converting their waste (Izugbara & Umoh, 2004). Several methods have been more effective than conventional 'western' methods. Indigenous waste management practices helped in protecting human health and the environment. These practices underpin culture and promote the norms and values of rural communities. Most community members are following on their ancestral footsteps of their ancestors when it comes to waste management.

Earlier studies show observed best practices based on indigenous waste management that have helped in addressing challenges faced by the countries where they were implemented. Western methods may not always function efficiently and can be used in conjunction with indigenous practices. Some indigenous methods were tested and found to be effective. In South Africa, the methods are not yet tested. It is therefore

recommended that Chief Albert Luthuli Municipality considers adopting indigenous waste management practices to help ease the burden of waste removal.

1.2. JUSTIFICATION OF THE STUDY

The idea of documenting IK is not a new concept (Ngulube, 2002; Hwang, 2005). Ngulube (2002) noted that missionaries and colonial district officers collected information on customary patterns of land tenure, livestock and traditional beliefs and rituals. Ngulube (2002), therefore asserts that IK documentation must be maintained and intellectual property rights protected. Many studies explain their perception of indigenous knowledge without covering all aspects of it. Prior studies have failed to address the documentation of indigenous waste management practices. This can result in the disappearance of the indigenous waste management practices.

This study documented indigenous waste management practices within the community of Chief Albert Luthuli Municipal area. In documenting the waste management practices, the community exchanged knowledge and practices. Some community members within the study area may have lost hope in the current municipal waste management systems, so it is reasonable to encourage communities not to ignore their cultural beliefs and solid waste management practices. Cultural beliefs have found to have an influence on waste disposal methods among households. In addition, cultural beliefs are confirmed to be contributing positively towards alleviating indiscriminate waste dumping problems.

1.3. PROBLEM STATEMENT

The way waste generated from human activities is handled, stored, collected, and disposed of can pose risks to the environment and to public health. Waste management includes all activities seeking to prevent environmental pollution and harm to human health. The Department of Environmental Affairs records that South Africa is generating about 107.7 million tons of waste annually (South Africa State of Waste Report, 2018).

According to Stats SA (2011), Chief Albert Luthuli Municipality has a population of 187 630. Within the study area, 19.3% of the population get refuse disposal services from the local municipality and the remaining 80.7% manage waste through alternative methods which are not formalized and regulated (Stats SA, 2011). The community has been using local knowledge systems of waste management which are indigenous to them. These methods are not documented, and the risks associated with those methods are not known.

Most of the communities in the Chief Albert Luthuli municipality fall under traditional authorities. Refuse collection services were never rendered to those communities since 1927 when the Black Administrative Act 38 of 1927 was enacted (Republic of South Africa, 1927) up until to date. The proliferation of indiscriminate dumping of waste was found to be a major challenge within the municipality where waste management services are rendered by the local municipality. A comparison that was done through observation has revealed that areas ruled under traditional authorities were cleaner compared to most urban townships.

1.4. RESEARCH AIM

The aim of the study was to document indigenous waste management practices that are prevalent in the Chief Albert Luthuli Municipality, South Africa.

1.5. RESEARCH OBJECTIVES

1.5.1. To examine the influence of community demographics on indigenous practices of the citizens of Chief Albert Luthuli Municipality.

1.5.2. To determine the factors that influence indigenous practices in households.

1.5.3. To assess indigenous methods of waste management in Chief Albert Municipality.

1.6. MATERIALS AND METHODS

1.6.1. Description of the study area

The study was conducted in Chief Albert Luthuli Municipality, Mpumalanga, South Africa (Figure 3.1). The municipality has a total population of 186 010 based on the 2011 census (Stats SA, 2011). Communities in this area rely on diverse economic activities like as agriculture, mining, income-generating ventures, and government-funded old-age benefits. The majority of community members are unemployed and those who are employed are depended on low household income for survival.
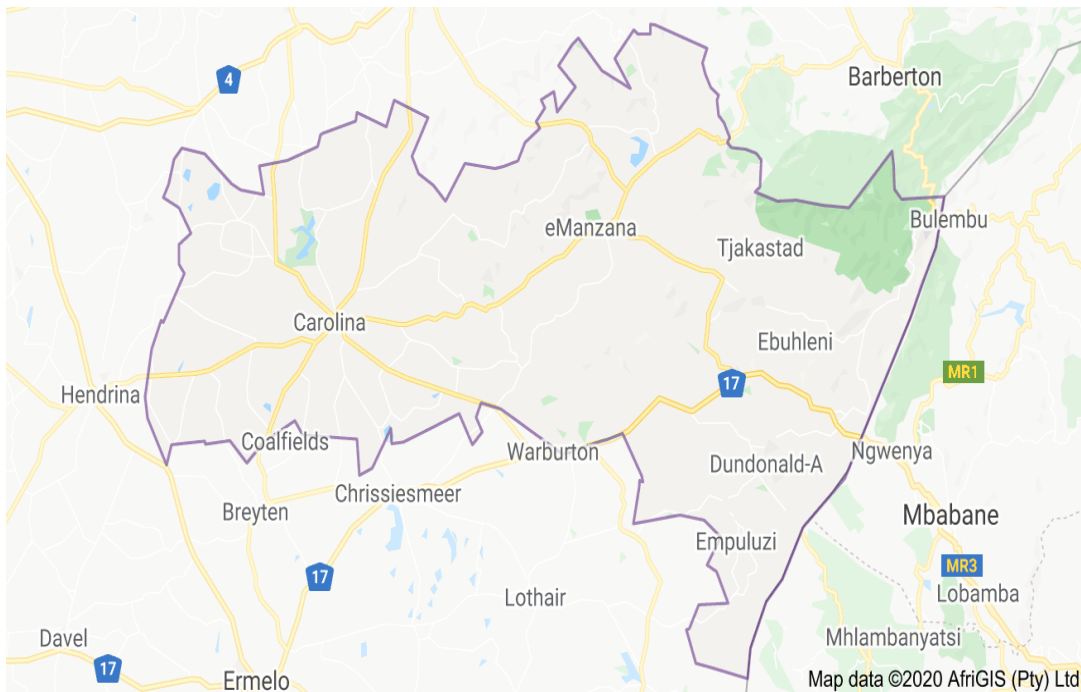
Figure 1.1: Map of the study area and settlement or townships

Source: Google Maps (2023)

Chief Albert Luthuli Local Municipality is part of the Gert Sibande District Municipality and shares its eastern border with the country of Swaziland. The Chief Albert Luthuli Municipality, the study area is located in the Gert Sibande District in Mpumalanga Province. The study area is a Category B municipality that shares municipal executive and legislative authority in its area with category C. Chief Albert Luthuli Municipality is one of seven municipalities in the district. Carolina is the seat of the municipality. The

study area has areas that are very close to one another and the following areas formed part of this study: Fernie, Diepdale, Avontuur, Tjakastad, Nhlazatshe, Badplaas, Glenmore, Dundonald, Silobela and Elukwatini. The study area is predominantly rural municipality, towards the boundary of Swaziland. The municipality is categorized into portion where farms are set for agricultural purposes, the state owned and the one owned by the traditional leaders.

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According to (Stats SA, 2011) there is a backlog in the delivery of waste service to about 2,1 million households. On the other hand, according to waste service delivery data, about 4,1 million households were not provided with any form of waste at all. Statistics South Africa shows that only 8,396 574 households were provided with waste service in 2011 (Stats SA, 2011). Chief Albert Luthuli Municipality has a population of 187 630. Within the study area, 19.3% of the population get refuse disposal services from the local municipality and the remaining 80.7% manage waste through alternative methods which are not formalized and regulated (Stats SA, 2011). The community has been using local knowledge systems of waste management which are indigenous to them.

1.6.1.1.   Geography, topography and density of the study area

The municipality is located on the eastern escarpment of Mpumalanga Province. According to (StatsSA, 2011) the study area has approximately 5, 560 km^2 with a density of 331 km^2 (87/sqmi). The study area has an elevation of: 1, 503m with a minimum elevation of 578m and maximum elevation of 3, 030m.

1.6.1.2.   Climate

The Gert Sibande District Municipality experiences a subtropical climate with hot summers and mild winters that eventually turn cold and frosty. Summer thunderstorms and rainfall are other characteristics of the region (Department of Cooperative Governance and Traditional Affairs, 2019). The area produces a large amount of summer cereals like maize and grain sorghum and is much cooler due to its altitude. The majority of the escarpment's hills are covered in exotic trees, gum, and wattle plants.

1.6.1.3.   Soil type and vegetation

The vast majority of the grassland in the Gert Sibande District Municipality is a result of the climate on the hills and escarpments. Rainwater from the grassland biome is stored in the ground, marshes, and seasonal pans. The Gert Sibande District Municipality has six different types of soil which are: black and red strongly structured clay soil with high base status, red and yellow massive or weak soils, red to yellow and greyish soils with low to medium base status, rock with limited soils, soil with minced clay accumulation strongly structured and reddish colour and soil with minimal development, usually shallow on hard or weathering rock. There are many different levels of soil suitability and very uneven soil potential. Inappropriate land use practices are causing soil and vegetation deterioration in the Chief Albert Luthuli Municipality study region (Gert Sibande District Municipality Spartial Development Framework, 2014).

1.6.2. Sampling

Sampling is defined as a procedure used to choose or search for cases, the frame of reference and/or respondents to stipulate effective data on the concept studied (Polit &

Beck, 2017). Sampling plays an important role in the credibility of data from fieldwork. A total of 397 respondents were sampled for the research purpose. A total of 398 randomly selected respondents participated in the study. The respondents to the study were 18 years of age and older, as 18 is the age of majority in South Africa as defined in Section 17 of the Children's Act no: 38 of 2005 (Republic of South Africa, 2005).

1.6.3. Data collection tools

Structured questionnaires were used for data collection, as recommended by (Leedy & Ormrod, 2010). Questionnaires were administered to respondents located in the ten villages of the Chief Albert Luthuli Municipality. A self-administered questionnaire generated both qualitative and quantitative data. Questionnaires were used for this study as they provide a cost-effective way of collecting data from a larger number of the population of Chief Albert Luthuli Municipality. The purpose of the questionnaires was to obtain demographic information as well as the indigenous methods used within the study area. For the purpose of this study a total of 398 questionnaires with closed and open-ended questions were used to collect data. The use of closed-ended questions allowed the respondents to choose an answer that is relevant to them and with the use of open-ended questions allowed respondents to give their own viewpoint and further explanation of the questions. Questionnaires encourage the respondents to be franker and more honest when answering questions. They also permit anonymity and does produce high practical data. When using a questionnaire there is less chance of any bias creeping form the targeted respondents. With the usage of the questionnaires the researcher did not require the help of the research assistants.

1.6.4. Determination of sample size

The population unit of the study was individuals within the municipal area, estimated at 186 010. The sample size of the study (n=398) was drawn using Equation 1 (Yamane, 1967).

$$1.\, n = \frac{N}{1+Ne^2}$$

Where:

n= sample size

N= household size

e= error tolerance (level)

The sample size determined at population confidence level of 95% with margin of error or error tolerance of 5% i.e. 0,05 (e) where n is the sample size, and N is the total population. The sample size for the population for the study were 397. $n=N\div1+Ne^2$

$=53480\div1+53480(0,05)^2$

$=53480 \div1+53480x0,0025$

$=53480\div1+133,7$

$=397$

1.6.5. Target population

Target population is the group of individuals that the intervention intends to conduct a research in and draw conclusions form. According to Gall, Borg and Gall (2003), target population provides a solid foundation and first step upon which to build a validity and reliability of the study. For this study target population consisted of community members form Fernie, Diepdale, Avontuur, Tjakastad, Nhlazatshe, Badplaas, Glenmore, Dundonald, Silobela and Elukwatini communities.

1.6.6. Study design

According to Mouton (1996), a research design is a set of principles and instructions that must be followed in order to answer the research topic. The choice of relevant and efficient procedures and research instruments is guided by the research design, which also serves as a guide for the research methods to be employed in carrying out the study. The research design outlines a thorough plan for how the study will be carried out, as well as how the data will be gathered and analyzed (Thyer, 1993). The research design that was ideal for the research that was conducted is descriptive design approach. Descriptive design can use a wide variety of quantitative and qualitative methods to investigate one or more variable. The type of design chosen provides a platform for the researcher to interact closely with the participants and also observe the cultural issues in order to make an authentic conclusion. A simple random sampling technique was used to select community members.

The study opted for mixed method research approach that combined qualitative and quantitative research approaches because there was the possibility that certain data collectable for this research possesses a numerical character which will require statistical clarity. The combination of both qualitative and quantitative research approaches makes it easier to have a comprehensive understanding of the problem. Data collection was from June 2021 to August 2021 in the area indicated above. The current research fits well under the above classification and description. This is because it also made use of participants/respondents who are practicing and sharing indigenous ways that are the major product of the current research.

1.6.6.1. Quantitative approach

Quantitative research is defined as research conducted using a variety of methods, which uses measurements to record and investigate aspects of social reality (Bless & Higson-Smith, 2020). According to Mark (1991), quantitative research is an investigation of a

phenomenon using numerical methods. The emphasis in these approaches is on counting, characterising, and employing basic statistics such as means and standard deviations. A quantitative research is therefore a research that utilizes numbers and figures, which this study utilized to analyses data gathered from the questionnaire. The quantitative data was collected by means of a questionnaire. The questionnaire was administered to 398 respondents. The questionnaire was divided into two sections; demographics (age, sex, gender, nationality, education levels, income level, occupation, size of the family household, etc.), and the waste management practices.

1.6.6.2. Qualitative approach

The qualitative approach is referred to as interpretative, constructivist, or anti-positivist. The researcher therefore characterizes qualitative research as research that attempts to evoke meaning that individuals connect to a phenomenon, amid external military deployment of the member (Leedy & Ormrod, 2005). Moreover, qualitative research attempts to recognize issues experienced by the research subjects to the extent that phenomenon is concerned. Due to the nature of the research problem in this study, the research approach used in this study is a combination of both qualitative and quantitative approaches. Qualitative data was organized and classified into different themes, dependent on each objective. The qualitative results were used to interpret the quantitative results.

1.6.6.3. Mixed-research method

The pivotal reason of this approach is that such integration of methods allows a more complete and synergistic usage of data, than isolate quantitative and qualitative data collection and analysis (Creswell & Creswell, 2017). The use of a combination of both qualitative and quantitative approaches ensures that the study is definitive and comprehensive (Hopper & Hoque, 2006). According to Mills (2007), triangulation involves collection of data through various data sources. Triangulation endows trustworthiness or confirms the regularity of the facts, while trying to take responsibility for basic bias (Mertler, 2009).

1.6.7. Data collection

Sources for the research at hand were vital for the study, usage of primary source of information to gather information were relevant to the objectives of the research. Structured questionnaires were used to collect the primary data. The questionnaires were mostly used to gather data information from community members of the Chief Albert Luthuli area that can read and write. The questionnaires were advantageous for the study as they were used to collect information from respondents through asking them similar questions and drawing up conclusion from their responses.   For the fact that questionnaires have been historically used in gathering data that relates to culture and beliefs in the past made them more befitting for the research at hand (Magwa & Magwa 2015).

1.6.8. Data analysis

Data analysis as defined by (Ibrahim, 2015) is the process of performing particular calculation and evaluation in order to extract relevant information from the data. According to Marshall and Rossman (1999), data analysis is aprocess of bringing order, structure and meaning to the mass of the collected data. After data were collected, the researcher ensured that all questionaires were properbly filled by repondents and completed. Data were later analysed using descriptive and inferential analysis. Data were analysed using the Statistical Package for Social Scientists (SPSS) version 25 and Microsoft Excel. The data was primarily qualitative (nominal and categorical data). Therefore, we used the frequency menu to summarise the data and the cross-tabulation menu in the SPSS Statistics version 25 was used to assess the association between two categorical variables. Specifically, the Chi-square ($\chi 2$) test was used to measure the degree of association between two categorical variables. If the p-value is less than 0.05, there is a significant relationship between variables i.e., the variables explain each other (Ugoni & Walker, 1995; Franke *et. al*, 2012). Microsoft excel was chosen because it is easy to reformat and rearrange data. Process data and analyses with graphs and charts. Identify and analyses trends and patterns in large amounts of data.

Chi-square (χ^2) was calculated according to equation (2) below:

$$2. \; x^2 = \varepsilon \frac{(o-e)^2}{e}$$ **Equation (2)**

Where:

X^2 = the chi-square test statistic

$\sum$ = summation operator

O = observed frequency

E = expected frequency

The square of the difference between the observed value (o) and expected value (e) divided by the expected value. SPSS was chosen for data analysis because it is easy to use , can accept data from any file type and uses that data to generate reports in the form of tables, charts, distribution plots and trends (Levesque & Balabanov, 2017). The results were summarised in table summarising the statistics and figures representing the variables and their relationships.

1.6.7. Data validity

According to Leedy & Ormrod (2010), validity is defined as the degree to which an instrument measures its intended construst. The concept can be furtherclassified into two categories: external and internal validity. External validity pertains to the extent to which the findings of a study can be applied to population beyond the sample used in the research. Conversely internal validity refers to the degree to which the design and data obtained from a study enble the research to draw precise conclusions regarding causality and other relationships within the data.

1.6.8. Limitations

According to University of South Africa (2017), limitations are influences beyond the researcher's control. They are the shortcomings, conditions or influences that a researcher cannot control, and that may restrict the methodology and conclusions. The expected limitations to the research are that population may not be willing to participate in the study. This may result in a biased sample and affect the generalisability of the findings. Additionally, external factors such as time constrains, budgetary limitations, and access to resources may also pose a limitation to the research. It is pivotal for the researcher to acknowledge and address the limitations.

1.7.   ETHICAL CONSIDERATIONS

Consent will be obtained from the potential participants verbally and in writing on the nature of the study. The researcher will inform all the participants that their participation is voluntary and that they can withdraw from the study at any stage. The participants will also be assured that their responses will be treated with confidentiality and anonymity, and they will not be exposed to any harm. Furthermore, the study will only be limited to adults from the age of 18-64 years.

1.8.   BREAKDOWN OF THE REMAINING CHAPTERS

1.8.1.   Chapter 2: Influence of community demographics on indigenous practices of the citizens of Chief Albert Luthuli Municipality

The manuscript addressed objective 1 and 2 of the study. The manuscript has dealt the definition of the concept Indigenous Knowledge. The chapter also addressed the factors that influence the adoption of indigenous methods in communities.

1.8.2. Chapter 3: Indigenous methods of solid waste management in the Chief Albert Luthuli Municipality, Republic of South Africa

The manuscript addressed objective 3 of the study. The second manuscript covered the Indigenous methods of solid waste management in Chief Albert Luthuli Municipality.

1.8.3. Chapter 4: Conclusions and recommendations

This chapter integrates the aims and objectives stated in Chapter 1 and provides the key findings addressing each research objective of the study. The chapter further integrates the two results chapters (Chapters 2 and 3) and highlights the nexus of the two chapters to main research aim and reflects how the later has been achieved in this study. Finally, the chapter reflects on the significances of the study in the waste management field, the professional area of environmental management and it ultimately address the future research areas and application of the research findings in policy and professional practice.

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CHAPTER 2:

INFLUENCE OF COMMUNITY DEMOGRAPHICS ON INDIGENOUS PRACTICES OF THE CITIZENS OF CHIEF ALBERT LUTHULI MUNICIPALITY

2.1. INTRODUCTION

The 21st century researchers acknowledge the proliferation of indigenous knowledge (IK) research, in the post- colonial history (Harawira, 2013). These universal developments signify the dawn of real end to colonial legacy and rebirth of the true human development potential. This paper seeks to add to the critical thinking theories that aim to unlearn colonial theories and teachings that elevated knowledge systems above others. One of the most controversial theories being that there are indigenous and other forms of knowledge in the world. Through systematic examination of what is defined as indigenous knowledge, this paper demystifies this notion and arrives at conclusion that all forms of knowledge in the universe are indigenous in communities where such knowledge originates.

The first discourse emerges from the lack of consistency in the definition of indigenous knowledge from different previous studies. For example, Ajibade (2007) defines indigenous knowledge as a local knowledge that is unique to a given culture or society and the knowledge is gained through experiences and practices the society has engaged in for a long time. Roue' and Nakashima (2002) define indigenous knowledge as home-grown information exceptional to a selected subculture or society. Comparing the two definitions, the former views it as local knowledge while the latter views it as a home-grown information. From the two, local and home-grown can be equated. However, is knowledge equivalent or synonymous to information? This question remains critical and unanswered in the understanding of the concept of indigenous

knowledge from these studies. Hopper (2002) adds that indigenous knowledge is comprehensive knowledge and practices among other factors. As opposed to the view espoused by Ajibade (2007) and Roue' & Nakashima (2002), Hopper (2002) shows that the concept indigenous knowledge goes beyond simple knowledge but involves the practice of what is known by the society in their daily lives. Although, it would be illogical to expect a verbatim definition of any concept, some inconsistencies are evident in these definitions.

The second issue emerging from the myriad definitions of IK is whether there is any knowledge, skill, technology, practice, or information in the universe, which is void of all the elements of indigenous knowledge. If any, such knowledge which does not constitute any of the IK elements discussed later in this paper may qualify to be classified as being not indigenous. For this purpose, this study reviewed 37 definitions of IK from studies conducted globally, sourced through Google search to examine elements that are frequently used to characterize IK (Figure 2.1).
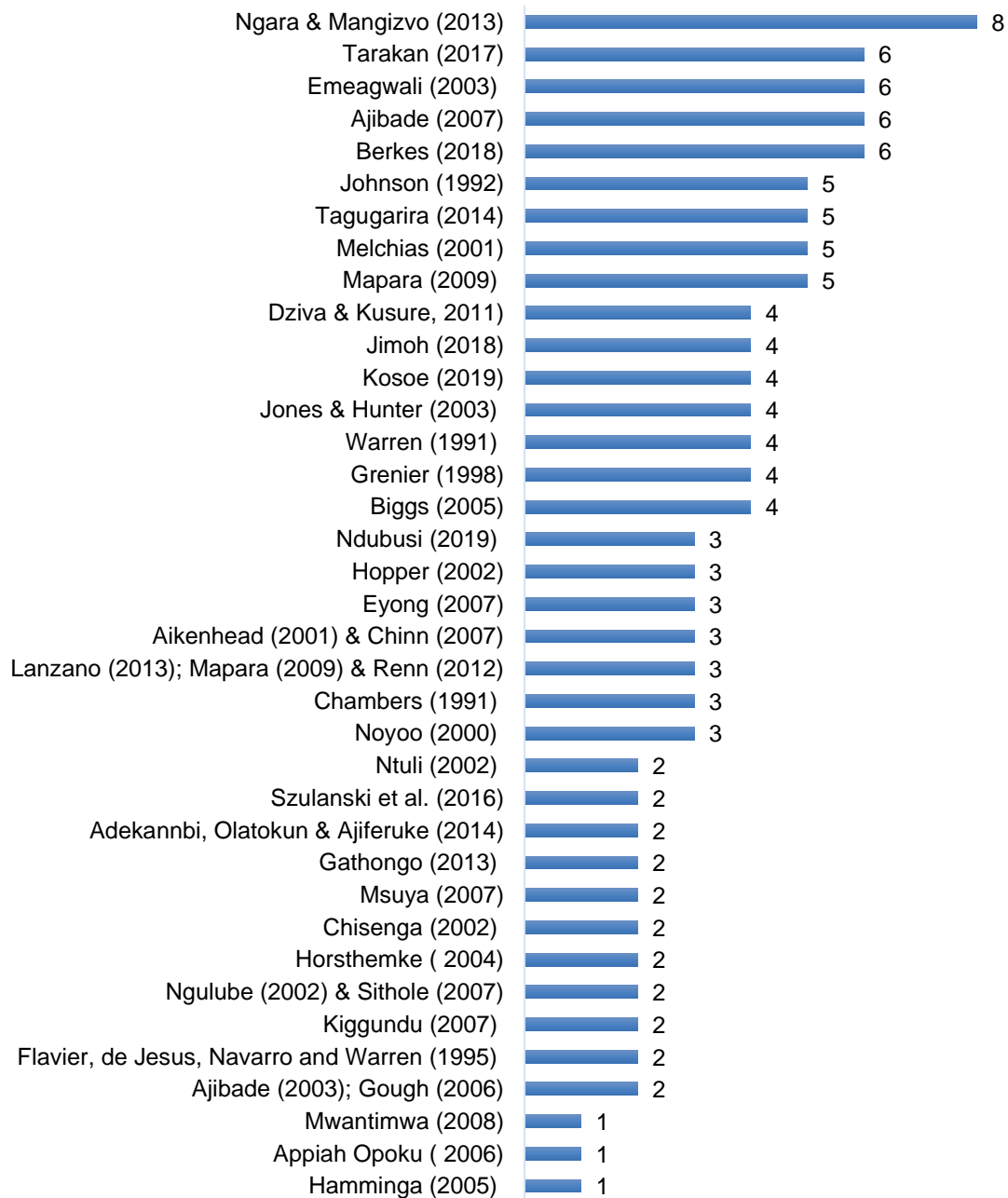
Figure 2.1: Number of elements used in the definition of indigenous knowledge per study

The results of the evaluation of definitions from the 37 studies show that on average, 3 to 4 elements were used to define indigenous knowledge (Figure 2.1). The results also show that more than 50% of the reviewed articles used 3 elements or less.

Furthermore, the difference between the lowest and the highest number of elements used was 7(range) and the standard deviation was 1.6. Most of the studies used 2 elements to define IK. This analysis provides a basis for the determination of a reasonable number of elements that can be used or are expected to be present for knowledge to be classified as indigenous or not. It is this criterion that is used to justify the argument made earlier about the non-existence of any form of knowledge that is not indigenous in the universe. This criterion was used as a standard to characterize the primary data from the study area if it qualifies as indigenous knowledge or not. From the 37 articles reviewed in this study and definitions of IK, Figure 2.2 presents the frequency of use of each element or characteristic in each definition.
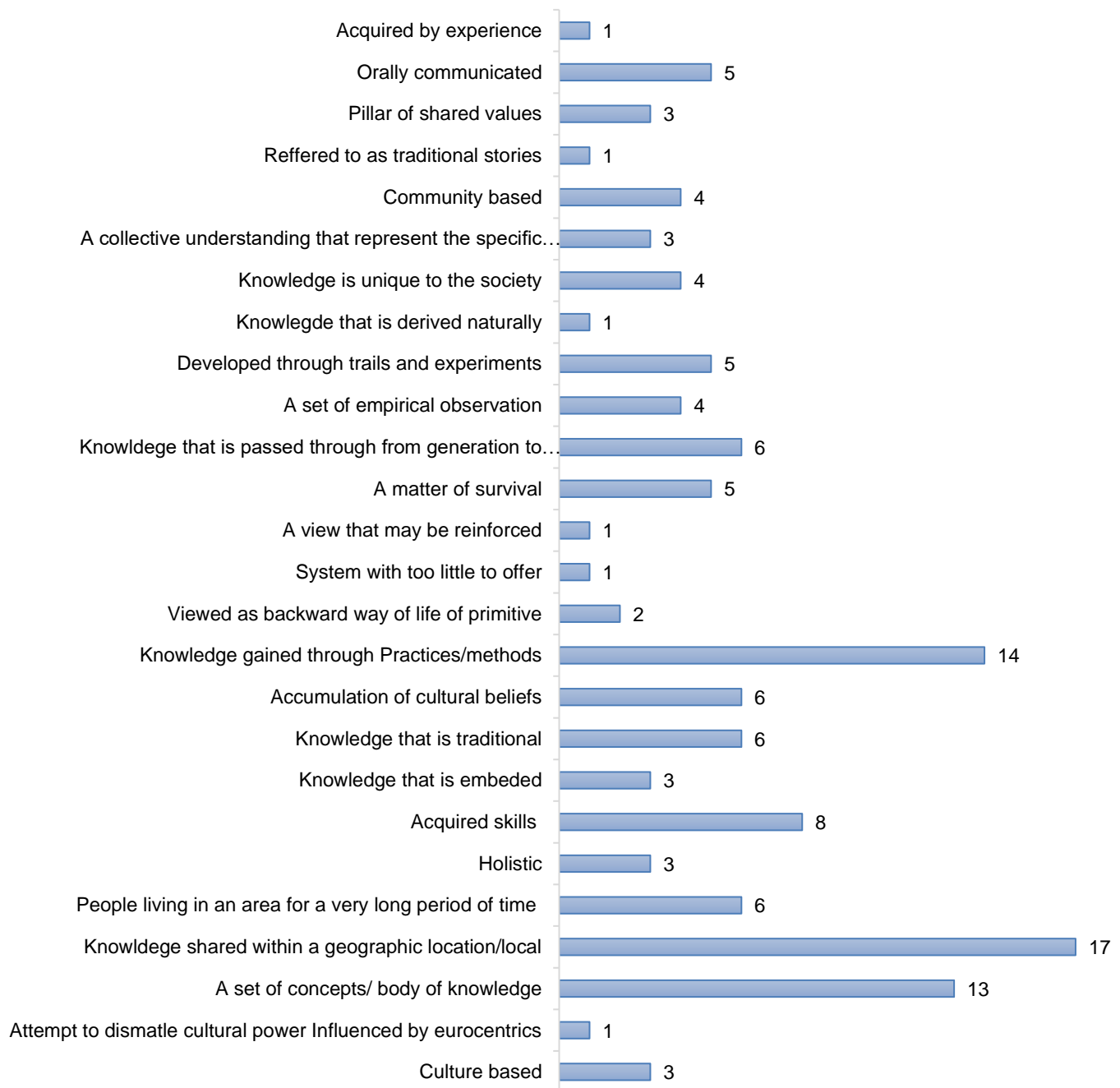
Figure 2.2: The frequency of use of an element in the definition of indigenous knowledge based on the 37 reviewed articles

In the study, 26 elements were identified from the 37 definitions of IK (Figure 2.2). The number of elements used to define IK among authors ranged from 1-to-17. On average 4.7 elements were used by the authors. Less than half of the studies used less than 4

elements, while more than 50% used 4 elements and above, with a mode of 1 element at 4.0 standard deviation. From the descriptive statistical analysis, this study deduced that 4 elements, which represents the 50% cut-off point, can be accepted as the most reasonable number of elements to be used in an average definition of IK and in characterizing knowledge or a practice as indigenous. The four elements that have the highest frequency (Figure 2.2) were selected as key elements in this study. These elements include: (1) knowledge shared within a geographic location, (2) knowledge gained through practices or methods, (3) a set of concepts or a body of knowledge and (4) locally acquired skills. Thus, the average definition of indigenous knowledge based on these four key elements would thus be a set of concepts or body of knowledge or skills shared or acquired locally and gained through practice within communities to sustain their livelihoods.

In addition to the earlier contributions, the current study also reflected on the etiology of the concept of indigenous knowledge. According to Goduka (2005) the concept of indigenous originates from the Latin words *indigenus* and *indigene.* The Word Hippo (2021) defines the word *indiginus* as an adjective and that is synonymous with the words (1) native, (2) indigenous, (3) aboriginal and (4) born within. Amaro and Watson (2016) share a similar understanding of the concept of indigenous where it is derived from the Latin word *Indigena* that means native and the word was initially used in the early 1640s. Amaro and Watson (2016) add that *indigena* translates to natural happening and it is from the old Latin *concept indu* that originated from the ancient *endo.* The later has the same meaning as the Greek *endina* (Amaro & Watson, 2016).

2.2.   DISCUSION OF THE RESULTS

The study used four elements that are frequently used to define the concept of indigenous knowledge. These are: knowledge shared within a geographic location,

knowledge gained through practices, or methods and set of concepts or body of knowledge and locally acquired skills. The language spoken by the respondents' forms part of indigenous knowledge as defined by Ngulube (2002) and Ndubisi (2019). It is mainly transmitted orally in specific geographic regions. The study also explored seven demographic profiles that influence indigenous knowledge practices within the study community i.e., language, employment status, education levels, household income, family size, age, and gender.

2.2.1. Language profile

A total of 398 questionnaires were administered to the participants within the study area. Language spoken by respondent was used to ask the questions during the interviews. Figure 2.3 shows the language spoken by the respondents.
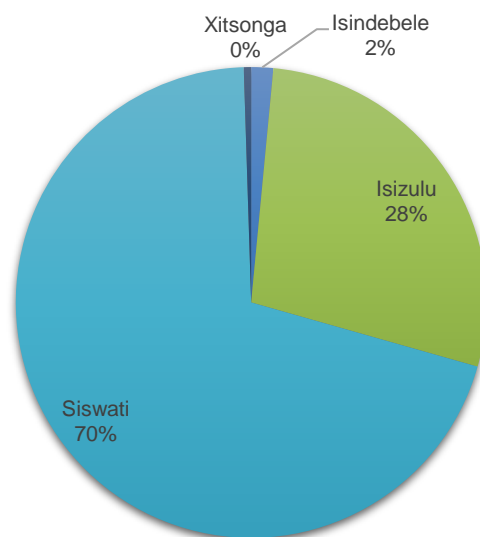
Figure 2.3: Language of household head

The results show that Chief Albert Luthuli Municipality consists of the Nguni tribe and Tsonga with 98.0% being of South African origin and 2.0% originated from Swaziland. Hopper (2005) note that indigenous knowledge (IK) is stored in the collective memory and communicated orally using language among members of the community and to the future generations through storytelling and songs among others. Most of the respondents were of Nguni descendent whereby they shared the same cultural background, ancestral practice, beliefs, and home language. Therefore, the ethnicity of the respondent and home language spoken by the respondent are key elements. Languages spoken by the respondents include siSwati (70.1 %), isiZulu (27.9 %), were isiNdebele (1.5%) and Xitsonga (0.5 %). The language composition is substantiated by Censors (2011).

During the colonial and apartheid periods, the African population of South Africa was divided into major ethnic groups that are Nguni, Sotho, Shangaan-Tsonga, and Venda, as well as Colored and Afrikaans. One of the main characteristics of ethnicity is language (South African History Online, 2016). The Constitution of South Africa Section 29 (9) recognizes 11 official languages that include siSwati, IsiZulu, IsiNdebele and Xitsonga. It is therefore extrapolated that culture and language are widely acknowledged as playing an imperative role in learning especially among indigenous people (Lipka *et al.*, 2013).

According to Whorf (1956) the inherent language of a person affects the way in which a person perceives the world around them. The Sapir - Worf hypothesis has asserted the influence of language on thoughts and perception. The linguistic system within a community setting has an influence on the indigenous methods of survival (Humboldt, 1767). Indigenous knowledge also encompasses the skills, innovations, beliefs, values, language, experiences, and they are communicated through language tools such as traditional storytelling, proverbs, and drama (Hunn, 2001). According to Donaldo (2017), the language spoken by an individual has an impact on reducing the

probability of being unemployed. According to Stats SA (2011) Mpumalanga employment rate went down by 96 000 based on the population structure and the Nguni speaking people were mostly affected.

2.2.2. Employment status of the respondents.

Figure 2.4 shows the employment status of the respondents.
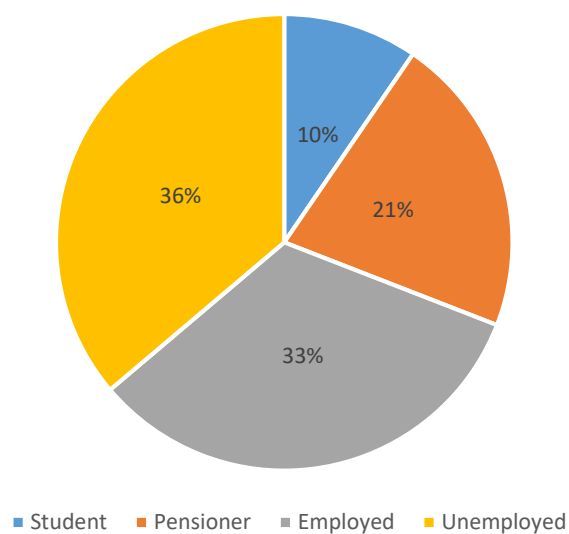
Figure 2.4: Employment status of household head

The International Labour Organization (ILO)'s definition of unemployment covers people who are out of work and still looking for work. They are actively looking for paid employment without success under the dominant economic circumstances. Figure shows that the unemployment rate among the young people is high in Chief Albert Luthuli Municipality area. Dreze *et al.*, (1991) also found out that unemployment rates among the young people are alarmingly high. The community survey conducted in 2011 found that the unemployment rate is high amongst community members in the age 18 to 64 group, and that is a major concern. The percentage of employment was 65.6% and the unemployment rate was 34.4% (Stats SA 2011). Furthermore, Figure

2.4 shows that 36.2 % of the respondents were unemployed, 32.9% were employed, pensioners and students made 21.4 % and 9.5 % of the respondents respectively. Poverty in South Africa has a strong rural dimension where 75% of poor South Africans lives in rural areas, mainly in the former homelands. The rural poor suffer from higher unemployment rates. In 2011, the official unemployment rate recorded in Mpumalanga was 21.9 % (Stats SA, 2011).

Lauer (2003) found that women have a higher unemployment rate than men i.e., 35% versus 25%. This is also indicated by the findings of this study that show in Chief Albert Luthuli Municipality most women are unemployed. The statistics confirm the previous findings by Meyiwa *et al.*, (2013) that the main source of their strength is indigenous knowledge system (IKS) to provide for their families as they were unemployed. The same was also observed in Chief Albert Luthuli Municipality where residents were recycling waste for a small amount of earnings as part of poverty alleviation. IK is constantly evolving in the process of intertwining with external knowledge. It connects the past to the present and the local with the non-local, instead of being disconnected from other kinds of knowledge. Bohensky & Maru (2011) assert that community members striving to solve their everyday challenges related to poverty and create IK-based innovations.

According to Barnhardt & Kawagley (2005) and Ndabeni (2016) IK is viewed as the social capital of the poor. For these reasons, developmental process needs to encourage the potential contribution of indigenous knowledge to locally managed, sustainable, and low-cost survival strategies. Indigenous knowledge forms the basis of problem-solving strategies for local communities, especially the poor, as it is closely related to surival and livelihoods in the decision making (Williams & Muchena, 1991;

Seehawer, 2018). Indigenous knowledge practices are seen in many parts of the world as another way to stimulate the development of poor rural communities (Briggs, 2005). The results of the statistical analysis show that there is a statistically significant association between employment status and handling and disposal of waste within the respondents' yard (x^2 =16.181, p=0.001). It is evident that a person's employment status is dependent on the indigenous practices as the p-value is less than 0.05. According to Eyong (2007) Indigenous knowledge systems became engines for rural development through the recycling of waste as they give a concrete sustainability point of reference.

High unemployment mostly affected those with only a primary school education. However, more recently those who have attended high school but failed to attain a Grade 12 certificate had a risk of unemployment. Even the better educated workforce appears to at risk of unemployment. Unemployment decreased for those with little education between 1997 and 2008 (Stats SA 2011). Emeagwali (2003) defined African indigenous knowledge system as a capable source of knowledge and skills which have successfully been used in self-employment amongst the African people of Sub-Saharan region. Almost one-third (29%) of the population lives below the poverty datum line, and unemployment is high especially among the young and less-educated rural people (World Bank, 2016).

2.2.3. Educational profile of the community

The Statistics South Africa Quarterly Labour Force Survey 2010-2020 found that the relationship between unemployment and a person's level of education. The most affected were the high school level group with 23.7% unemployment. Figure 2.5 shows the level of education of the respondents in Chief Albert Luthuli Municipality.
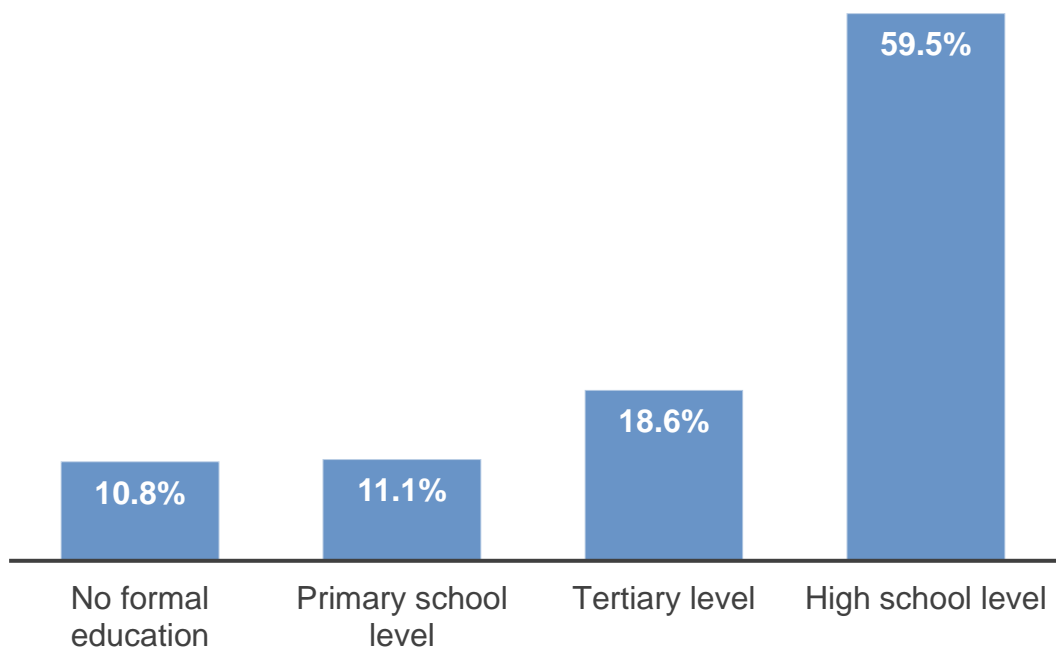
Figure 2.5: Highest level of education achieved

Indigenous societies consider education as learning for life experience (Kanstrup-Jensen, 2006). Ranasinghe (2015) defined the concept education as a human condition for survival. It also means that one generation passes on wisdom, knowledge and experience that prepares the next generations for life's challenges (Warren, 1991). The World Bank (2016) found that 8.2% of the South African population aged 25 years or over, were in possession of at least a completed bachelor's or equivalent degree or higher in 2017. Statistics South Africa (2011) found that for those aged 20 years and older, 4.4% completed primary school, 28% had some secondary education, 27% completed matric and 63% had some form of higher education.

The results of this study show that 10.8 % of the respondents had no formal education, 11.1 % had only primary education, 18.6% have tertiary education and most of the respondents (59.5%) had high school education (Figure 2.5). The respondent's level of education can be traced back with the influence on how participant is perceived as indigenous. In this logic, aboriginal can be idealized as a state of amalgamation between indigenous peoples and their accustomed environments (Durie, 2004). Woods & Cortada (2000-2001) highlights that education plays an important role on the influence of knowledge and skills that enables individual persons to function as an economic transformation proxy in the community.

2.2.4. Influence of family size on indigenous knowledge or practices

Figure 2.6 illustrates the relationship between family size and the total ratings for indigenous knowledge practices. There is no strong relationship between the two variables (R^2 = 0.0078).

Figure 2.6 illustrates the relationship between family size and the total ratings for indigenous knowledge practices with trend line $y = 0.1963x + 4.1614$ and $R^2 = 0.0078$.
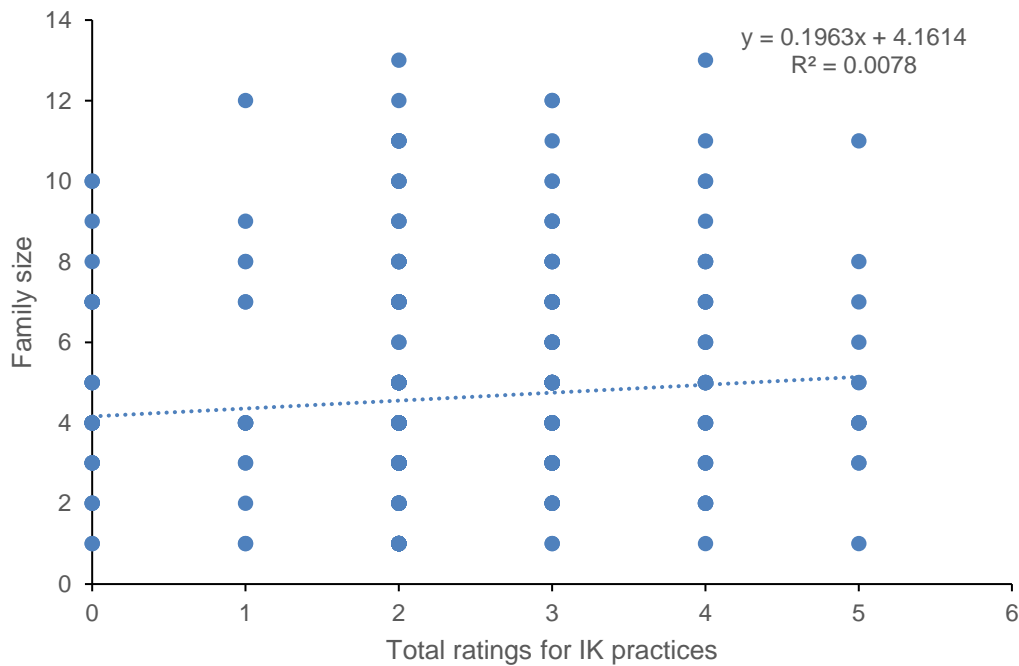
Figure 2.6: Influence of family size on indigenous knowledge or practices

2.2.5. Influence of the household income on indigenous knowledge practices

Figure 2.6 shows the influence of household income on indigenous knowledge or practices of a household.
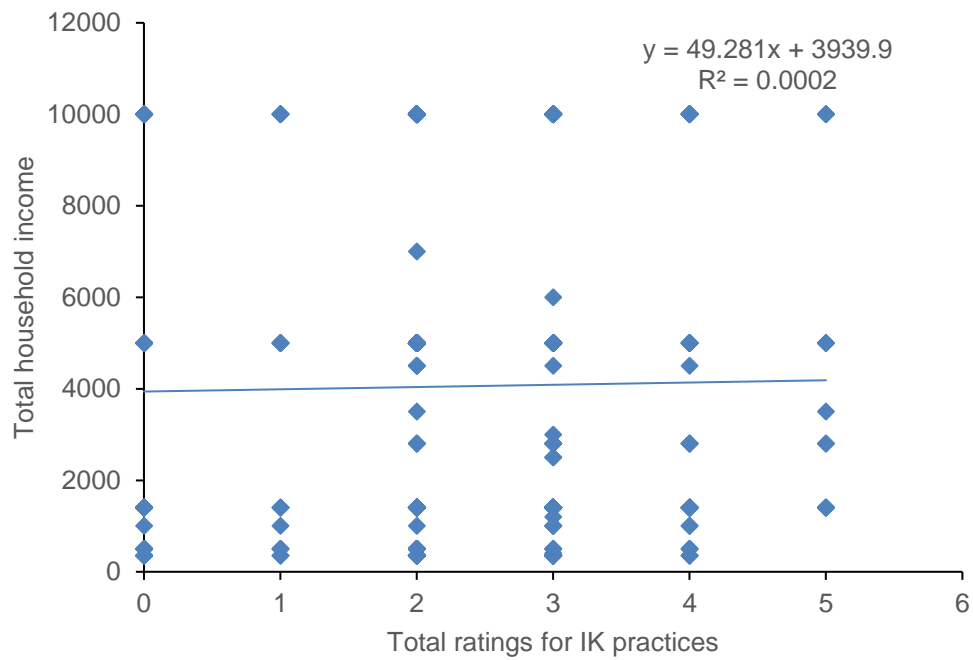
Figure 2.7: Influence of household income on indigenous knowledge or practices

Figure 2.7 illustrates the relationship between household income and the total ratings for indigenous knowledge practices. There is no strong relationship between the two variables. It was deduced that total household income does not influence indigenous knowledge practices.

2.2.6. Association between household income and family size

Figure 2.8 shows the relationship between total household income and family size. There is no strong relationship between the two variables (R^2 = 0.0657).
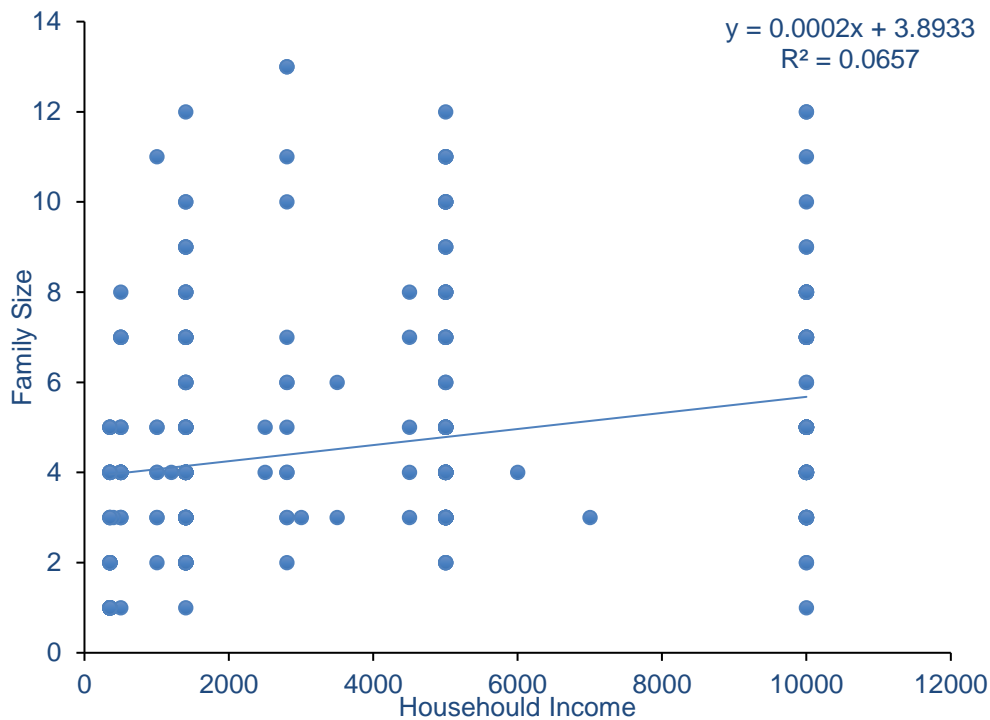
Figure 2.8: Association between household income and family size

Treas (1981) defines family size as the total number of individuals comprising in a family unit. Household income is a particular disadvantage for rural based community as shown by the weak positive relationship between family size and household income (R^2 = 0.0657). The results are also supported by the findings of Niyaz & Siddiq (2020) and Orbeta (2005). These findings are also supported by Moore *et al.,* (2006) who identifies a linkage between family size and ethnic groups, of which in this case is the African race. Factors that resulted in varying family sizes as identified are the culture of the country from which they come from, and the age and sex distribution.

On average, the household income and expenditure of the respondents per month is less than the R624 per person per month, which indicates the food poverty line as per Statistics SA (2021). According to Statistics South Africa, about 4.75 million South

African households are living below the poverty line. According to the Poverty Report of Statistics South Africa (2016) the proportion of people living in poverty in rural areas rose from 77 % in 2011 and increased to 81.3% in 2015. Poverty reduction in rural areas can be done through the application of Indigenous Knowledge. Furthermore, indigenous knowledge is often the most accessible and applicable knowledge for everyday life in poor rural communities in developing countries (Hagar, 2003; Domfeh, 2007). The World Bank (2010) also recognized that socially and economically marginalised locals can use indigenous knowledge to solve problems. Indigenous knowledge is therefore, knowledge which is known to groups of people or is embedded in communities, especially the rural population (Emeagwali, 2003).

Poverty is on the rise in South Africa with over 30 million people living in poverty with women being the most vulnerable to increased poverty. This amount of poverty puts pressure on people particularly women in rural areas to depend on natural resources and their Indigenous Knowledge to survive. Kandiyoti (2019) states that there is gender-based division of labour based on classical patriarchal culture among poor peasant households in Anatolia. Women experience poverty more deeply than men, and families in which women are increasingly single-parent and head of household (Ndung'u *et al.*, 2020).

2.2.7. Influence of gender on indigenous knowledge or practices

Figure 2.9 shows the relationship between indigenous knowledge and gender.
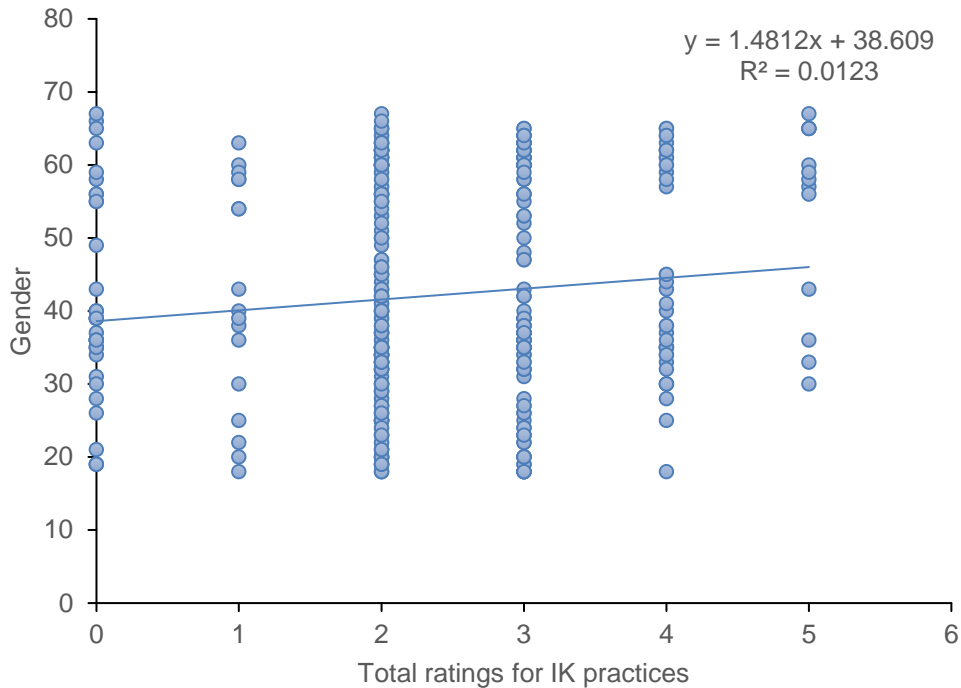
Figure 2.9: Relationship between gender and IK practices

From the total questionnaires administered 54.8 % of the respondents were female while the remaining 45.2 % were males. Gender refers to the culture specific traits that determines how women and men behave and how they interact with each other. It also refers to social rather than the biological differences, between women and men which are learned, change over time, and vary widely both within and between cultures (Adamo & Horvoka, 1998). A study by Samal & Dhyani (2006) revealed that women are the actually the custodians of the indigenous knowledge system which is also indicative on the study area.

2.3. CONCLUSION

The definition of indigenous knowledge based on key elements is a set of concepts or body of knowledge or skills shared or acquired locally and is gained through practice within communities to sustain their livelihoods. Chief Albert Luthuli Municipality is rural based in locality in which most of the respondents' households spoke Nguni language

and only 0.5% were Xitsonga speaking households. The environmental settings also indicated that most of the respondents were unemployed and resorted to indigenous practices as skilled were shared amongst the community. Thus, indigenous knowledge should be acknowledged by all local communities to appreciate local traditions and culture and being used as a survival tool.

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CHAPTER 3:

INDIGENOUS METHODS OF SOLID WASTE MANAGEMENT IN THE CHIEF ALBERT LUTHULI MUNICIPALITY, REPUBLIC OF SOUTH AFRICA

4.1. INTRODUCTION

This paper dissects the key elements commonly used to characterize indigenous methods and practices of communities. The Oxford Dictionary (2022) defines indigenous as an adjective for native, aboriginal, or local and methods as noun used to show a particular procedure for accomplishing something especially a systematic one. The collective usage of the concept "Indigenous methods" refers to an act of reclaiming, reviving, retelling indigenous knowledge (1). Indigenous methods emerge from language, culture, place and customs (2). Indigenous methods were mostly practiced in developing countries, which included social, economic and environmental activities practiced by the community for survival (3). The practice of indigenous knowledge goes beyond all human activities, including waste management in an effort to preserve the environment for future generations (4).

Several indigenous waste management methods were practiced by the elders in developing countries to manage environmental and public health risks associated with waste in Africa and the world at large. According to National Environmental Management: Waste Act No 59 of 2008, waste is defined as is any substance, material or object that is unwanted, rejected, abandoned, discarded, or disposed of by holder of that substance (Republic of South Africa, 2008). According to (5), waste management is a process by which waste material is gathered, transported and processed before disposal of the remaining residues. Waste management is a significant common concern for national and local authorities in developing countries (6).

According to the United Nations in 2014, South Africa is classified as a developing country (7). As per Statistics South Africa (2016), households in rural municipalities typically receive fewer and inferior services than households in more affluent urban municipalities (8). Whilst various factors contribute towards this discrepancy, significant factors include historical inequalities in the provision of development support and services (evident predominantly in former homeland areas) due to the country's political past, the high level of poverty which was resulting in the inability to pay for services, and the practical and financial constraints associated with extending services to remote rural or inaccessible informal areas (8). In South Africa in 2016 about 59 percent of the households had their waste collected and 34 percent did not receive basic refuse removal services and the remaining 5 percent of waste was dealt with through other means (8). Other methods may mean that some communities were using indigenous systems to dispose of their waste as they had no access to municipal collection services. In Mpumalanga Province 3.1% of the households were using indigenous waste management practices. There are quite a number of factors that contribute to the use of indigenous waste management practices in the rural areas such as the level of social change, climate, population growth, growing waste generation and the nature of socioeconomic development (9,10).

Chandrappa and Das state that waste in rural areas is classified according to the culture and practices of the local population (11). Local beliefs and culture are closely related to how the community manages their waste. The need for the study was stirred by the indiscriminate dumping of waste in open spaces which were observed to be more prevalent in areas which receive waste collection services from the local municipality as compared to the areas where waste is not collected by the local municipality. Most of the communities in the Chief Albert Luthuli Municipality areas fall under traditional authorities and refuse collection services were never rendered to those communities from when Black Administrative Act 38 of 1927 was still enforced up until in the century we are living in (Republic of South Africa, 1927). The lack of accessibility to the services especially for waste management means that the people use the local knowledge that is embedded in their culture to manage waste.

Most human activities generate waste due to lifestyle changes and growing populations (12). The first and fundamental point is to know the quantity and characteristics of waste generated in order to determine the most effective and efficient waste management strategy (13). Environmental issues related to waste generation are part of societal changes whereby households play a significant role. The factors affecting waste generation are different in each area. These include local conditions such as climate, standard of living, beliefs, customs and culture, economic issues, population growth and size of households (14,15). These societal changes affect specific household characteristics, such as family size, monthly income, social status, education level, place of residence and community status (16,17).

A lifecycle of the generated waste until its disposal is called waste stream. A waste stream of growing concern in Sub-Saharan Africa is plastic waste (18). Waste streams in Sub-Saharan countries are also changing as end user behavior changes and new developments are taking place. Figure 1 shows the waste generated around the world as well as from the Sub-Saharan region.
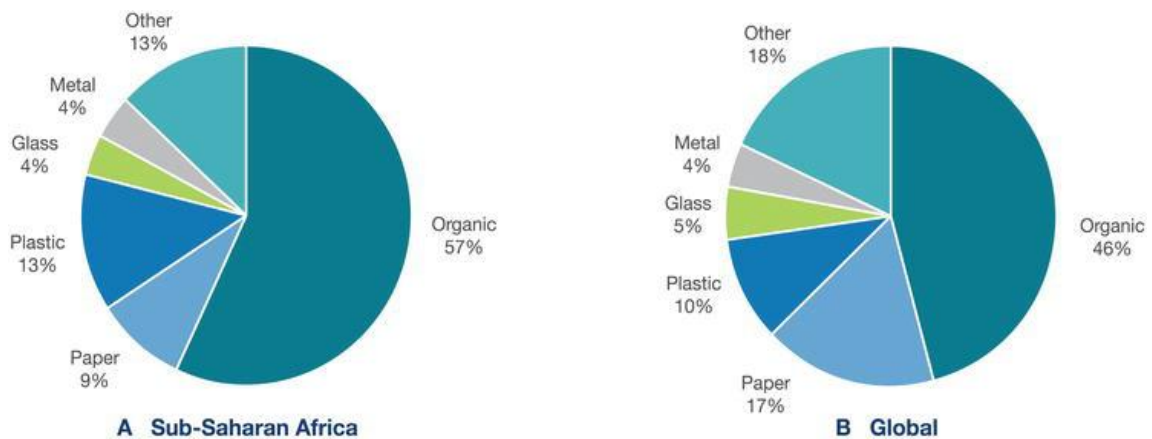
Figure 3.1: Global and Sub-Saharan common waste streams (18)

Approximately, 57% of waste generated in Sub-Saharan Africa is organic waste which can be easily processed into valuable products such as compost and biogas. A waste

stream that is of growing concern in the sub -Saharan Africa is plastic waste that constitutes 13%, with South Africa having the 11th highest kilograms of plastic waste that is mishandled per year as compared to other African countries (19,20). However, Plastic SA records that 46.3% of the plastic waste that was generated in 2018 was recycled and 18% was exported whereas the remaining 38.7 % is still being discarded and causing environmental pollution (21). Most non-whites in South Africa resides in townships and poor service deliveries such as waste management services are experienced. With a gap in the current waste collection systems, the discarding of plastic into the environment poses a significant threat to the environment and economies.

The world's population is growing and the wealthier the economy, the greater the population that results in more waste generation (22,23). Lifestyle changes due to economic growth and the consequent change in household consumption patterns have created problems in societies (21). Hence, the discarding of used plastic is increasing. There were various methods of waste management that were used across the globe. In considering sustainable rural livelihoods, it was pivotal that the communities implement survival strategies such as agriculture, weaving (using plastics and palm leaves) and carving (24). Several studies were conducted in Africa on how waste was managed.

A study conducted in Nigeria observed that food waste and garden waste were collected, dried up to prevent decomposing and fed to animals such as cows (25). Animal dung was collected, dried up and spread as manure or placed in containers, added water, stirred up and left for months to decompose for usage as manure in the farmyards (25). Ash is another waste stream used to clean stained cooking pots, to clean teeth by children and was also used as primary raw material for making black soap (4). Ash was scattered on farms by indigenous communities in Liberia to make the soil fertile (26).

A study by (27) in India found that traditional practices of using waste as fuel, animal feed and agricultural fertilizer account for nearly 90% of total waste recovery. Animal dung was cake formed and dried for use as fuel and stored for use in the home kitchen. Animal dung, kitchen ash and crop residues were piled up in the corners of the house-yards for several months to a few years for decomposition and used as manure (28). Another indigenous waste management method was garden decoration using halved tyres in Pondal, a central Vepsian village (29).

Most of the communities in the Chief Albert Luthuli areas fall under traditional authorities and refuse collection was never rendered to those communities from when Black Administrative Act 38 of 1927 was still enforced until recently (Republic of South Africa, 1927). The community has been using local knowledge system of waste management which is indigenous to them.

There is a gap in linking indigenous waste management practices and the societal practices. Therefore, this paper aims to identify the indigenous methods of solid waste management in Chief Albert Luthuli Municipality. It is fundamental to investigate the different factors influencing the adoption of indigenous methods and assess indigenous solid waste management practices that are prevalent within the study area.

4.2.   RESULTS

4.2.1. Waste stream and waste generation

Figure 2 presents the waste streams and the practices that are used within the Chief Albert Luthuli Municipality area. The information was extracted from the data analysed in Microsoft excel. Household waste streams presented in Figure 2 are generated through household activities such as cooking, sweeping, cleaning, and gardening. Some of the household waste streams from the study area include food waste, used products or material such as glasses, cans, papers, plastics, tyres, and newspapers.

Much of the waste generated in Chief Albert Luthuli is burnt within the household setting. The Chief Albert Luthuli community was found to be re-using leftover food for feeding animals. The study also shows that recycling of bottles, cans and glasses was also observed to be taking place within the area. Composting was also observed within the study area.

The socio-demographic factors of Chief Albert Luthuli Municipal area were analysed as well as different waste streams generated at the household level. Waste management has been a major challenge facing the environment and human wellbeing in the rural communities of Chief Albert Luthuli Municipality. The lack of formal waste management systems in the rural areas of Chief Albert Luthuli have resulted in different indigenous systems and practices of waste management.

In the study area, the most used method is composting using animal dung, garden waste and food waste. Before the introduction of convenience waste management, human beings had other ways/methods to reduce the amount of waste being disposed of. The methods applied were indigenous to that society and were passed on the descending generations within that locality. How each waste stream is managed in an indigenous way and the applications are presented in Figure 3.2.
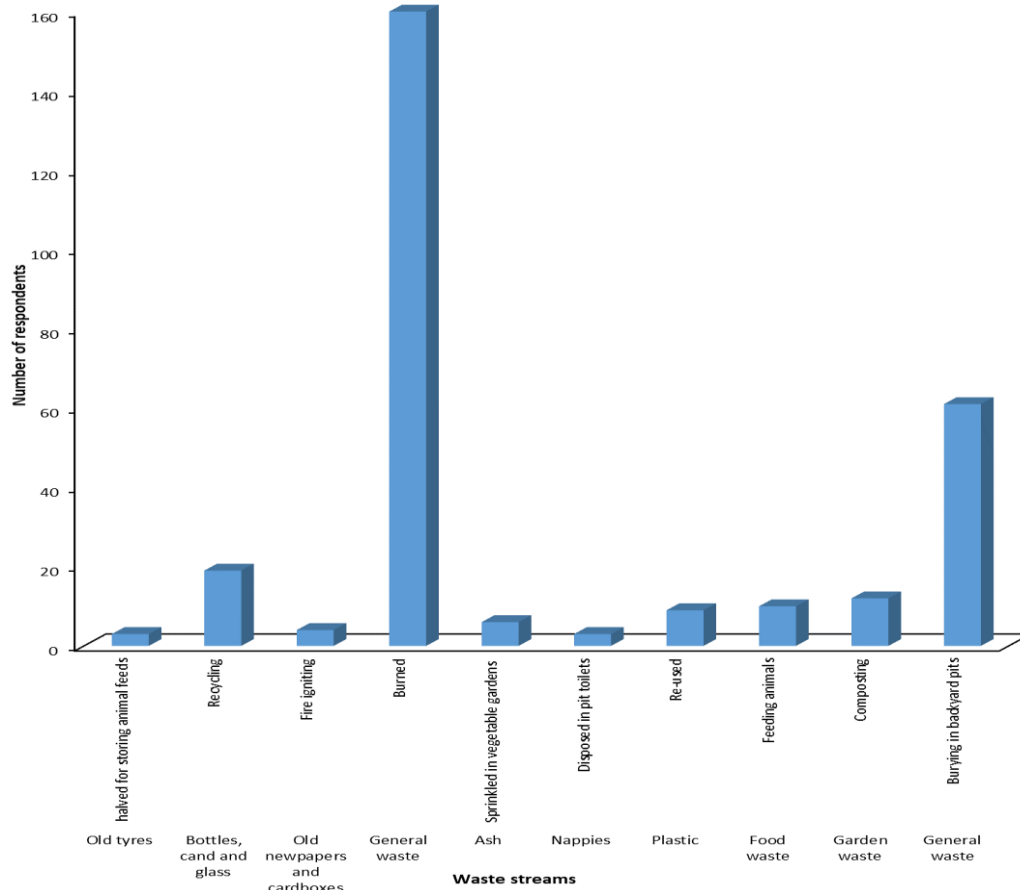
Figure 3.2: Indigenous methods used to manage different waste streams within the study area.

Figure 3.3 and Table 3.1 show that most waste streams and their uses had a maximum of 4 applications and a minimum of 1. Usage of organic waste was also observed within Chief Albert Luthuli Municipality area whereby 3.6% use garden waste for compost purposes. The use of ash was also observed within Chief Albert Luthuli Municipality in which 0.3% of the respondents were using ash to sprinkle on their vegetable gardens for pest control. Animal dung is collected for composting in the Chief Albert Luthuli Municipality mostly in the Dundonald and Diepdale areas. Within the study area, 1% of the respondents were re-using food waste to fertilize the household gardens. The community of Ontbekend farm located outside of Carolina, Chief Albert Luthuli area use leftover food waste to feed their animals. The re-use of plastic containers was also observed in the Fernie area of the Chief Albert Luthuli Municipality area. Cans are used to make local products such as lanterns, funnels,

and molds for baking bread. Halved tyres were used to store animal feeds by a few households in Onbekend farm just outside Silobela Township within the study area.
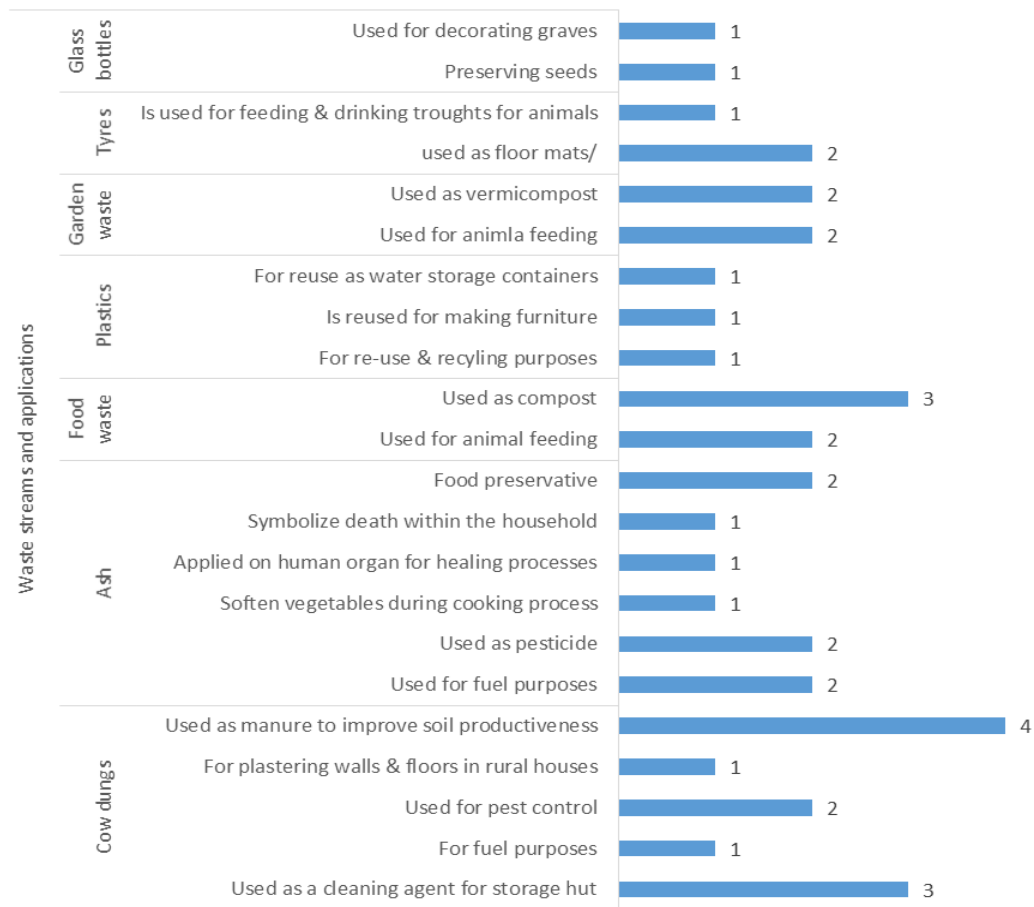
Figure 3.3: Various waste stream across the African region and methods applied per waste stream

Table 3.1: Analysis of the number of waste streams

Standard Deviation	0.845154
Minimum	1
Maximum	4
Mode	1
Median	2
Average	1.714286

4.2.2. Factors explaining waste management practices in Chief Albert Luthuli Municipality

Figure 3.4 presents waste quantities generated per week in relation to the income levels of respondents. The Chi-square test indicated that there is a weak association between total household income and the estimated amount of household waste generated per week (x^2=16.006, p=0.184). The p-value is greater than 0.05, which implies that the total household waste generation cannot be explained by monthly income. Most of the respondents are using one polythene bag for household waste per week (Figure 3.4)
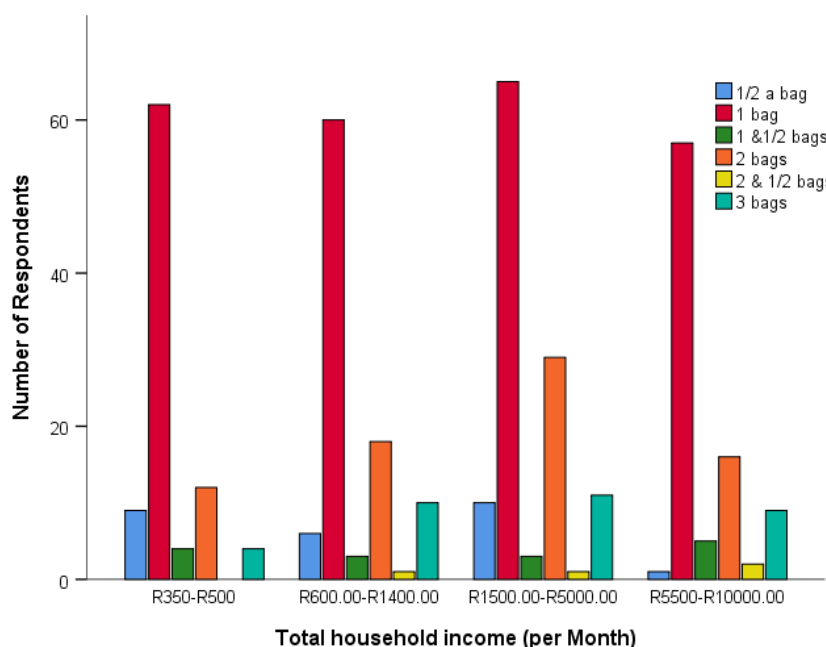
Figure 3.4: Association between the estimated amounts of waste generated per week and household income

Figure 3.5 shows the results of the 3R's practiced by the community in the study area. Figure 3.5 presents the association between the household income and their participation in reduce, re-use and recycling by community of Chief Albert Luthuli Municipality. There is a statistically significant association between household income and the implementation of reduce, re-use and recycling (x^2 =11.081, p=0.011). The p-

value is less than 0.05, therefore the total income per month can explain the implementation of reduce, re-use and recycling of waste. Figure 3.5 illustrates that the most people who are practicing reduce, re-use and recycling of waste are persons with the total household income of R1500.00-R5 000.00.
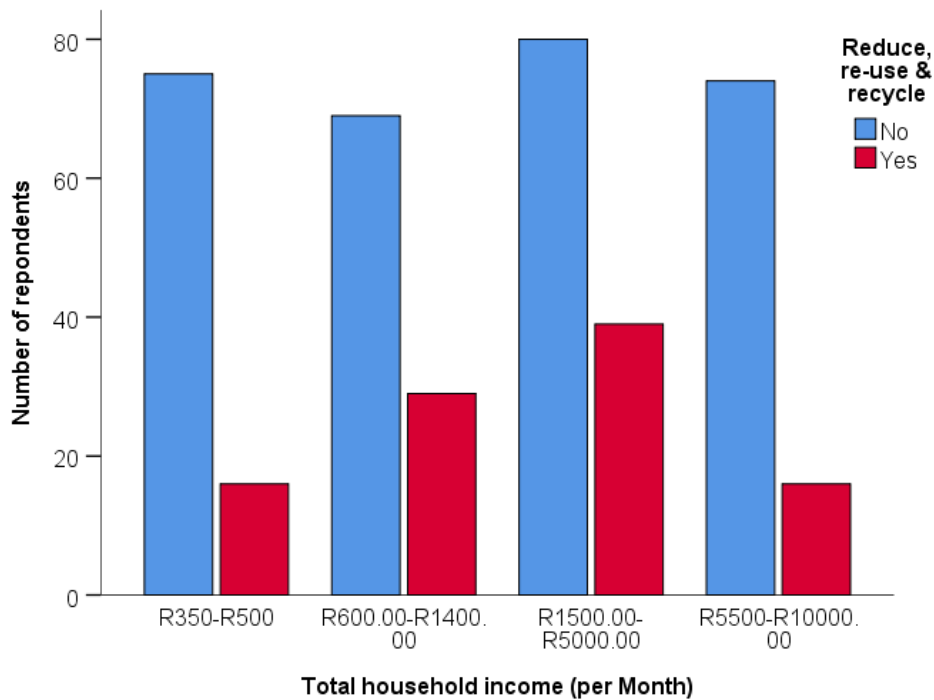
Figure 3.5: Association between the household income and participation in recycling, reuse and reduce

Table 3.2 shows the relationship between the total household income and the usage of temporary storage of waste. There is a statistically significant association between household income and the usage of temporary storage for waste (x^2 =9.574, p=0.023). The table reveals that temporary storage is occurring in areas where the respondents can purchase black refuse bags or waste containers for storing their waste. The p-value is less than 0.05, therefore the total income per month can explain the use of secondary storage of waste by respondents. Table 3.2 shows that most people who are using temporary storage have a total household income of between R1500.00-R5 000.00 (29.9%) and mostly residing in areas where the municipality is collecting waste.

Table 3. 2: Relationship between household income per month and temporary storage of waste

		Temporary storage of waste after generation		
		No (%)	Yes (%)	Total (%)
	R350.00-R500.00	14.57	12.81	22.86
Total household income (per Month)	R600.00-R1400.00	12.81	11.81	24.62
	1500.00-R5000.00	17.09	8.29	29.90
	R5500-R10000.00	14.57	8.04	22.61
Total		**59.05**	**40.95**	**100.00**

Table 3.3 shows the association between employment status and the participation in reducing, re-using and recycling of waste by the households.

The results show a significant association between employment status and the implementation of reduce, re-use and the recycling of waste (x^2 =9.533, p=0.023). The p-value is less than 0.05, therefore employment status can explain the implementation of the 3Rs principle. Table 3.3 shows that most of the respondents were unemployed i.e. (36.18 %) whilst 31.91% were employed group. Some respondents from the study area were selling recyclables for generating income for their households. From the implementation of 3Rs' by the community members, just a few were practicing the re-use for composting purpose as shown in Figure 3.6.

Table 3.3: Association between employment status and participation in reducing, re-using and recycling (3Rs)

	Implementation of 3Rs		
	No (%)	Yes (%)	Total (%)

Employment status				
	Employed	24.12	8.79	32.91
	Pensioner	11.56	9.80	21.36
	Student	5.78	3.77	9.55
	Unemployed	25.38	10.80	36.18
Total		**66.83**	**33.17**	**100.00**

Figure 3.6 presents the relationship between the total household income and the biological treatment of waste. There is a statistically significant association between household income and biological treatment of waste (x^2 =8.527, p=0.036). The p-value is less than 0.05, therefore the total income per month can explain the biological treatment of waste. Figure 3.6 illustrates that respondents who are practicing biological treatment of waste have a total household income of between R600.00 andR1400.00.
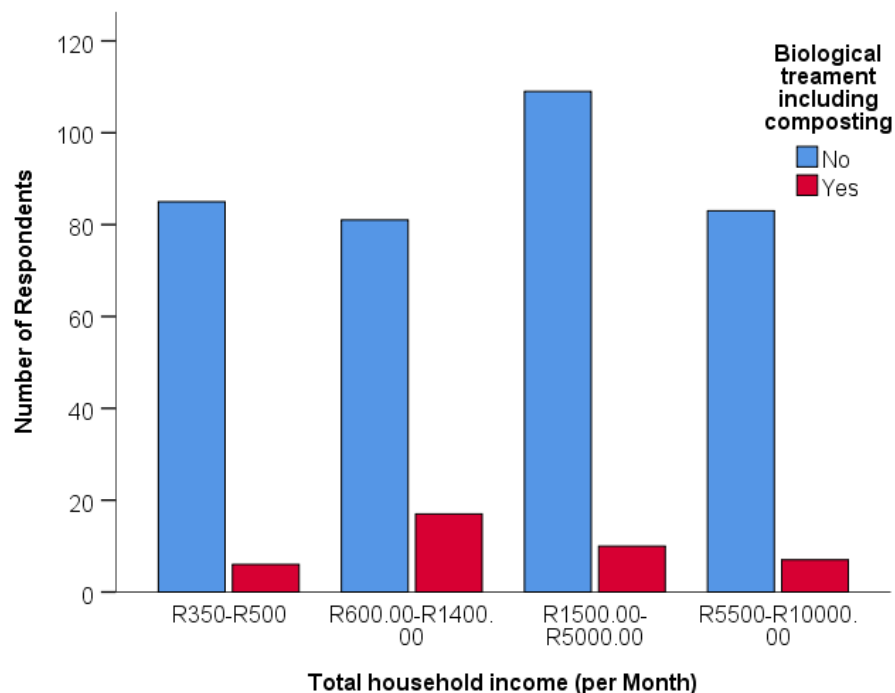
Figure 3. 6: Relationship between household income and biological treatment of waste

Figure 3.7 presents the association between the estimated amount of waste generated and the family size. There is a statistically significant association between family size and the estimated amount of household waste generated per week (x^2 =79.620, p=0.000). The p-value is less than 0.05, therefore family size can explain amount of household waste generated per week. Most of the respondents with family sizes of 4-6 members and 1-3 generate one polystyrene bag per week (Figure 3.7).
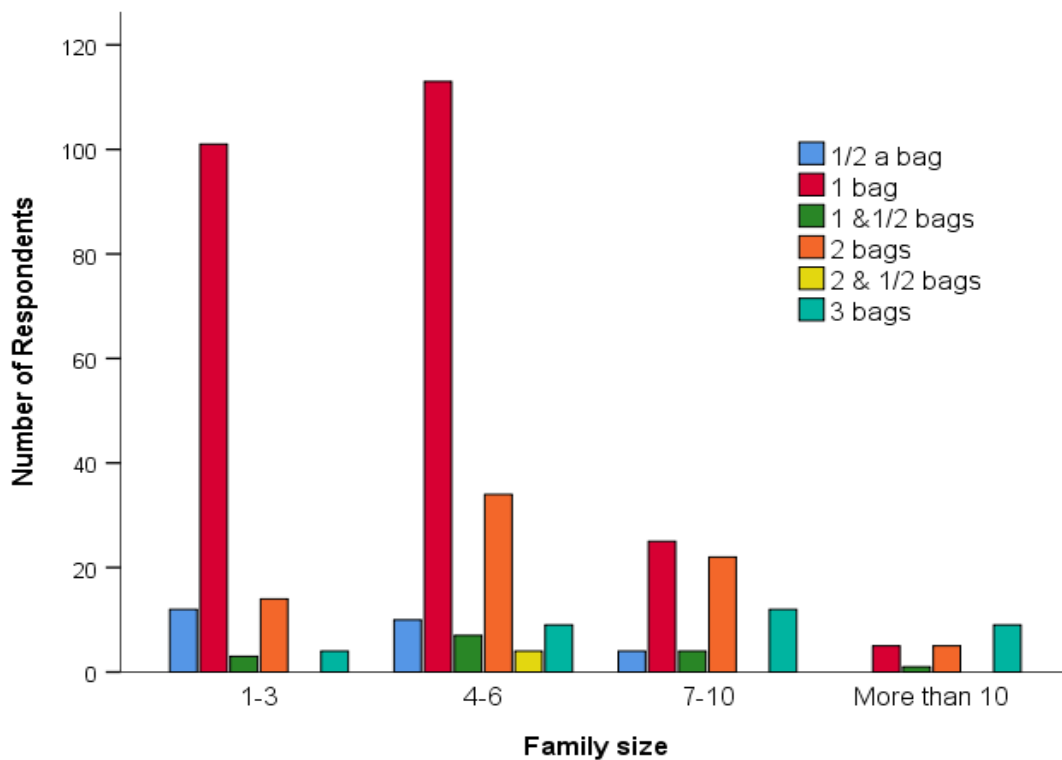
Figure 3.7: Association between estimated amounts of waste generated per week and family size

Table 4.4 presents the association between the employment status and the estimated amount of waste generation per week by respondents. There is a statistically significant association between employment status and estimated amount of waste generated per week (x^2 = 31.036, p = 0.009). The p-value is less than 0.05, therefore employment status can explain amount of waste generated per week. Table 3.4 shows that most respondents who are unemployed (25.38%) are mostly using 1 bag per week

followed by the employed (19.85%), pensioners (10.55%) and students (5.53%) respectively.

Table 3.4: Association between employment status and the estimated amount of waste generated

		Estimated amount of household waste generated per week						
		1 &1/2 bag (%)	1 bag (%)	1/2 a bag (%)	2 & 1/2 bags (%)	2 bags (%)	3 bags (%)	Total (%)
	Employed	1.01	19.85	1.01	0.25	8.04	2.76	32.91
Employment status	Pensioner	0.75	10.55	1.76	0.75	4.27	3.27	21.36
	Student	0.50	5.53	1.01	0.00	2.26	0.25	9.55
	Unemployed	1.51	25.38	2.76	0.00	4.27	2.26	36.18
Total		**3.77**	**61.31**	**6.53**	**1.01**	**18.84**	**8.54**	**100.00**

Figure 3.8 presents the association between employment status and the biological treatment of waste. There is no statistically significant association between employment status and the biological treatment of waste (x^2 =0.689, p=0.876). The p-value is greater than 0.05, therefore employment status cannot explain the biological treatment of waste. Figure 3.8 illustrates that most of the people who are not treating their waste using the biological methods were the unemployed. Few respondents across all employment categories are treating their waste using the biological methods.
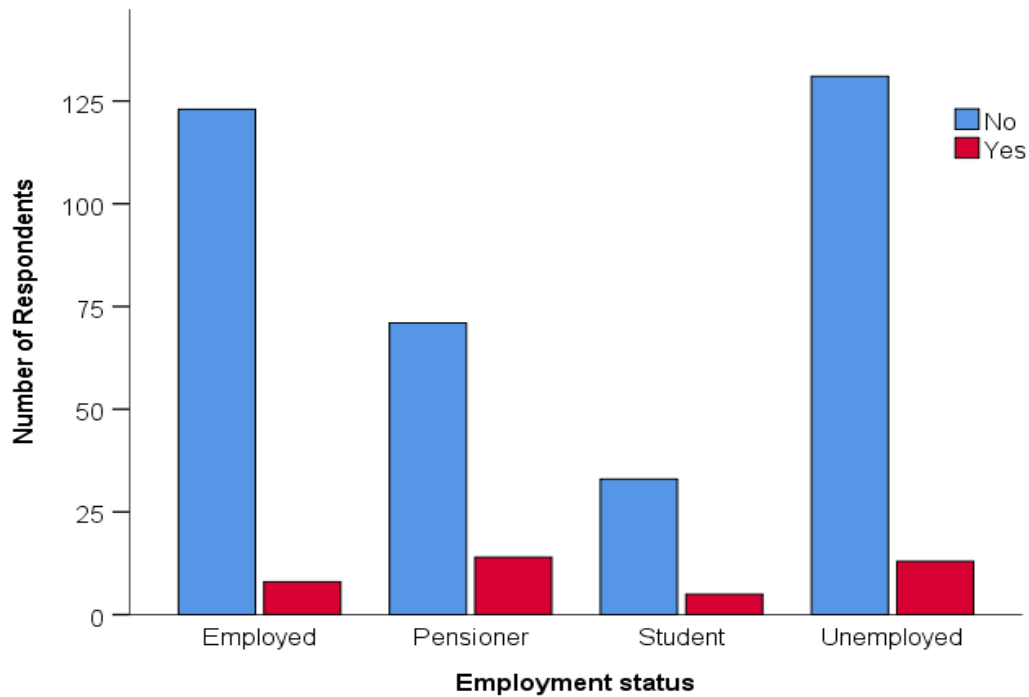
Figure 3.8: Association between the employment status and the biological treatment of waste

Table 3.5 presents the relationship between the level of education and the estimated amount of waste generated per week by the respondents. There is a statistically significant association between level of education and the estimated amount of waste generated per week (x^2 =14.982, p=0.002). The p-value is less than 0.05, therefore the level of education can explain the amount of waste generated per week. Table 3.5 shows that respondents with high school education level were more likely to use 1 bag per week.

Table 3.5: Relationship between the level of education and the estimated amount of waste generated.

	Estimated amount of household waste generated per week		

		1 &1/2 bags (%)	1 bag (%)	1/2 a bag (%)	2 & 1/2 bags (%)	2 bags (%)	3 bags (%)	Total (%)
	High school level	2.76	39.70	3.02	0.50	9.05	4.52	59.55
Highest level of education	No formal education	0.50	5.53	0.75	0.50	1.76	1.76	10.80
	Primary school level	0.00	6.03	1.76	0.00	3.02	0.25	11.06
	Tertiary level	0.50	10.05	1.01	0.00	5.03	2.01	18.59
Total		**3.77**	**61.31**	**6.53**	**1.01**	**18.84**	**8.54**	**100.00**

Figure 3.9 presents the association between the highest level of education and re-use of waste by the respondents. There is a statistically significant association between the level of education and the re-use of waste (x^2 =11.496, p=0.009). The p-value is less than 0.05, therefore the level of education can explain the re-use of waste materials. Figure 3.9 shows that respondents with high school education are mostly not re-using their waste. There seems to be a positive correlation between educational status and best waste management practices.
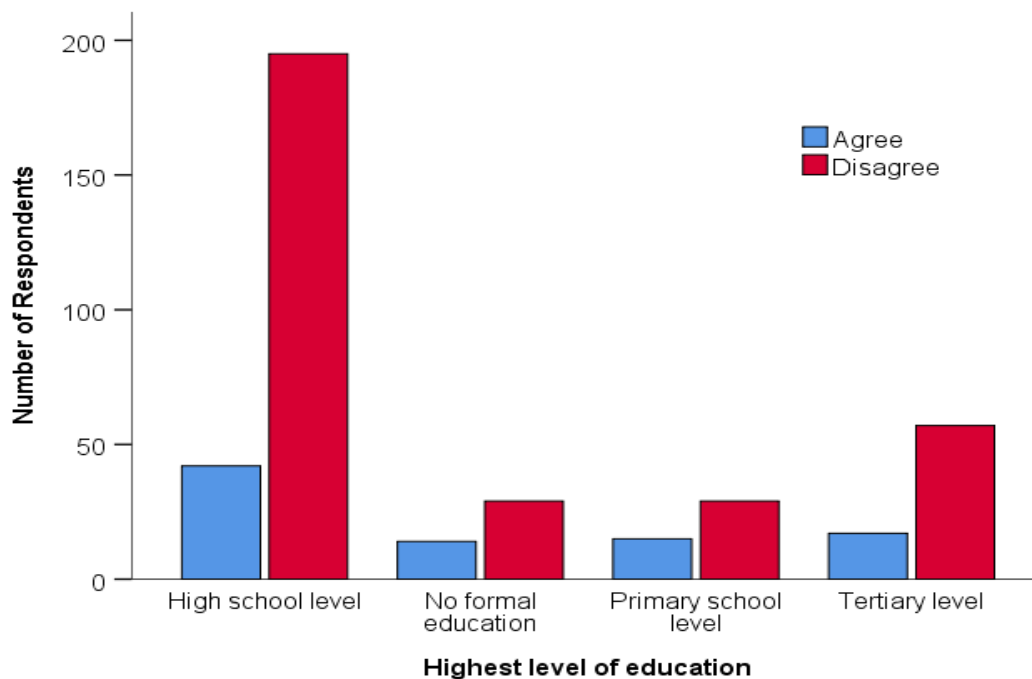
Figure 3.9: Association between highest level of education and re-use of waste

Figure 3.10 presents the relationship between the highest level of education obtained by the respondents and recycling. There is a statistically significant association between level of education and the recycling of waste (x^2 =12.285, p=0.006). The p-value is less than 0.05, therefore the level of education can explain the implementation of recycling of waste materials. Figure 3.10 illustrates that respondents with high school education level are mostly not recycling their waste.
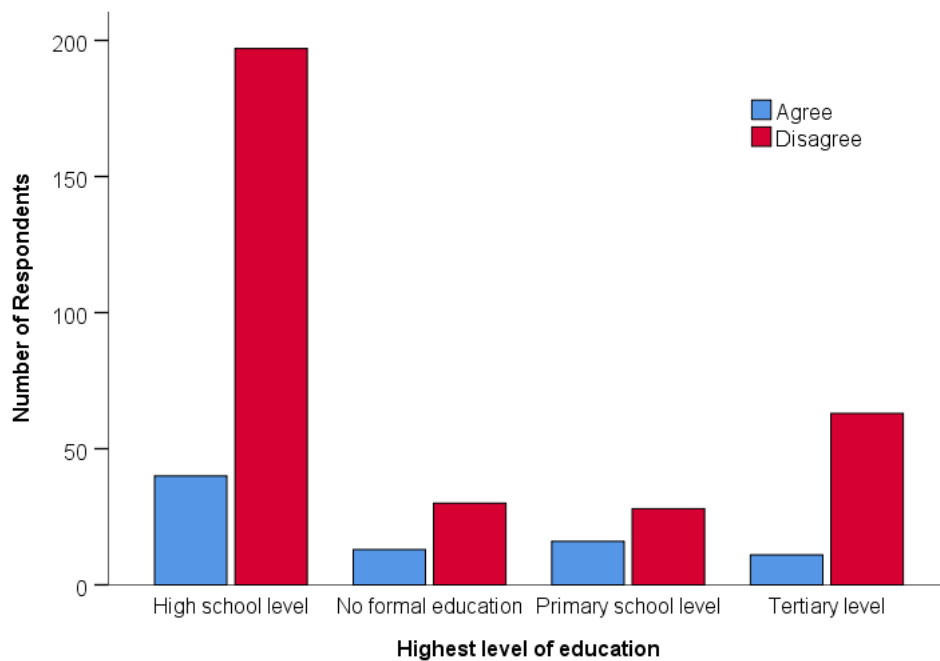
Figure 3.10: Relationship between the highest level of education and waste recycling

Table 3.6 presents the relationship between the level of education of the respondents and them participating in composting. There is a statistically significant association between the level of education and the use of organic waste for the purpose of composting (x^2 =10.768, p=0.013). The p-value is less than 0.05, therefore the level of education can explain the composting of waste materials. The analysis

demonstrates that most respondents with high school education are not converting their organic waste into compost.

Table 3.6: Relationship between level of education and composting of organic waste

		Involved in composting of organic waste		
		Agree (%)	Disagree (%)	Total (%)
	High school level	7.54	52.01	**59.55**
Highest level of education	No formal education	3.27	7.54	**10.80**
	Primary school level	1.76	9.30	**11.06**
	Tertiary level	2.26	16.33	**18.59**
Total		**14.82**	**85.18**	**100.00**

Table 3.7 presents the relationship between the period in which a person stayed in the place and them participating in recycling. There is no statistically significant association between the time of residence and the implementation of 3Rs principle (x^2 =1.054, p=0.788). The p-value is greater than 0.05, therefore the time which a respondent resided in the area cannot explain the implementation of 3R principle. Table 3.7 illustrates that most of the respondents who are not implementing the reduce, re-use and recycle principle are in the 1-15 years residence time category.

Table 3.7: Relationship between the time of residence and participation in reducing, re-using or recycling waste

	The implementation of reduce, re-use or recycle (3Rs) within the household

		No (%)	Yes (%)	Total (%)
	1- 15 years	28.14	13.82	**41.96**
How long have you been a resident of your current household locality?	16-30 years	20.10	9.55	**29.65**
	31-45 years	13.82	6.53	**20.35**
	46- 60 years	4.77	3.27	**8.04**
Total		**66.83**	**33.17**	**100.00**

Table 3.8 presents the relationship between the time of resident of the respondents and their involvement in re-using waste for composting purposes. There is no statistically significant association between the time of residence and the implementation of biological treatment of waste (x^2 =7.524, p=0.057). The p-value is greater than 0.05, therefore the time which a respondent resided in the area cannot explain biological treatment of waste. Table 3.8 shows that most of the respondents who do not treat waste using biological methods have a time of residence between 1-15 years.

Table 3.8: Relationship between time of residence and the involvement in composting

		Involved in a composting of organic waste		
		Agree (%)	Disagree (%)	Total (%)
	1 - 15 years	5.28	36.68	**41.96**
How long have you been a resident of your current household locality?	16 - 30 years	5.03	24.62	**29.65**
	31 - 45 years	2.76	17.59	**20.35**
	46 - 60 years	1.76	6.28	**8.04**

Total		14.82	85.18	100.00

Figure 3.11 presents the association between the age of the respondent and their participation in recycling. There is a strong association between age and the implementation of recycling (x^2 =16.180, p=0.000). The p-value is less than 0.05, therefore age group can explain the implementation of recycling of waste. Figure 3.11 illustrates that the most people who are not practicing recycling of waste are persons in the age category of 18-34 followed by the 35-59 age category and the 60 years and above age category.
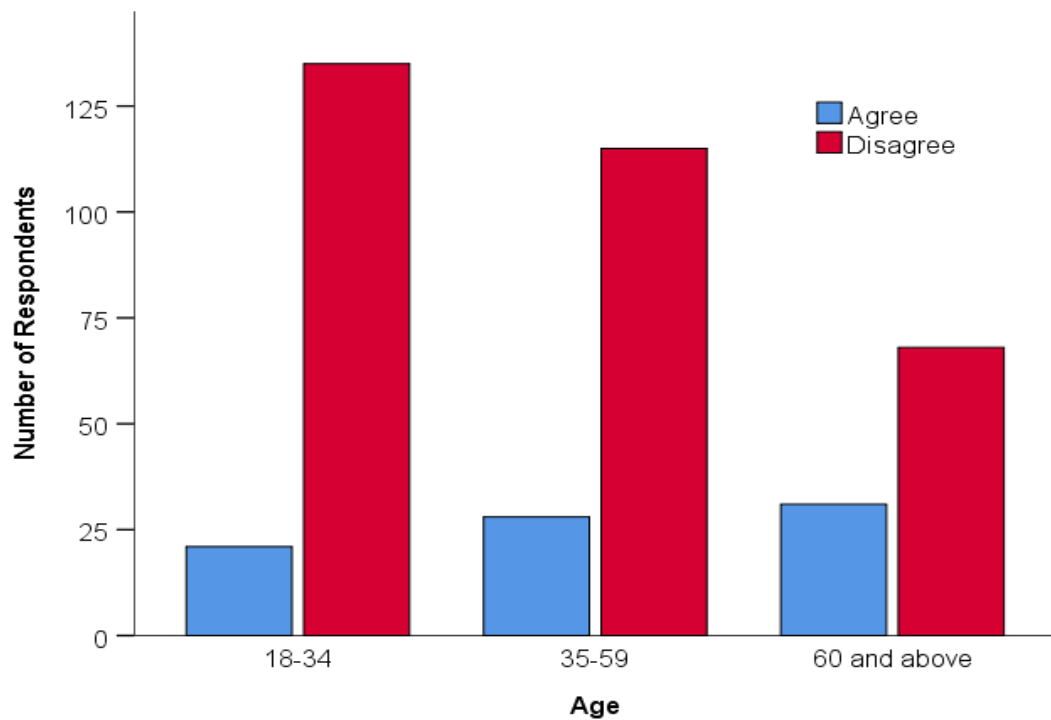
Figure 3.11: Association between age and participation in recycling

Table 3.9 presents the relationship between the age of the respondents and their participation in composting. Respondents across age categories practice waste re-use by making compost. Older persons and youth have the same percentage in terms of composting. There is a statistically significant association between age group and composting of organic waste by household (x^2 =6.265, p=0.044). The p-value is less than 0.05, therefore age can explain composting.

Table 3.9: Relationship between age and the participation in composting

		Involvement of the household in a composting of organic waste		
		Agree (%)	Disagree (%)	Total (%)
	18-34	4.77	34.42	39.20
Age	35-59	5.28	30.65	35.93
	60 and above	4.77	20.10	24.87
Total		**14.82**	**85.18**	**100.00**

4.3. DISCUSSION

As people become more prosperous, the amount of waste generated increases (35). Countries with fast growing economies are mostly faced with high volume of solid waste Per capita data showed that low-income countries generate less waste generation compared to middle- and high-income countries (36). The Sub-Saharan African region generates waste that is expected to increase at higher rate due to urbanisation and estimated population growth (37). South Africa is generating about 107.7 million tons of waste annually (13). A large part of the waste generated by households is landfilled (8). The amount of waste generated is considered to be higher in urban areas, but Mpumalanga Province has a bigger percentage of the population living in traditional or rural areas (56%) which makes up much of the waste generated

province (8). The Chief Albert Luthuli Municipality generates 60% of waste that accounts to 7904.24 in tonnage and most of waste streams are organic waste (38). The same results were observed in this study. It is imperative to understand the entire waste stream and their characteristics for the purpose of managing it. The characteristics of waste are analysed by categorising the components into degradable and none-degradable wastes. Wherein, waste is further classified into organic or biodegradable, inorganic and non-biodegradable waste (39). Waste composition can be influenced by outward influences such as geographical location, the population's standard of living, energy source and weather (40).

Waste management is an approach an organization uses to dispose, reduce, reuse, and prevent waste to save the environment form toxic effect elements in waste. In South Africa the Constitution (RSA, 1996), consigns the responsibility of refuse removal, refuse dumps and solid waste disposal to municipalities under (Section 156(1) (a) and schedule 51). Most municipalities are failing to execute the task as the waste management budget are limited. Due to the factors responsible for waste generation, the municipalities end up with challenges in proving waste management services including, storage, collection of waste, transportation and disposal to the landfill site (13). From the total domestic waste generated by households in South Africa, approximately 3,67 million tons of waste from the generated 12.7 million tons per annum are not collected and treated through formal waste system (41).

The household waste streams from the study area include food waste, used products or material such as glasses, cans, papers, plastics, tyres, and newspapers. The setup of this waste stream is also supported by (37).

Much of the waste generated in Chief Albert Luthuli Municipality is burnt within the household setting. The community is resorting to burying and burning of waste to manage the waste generated from the households. The practice of burying and burning of waste was also observed in an indigenous community in a remote area in

Canada (42). Both rural communities in developing countries and the indigenous communities in the developed countries have been practicing backyard household waste burning and burying to prevent stenches and vermin infestation (43). In Kelantan, the usual practice of waste disposal in rural and remote areas is by bury and burn the waste(44). Traditional knowledge plays an important role in waste management and disposal practices of the residents of the cities of Accra and Kumasi(45). Some indigenous methods of waste streams were found to be applicable in more than one country.

The Chief Albert Luthuli Municipality community was found to be re-using leftover food for feeding animals. The use of food waste to feed animals was also observed within rural com-munity of Maseru in Lesotho (46). Food waste is also defined as food loss or unconsumed food (47). Food waste is generated from households, markets, hawker centers, supermarkets, and food eating establishments. Food waste recovery can be used for animal feeding and composting. Food waste can be used as organic fertilizer by compositing (48). The community in the western part of Nigeria recycle food waste by preparing animal feeds after they are dried up to prevent decomposition (4).

Composting was also observed within the study area. This is another indigenous technique of managing waste among the Ngwa (49). In the rural part of Lhasa in Tibet people harvest vegetation and return any leftovers to the land as compost or as livestock feed. People in this area also collect cow dung for heating then return it to nature as manure (17). These kinds of practices have always been used decades ago. It therefore validates that those African countries generate almost the same type of waste streams and their applications. Waste can be effectively collected and properly disposed of and it can also be converted to useful materials by separating it into organic and inorganic components (50). Most waste in developing countries is of fermentable nature. Composted organic waste can be used for soil fertility improvement and minor plant nutrients (51). The long-term application of food waste as organic fertilizer has shown improvement in soil quality, stimulate crop yields, and even have a positive influence on the growth of soil bacteria (52). Composting is an

important and necessary method of food waste management. However, digested food waste fertilizer contributes to global warming and has more negative effects than chemical fertilizer (53).

Ash is one waste stream recorded in African countries. It is commonly being used as preservative by spreading it evenly at the bottom of the tomatoes and keeping them in a cool dry place. Ash is also a good source of potassium, phosphorus and magnesium therefore a user friendly as a fertilizer (54). Wood ash is a good source of many micronutrients needed in trace amounts for adequate plant growth (55). In Zimbabwe, a mixture of mud, cow dung and ash are used to clean the *tsapi* (Shona' storage hut for grains) in preparation for grain storage and this prevents coleoptera, Aphidoidea and rodents (56). The other use of ash is to protect maize kernels from weevils and grain borers (56). With ash having many uses, beliefs and rituals were observed in Maseru, Lesotho, whereby ash heaps are used for many traditional practices such as applying ash on human body organs such as legs and feet to traditionally heal unknown conditions and diseases (57). Ash was also recycled in Nigeria to make black soap (4).

Cow dung is also another waste stream common if Africa and it harbours a rich microbial variety containing different species of bacteria, protozoa and yeast (58). Historically cow dung was collected, caked and dried cow dung and used as fuel. Dung may also be collected and used to produce biogas to generate electricity and heat (59). Inhabitants in Indian villages use cow dung for cooking purpose by direct burning and they also use it for plastering walls and floors in rural houses for providing insulation during winter and summer (60). The use of smoke generated from burning cow dung as mosquito repellent and subsequent ash as cleaning agent for kitchen utensils is an ancient practice (56). The manure is used for making an excellent growing medium for garden plants as also shown in the results of this study. When processed into compost and fed to plants and vegetables, cow dung becomes a nutrient-rich fertilizer that can be mixed into the soil or used as a top dressing (60). Use of cow dung for composting was observed in Chief Albert Luthuli Municipality In

lower-middle and low-income countries, composted and recycled waste account for 10% of waste (61). Waste composting helps to protect underground water from becoming polluted compared to the landfilling method of waste disposal, which can pose a pollution threat to underground water (62). There is also a reduction of the microbes and chemical pollutants during composting. In ancient history waste were used for several purposes in an effort to divert the waste from being disposed of (62). Other studies in Kenya and Ethiopia indicated a minimal engagement in household composting(32,63). Combustion (44%) and composting (16%) were the methods of re-using and reducing waste (64).

In 2016 it was reported that the world generated 242 million tons of plastic waste (21). The use of plastics has had negative environmental impacts associated with their production and disposal (65). Approximately 10% of household waste is plastics and mostly end up being disposed of (66). There is a growing environmental and public health concern about the potential effects of the disposal of plastic waste because of the types and quantities of toxic chemicals and their potential for leaching into the environment. Good practices where plastic containers were re-used for holding leftover food and cooking and plastic bags were re-used to carry schoolbooks and storing food in the freezers were observed in Eswatini (67). People in Ngwa, southern Nigeria used bottles that were considered as waste to decorate graves, preserve seeds and store pearls and decoration of graves using bottles was believed to protect the spirit by warding off outer evils (49). Re-use of waste material was also observed in this study. The study also show that recycling of bottles, cans and glasses were also observed to be taking place within the area. Waste reuse and recycling can contribute to income generation and may help to reduce complications in handing and disposing of huge volume of solid wastes (68). Literature indicates that waste recovery and reuse can also yield direct economic benefits (69) and help in the protection of public health and environment.

The results are similar to earlier studies that observed that there was no significant correlation between waste generated and level of income at 95% confidence interval

(70). However, other studies observed that standard of living and waste generation in Islamabad are directly related, i.e., the high-income group has the highest waste generation rate and low-income group has the lowest (36). The amount of waste at household level varies vastly across countries depending on the level of income and community development (71). Rapid increase of lifestyle and income level are the major factors of solid waste generation (37). However, this was not observed in this study.

The results of this study show that household income explains the implementation of reduce, re-use and recycle principle. Other studies have proven that income has a positive association with waste generation rate and has a negative influence on recycling rate (72). 89% of the most common types of waste in Mthatha were waste that can be recycled and reused, and if implemented, it can result in large amounts of waste being recycled rather than landfilled (73). Only 1.7% of respondents practiced waste reduction and recycling as well as backyard composting of wastes (74). Thus, the relationship between income and practicing the 3Rs has not been established elsewhere. Recycling for income generation can be the motivation factor for low-income earners (75,76). The monthly income of respondents in Nsukka, Enugu state was low with 54% of the respondents had waste containers which were used for temporal storage of waste(77). Income is a strong factor affecting the rate of waste generation, storage, and disposal pattern.

The study found that family size can influence the amount of waste. A positive correlation between the amount of household waste generated and household size was established ($r = 0.37$) (78). In addition, a positive correlation was found between household waste generation and monthly income ($r = 0.626$), household size ($r = 0.37$) (79). These findings on monthly income are closely related to the employment status. Therefore, higher income levels influence the waste management behaviors (80). Similarly, a positive influence of educational status on the waste generation rate was found in Ibadan metropolis, Nigeria (81). On the contrary, a negative correlation was found between household waste generation and the level of education of the

household head (r = −0.649) (79). Education is critical for promoting sustainable development and improving the capacity of people to address environmental issues (82,83). Other studies found a statistically significant negative relationship between recycling and educational level in African households(84).

The results indicate that age group can explain the implementation of recycling of waste. This observation is supported by the findings of previous studies that middle aged and older people are more likely to recycle (85,86). Similarly, the recycling behavior of residents was slightly improved with their age and the elderly people participated more in recycling activities than younger citizens(87). This is contrary to the findings by other studies who observed that respondents aged 46 and older were 2.7 times more likely to do composting than youth (88).

4.4. CONCLUSIONS

From the listed categories of waste that were observed in the study area of Chief Albert Luthuli Municipality, there were also indigenous systems that were practiced by the local community to manage waste. Indigenous systems of waste management refer to local practices of waste disposal that are unique to a given culture or society (4). In most developing countries like Nigeria, there have been some indigenous waste management practices which include waste re-use and recycling of waste (4).

Scholars have also explored the influence of education, income, age, and gender on behavior and attitude towards waste management (89). The time of residence and gender do not seem to have any significant influence on the choice of waste management method used by respondents (90). Higher income levels were shown to influence positive waste management behaviors.

Waste collection system is a major challenge in the rural communities of Chief Albert Luthuli Municipality and seems like the services will take decades to reach the rural areas. The lack of formal waste management systems in Chief Albert Luthuli Municipality rural areas has resulted in different indigenous systems and practices of waste management. Wastes are often improperly managed using orthodox methods (91). Hence, it is recommended that indigenous waste management practices be formalised by rural municipalities to minimise challenges associated with waste disposal. The government can finance and advocate for the adoption of Indigenous methods practiced by rural communities.

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CHAPTER 4:

CONCUSIONS AND RECOMMENDATIONS

4.1. INTRODUCTION

According to section 1.4 of chapter 1, the aim of this study was:

"To document indigenous waste management practices that are prevalent in the Chief Albert Luthuli Municipality, South Africa".

This chapter, therefore, draws inferences about the outcomes of the investigation and answers whether the research aim was or not achieved. In addressing the research, section 1.5 outlined three objectives in subsections 1.5.1-1.5.3 from the three set objectives, two results chapters (Chapter 2 and 3) were produced in a form of manuscripts and were submitted to accredited journals. These chapters address each objective, variables and facts of each objective, sub-variables, and relevant parameters to test each objective. In Section 4.2 below, a detailed reflection of key findings presented in relation to individual objective and the chapter or specific section of the dissertation are reflected.

4.2. MAJOR FINDINGS OF THE STUDY

4.2.1. The influence of community demographics on indigenous practices of the citizens of Chief Albert Luthuli municipality.

Section 2.2 presents demographic factors that influence the adoption of indigenous knowledge or practices by communities. These factors include:

4.2.1.1. Language of the household head

4.2.1.2. Employment status

4.2.1.3.   Level of educational

4.2.1.4.   Family size

4.2.1.5.   Household income levels

4.2.1.6.   Age of household head

The extent to which each of these generic factors have an influence of household adoption of indigenous practices have also been analysed through inferential statistics, by means of probability or regression analysis. In this study, the above factors are thus referred to as demographic factors that influence the adoption of indigenous practices of households at the Chief Albert Luthuli Municipality.

4.2.2. The factors that influence indigenous practices in households.

This objective is addressed across Chapters 2 and 3. Firstly, the objective identified both demographic and other non-demographic factors that influence indigenous practice adoption. In Chapter 2, demographic factors are presented or identified in Section 2.2. In Chapter 3, the other factors are addressed in Section 3.3. The non-demographic factors included:

4.2.2.1.   Characteristics of the waste generated (nature of waste streams) generated by households,

4.2.2.2.   Quantities of the generated waste,

4.2.2.3.   Availability of alternative waste management practices or services availability,

4.2.2.4.   Existence of and extent of recycling practices in a community, and

4.2.2.5.   Period that households have been resident to an area.

The study revealed that household waste streams such as food waste, used products or material such as glasses, cans, papers, plastics, tyres, and newspapers are generated through household activities such as cooking, sweeping, cleaning, and

gardening. Much of the waste generated in Chief Albert Luthuli Municipality is burnt within the household setting. The study also revealed that recycling of bottles, cans and glasses was also observed to be taking place within the area due to the factors such as high rate of unemployment observed, leading to the community having practices that are unique to them to survive. Income and age had an influence on behavior and attitude towards waste management by the community. The time of residence and gender does not seem to have any significant influence on the choice of waste management method used by respondents. Higher income levels were shown to influence positive waste management behaviors.

4.2.3. Indigenous methods of waste management in Chief Albert Municipality.

Through figures 3.2 and 3.3, in chapter 3, the different methods categorised as being indigenous to the community of Chief Albert Luthuli Municipality are presented. The categorization criterion used in the study was based on the factors discussed in figures 2.1 and 2.2, which detailed the factors that are globality used to classify knowledge or practices as indigenous to a defined community.

Within the study area, the most used method is composting using animal dung, garden waste and food waste. The methods applied were indigenous to that society and were passed on the descending generations within that locality. Usage of organic waste was also observed within Chief Albert Luthuli Municipality area whereby 3.6% use garden waste for compost purposes. The use of ash was also observed within Chief Albert Luthuli Municipality in which 0.3% of the respondents were using ash to sprinkle on their vegetable gardens for pest control. Animal dung is collected for composting in the Chief Albert Luthuli Municipality mostly in the Dundonald and Diepdale areas. Within the study area, few of the respondents were re-using food waste to fertilize the household gardens. Halved tyres were used to store animal feeds by a few households in Onbekend farm just outside Silobela Township within the study area.

From the listed categories of waste that were observed in the study area of Chief Albert Luthuli Municipality, there were also indigenous systems that were practiced by the local community to manage waste.

Responds analysis using the structured questionnaire revealed quite several waste management methods that were used within the study area in relation to the waste management practices that they have learnt or observed from the elders, and they are yet still practicing them. Waste in rural areas is classified by the culture and practices of the specific populations. Therefore, the way that these waste streams are managed within Chief Albert Luthuli Municipality were indicative correlative evidence that the respondents within the study area were practicing indigenous waste management methods.

From the analysis it is evident that waste generated by the households is still put to useful purpose and the conventional methods of handling the waste generated have been adequate. It is clear from results that there is a lack of formal waste management system rendered by the local municipality in rural areas of Chief Albert Luthuli Municipality area and this has resulted in different indigenous waste practices emerging.

Scholars have also explored the influence of education, income, age, and gender on behavior and attitude towards waste management. Higher income levels were shown to influence positive waste management behaviors. Indigenous methods of waste management support sustainable development through selling of recyclables by community members. Rural communities have their own way of living and of doing things in up keeping of their culture, norms, and values. It is therefore concluded that

indigenous practices has been an instrumental waste management tool in rural households. It is clear from literature that there is lack of documentation of indigenous knowledge, more specifically on the waste management practices.

4.3.   SIGNIFICANCE OF THE STUDY

Indigenous Knowledge (IK) has been overlooked and considered backward by the non-users of the system for centuries. Hence, fewer studies were conducted in relation to its documentation. The study had a brief analysis of several definitions of the concept indigenous knowledge to explore its possible meaning, common and different elements thereof.

This study contribute to the literature on IK as less research are conducted in the field. The study has found that traditional knowledge plays an important role in the waste management and disposal practices of the residents. The study found that there is a strong correlation between the household incomes, age, employment status, level of education with the implementation of reduce, recycling and re-use of waste materials as well as with the biological treatment of waste. The study established that from the 10 sections (within Chief Albert Luthuli Municipality) selected for the study only 3 were receiving waste collection services from the municipality whereas the remaining 7 were handling and finally disposing their waste in waste pits, burning their waste in the waste pits, burying of waste in waste pit and lastly some were practicing indiscriminate disposal of waste.

Significance of the study to the community of Chief Albert Luthuli Municipality is firstly letting the study community know about the recent study conducted within their area, through awareness on local platforms such as radio stations and local newspapers. Knowledge will be shared to the community via libraries to ensure that it also influence

the attitude of the society towards waste. Government should also consider integrating different waste management systems in South Africa.

Fewer methods were indicated to be practiced by the community of Chief Albert Luthuli Municipality. The identified methods might be incorporated within the integrated waste management plans of the local as well as that of the district municipalities. The study became relevant, to contribute firstly on examining the history and origin of the concept Indigenous. Available literature has also interpreted the concept Indigenous knowledge differently. There are inconsistencies in numerous studies in defining indigenous knowledge. Furthermore, the study has also contemplated on the concept waste management in relation to the indigenous practices within Chief Albert Luthuli Municipality.

4.4. FUTURE STUDIES

Government and other key stakeholders to consider studies in the following:

4.4.1. Conduct studies beyond Chief Albert Luthuli Municipality and extend it to bigger scale.

4.4.2. The study was based on the questionnaires which has drawn its conclusion based on the people's opinion, and more experimental studies to test the methods observed should be done nationally.

4.4.3. Comparative study to check the impact of the indigenous methods used on the water quality of the surrounding streams as well as on the rate of indiscriminate dumping.

4.5.   CONCLUSION

The study was able to investigate and documented different indigenous waste management practices that were prevalent in the Chief Albert Luthuli Municipality, South Africa. The main objectives of the study were to examine the influence of community demographics on indigenous knowledge, to investigate the different factors influencing the adoption of indigenous methods, as well as assessing indigenous solid waste management practices that are prevalent within the study area. The main aim was to document indigenous methods of waste management within the study area.

Based on the comprehensive understanding of the concept indigenous knowledge, it was deduced that indigenous knowledge is knowledge that is shared within a geographic location/area and the lesser being that Indigenous knowledge is referred as a system with too little to offer and is used to attempt to dismantle ideological and cultural power influenced by the colonialist. Indigenous knowledge being derived naturally or through acquired by experience.

4.6.   RECOMMENDATIONS

The indigenous waste management methods of solid waste management are currently not regulated and formalised. It is therefore recommended on the formal documentation of the indigenous waste management methods. As this might bring a solution to the backlog faced by the local municipalities with regards to waste collection services. Awareness can be raised by documenting and sharing the norms and values, that will lead to people adopting the waste management practices and not overlook at them as being backward.

It is recommended that future research be done on the role of Chiefs or traditional leaders and the contributions on the teachings and learning of indigenous knowledge

with regards to waste management in villages as IK is slowly diminishing with the passing on of the knowledge holders. Indigenous knowledge playing a crucial role in local municipalities, involvement of knowledge holders during strategic planning in which it helps in alleviating the indiscriminate dumping of waste as observed daily.

Holders of indigenous knowledge to assist in changes in an effort aimed at protecting the natural resources i.e., environmental sustainability. Advocating for indigenous knowledge to be reignited and the community to be encouraged to maximize documentation and knowledge sharing. Sharing indigenous waste management practices through documentation can help enhance cross-cultural understanding and promote the cultural dimension of development.

ANNEXURES

Annexure A: Data collection tool

STRUCTURED INTERVIEW QUESTIONNAIRE

Kindly complete the following demographics about (respondent)

1. Gender

Female	
Male	

2. Age

18-35	
36-50	
51 and above	

3. Total household income (per month)

R350-R500	
R600.00-R1400.00	
R1500.00-R5000.00	
R5500-R10 000.00	

4. Family size

1-3	
4-6	
7-10	
More than 10	

5. Employment status

Student	
Unemployed	
Employed	
Pensioner	

6. Highest level of education

No formal education	
Primary school level	
High school level	
Tertiary level	

7. Home language

Isizulu	
Siswati	
English	
Other-specify: ………………	

8. Nationality

South African	
Other-Specify: ………………	

9. Historic area/country of origin(ancestry)

South Africa	
Other-Specify: ………………	

10. Race

Black	
White	
Coloured	
Other-specify: …………….	

11. GP coordinates……

12. How long have you been a resident of your current household locality? ....

13. What is the estimated amount of household waste generated per week? ....

14. Do you reduce, re-use or recycle your household waste……………………………………………………………………?

15. If yes, to the above, kindly discuss how do you reduce, re-use and recycle your household waste

………

………

………

………

……………………………………………………………………………

16. How frequent do you remove your waste for final disposal?...

Kindly list the most common items that you dispose (form part of your household waste stream)

17. ……
………………………

18. ……
………………………

19. …….…………
………………………

20. ……….…………………
………………………

21. ……………………………………………………………………………………………………..……

……………………

22. Briefly discuss how your household manages each category of waste listed above

……

……

……

……

……

……

…………………………………………………………………………………………

Kindly select the most applicable situation in your household (use the scale below**)**

	Agree	Disagree
23. Waste is separated at source and stored in different containers in my household		
24. Some waste items are re-used		
25. There is no refuse collect by municipality or private contractor from my household		
26. My household handles and finally disposes its waste within the yard		
27. My household is involved in waste recycling		
28. My household is involved in a composting of organic waste		

How does your household handle waste in each of the following instances (if applicable)?

29. Temporary storage of waste after generation	

30. Secondary storage from primary storage	
31. Reduce, re-use and recycling	81
32. Biological treatment (including composting)	
33. Physical treatment	
34. Chemical treatment	
35. Disposal	

Thank you for your participation

Annexure B: Ethical clearance

UNISA-CAES HEALTH RESEARCH ETHICS COMMITTEE

Date : 12/04/2021

Dear Ms Famo

NHREC Registration # : REC-170616-051
REC Reference # : 2021/CAES_HREC/047
Name : Ms M Famo
Student #: 48037524

Decision: Ethics Approval from 08/04/2021 to 31/03/2024

_____

Researcher(s): Ms M Famo
48037524 @mylife.unisa.ac.za

Supervisor (s): Ms M Matlala
matlamd1@unisa.ac.za ; 011 - 471 - 2149

Ms N Thabethe
ethabend@unisa.ac.za ; 011 - 471 - 2349

Working title of research:
Documenting indigenous waste management practices that are prevalent in the Chief Albert Luthuli municipality, South Africa

Qualification: MSc Environmental Management

_____

Thank you for the application for research ethics clearance by the Unisa - CAES Health Research Ethics Committee for the above-mentioned research. Ethics approval is granted for three years , **subject to further clarification and submission of yearly progress reports. Failure to submit the progress report will lead to withdrawal of the ethics clearance until the report has been submitted.**

The researcher is cautioned to adhere to the Unisa protocols for research during Covid-19.

Due date for progress report: 31 March 2022

Please note the points below for further action:

1. The questionnaire asks for the GPS coordinates of the farm – this information can be used to identify the participants and should be removed unless it is essential to the success of the project.

2. In the questionnaire, when questions with a Yes/No answer is asked, the follow-up questions should relate to both. In many instances the follow-up questions are only applicable to a Yes answer, and someone that has selected the No option will not be able to answer those questions.

3. The researcher must stipulate how the risk posed by Covid-19 will be mitigated during data collection.

4. The sampling methodology should be further explained. The researcher must identify the strata and indicate how many there will be. How will the total sample size be allocated to the individual strata?

5. Is exploratory analysis enough to address the research objectives? The researcher should indicate how the data collected to address each objective will be analyzed. Identify the statistical model that will be used for each and identify the variables that will be applied.

*The **low-risk application** was **reviewed** by the UNISA-CAES Health Research Ethics Committee on 08 April 2021 in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.

2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

3. 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.

4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

5. 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.

URERC 25.04.17 - Decision template (V2) - Approve

6. The researchcher 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 le gislation 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.

7. 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.

8. No field work activities may continue after the expiry date. Submission of a comple ted research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2021/CAES_HREC/047** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*
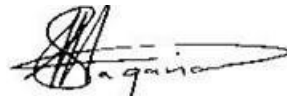
Yours sincerely,

_____
Prof MA Antwi
Chair of UNISA-CAES Health REC
E-mail: antwima@unisa.ac.za
Tel: (011) 670-9391

_____
Prof SR Magano
Executive Dean CAES
E-mail: magansr@unisa.ac.za
Tel: (011) 471-3649

Annexure C: Proof of manuscript submission and acceptance

1.   Manuscript Submission

matlhodi tlholo <matlhoditlholo@gmail.com>   Tue, Sep 27, 2022, 1:02 AM

to ajest

Good evening, Editor

The African Journal of Environmental Science and Technology. We hereby wish to submit an original research article for your consideration. We confirm that the work is original and has not yet been published elsewhere.

Hoping to hear from you soon.

Kind regards

Matlhodi

2 Attachments • Scanned by Gmail

2. [Waste] Manuscript ID: waste-2099577 - Accepted for Publica

Waste Editorial Office **<waste@mdpi.com>**

to me, Matlhodi, Machete, Waste, Steven

Dear Ms. Famo,

Congratulations on the acceptance of your manuscript, and thank you for submitting your work to Waste:

Manuscript ID: waste-2099577
Type of manuscript: Article
Title: Indigenous methods of solid waste management in the Chief Albert Luthuli Municipality, Republic of South Africa
Authors: Matlhodi Famo *, Machate Machate *
Received: 30 November 2022
E-mails: 48037524@mylife.unisa.ac.za, machef@unisa.ac.za

https://susy.mdpi.com/user/manuscripts/review_info/336ff3db63af5df74679791126063ad1

We will now edit and finalize your paper, which will then be returned to you for your approval. Within the next couple of days, an invoice concerning the article processing charge (APC) for publication in this open access journal will be sent by email from the Editorial Office in Basel, Switzerland.

If, however, extensive English edits are required to your manuscript, we will need to return the paper requesting improvements throughout.

We encourage you to set up your profile at SciProfiles.com, MDPI's researcher network platform. Articles you publish with MDPI will be linked to your SciProfiles page, where colleagues and peers will be able to see all of your publications, citations, as well as other academic contributions.

We also invite you to contribute to Encyclopedia (https://encyclopedia.pub), a scholarly platform providing accurate information about the latest research results. You can adapt parts of your paper to provide valuable reference information, via Encyclopedia, for others both within the field and beyond.

Kind regards,
Mr. Steven Tu

Assistant Editor

Waste Editorial Office

Polymers is recruiting Topical Advisory Panel Member

See details and apply for the position at:

https://www.mdpi.com/journal/polymers/topical_advisory_panel_application

The Polymers Special Issue Mentor Program is announced:

https://www.mdpi.com/journal/polymers/announcements/3892