Use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in KwaZulu-Natal.

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LIST OF ACRONYMS

4IR	Fourth Industrial Revolution
ANOVA	Analysis of Variance
CRA	Community Research Assistant
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussions
ICT	Information Communication Technology
IK	Indigenous knowledge
IKS	Indigenous knowledge systems
SWOT	Strengths Weakness Opportunities and Threats

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Abstract

Indigenous farming methods are complex, environmentally friendly, sustainable, cost-effective, culture-specific and play a vital role in the cultivation of indigenous crops and livestock rearing among indigenous communities. It has been argued that some aspects of African traditional agricultural systems can play a key role in alleviating poverty and food security. The objective of this study was to determine the use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in KwaZulu-Natal. This was a mixed method study conducted in two villages, Mgedula and Ndumo, in uMkhanyakude District, KwaZulu Natal province of South Africa. Five focus group discussions, six key informant interviews, and 66 questionnaires were carried out to determine the farmers' knowledge and attitudes on indigenous farming methods and modern scientific based methods. The study showed that the communities were aware of the importance of both indigenous and scientific-based methods and the methods were practiced in different situations and in some cases the methods were mixed in varying degrees. Availability of water and financial capacity appeared to be the major determinants for the choice of method. The Mgedula village which is generally drier had more communal gardens and field crops than those from Ndumo and the farmers there were more likely to use traditional farming methods. In contrast, the people in Ndumo cultivated their field crops in the Pongolo plain whose moisture regime lasted longer, and occasionally used diesel-powered irrigation pumps. The main activities include fishing, gardening, and field crops. The Ndumo B irrigation scheme contrasts sharply with the surrounding farming activities. It is an all-year green belt run using modern farming methods and business approach with access to extension workers and finance. Farmers from both villages lamented the loss of indigenous knowledge management in the younger generation who seemed not keen and suggested that the school curriculum should revisit this area. These modern and indigenous schemes can learn from each other. It is important to define areas where either has limitations or benefits.

Keywords:

Indigenous knowledge management, Indigenous knowledge system, Fourth Industrial Revolution (4IR), Knowledge transfer

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CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 Background to the Study

In the African context of community-based natural resource management, the construction of crisis narratives has been used to prop up Western ideologies in opposition to the African way of doing things. Therefore, it is in this light that during the colonial era, Africans were not considered to have the capacity to use scientific-based technologies to exploit natural resources. Consequently, some sections of society often perceived African Indigenous knowledge as ascribable to inferior people and this led to the decline, and in some cases, abandonment of the indigenous agricultural technologies which would otherwise have improved the sustenance of food security for most households (Okoye and Oni, 2017).

Crisis narratives were not only used to suppress other ideologies but also to perpetuate Western narratives as purportedly derived through the so-called scientific principles alleged to be applicable to all facets of life. This was important in maintaining the view that local people are not able to manage their resources in a sustainable manner based on their own indigenous knowledge. This gave the impression that ideas from the Western world with a biased leaning towards Western scientific principles and research were the solution to African problems. In a way, using developmental experts and professionally trained resource managers from the west was aimed at job creation, while at the same time sought to downgrade indigenous knowledge (Briggs, 2005). There was a radical change in the farming system during the colonization of most African countries and South Africa was no exception (Tembo 2016, Mkandawire 2016). As this happened, there was also a shift in priorities from subsistence farming to cash crops like cotton, forced labour and the need to pay taxes (Tembo 2016) coupled with some sophisticated methods that allowed large scale production (Bjornlund et al., 2020). It has been argued that the introduction of taxes by the colonizers coerced African farmers to work on non-traditional roles to be able to pay these taxes. As argued by O'Laughlin (2015), and Tembo (2016), this was also buttressed by forced cropping. Forced cropping was a system of coercion usually on people in occupied countries to plant crops that generated profits for the occupying powers (Sumarno et al., 2018; Van-Melkebeke, 2020). This resulted in a major shift in the farming system and way of life. There was a deliberate policy by the colonialists to suppress local indigenous agro-industries which was to the advantage of the European market. This resulted in the destruction of the local

agro-based industries and this became a problem which successive African governments have not been able to adequately address since independence from their colonial masters (Quan-Baffour, 2017). Colonialism supported with its education on natives and religion imposed the belief that the colonizers' culture, language, and way of life were superior to those of the colonized, creating a hierarchy that devalued indigenous identities leading many colonized peoples to internalize feelings of inferiority, resulting in self-hate, loss of cultural practices, and the erosion of native languages in favour of the colonizers' customs and language (Mawere & Tshamano, 2023). Arguably, therefore, colonialism promoted superiority complexes over their subjects and this resulted in self-hate of the colonized and loss of language, culture, and customs. In the process, the colonizer's knowledge systems were viewed in a better light (Fannon 2008). It can be argued, therefore, that understanding of the impact of this narrative is important in remedying this situation by countering the negative perceptions thus created to enable African indigenous communities to derive benefits from the indigenous system. It has been suggested that indigenous knowledge should be taught in schools (Reij et al 2017). This suggestion stems from the fact that indigenous knowledge systems are a social capital for the poor and as such it is a major asset that ensures survival, food production and livelihoods (Mafongoya & Ajayi 2017; Senanayake, 2006).

Notably, the arguments advocating the promotion of indigenous knowledge systems are informed by the realization that the emergence of foreign teachings and concepts that promise development and solutions to local challenges lead to its loss (indigenous knowledge). These promised solutions, as noted, are not always sustainable because by establishing monoculture rooted in colonial legacy in many Indigenous communities, Western science threatens indigenous cultures and sustainable agricultural practices (Datta, 2018)**.** This impacts negatively on local communities when proven sustainable skills, knowledge and expertise are lost (Mafongoya & Ajayi 2017). It is notable, however, that some African communities have shown interesting innovative methods for preserving knowledge. For example, the South African BaNtwane tribe has a rich beadwork tradition with an oral foundation (Reitsma 2013).

Indigenous knowledge, has been hailed as the basis of all scholarship (Smit & Mogomme 2012). This has been buttressed by the observation that African indigenous knowledge developed along western knowledge during colonial and apartheid times of rapid modernization and deliberate suppression of indigenous knowledge systems. It was marginalized and codified as a priori or primordial knowledge with its own limitations and was regarded as not dynamic and irrelevant (Smit and Mogomme 2012). Transfer of the African indigenous knowledge usually requires direct contact between the person

transmitting and the person receiving it. This mode of transfer, on the one hand, is not effective when those knowledgeable in it migrate to other areas due to reduced person to person contact. On the other hand, westernization of community members has rendered indigenous knowledge less relevant. Notably, there are other non-contact modes of indigenous knowledge transfer such as the BaNtwane beadworks. These are used to convey meanings or messages relating, for example, to the wearer's status, the wearer's tribal affiliation and significant events the wearer has experienced. This type of knowledge transfer has evolved over many generations into the current combination of being (i) learnt-through-observation, (ii) making connections between beadwork, a particular event, and the person wearing it, (iii) parent to child topical conversations, and (iv) storytelling (Reitsma 2013). It is important to note that the South African government has made great strides in documenting and unpacking African indigenous knowledge and this includes bringing it to the fore in academic settings (Kaya and Seleti 2014, Msila and Gumbo 2016).

For many years, holders of indigenous knowledge have been marginalized and have been under threat of being disinherited of their indigenous resources through on-going misappropriation and commercialization (Mashoko et al 2016). Consequently, scientific methodologies have been promoted at the expense of local knowledge among farmers (Omari 2018). Where new technologies and systems are introduced by established organizations or donors it is common for external experts to retain overall managerial control even where indigenous knowledge systems contribute to the sound management of natural resources (Briggs, 2005). However, new research points to diverse farming practices among farmers in indigenous communities with the potential to boost food security thus making it important and sustainable to integrate these methods with mainstream scientific methods (Omari 2018). Mistry and Berardi (2016) cite epistemological differences as one of the reasons for low utilization of indigenous knowledge. This derives from the view that modern scientific methods considered to arise from empirical evidence while IK is considered to be subjective and arbitrary.

Current studies show that changing life styles and dietary patterns from primarily African diets to 'Western diets' (Torre et al 2015; Fedacko et al., 2022; Adolph and Tilg, 2024) has led to the appearance of 'Westernized' diseases, such as colon cancer, inflammatory bowel disease, and obesity. South African statistics show that deaths due to major non-communicable diseases (NCD) such as cardiovascular diseases, cancer, diabetes, and chronic lower respiratory diseases increased by 58,7% over 20 years, from 103 428 in 1997 to 164 205 in 2018 in the country (Statsa 2023). It is important to find ways of maintaining qualities of the traditional diet to prevent the emergence of westernized diseases. Such studies are important

to provide evidence for the preservation of indigenous farming knowledge, suggest effective intervention policies and demonstrate harmful effect of uncontrolled changes in farming methods and diet. South Africa still grapples with high levels of poverty and unemployment although it is classified as a middle economy (Gaihre et al 2016). It has been suggested that agriculture can be a powerful tool to eliminate poverty in disadvantaged communities in South Africa (Hlahla et al 2016) and this is important considering the proportion of South Africans living in rural areas and that 65 percent of poverty has been reported in rural communities (World Bank 2014). Studies suggest that Africa needs a uniquely African strategy for sustainable intensification of its agriculture (Tittonell and Giller 2013). Understanding and reassertion of the role of indigenous knowledge and its contribution to past and present implication to food security not only demystifies the role of modern science and western experts but makes Africans feel proud of their own heritage (Reij et al 2013). Several efforts have been made to bridge the gap between scientific knowledge and indigenous knowledge. However, challenges such as differing participatory approaches, epistemological and ontological perspectives, divergent criteria for knowledge validation, and conflicting views on nature have been identified as key contributors to this gap. (IPBES 2014). It has been suggested that it is important to facilitate cross-fertilization of knowledge as both systems stand to benefit.

1.2 Statement of the Problem

Unemployment and food security remain as challenges in South Africa although some government initiatives such as the presidential node system have been put in place to mitigate these challenges. Areas like uMkhanyakude district has been declared as presidential nodal areas due to high level of poverty although it is endowed with natural resources (Mhlongo 2011; Sukhai and Jones 2014; Rogerson and Nel 2016). These areas are characterized by under development and contribute little to the GDP. Improving agricultural productivity is one of the government's priority in these areas (National Planning Commission 2011; Page and Shimeles 2015). Indigenous farming methods have been shown to improve food security in a sustainable manner and is important in mitigating poverty especially in resource limited rural farmers.

It is important to understand factors leading to low utilization of indigenous methods with a view of promoting them to improve agricultural production. Recognizing the role of local

farmers is vital where the government is rolling our agricultural policies for improvement of food security. Integrating modern scientific based methods with traditional systems results in effective adaptation of new policies and builds on the base of local knowledge. However, there is not much research on this area. (Notsi 2012). The traditional Zulu *muzi*, which basically is a home garden, has been shown to have a potential in providing food requirements for households (Nemudzudzanyi et al., 2010; Mosina and Maroyi 2016; Ngcaba and Maroyi, 2021). This study looked at the areas that are predominantly rural to see how indigenous knowledge is managed to form part of economic development.

In agriculture, indigenous knowledge system has ensured sufficient information transfer and sharing enabling successful adaptation to the ever-changing conditions. However, currently there is a lack of proper management system and dissemination of indigenous knowledge from the older generation due to introduction of the Western culture-based practices. It is important to note that although several achievements have been ushered by the Millennium Development Goals which reduced extreme poverty, hunger, disease, and lack of shelter, many of the world's poor continue to suffer. Many countries that have advanced nationally on development indicators have become more unequal with time (UN 2015).

As argued by Lake (UNICEF 2013) certain national achievements are overshadowing moral and practical shortcomings, as people in rural communities or urban slums are often left behind. South Africa, in particular, still faces serious food security challenges which can be summarized as follows (Department of Social Development, 2013 pp3-4):

(a) There are inadequate safety nets and food emergency management systems to provide for all those who are unable to meet their immediate food needs or to mitigate the impact of natural and non-natural disasters on food security;
(b) Citizens have inadequate access to knowledge and resources to make optimal choices for nutritious and safe diets;
(c) In cases where productive land is available, it is not always optimally utilized for food production, often for want of inputs, or skills; at the same time, there is a need to ensure that overproduction does not drive down prices to the point that farming becomes unprofitable.
(d) There is limited access to processing facilities or markets for small –scale primary producers, including farmers, fishers and foresters;
(e) Climate change and altered patterns of land use pose a threat to domestic production;
(f) There is no adequate, timely and relevant information on food security.

There is need, therefore, to understand the level of indigenous knowledge among rural

populations. Research should also be focussed at how the community use traditional indigenous knowledge in their day to day agricultural practices and their attitudes towards these practices in modern day settings.

1.3 Aim of the Study

The aim of the study was to determine the use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in KwaZulu-Natal.

1.4 Objectives of the Study

The objectives of the study were:

(a) To explore the underlying factors that impacts utilisation of indigenous knowledge system.
(b) To explore the underlying factors affecting the effectiveness of the indigenous knowledge management in the agricultural sector.
(c) To compare the knowledge regarding the modernised and the indigenous knowledge management in agriculture.
(d) To investigate an integrated agricultural system which can be more accessible and transferable to most parts of rural community in combating poverty.

1.5 Research Questions

The following questions served as a guide to formulate a questionnaire for collecting data to support the problem statement:

(a) What are the factors that reduce utilisation of indigenous knowledge?
(b) How is indigenous knowledge management being utilised in the field of Agriculture?
(c) Is there a knowledge gap between the modernised and the traditional indigenous knowledge in agriculture?
(d) Is there an integrated knowledge management system for agriculture that is accessible and transferable to community members?

1.6 Motivation of the study

Agriculture remains one of the key sectors in improving employment levels in the rural communities and improving food security (Quan-Baffour 2017). Traditional farming practices and knowledge can be key in improving agriculture and livelihoods in rural communities who may not always have access to modern farming accessories and financing. (Toribio et al 2018). There are many underlying challenges in uptake and utilization of indigenous agricultural practices. There are gaps in knowledge transfer. It is important therefore to understand the communities' perception on these practices in order to formulate policies that preserve and promote these practices (Osabohien et al 2019). It has been argued that some aspects of African traditional agricultural systems can play a key role alleviating poverty and food security. There are, however, few studies on the harmonisation of the traditional agricultural African knowledge system with modern western based system yet it has been shown that pre-colonial African communities were self-sufficient in food security (Adenle et al 2019).

This study will capture information on knowledge and attitudes on the traditional agricultural practices with a view of recommending best practices and preserving or promoting those aspects of traditional practices that will result in improved food security and employment. The majority of the communities in the Republic of South Africa, have not yet made it to the point where access to food is guaranteed despite the government policy for "access to food for all" (FAO 2013). This has been attributed to several reasons such as globalization, unfair international trade regimes, effects of climate change, inequitable food distribution chains, the poor harvest and storage technologies (Tuomala and Grant 2022; Margulis et al 2023; Sukanya 2024).Thus, coordinated local and international interventions are important in improving good nutrition to the greater population and reducing populations at risk to inadequate access to food. (Department of Social Development, 2013). The current situation does not support the theory of a "straightforward view of development as an upward climb which is common to all nations but with different countries at different stages seems inadequate for the twenty-first century" (Harris 2000 p5).

The situation as it obtains demonstrates that there are absolute gaps between the developed and under- developed countries. It is also notable that even within the country there has been widening of gaps between rich and poor members of the community. This has given impetus to the current strategy of "sustainable development". As a result, the old thinking in relation to the concept of sustainable development has been challenged. Notably, sustainable

development advocates for development which advances socio-economic status of the community while protecting the environment for the future generations (Emina 2021; Hariram et al.,2023),

There have been concerns on the downward decrease in diversity of traditional diets and this has been cited as a common cause of dietary deficiency ultimately resulting in food insecurity. Food processing and preservation are important in achieving food security. Traditional knowledge plays a pivotal role in food processing and preservation, such as, fermenting and malting, which is important in influencing nutrient content in food. This contributes to diversity and is important in improving the health of rural populations (Ibnouf 2012). Nutritional analysis has shown that indigenous foods have the same nutritional content with Western derived cereals and vegetables and in some instances are superior to them (Ibnouf 2012; Matsa et al 2013) suggesting an advocacy for African traditional food.

Neglecting indigenous foods is cited by the South African government policy on food and nutrition security (2014) as a cause of micro nutrient deficiency in the population. Some local crops such as "Spider plant" (*Cleome gynandra*)' and "Amaranth" (*Amaranthus hypochondriacus*) contain more micro nutrients than exotic vegetables like cabbage and lettuce. The policy notes the relationship in promotion of indigenous crops consumption and their production. If the crops are consumed, it will spawn their production due to a ready market thereby creating employment opportunities for indigenous farmers and rural economies. It emphasizes that promotion of indigenous crops such as bambara ground nuts (*Vigna subterranae*), *amadumbe* (*Colocasia esculenta*) and cowpeas (*Vigna inguiculata*) is integral in ensuring that households consume more diverse diets.

1.7 Definition of Terms

Below is the definition of food security:

According to the International Food Policy Research Institute (IFPRI) citing UN (*https://www.ifpri.org*), 'food security means that all people ,at all times ,have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life'.

It refers to the availability of food where all people have access to equitably and have control over production means. Oxfam (2013) is advocating for the availability of food for the vulnerable society members. Food has to be secured through activities leading to robust food production and improved access to food in a locality. Sustainable Development is generally described as development that meets the needs of the present without compromising the

ability of future generations to meet their own needs (Bebbington & Unerman 2018). This concept of sustainable development aims to maintain economic advancement and progress while protecting the long-term value of the environment (Brodhag & Taliere 2006).

1.8 Significance of Study

This study provides information that can be used to improve the communities' perception on traditional agricultural systems and form an integrated management system that will result in employment creation and food security. The study highlights the importance of both indigenous methods and scientific based methods in promoting food security. The study results, discussion and recommendation will add to the body of knowledge available to policy makers and base for further studies in improving utilisation and preservation of indigenous farming knowledge. This will increase knowledge in understanding of how traditional agricultural practices can be improved and incorporated into current practices to combat poverty and unemployment in South Africa.

The findings and recommendations complement existing strategies and policies related to food security. Notably, the South African policy document on food and nutrition states that "food and nutrition security is a multifaceted and multidimensional issue which will not be attained through a single approach – be it in the form of social relief or agricultural production" (DAFF 2014 p6). Characteristically, therefore, food and nutrition security requires well-managed inter-sectoral co- ordination, and the genuine integration of existing policies, programs, agrarian reforms and agricultural development (Department of Social Development, 2013).

1.9 Research Methodology

The study used mixed methods. A structured questionnaire was used for quantitative data collection. The study also carried out focus group discussions on randomly selected participants and key informant interviews with selected individuals for qualitative data collection. Observations in the study area were also recorded. The study was carried out in uMkhanyakude District of South Africa. Key informants included agricultural officers, health officers, traditional leaders like izinduna (sub-chiefs), and farmers. Although these were interviewed individually there were times when group discussions were held. Questionnaires were administered to randomly selected adults in the study area.

1.10 Limitations of the Study

It is important for the researcher to deal, though briefly, with the inevitable limitations in this study. Notably, some limitations were not been overcome and should be stated in more overt terms. The limitations encountered were the following:

a) African indigenous knowledge has not been documented and is transferred by word of mouth hence some important information and practices are often lost hence limiting the capacity of respondents.

b) Time and resource constraints resulted in a limited sample size selected for the study.

1.11 Summary

Unemployment and food security are challenges in South Africa although some government initiatives such as the presidential node system have been put in place to mitigate these challenges. Agriculture remains one of the key sectors in improving employment levels in rural communities and food security. Traditional farming practices and knowledge can be key in improving agriculture and livelihoods in rural communities that may not always have access to modern farming accessories and financing. There are many underlying challenges in the uptake and utilization of indigenous agricultural practices. There are gaps in knowledge transfer. It is important, therefore, to understand the communities' perception of these practices in order to formulate policies that preserve and promote these practices. This study is intended to provide information that can be used to improve the communities' perception on traditional agricultural systems and form an integrated management system that will result in employment creation and food security.

This chapter thus highlighted the background information on exploring an integrated approach on food security using organic knowledge management tool as a viable resource in combating poverty and unemployment. A brief analysis of indigenous knowledge of the African people before the colonial era and the rapid change of knowledge systems just after colonization was rendered. Overall, this chapter dealt with the research problem, justification of the study, research methodology and the target population whose participation in the study was enlisted.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature related to the study and introduced an integrated approach on food security using the organic knowledge management tool as a viable resource in combating poverty and unemployment. The review, therefore, focused on the applicability and relevance of indigenous knowledge in modern day settings. Thus, the chapter renders a detailed analysis of relevant historical perspectives on the changes in indigenous knowledge utilization before and after African colonization.

This chapter also gives an overview of the challenges that obtain in the utilization of indigenous methods and as a result of this overview introduces the concept of integrated knowledge systems. In this literature review, not only are some of the indigenous technologies discussed, the research problem and research objectives are also addressed. To this end, peer reviewed scholarly journals, published books and publicly available online government policy documents have been utilized to elucidate the research problem as identified by the researcher.

2.2 Indigenous knowledge

Indigenous knowledge is construed as “a living system of information management which has its roots in ancient times” (Ponge, 2013). Thus, for societies in indigenous communities “traditions are conveyed more through speech than through writing, and oral literature is often an important medium for the transmission of ideas, knowledge and history” (Kaul, 2018). In this regard, “indigenous knowledge or local knowledge is a particularistic knowledge of place and the things in it” and “it is born from rooted experience and has precisely the kind of intimacy that may be unavailable to an outsider” (Ponge, 2013). Similarly, Kamwendo and Kamwendo (2014) assert that all forms of indigenous knowledge share the characteristic of being unique to specific communities and hold significant value in addressing challenges such as environmental management, health, and food security. In a similar vein, Davis (2006) argues that indigenous knowledge “relates to culture and artistic expression and physical survival and environmental management (p155)” and that in so doing “it controls individual behavior, as it does community conduct (p155)”. Comparatively speaking, therefore, it is a concept that cannot be fully captured by Western terminology but is central to the foundation of Indigenous society. (Davis, 2006).

Additionally, Reitsma (2013) asserts that indigenous knowledge is specific to a culture or community, consisting of any of currently relevant knowledge, shared between successive generations in a socially segmented manner and is orally transmitted. Thus, the following aspects as regards the regulation and management of indigenous knowledge in rural communities are worth noting at length:

(a) The communities are not technologically mediated Bohensky, and Maru, 2011;Thompson et 2020)

(b) It has not been ascertained how the people communicate with each other and how they share their knowledge as indicated in everyday communication practices (Hill et al 2020)

(c) It has become evident that the "chain of inter-generational transfer need to adopt an indigenous knowledge management system which maps communication patterns and thoughts (Singha, 2023)

Inequality, poverty, and unemployment are interdependent socio-economic phenomena labelled the 'triple challenge' in South Africa (NA 2018). These problems persist although the country is classified as a middle-class country (Gaihre et al, 2016). Thus, it has been suggested that agriculture can be a powerful tool towards eliminating poverty in disadvantaged communities in South Africa (Hlahla et al. 2016) and this is important considering the proportion of South Africans living in rural areas and that 65 percent of the poverty has been reported in rural communities (World Bank, 2014). The importance of indigenous knowledge and its promotion to tackle food security helps demystify the role of modern science and western experts and makes Africans feel proud of their own heritage (Reij et al, 2013). Thus, this study evaluated the state of the farmers' knowledge of agricultural production practices within the context of food security, information management, crop yield and the importance of both the modern and the indigenous practices in farming. This chapter is a synthesis of the literature reviewed on indigenous farming systems and the modern scientific farming methods. The literature mainly focuses on local practices. However specific regional and global practices are also discussed for comparison. Research gaps on ways to improve indigenous knowledge retention, utilisation in integration with mainstream scientific backed knowledge are also identified with the way forward being suggested as part of resolving the loss of indigenous knowledge utilisation.

2.3 Indigenous knowledge systems

Broadly, indigenous knowledge systems are defined as a body of knowledge, or bodies of knowledge practiced or held by an indigenous community in a specific geographical area

which they have used or possessed over a long period (Enock, 2013) as opposed to the scientific knowledge that is generally referred to as 'modern knowledge'. Mposhi et al (2013) aver that this knowledge is held by people who are not regarded as developed as far as modern science and civilization are concerned. This knowledge is usually used to identify the community or their culture. African indigenous culture has evolved and remains relevant to African societies since colonial invasions. There have been few meaningful attempts to truly understand African Indigenous knowledge, and the limited efforts that have been made often rely on colonial frameworks, which fail to accurately validate or appreciate it (Gallert et al, 2018; Mugambiwa, 2019). For example, traditional healing practices are often dismissed when evaluated by Western medical standards, rather than being understood within their own cultural and practical contexts (Jansen et al 2021).

Colonialism and its subsequent modern forms (such as imperialism, apartheid in South Africa, and economic globalization) have been instrumental in maintaining unequal knowledge relationships and deliberate censoring of formal knowledge (Smit & Mogomme, 2012). It is important to note that mainstream knowledge and information are produced in the Western World and more so for the Western World. This has been used to portray a powerful image of the Northern Hemisphere and its dominance over the rest of the World. Arguably, therefore, this has had the net effect of portraying the image of science as being monopolized by the West thereby marginalizing and downgrading the role of alternative knowledge and information such as indigenous knowledge in scientific contributions in the process (Smit and Mogomme, 2012).

Indigenous farming methods are still practiced in rural areas in Southern Africa (Mapara 2009, Reiji et al, 2013). These methods are a mix of field crops, vegetable gardening, and livestock rearing (Seko, et al 2021). Most households have considerable food security through the crops and use of livestock as sources of investment and these usually determine one's social status in the community (Davis et al, 2017). The animals can be traded off for a variety of purposes such as cultural functions and religious rituals. Nnadozi (2009) and Ngailo and Northcliffe (2007), cite the Wusukumi community in Tanzania as having discovered that the local farmers have a way of naming and classifying the soil. It has also been shown that livestock production is supported by using herbal remedies to improve health, milk production and general ailments (Kunene and Fossey, 2006). The Zulu people kept home gardens (Zulu *muzi*) with indigenous plant species that were used for improving the community health for nutritional benefits, general ailments and ointments (Nemudzudzanyi, 2010). Therefore, livestock production as a bedrock for food security needs to be improved in these areas.

It has also been shown that Africans from time immemorial were quite aware of the need for the post- harvest protection of grain (Masarirambi, 2010). As indigenous knowledge is not locally homogeneous, differences exist along the lines of gender, age, class and occupation (Garutsa &Nekhwevha, 2016) and along lines such as the level of education (Liu et al 2010) and religion (Berkes, 2000; Mawere, 2014). The reduction in the use of indigenous knowledge in Africa due to the adoption of the Western culture and the passing on of those with full knowledge without passing it on to the next generation or documenting this knowledge undermines the developmental efforts that seek to reduce food insecurity in Africa. This increases conflicts, reduces the quality of livelihoods and contributes to a loss of biodiversity. It is in light of this, therefore, that much effort should be put in place to preserve and promote this very important resource. Thus, a new path and paradigm shift must be charted involving all the stakeholders such as governmental and non-governmental bodies as well as the local people themselves (Okoye and Oni, 2017).

Current trends show that the preservation of indigenous knowledge as a scholarly field is becoming increasingly important since there is a need for preservation systems to stem the gradual disappearance of indigenous knowledge in many communities (Lizette Reitsma et al, 2013). Notably, Reitsma et al (2013), draw a line between preserving and conserving indigenous knowledge as they insist that preserving is dynamic. This is important in that 'preserving' captures the values of the cultural traditions in a way that fits the contemporary lifestyle of the community itself thereby making it relevant to future generations. Thus, it is remarked that, in order to survive in harsh conditions and to maintain their cultural vitality, indigenous groups rely on collective capabilities that sustain knowledge, and collective action and that are crucially linked to the monitoring and adaptive management of dynamic ecosystems and natural resources (Bockstael & Watene, 2016 p267). Indigenous peoples' values are tied to their natural resources and land and are important to them to be able to carry out and uphold their traditions, practices, cosmologies, and the relationships with nature that are obtained in their ancestral lands (Schlosberg & Carruthers, 2010).

2.4 Agriculture and Human Development

Agriculture forms part of the backbone of rural life and can be targeted as a way of developing the people themselves. The human development and capability approach considers development as a multidimensional and multidisciplinary process of enlarging people's choices and freedoms (UNDP, 2018). As such, it asserts that people are the ends and

means of development. This theory is explained in relation to the capabilities that people have reason to value (Sen, 1999). In this approach, the main goal for wellbeing and development is that people are able to do and have, that is, peoples' capabilities to function and the kinds of lives they value (Nussbaum 2006; Sen, 2009). Among many considerations, the human development and capability approach considers human well-being and inequality and the connections between social and economic policy in addressing poverty and inequality. However, several inequalities exist that hinder individuals or nations to achieve development potential (UNDP, 2019). Alkire (2010) asserts that people are both the beneficiaries and the agents of long term, equitable human development both as individuals and as groups and that human development is a process that is participative and empowering. The accompanying principle in this regard includes equity, efficiency, sustainability, respect for human rights and responsibility. These are captured in several UN frameworks such as The Millennium Development Goals (MDGs) that captures human rights, human security and happiness and the more recent Sustainable Development Goals (UNDP, 2019).

As a theory, the Capability Approach considers the importance of people having the freedom (capabilities) to have the kind of lives they want, the freedom to do what they want and value. Important considerations of the Capability Approach are 'functionings' and 'capabilities'. A 'functioning' is considered as an achievement while a 'capability' is considered to be the ability to achieve the former (Kettle et al, 2017). The theory mentions human functionings' as 'beings and doings' constituting human life. These include being adequately nourished, good health, avoiding escapable morbidity and premature mortality, a decent and valuable job, self-respect and other higher desires as described by Maslow (Maslow & Lewis, 1987; Robeyns, 2016; Kettle et al, 2017). It is thus argued that development focuses on such capabilities has a greater potential for applications in different aspects of people's lives (Algraini, 2019). The capability approach as explicated by Ziegler (2018), shifted attention from money to goods. This is an important consideration in the indigenous mode of agriculture, where money is not the usual desired end product, but rather food and functionality, such as animal draught power, which is essential for increasing productivity, reducing labour demands, and supporting sustainable farming practices (Shackleton & Ntshudu 2023).

In light of the foregoing explication above, it is thus argued that traditional indigenous knowledge management may help reduce human inequality which Therborn (2018) classifies in three forms namely, vital, resource and race inequalities. Vital inequality is a result of social

construction shaping human life-courses with respect to life expectancy, health and mental-somatic development; resource inequality is usually measured in terms of wealth and income but may also include social connections, social capital and power whereas race inequality is considered as an existential inequality (Therborn, 2018). Thus, characteristically, vital inequality creates inequality among human beings as living beings, resource inequality among humans as actors and existential inequality impacts humans as persons. Inequality is very closely relevant to at least six of the seventeen global goals in the post-2015 sustainable development agenda. Africa is prominent in the United Nations Sustainable Development Goals (SDGs) which are concerned with fighting hunger, poverty, reduction of inequalities and improvement of water access and sanitation which are the themes recognized as challenges for this region (Salvia et al, 2019).

2. 4 Government's framework for smallholder farming operations

The South African framework document for the development of smallholder farmers through cooperatives development states that smallholder farmers are the drivers of many economies in Africa notwithstanding the fact that their potential is often not recognised (DFFF, 2012). Smallholder farmers are construed as 'small-scale', 'resource poor' and sometimes 'peasant farmers' and are seen in all instances as having limited resource endowment compared to other farmers in the sector as they own small-based plots of land on which they grow subsistence crops and one or two cash crops relying almost exclusively on family labour (Kuivanen et al 2016; Beumer and Swart, 2021). It is in this group of farmers that indigenous farming methods are mainly practiced due to their relative low cost in their implementation and would allow even a nuclear family to cultivate full-time (Baloi 2022).

The framework document notes that the main characteristics of production systems of smallholder farmers are simple, use outdated technologies, have very low returns, experience high seasonal labour fluctuations with women as the major participants in labour. By defining the farming methods as outdated, the department may be seen not to be promoting indigenous methods. The terminology used by the department of agricultural management demonstrates the need to change the "thinking" of policymakers. However, the document alludes to the fact that smallholder farmers can play an important role in the creation of livelihoods amongst the rural poor and that their production is important for household food security despite their output being low.

The South African government is concerned about lack of interest of rural households in

agricultural production and thus proposes that measures to increase the productivity of smallholder farmers be adopted to ensure long term food security (Mathinya et al 2022). These measures, among many solutions, include encouraging smallholder farmers to pursue sustainable intensification of production. Thus, the framework notes that constraints in production include lack of both physical and institutional infrastructure and poor marketing strategies. The poor road networks in the rural areas and unreliable distribution may force farmers to grow their own food and less of perishable commodities resulting in lower productivity. The government framework notes that since most of the farmers are often illiterate with poor technological skills, they face hurdles in accessing useful formal institutions that disseminate technological knowledge and are not capacitated with financial and marketing skills. It is important that these farmers be capacitated to be able to meet the quality standards set by external markets.

2.5. Indigenous knowledge and gender

Women are the main drivers of community activities and practices related to food security, health, and natural resource management in Africa (Pitso and Kaya, 2012). This has attracted the attention of development agencies on the significance of the utilization of indigenous knowledge in poverty reduction with women as key players. A case in point is the Food and Agricultural Organization (FAO), which recognized their role in the conservation of genetic resources for food and agriculture by maintaining and propagating indigenous crop varieties (FAO, 2017). It has been suggested that women in most traditional local communities in South Africa are complementing government efforts to initiate various community-based poverty alleviation projects using their indigenous knowledge in vegetable production and food processing, among others. Notebly, a gender analyst has shown that men are not keen to participate in these projects (Sarafa, 2005). Gender equality is important in rural agricultural systems. Gender equality has been described as a state of equal ease of access to resources and opportunities regardless of gender, including economic participation and decision-making; and the state of valuing different behaviours, aspirations and needs equally, regardless of gender (Merikul et al, 2017).

Gender inequality remains one of the greatest barriers to human development. Using the standard metric of development, the Human Development Index (HDI), average HDI for women is six percent lower than that of men and this gap is more pronounced in developing

countries. The United Nations Developmental Program estimates that it could take at least 200 years to close that gap globally (UNDP 2018). Gender Empowerment Measure exhibits the highest level of inter–country inequality compared to HDI and Gender-related Development Index, irrespective of the inequality measure used (Ogwang, 2010). It has been suggested that achieving gender equality requires eliminating harmful practices against women and girls, gender wage gap and access to opportunities (Meriküll and Mõtsmees, 2017;UNFPA, 2019). Gender-based exclusion from resources begins early when the girl education is restricted due to early marriages, prejudice based on gender stereotypes at home, at school and in the community, with the result that the boy child is usually the one that ends up going to school in some families (Plan International, 2015: UNHR, 2015; UNPF, 2019).

It is important to note that several African Nations have made considerable strides in addressing this imbalance and the World Economic Forum's (WEF's) 2018 Global Gender Gap Index shows that sub-Saharan African and North African countries have bridged 66% and 60% of their gender inequality. This is still low considering that women still face challenges in terms of several indicators which include property ownership in rural areas, gainful employment and political power. As aptly put by the UNDP (1995 p1), "the recognition of equal rights for women along with men, and the determination to combat discrimination on the basis of gender are achievements equal in importance to the abolition of slavery, the elimination of colonialism and the establishment of equal rights for racial and ethnic minorities". Racial and economic inequalities render women vulnerable to exploitation like prostitution (McBride et al 2022). Economic inequality and race/ethnic inequality coexist with sex inequality. It has been suggested that economically and ethnically marginalized women are treated as a lower class whose purpose is to serve men sexually and where legalised, prostitution formalizes women's subordination by sex and race (Farley et al, 2014).

2.6 Indigenous Knowledge and Social and relational Concepts

Development has to be relevant in the cultural or national contexts and address issues in developed nations as well as developing countries. While the capabilities approach (Kettle et al, 2017) seems to concentrate on importance of the individual's ability to have freedom (capabilities) to lead the kind of lives they want to lead, to do what they want to do and to be the persons they value and want to be, there is need to consider it in a relational context. For example, one important African concept is based on the understanding that happiness comes

about if one is willing to pursue communal relationships with other members of the community and valuing such relationships and this is termed Ubuntu, after the Southern African isiNguni word for humanness (Hoffmann et al, 2017). This concept is significant in indigenous farming systems, where livestock graze together in communal fields, and the illness of one animal can easily spread to others, as commonly seen in rural South African communities like KwaZulu-Natal (Ngoshe et al., 2022). Similarly, the prosperity of one family is shared with others; for instance, mating bulls and seed stock are often shared among families, fostering collective well-being (Rege, 2003). It can be argued, however, that relationality is part of the concept of capability itself where such relationality has intrinsic ethical value such as where an individual's poverty results in the inability to achieve goals that the individual has reason to value, such as caring for others. To that end, Hofmann et al (2017) combines the two concepts by suggesting that in terms of the Ubuntu ethic, freedom is achieved at least partially in terms of an individual's ability to care for others suggesting that an individual's freedom is inherently a form of interdependence with others. Hofmann et al., (2017) conclude by asserting that the normative conception of relationship inspired by African philosophy recognizes the human need to take care of others as much as they need to be cared for, and that it is central to living well.

2.7 Indigenous knowledge in food processing

Although indigenous methods of food preservation in many parts of Africa vary, they generally suffer from lack of innovation and long held beliefs that lack openness and flexibility to necessary or constructive changes (Okoye & Oni, 2017). The processing and preservation of food products greatly increases the value of perishable food stuffs by making them available for longer periods of time (Quan-Baffour, 2017). With the global rapid population, increase of food security has become a great challenge to humankind because of the inability of many developing countries to feed every mouth. Another problem is that even when abundant food is produced, preservation and storage facilities challenges causes produce to get rotten and thus create scarcity of food during the drought season. However, some farmers use their ingenuity and heritage to preserve some of their major foodstuffs to ensure that their families have access to food throughout the year (Quan-Baffour, 2017).

With regard to food processing, some community members have inherited special skills in brewing traditional beer, for example, mixing *imithombo yamabele* (warm sorghum) with warm water to allow it to be brewed after which it is kept for five days before it becomes

traditional beer (Xolo 2023). As for meat, it is boiled and smeared with vinegar or is salted to avoid butterflies from laying eggs on the meat and to prevent spoilage (Hill, 2002) Since many rural communities have no refrigerators, the meat is then dried in the sun before it is brought into the house for safe-keeping for a few days. Some community members have also learned how to boil and salt green vegetables (imifino) before having it salted and dried in the sun after which it is kept in a dry place for future use (Tshidzumba 2020; Nxusani et al 2023). Additionally, these community members have learned how to boil and grind raw maize using smooth stones prepared for such (McCann, 2009, Dold and Cocks, 2012).

There are successful stories of indigenous food processing cooperatives with assistance from local government in South Africa. These cooperatives focus on harnessing skills and training for empowering unemployed men, women, and the youth in entrepreneurial activities such as the Molemole Indigenous Food Processing Cooperative (MIFPC) founded in 2006 propelled by the high abundance of indigenous prickly pears and marula wild fruits which are utilized for commercial purposes (Jideani and Masipa, 2014). Women are primarily involved in the preservation of vegetables, fruits and milk in times of abundance for times of scarcity using indigenous techniques such as drying or fermentation and sun drying (Dweba and Mearns 2011;Okoye and Oni, 2017).

2.8 Food technology fermentation techniques

A significant number of the custodians of indigenous knowledge draw from traditions passed down through generations. They are inspired by the desire to enjoy traditional food throughout the year and out of season without it being spoiled. This harvesting and post harvesting technology has been mastered by community members over time to allow future use of harvested crops and food. For example, community members harvest and dry maize crops in the sun in order to have it stored for many months. Fermentation of food is one of the indigenous methods for food processing and preserving food that has been used to define culture and is an adaptation to the hot climatic conditions of arid and semi-arid areas (Ibnouf, 2012). Thus, it bears repeating that indigenous knowledge is knowledge that is unique to a given culture or society including skills and practices developed over ages and passed down through generations. Given these inherent qualities, indigenous knowledge for rural communities "has been the basis for local level decision making in agriculture, health care, food preparation, education, natural resource management and a host of other activities" (Maru et al, 2019 p2).

2.9 Challenges to Utilization of Indigenous Farming Methods

Mistry and Berardi (2016) cite epistemological differences as one of the reasons for the low utilization of indigenous knowledge. This derives from the view that modern scientific methods arise from empirical evidence while indigenous knowledge is subjective and arbitrary. Another challenge relates to attitudes and perceptions of farmers with regards to the use of indigenous knowledge systems. There have been some studies on how the knowledge is transferred and some of the models introduced in rural communities in particular seek to undermine or make irrelevant the input from indigenous knowledge (Mapara, 2009; Fanon, 2008; Tembo, 2016). It has, however, been shown that indigenous people have their own ways of handling agricultural products which over time have been modified and codified as scientific without proper acknowledgment of the original source.

As argued by Matsa et al (2013 p234), "indigenous knowledge systems (IKS) in farming form the bedrock of a community's composite and collective wisdom which is passed from one generation to the other". Similarly, Mapara (2009) in Matsa et al (2013 p234) argues that a "wide range of indigenous agricultural land use practices by farmers are based on generations of informal experience and experiments and intimated understanding of biophysical and social environment." In this light, therefore, "the traditional life cycle of rural people is a continuous process of acquiring, experiencing, possessing and sharing of traditional knowledge (Ibnouf, 2012 p240).

There are several dimensions to sources of indigenous knowledge (Hirst, 2005; Chidester, 2008; Yang, 2020) and these have been attributed at times to have been imparted to the traditional healers and the diviners through dreams for onward dissemination. In some instances, it is construed as having been bestowed upon the villagers as a result of their ancestral worship (Hirst, 2005) and is regarded as knowledge that is personal. As such, it is only available in people living in that particular community. Notably, this knowledge is not only tacit in nature but is also embedded in the practices of the rural people. It is worth noting, therefore, that the emphasis is that this knowledge is stored in the minds of the people and is thus gained through socialization and mutual trusts among the members of any given community (Turner, 2018).

Indigenous knowledge is stored in people's memories and activities and is expressed in stories, proverbs, cultural values, beliefs and local knowledge. The implication here is that indigenous knowledge is deeply embedded in specific geographical regions, making it a natural asset of the individuals within those communities (Ezeanya-Esiobu 2019). . Ponge

(2013) supports the idea that indigenous or local knowledge is inherently tied to a specific place and the elements within it, emerging from lived experiences that are often inaccessible to outsiders. From this perspective, indigenous knowledge is seen as a dynamic system of information management with deep historical roots.

It is also worth noting that indigenous knowledge does not only "relate to culture and artistic expression" but also "to the physical survival and environment management "(Ponge, 2013). Howden (2001 p62) argues that there are certain identifiable characteristics that are said to be common to all types of indigenous knowledge and that these include the following:

(a) the holding of community rights and interests in knowledge.
(b) a close interdependence among knowledge, land and spirituality.
(c) the passing down of knowledge, innovation and practices according to customary rules and principles.
(d) the existence of rules regarding secrecy and sacredness that governs the management of knowledge Howden (2001 p62).

The outlined characteristics shared by all forms of indigenous knowledge clearly indicate that these systems are unique to specific communities and play a crucial role in addressing challenges related to the environment, health, and food security (Kamwendo & Kamwendo, 2014). Indigenous methods and solutions applied by women to sustain household food supplies are culturally acceptable, economically practicable and more appropriate for the total environment and conditions than modern techniques and solutions suggested by scientific experts (Ibnouf, 2012). As such, it is built up naturally by a group of people through generations.

It is worth noting, therefore, that for societies in which traditions are conveyed more through speech than through writing, oral literature is often an important medium for the transmission of ideas, knowledge and history (Kaul, 2018; Anderson, 2018). Its pragmatic significance is that it empowers community members with skills on how to use oxen to till the land without using modern machinery such as tractors. The custodians of indigenous knowledge have full understanding of the nature of such knowledge. This view is corroborated by the fact that 85% of the indigenous knowledge is arguably imparted from generation to generation through community/cultural norms and values of the traditional elders. Thus, it can be inferred from this observation that rural people use their natural endowment and inherited knowledge not only to survive but also to perform their day-to-day activities.

2.9.1. Fourth Industrial Revolution and Farming

The Fourth Industrial Revolution is hailed for 'disruptive' technologies that have been designed to change human lifestyle. The revolution has changed how technology and information are used by humans. Agriculture has not been spared by these technologies as they have transformed the social, economic and environmental spheres and thus promise to eliminate disease, inequality, protect the environment, provide energy, food, water and empower individuals and communities. Like many disruptive technologies, it has been met with mixed views that include enthusiasm, scepticism and fright as has happened with previous revolutions. The increasingly powerful converging technologies have generated fears of creating a global 'wild west' of technology innovation, where good intentions may be among the first casualties and a landscape far beyond the control of current regulations and governance frameworks. The concerns include job insecurity, the potential creation of biological anomalies, and the emergence of incurable diseases, all of which pose significant challenges to immigration management (Maynard, 2015).

There are notable parallels between the four industrial revolutions and the five ages of civilization (stone age, bronze age, iron age, classical era and medieval era), which provide valuable insights for anticipating the challenges and opportunities presented by the Fourth Industrial Revolution. Understanding these similarities allows for more effective strategies to maximize benefits while mitigating potential risks (Chandler, 2018).

Thus, it is important to understand the impact of the Fourth Industrial Revolution on agriculture and its social and economic impact on the farmers and the nation at large. Although there is no universal agreement on what constitutes an 'industrial revolution', it is generally agreed that during the "first Industrial Revolution" water was used to produce steam power which mechanized production and electricity was invented during the second industrial revolution and was used for mass production of goods (Mohajan, 2019). In the third revolution electronics and information technology were used to automate production and replace human labour. The fourth industrial revolution has been described by combining all the technologies and thus blurred the lines between the physical, digital and biological spheres (Maynard, 2015; Schwab, 2016).

It is notable that the fourth industrial revolution alternatively denoted 4IR is defined as the fusion of technologies which blurs the lines between the physical, digital, and biological worlds (Davis, 2016; Mhlanga & Moloi, 2020). The speed and measure of the changes coming with the fourth industrial revolution brought about shifts not only in power and

wealth but also in knowledge. Understanding these changes is important in ensuring that these advances in knowledge and technology reach all and benefit all (Xu, 2018). While the impending change holds great promise, the patterns of consumption, production, and employment created by it also pose major challenges requiring proactive adaptation by corporations, governments, and individuals. Major socio-economic, geopolitical, and demographic impacts are expected. Job cuts through redundancy will occur in some sectors while some sectors will record rapid job growth. There will also be a change in the skill sets required to do some current jobs (WEC, 2016). It is contended that while the main assets and primary drivers of the industrial age were machines and capital, people were necessary but replaceable (Xu, 2018). In many industries and countries, the most in-demand occupations or specialties did not exist ten or even five years ago and the pace of change is set to accelerate. According to one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that do not exist now (WEC, 2016).

2.9.2. Capacity to embrace 4IR

The Fourth Industrial Revolution has impacted countries differently. The World Economic Forum (WEF) (2018) has reported on the 4IR-readiness of 100 countries according to twelve identified core technology-related innovations: big data, artificial intelligence (AI), internet of things (IoT), virtual and augmented realities, additive manufacturing, blockchain and distributed ledger technology, advanced materials and nano-materials, energy capture, storage and transmission, new computing technologies, biotechnologies, geoengineering, neurotechnology, and space technologies. The WEF (2018) explains readiness for the changes these technologies are bringing as operating on a scale from: 1) Leading; 2) High potential; 3) Legacy; and finally 4) Nascent readiness (Lieu et al, 2018). Readiness was assessed using six standard drivers: Technology and Innovation, Human Capital, Global Trade and Investment, Institutional Framework, Sustainable Resources, and Demand Environment (WEF 2018).

There have been variable reports on the impact of the 4IR in sub-Saharan Africa (Cilliers 2016; Taiwo, 2020; Wim, 2017). Taiwo (2020) avers that various governments in Sub-Saharan Africa and entrepreneurs are benefitting from the opportunities provided by the current industrial revolution. These range from mobile banking in East Africa, a phone-based recruitment solution for blue-collar workers in Mozambique, and the medical app Vula Mobile in South Africa which connects health workers with specialist care providers for their

patients while internet penetration in Kenya, Nigeria, and Seychelles has increased to 50% (Abdychev et al 2018; Mbunge et al., 2022). However, it is suggested that the technological progress does not significantly impact economic growth in sub-Saharan possibly due to the inability of the region to take full advantage of the industrial revolution which has significantly transformed the economies of the developed countries. Thus, it is argued that in order for the continent to benefit from the 4IR, more needs to be done to improve entrepreneurship and education (Wim, 2017).

Cilliers (2016) asserts that Africa's average economic trajectory is falling further behind that of the rest of the world. It is noted that instead of industrializing, Africa is deindustrialising due to structural transformation from low-productivity informal agriculture to low-productivity urban-based retail which stands in opposition to transforming into higher rates of productivity. Wim (2017) argues that the 4IR impacts on the industrialization options for Africa through three interrelated sets of technologies namely, automation, additive manufacturing and the Industrial Internet. These pose threats which, among other things, include job-losses and the re-shoring of manufacturing to advanced economies. It is notable that among the opportunities are products-as-services, the sharing (collaborative) economy, digital services and digital exports (Naudé, W., 2017). Christiaens et al (2013) have shown that around fifty per cent of people who escaped from poverty in Tanzania between 1991 and 1994 did so by migrating out of agriculture into non-farming and urban-based activities, including manufacturing.

2.9.3. Education

The rapid advance in technologies demands a more proactive response from the educational sector than the more gradual societal evolution and subsequent response from educational institutions in earlier industrial revolutions. To this effect, the impact of the emerging 4IR technology in economic and environmental terms will require a drastic reconsideration of the curriculum within higher education to enable students both to comprehend the individual technologies in detail and thus be able to thoughtfully analyse and predict the evolution of networked systems of technology as well as the environment and socio-political systems (Penprase, 2018). To successfully embrace the 4IR paradigm in a socially sustainable way, manufacturing enterprises will need to accompany their technological transformations with training and development programs for their workforce, in new tools and technologies that skilled labour uses and by which the operators are directly and indirectly affected (Romero et al, 2016). Hence education has to be aligned to these new needs.

Fomunyam (2020) suggests that the curriculum currently used in Africa is obsolete as it does not capture the changes being ushered in by the 4IR. It is for this reason, therefore, that the higher education curriculum must be responsive to the Fourth Industrial Revolution. Thus, it is concluded that to prepare students in Africa for the challenge ahead, there is a need for deterritorialization and reterritorialization towards emphasizing the introduction of Science, Technology, Engineering, and Mathematics (STEM) education into the African higher-education curriculum in Africa. Notably, success stories in this regard are different across the African continent. This is attested to by a recent study in South Africa which showed that during the lockdown, a variety of 4IR tools were unleashed from primary education to tertiary education where educational activities switched to remote (online) learning thus demonstrating that the South African education sector is ready for the 4IR (Mhlanga and Moloi, 2020).

Mhlanga and Moloi (2020) also highlighted that while access to education, particularly at a higher education level, has always been a challenge due to a limited number of spaces available, the pandemic has presented an opportunity to assess successes and failures of deployed technologies, costs associated with them and scaling these technologies to improve access. There is usually a significant lag of time for new technologies to be fully adapted to a level where they provide measurable impacts on productivity and this has been attributed to the time it takes for training and experimentation with new technology to have it widely disseminated throughout society (Atkeson & Kehoe, 2007; Penprase, 2018). The proliferation of new educational institutions and new curricula after the first two industrial revolutions enabled the technical and managerial capacity to implement the massive expansion of the economy and manufacturing that arose in the twentieth century (Penprase, 2018). As the COVID-19 (Coronavirus) pandemic evolves, schools and universities have had to totally shut down across the globe. More than 1.2 billion children worldwide have been out of classrooms due to the lockdown restrictions and social distancing considerations (WEF, 2020). As a result, many online learning platforms have emerged like Zoom (Ibrahim, 2020).

2.9.4. Regulatory Frameworks

Guidelines, regulations, and ethical boundaries are still unclear when it comes to preventing the excessive manipulation of genetics for desirable traits in agriculture (Tóth et al 2022). Similarly, while agricultural robots have become more advanced and autonomous, they still lack the ability to engage in moral reasoning, raising concerns about their role in decision-making processes, such as the ethical treatment of animals and the sustainable use of

resources (Ryan et al 2022). These gaps highlight the need for robust frameworks to guide the integration of biotechnology and automation in farming. Moral values differ greatly from individual to individual, across countries, religions and ideological boundaries (Al-Rodhan, 2015). The convergence between robotics, nanotechnology and cognitive augmentation, for instance, and that between artificial intelligence, gene editing and maker communities both push us into uncertain territory. Maynard et al (2015) note that despite the vulnerabilities inherent with fast-evolving technological capabilities that are tightly coupled, complex and poorly regulated, we lack even the beginnings of national or international conceptual frameworks to think about responsible decision making and responsive governance.

2.9 .5. Success of the 4IR

It is anticipated that emerging work environments, such as the 'cyber-physical farm,' will significantly impact agricultural workers and the nature of farming tasks, leading to new interactions between humans and machines (Naudé, W., 2017). This shift is expected to transform traditional farming practices by integrating advanced technologies and automation, reshaping how labour and machinery collaborate in agriculture (Sarkar,et al 2024).

Therefore, socio-technical transformation towards the agriculture of the future will need new design and engineering philosophies for twofold ‘human-centric’ and ‘cyber-physical’ production systems where automation, robotics, and other advanced manufacturing technologies (Romero et al, 2016). Countries have to prepare for the 4IR to stay viable in the global economy and must, therefore, prepare their populations for the pending shifts on how we work (Lieu et al, 2020).

2.10 Modern Scientific Knowledge-based Farming

Farming methods have changed from the development of the animal-drawn plough, then the heavy plough around AD 1000 (Andersen et al, 2016) to the current diesel-powered mechanized farming. These mechanized methods were accompanied by changes in soil management. Intensive research efforts across the globe changed the landscape of crop through a variety of methods such as animal and crop breeding for higher production, disease resistance, soil fertility enhancement, value addition and a sophisticated marketing chain and supporting industry (Andersen et al, 2016; Molnar, 2019; Evans and Lawson, 2020). Thus, it is widely acknowledged that a revolution in agriculture accompanied by the industrial revolution, took place and productivity more than doubled between the years 1700 and 1850

(Clark, 2018).

The subsequent 'Green Revolution' further accelerated progress through advances in biotechnology, which introduced superior genes, improved yields, and enhanced livestock production. Mistry and Berardi (2016) also highlight how external sources of knowledge, including immigrants, returning citizens, extension workers, and visiting businesspeople, have impacted indigenous knowledge systems, adding new dimensions to traditional agricultural practices and integrating modern innovations.

Research shows that although organic fertilizers typically used by indigenous farmers are sustainable, there is a maximum limit before reaching a threshold necessitating the use of inorganic fertilizers. Using both methods in a sustainable manner has been shown to produce good results (Epule et al, 2018). Although inorganic fertilizers can be used to improve yields, lower quantities are needed if there is an organic fertilizer base. This is an important consideration with resource constrained farmers. Organic farming is based on the concept of working ‘with nature’ as opposed to working against it (Andersen et al, 2015). Thus, it has been suggested that the training of farmers on the benefits of both types of fertilizer will allow for informed choices. To this effect, evaluating either system on site by farmers is important for the securement of food and protection of the environment (Chebet et al, 2018; Mikuláš et al, 2018).

2.11 Integrated approach

Okoye and Oni (2017) advocate for a combination of the modern scientific based knowledge systems and indigenous knowledge system for effective output and eventual sustainability. This advocacy derives from recognizing that African indigenous knowledge should not be construed as downplaying the role which modern scientific knowledge has played. The view of indigenous knowledge as an untainted, pristine knowledge system is deemed as it cannot be assumed that indigenous knowledge will of necessity provide a sustainable answer to production challenges in poor rural communities (Briggs, 2005). Allen (2014) avers that ideally, perfect knowledge is knowledge that presents a network of interconnections where all experiences are valued and construed as contributing to knowledge already accumulated with the view of solving problems in new contexts in the future. This type of knowledge becomes powerful through its influence and widespread acceptance, much like the dominance of Western scientific knowledge.

It cannot be denied that the idea that indigenous knowledge alone provides a more

appropriate and sustainable approach to land management, compared to Western science, is untenable. A balanced integration of both indigenous knowledge and scientific methods is necessary for effective and sustainable land management solutions (Mazzocchi et al 2018). Although few farmers compartmentalize knowledge into separate self-contained entities, farmers in general develop knowledge as hybridized, mediated and local. This demonstrates that farmers are pragmatic and utilitarian on their assessment and use of knowledge. If a particular piece of knowledge works for the farmer in question and makes economic and socio-cultural sense, then such a farmer will use it regardless of where it is drawn, be it from Western science, a repertoire of local knowledge or some other source (Briggs, 2005). Sonwa (2017) is of the view that thorough research is a prerequisite for understanding what needs to be done to allow adaptation of new technologies and policies and not piece meal fixes. Understanding how different variables interact is important in determining possible outcomes.

Westgate et al. (2016) highlight an example from Uganda where farmers, skilled in banana cultivation, had abandoned the practice due to the high costs associated with pest-related challenges. However, when superior banana varieties resistant to pests and diseases, along with modern crop protection methods, were introduced, banana production regained popularity. This resurgence was driven by extension workers collaborating with farmers to demonstrate the effectiveness of the new resistant varieties, blending scientific advancements with the farmers' traditional knowledge. On the other hand, agricultural programs which were introduced in the area by non-profit organizations which were enthusiastically accepted quickly failed because they did not have an indigenous knowledge base (Westgate et al, 2016). This highlights the importance of the participatory approach and the value of the indigenous knowledge base of the farmers.

The concerns by the scientists, including the agricultural scientists, of possible extinction of the protected species have led to the suppression of the indigenous knowledge system in the agricultural space. Manning (2013) in his “KEDI model” describes the importance of the integrated system which acknowledges the interplay of “social constructivism” whereby the context and the condition in which the learning takes place are crucial. Knowledge transfer has an element of taking people as blank slates to be dictated to instead of regarding them as a resource to be incorporated in the development process at all times.

Dahlberg (2009) revealed that Wetland areas within uMkhanyakude particularly the Isimangaliso Wetland Park are predominantly agricultural and are densely populated by indigenous plants and animal (flora and fauna) thus making such places lucrative for farming.

Dahlberg's (2009) study, however, does not show any acknowledgment of indigenous knowledge management practices as being part of the solution in crafting the conservation strategy. This resulted in resistance from the community to accept the Isimangaliso project due to the top down approach used in its implementation (Hansen 2014). The consultations that have been made in many community-based projects are one sided as they mainly focus on giving directions as opposed to appreciating and exchanging knowledge whereby the community chooses what has been recommended as viable. This approach results into resistance as indigenous people on the ground understand the meaning of consultation as a two-way stream as it is a common practice applied in different forums. The lack of consideration for indigenous knowledge appears prevalent from Western societies' think tanks working on developing countries, which may lead to loss of indigenous knowledge (Mbah et al 2021).

According to Buthelezi (2010), the traditional local knowledge of soils has not been considered by mainstream scientific researchers and this has resulted in the failure to improve land use in rural areas. It is, therefore, important for researchers to understand farmers' indigenous knowledge and management systems and attitudes (Gowing, 2004) as the concept of land can be closely related to that of a cultural ecosystem which includes the influence of man on the land's attributes. Thus, it is very beneficial to incorporate indigenous knowledge systems with modern systems (Masinde et al, 2011).

The major reason for the limited engagement with indigenous knowledge is the persistence of epistemological differences and the associated politics of representation within the social and governance context (Weiss et 2013; Mbah et al 2021). This stems from the fact that local ecological knowledge is construed as subjective, arbitrary and based on qualitative observations of phenomena and change. Scientific knowledge, by contrast, is viewed as objective and rigorous with precise measuring and empirical testing of events and trends confirming credibility and legitimacy (Weiss et al 2013). Attempts to evaluate local ecological knowledge thus often use scientific methods to prove its validity. However, all forms of knowledge, including scientific knowledge, are produced by socially situated actors and are value-laden (Mistry & Berardi, 2016).

2.12 Knowledge transfer

Knowledge, as a concept, is open to many interpretations depending on cultural and global perspectives, with certain forms, particularly those rooted in scientific inquiry, often being

viewed as more dominant or authoritative (Roos 2024). According to Smith et al (2011), individuals gain experience as a result of how they live and associate with others. The issue of boundaries sometimes comes into play in the interpretation of concepts like knowledge while other perspectives outside the set parameters are suppressed under the pretext of not being scientifically proven. Thus, there have been intensified efforts by most African countries to educate and train communities in rural areas through agricultural extension workers, who typically are the link between academics and farmers, on modern sound agricultural practices (Lwoga, 2003). However, adoption of new technologies has been low due to the weak coordination between research and extension services, which is not-for-profit organizations, libraries, and farmers (Tire, 2006). Dissemination of information suggests the transfer of knowledge, which Manning's (2013) "KEDI model" views as a one-sided approach with one stakeholder giving direction. In light of this, Manning (2013) advocates for the creation of proper platforms to forge synergies of an efficient and accessible agricultural system including the utilization of indigenous knowledge to its full potential.

Manning's KEDI Model (2013) describes Knowledge Exchange (KE) and Diffusion of Innovation as a theory of collective action in appreciating the fact that the field of agriculture can be more successful by acknowledging the existence of both knowledge transfer and knowledge exchange as being complimentary with measurable outcomes. Such outcomes would range from more efficient use of resources, an increase in the value of existing products, services or assets or the reduction of costs can be developed and integrated into KE process. Mchombu (2004) is of the view that the human development and capability approach needs to view ICTs as tools for establishing and increasing access to information for marginalized groups within society. Thus, these must be construed as tools that promote not only autonomy and participation but also promote and protect local knowledge and as vehicles that are complimentary to traditional channels of communication.

2.13 Climate Change impact on indigenous farming

It has been predicted that climatic events will radically change and this will result in the increased length of drought periods and flooding events (IPCC, 2007). Additionally, some crops might be affected differently by such changes in weather conditions. Considering the importance of temperature and water in the plant life cycle, crop growth and yields may be negatively affected.

These changes will impact negatively as this will contribute to the eruption of crop diseases

and render weed control difficult to handle. Thus, it is important to understand how traditional indigenous methods will adapt and minimize the impacts of these changes on food production (Altieri et al, 2015).

Studies by Mijatović et al. (2013), Martin et al. (2019), and Dardonville et al. (2020) demonstrate that the impact of adverse climatic conditions on agricultural productivity over the past two decades shows that resilience to these challenges is linked to increased biodiversity. This biodiversity, a key aspect of indigenous farming practices, plays a crucial role in mitigating the negative effects of climate change on agriculture. This has led to suggestions that these indigenous management systems should be preserved and promoted to improve food security in a sustainable manner for resource constrained rural farmers in the event of climate change predictions being realized as predicted (Altieri et al, 2017). Notably, indigenous people have always had a way of predicting climate change and variability. In Mpumalanga in South Africa, smallholder farmers have used animal behaviour, plants, atmospheric indicators, and human ailments to predict weather (Ubisi et al, 2020).

2.14 Indigenous use of Wetland

Chen (2010 p299) define wetlands as "a transitional area between aquatic ecosystem and terrestrial ecosystem that is inundated or saturated with water for long enough periods to produce hydric soils and support hydrophytic vegetation. River seasonal flow patterns resulting in seasonal flooding support wetlands and these have important ecological and economic significance. They comprise key resources for human use in the dry regions and are a major target for the activities of development (Lammers et al, 2015, Yurco et al, 2017). Also, flooded deltas are used for extensive fishing and thus provide a good source of protein. Wetland crops like rice and tubers are harvested during this time thus offering a variety of food for local people which is a common feature of traditional farming. Intercropping is usually practiced due to the abundance of moisture and this improves food security. Wetlands have a strategic economic importance and are integrated closely with that of surrounding dry lands with many examples of communities in this respect having one foot in the wetland and another in the dry. This is important in mitigating risk as it provides food security. Of importance to note, therefore, is that as the river recedes during the dry season, the wetlands provide pasture to livestock. Thus, the integration of the valley and the upland environments is one of the three basic features of indigenous agriculture in many parts of Africa where wetlands exist (King et al, 2018).

2.15 Way forward for agricultural indigenous methods

Indigenous methods have evolved over time and this demonstrates their resilience. On this basis, indigenous methods should be accepted alongside scientifically derived approaches, rather than subjected to blanket 'sanitization' to make them 'scientifically' recognized. In many cases, these indigenous methods are unique and capable of standing on their own, without needing validation through scientific frameworks. (Ford et al, 2105, Klenk et al, 2015). Several studies have looked at the dietary impact of westernization (Hu et al, 2016, Torre et al, 2016, Imamura et al, 2015) and have established a link between processed food and refined carbohydrates diets and the high rate of non-communicable diseases.

There are, however, not many studies on the management of indigenous practices and drivers that lead to the preference of farming methods that favour Westernized approaches producing less organic food. This fact notwithstanding, it is encouraging that in many countries, including South Africa, current research has included studies on indigenous knowledge and has incorporated this into school science integration. In South Africa, this has included the documentation and articulation of not only Indigenous Knowledge Systems (IKS) and IKS epistemological identification but also strategies for appropriating the teaching of IK in school science lessons (Barnhardt and Kawagley, 2005).

Thus, while, on the one hand, smallholder irrigation has shown great potential in improving food security, it has had, on the other hand, various challenges which are both technical and institutional. Of importance to note in this regard is that although the South African government has put significant effort in supporting these schemes, there have been no notable improvements. This has largely been attributed to the fact that the local farmers are not involved in policy development and rollout of the programs being implemented (Nolwazi, 2016).

2.16 Summary

Indigenous farming methods can play a pivotal role in improving agricultural production and food security. Thus, understanding the gaps in the methods of indigenous knowledge and how to manage the constraints towards improving and utilizing applicable agricultural concepts in the modern era where scientific methods are continuously being generated at universities and research centres would make these methods appealing to those in the rural areas who stand to benefit most.

Despite its status as a middle-income country, South Africa has significantly high levels of

poverty and unemployment and agriculture can be a powerful tool towards eliminating poverty in the most disadvantaged communities. This is an important consideration given the fact that there is a significant number of the South African population in rural areas and besotted by high levels of poverty. It is worth underlining the fact that the shifting climatic conditions have resulted in more droughts. This necessitates understanding the resilience of indigenous methods under prevailing conditions. Poverty reduction has been demonstrated in many poor African countries and this suggest that if more effort is directed to this cause, success may be achieved.

The reviewed literature suggests that demonstrating the significance of African indigenous knowledge in the past and outlining its significance as a way forward in contributing towards food security will help correct some myths about the contribution of Western experts while also making Africans feel proud of their own heritage. In the context of sustainable development as it relates to food security, information management systems which are timeous, accurate and having relevant information about food are pivotal to the policy goal of eradicating hunger, malnutrition and food insecurity (Department of Social Development, 2013). Many custodians of indigenous knowledge draw from their personalized experiences to specialize in traditional food by having it prepared and keep it for many months without being spoiled. With regard to the harvesting of crops from the field, the community members have specialized knowledge on how to render the harvesting handled with relative ease and preserve the harvested crops for future use.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methodology used in this study. The study design was based on the aims and objectives of the study. This study examined the use of traditional indigenous knowledge management and modern agricultural technology as viable tools for combating poverty in KwaZulu-Natal. It aimed to explore the factors influencing the utilization and effectiveness of indigenous knowledge systems in agriculture and compared these with modern agricultural practices.

This is done by giving an overview of the research design, data collection methods, study area and sampling procedure used. Hussein (2015) defines a paradigm as the basic belief system or worldview that guides the investigator in choosing the methods of inquiry for the study in question. These can be categorized by three approaches namely, an ontology which looks at what is real; epistemology which looks at how one can know that reality and methodology which is concerned with the process of finding out the reality being investigated (Sutrisna, 2009), Thus, a research paradigm is an all-encompassing system of interrelated practice and thinking that defines the nature of enquiry along these three dimensions.

The positivist paradigm is based on the conviction that there is a single reality. This paradigm asserts that this reality can be measured and elucidated upon. Thus, studies can be conducted using both quantitative and qualitative methods which entail questionnaires, focus group discussions and interviews. In this light, a positivist paradigm is one in which a scientific method is used to determine a causal explanation of the topic being researched (Leech, 2016, Baldwin, 2017). This study, therefore, used the positivist paradigm since it is aligned to scientifically deduced evidence. In this regard, the research methodology employed in this study gathered data and analysed it to answer the research questions formulated for such.

3.2 Research Design

Due to the complexity of the research problem, the research design selected for this study was a mixed methods approach including both quantitative and qualitative data collected for a more comprehensive and deeper evaluation of the research problem as opposed to utilizing one method. Structured and semi structured questionnaires were administered to the respondents. Additionally, key informant interviews were conducted to obtain in-depth understanding of the community perceptions of indigenous knowledge in agriculture. Focus

group discussions were also carried out with the purpose of gathering together people from similar backgrounds or experiences to discuss a specific topic of interest. Observations by the researcher were also recorded.

3.3 Study Setting

The study was carried out in the Ndumo and Mgedula villages respectively. These villages are situated in the uMkhanyakude district which is considered one of the most underdeveloped districts in South Africa. The district is situated in the Northern part of KwaZulu-Natal province in South Africa. This district has a subtropical climate with low rainfall and as such droughts are a common feature (Manyangadze et al, 2021). The villages are under the jurisdiction of the Jozini Municipality.

Study area

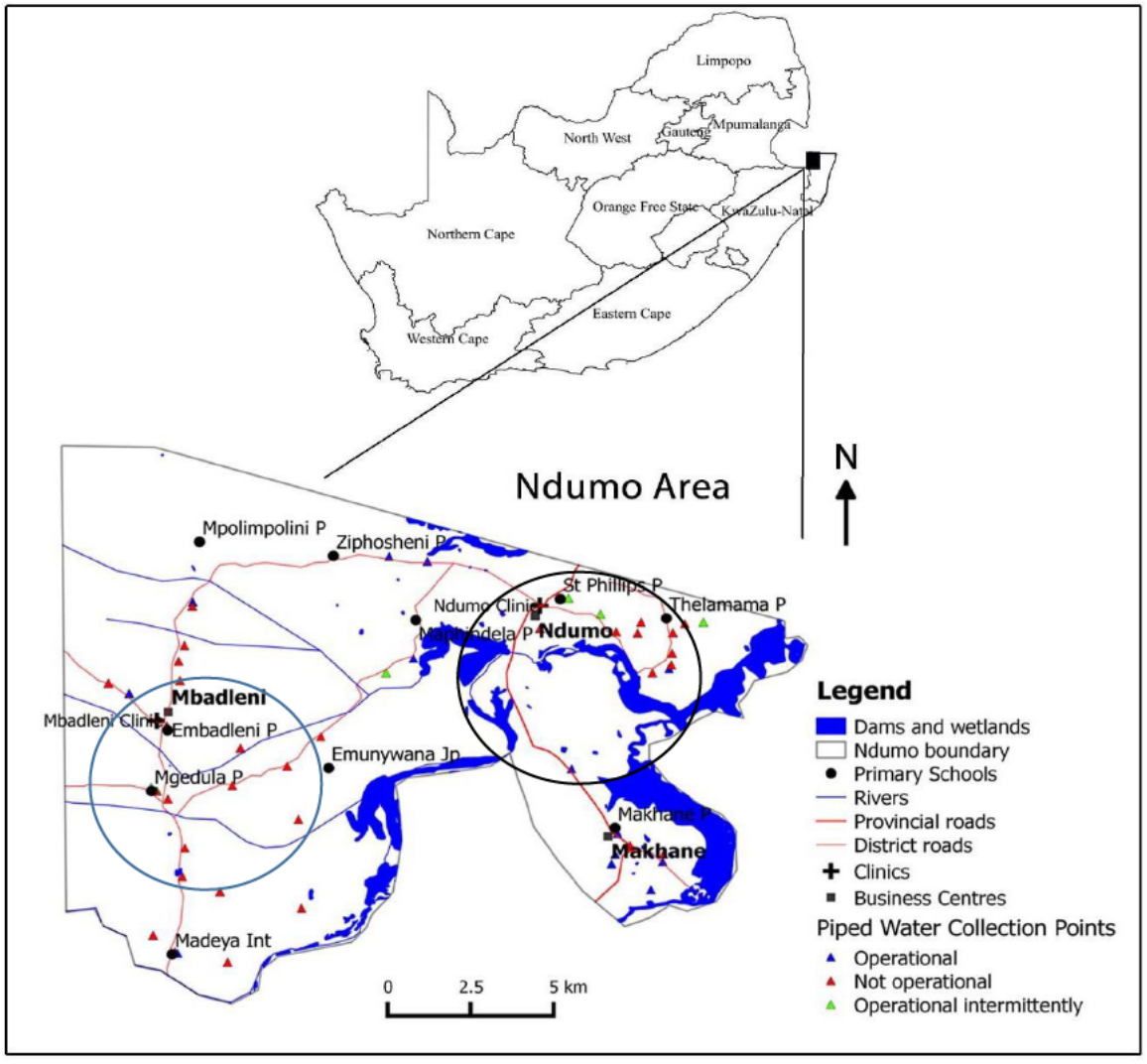

Figure 3.1 Map of Study Area (Manyangadze et al, 2016)

Represented above is the actual study area where the data for the study was collected.

Mgedula village is represented by the blue circle and the Ndumo village is represented by the black circle (Adapted from Manyangadze et al, 2016 p3).

3.4 Population and Sample Size

Random sampling of households was carried out for the administration of the questionnaire. The sample of the study was calculated based on number of households in the villages. The villages around Mgedula such as Munywana and Mbadleni have an average of slightly less than 300 households while Ndumo has about 1000 households with these including government employees and other service providers (STATS SA, 2023). Taking into account the long distance between houses, logistics and budgetary requirements, this study administered questionnaires to 10% of the households in each village. Thus, the study used the 10% sampling based on Barreiro and Albandoz (2001). About 30 households were randomly selected in Mgedula and Ndumo village although Ndumo had a bigger population. The study considered that the bulk of Ndumo households consisted of civil servants, workers at the Ndumo Mall and construction employees. These workers were renting accommodation and did not participate in agricultural activities. The Ndumo B irrigation scheme was considered as a separate entity. The irrigation scheme operates on a commercial basis compared to subsistence farming carried out in the two villages. Cash crops are mainly grown in the scheme which utilises irrigation and is well supported by extension workers from the department of agriculture. Formal structures were considered as the existing organizations including local authorities with non-formal structures including the ordinary citizens who were not members of any organization. For qualitative aspects of this study, purposive sampling was carried out to include community based agricultural cooperatives and NPOs and Local Economic Development Officers, Development Agencies, Local Authority. Purposive sampling entails selecting 'information-rich cases' in the form of informants and depends not only on the availability and willingness of the participants to participate but also on cases that are typical of the population selected (Terre Blanche, 2006).

3.5 Data Collection

A more synergistic and nonlinear utilization of data was required as it provides an integrated tool in a more complex environment like uMkhanyakude which is mainly rural with both drylands and wetlands. Rural communities have been using very diverse methods of knowledge preservations and skills transfer from generation to generation. The study investigated the consistency of the generational passing on of skills particularly in agriculture

in Mgedula and Ndumo villages.

Table 1 Study Population

Target Category	Total Population	Mgedula Village respondents	Ndumo Sample Respondents	Data collection Instrument
Councillor	1	0	1	In Depth Interview
Cultural leaders	4	2	2	In Depth Interviews
Department of Social Work	1	0	1	In Depth Interviews
Nongovernmental organizations (NGO)	1	0	1	In Depth Interviews
Community members	66	33	33	Questionnaire
Community members	16	8 members	8 members	Focus group discussion

3.5.1 Qualitative data

The local economic development office of the municipality has already established development forums which are used in mobilizing the community to participate by opening discussions related to development including challenges and possibilities. Male and female respondents were split for

purposes of focus group discussions in Mgedula and Ndumo villages. Key informants for the study were purposefully selected based on their involvement in agricultural activities and their knowledge in the area of food security. The key informant interviews were conducted with two headmen (Indunas), one in Mgedula village and the other in Ndumo village, the councillor, the community liaison, and two local holders of indigenous knowledge identified by the community research assistants (CRAs). Two focus group discussions were held in each village with one comprising the men and the other comprising the females to facilitate fully participation of participants. I t has been reported that women may not speak freely in the presence of men (Candy, 2013).

3.5.2 Quantitative data

The interviews and questionnaires were carried out with the assistance of two CRAs. The

CRAs assisted in refining the questionnaire to suit the local language and dialect. They also helped in updating the researcher on the customs and norms of the local community with the view of gaining trust with the research subjects since the questionnaires were administered in the respondents' homes. These CRAs were trained on data collection, interview and questionnaire techniques and given detailed information on the research objectives by the researcher. The CRAs in turn explained the study objectives to the target population and were instrumental in obtaining consent from the sampled households for data collection. The CRAs were recruited from the study area and were familiar with the local people and assisted with the translation of the recorded interviews which were then transcribed. The CRAs were responsible for administering the questionnaire. The interviews and questionnaire were conducted in isiZulu by the CRAs. The researcher conducted the FGDs. The FGDs were also conducted in the local language, isiZulu. The researcher is also a native speaker of the isiZulu language.

3.6 Research Methods

The study used the mixed method approach and quantitative and qualitative research methods were used for data collection.

3.6.1 Quantitative data

A structured questionnaire (Appendix B) was administered to randomly selected farmers in the study area for quantitative analysis using the face-to-face method. One questionnaire was administered per farming household and data was coded and entered into a statistical spreadsheet. Once selected, an interviewer-administered the questionnaire to the farming household's head or their representative. A household was defined as a person with his/her spouse, unmarried sons or daughters, and related or unrelated persons, who live together and constitute one unit with a combined income stream. Only respondents above the age of 18 were eligible for inclusion since they can legally be deemed able to consent. In order to aid the household's head with recall, other family members were allowed to help with the answering of some of the questions on household activities. The questionnaire was designed to establish demographic information of the respondents and information related to the study research questions and objectives.

The questionnaire measured the respondents' perceptions and knowledge levels on a five-

point Likert Scale (Likert 1932; Ali et al, 2019). The responses were categorized from a high negative response to a high positive response.

3.6.2 Qualitative data

Qualitative research is important for studying complex issues like cultures, values and beliefs (Kalu & Bwalya, 2017). Development of rapport and dialogue is essential in interviews as applied in the qualitative method. The CRAs were given training in these aspects and drew from their experience as CRAs in an existing project in the area. The interviews were recorded and the tapes later transcribed for analysis. Notes were taken during the interviews. Interviews were carried out for key informants like agricultural extension officers, NGO personnel working in the area on poverty alleviating programs, local chiefs (indunas), rural health workers, political councillors, the economic development officer, two headmasters (one in each village) and other influential people. Semi structured interviews allowed informants the flexibility to express their views in their own terms while allowing the researcher to focus on topics that arose from the interview.

Focus group discussions were carried out with specific interest groups with the view of gaining insight into indigenous information transfer coupled with the role of agricultural indigenous knowledge in poverty alleviation. The researcher also recorded non-verbal observational notes during the discussions and the data that emerged.

3.7 Data collection

The CRAs administered the questionnaire under the supervision of the researcher and the units of analysis comprised social artefacts or organizations, individuals and groups. For this study, indigenous or traditional plants were defined as those whose leaves, roots or fruits are acceptable and are used as food by the communities through customs, tradition, and habit (FAO, 1998). African indigenous plants, on the one hand, were used to refer to a crop of species which are known to have originated from the study area without a history of being imported as far as the respondents could remember. On the other hand, non-indigenous crops were those that had been imported from other regions (Notsi, 2012).

3.8 Ethical Issues and Considerations

The study was reviewed and approved by the Humanities and Social Sciences Research Ethics Committee of the University of KwaZulu-Natal. Respondents' consent was sought after explaining the research objectives and methodology. The data was coded and treated

confidentially. Gatekeepers and village chiefs were informed about the purpose and procedures of the study. The respondents were allowed to withdraw from the study at any time.

3.9 Data Analysis

The quantitative data was analysed using IBM Statistical Package for the Social Sciences (SPSS) Version 23 to obtain frequencies and Chi Square Test to test relevant relationships. Regression analysis was used to determine factors affecting indigenous knowledge usage. Thematic analysis was used for the qualitative data (interviews, and focus group discussions).

3.10 Reliability

It is important that a method produces similar results when carried out (Cohen et al., 2017). This is significant when designing the research tools, data collection and interpreting results. The researcher considered the design, rationale and sampling in previous related studies. The questionnaires were administered and interview guides were pre tested to a sample outside the study area who were representative of the study area.

Reliability Qualitative: The researcher utilized standard coding techniques that allow consistency should another researcher analyse the same data (Cohen et al., 2017). This makes the results dependable. The study also followed systematic data collection and analysis procedures such as detailed documentation of the research process.

Reliability Quantitative: The study design used established data analysis methods that allow consistency of results over time when the same measurement instrument is administered to the same group of participants on multiple occasions (Taherdoost, 2016; Singh 2017).

3.11 Validity

Validity ensures that the research design and method are aligned with the objectives of the study in order to produce the desired results (Cohen et al., 2017). It is important for the researcher to systematically demonstrate transparency and accountability from design, data collection and analysis. The interviews were aligned to the objectives of the study.

Validity Qualitative: In order to improve the extent to which the findings accurately represent the participants' experiences and perspectives the study employed techniques such as prolonged engagement, member checking, and triangulation of data sources (Cohen et al., 2017). This allows findings to be applied or transferred to other contexts or settings. The

researcher aimed to have data saturation when enrolling key resource persons interviews. Data saturation is the point when additional interviews would not yield new information (Mwita, 2022).

Validity Quantitative: This generally refers to the extent to which the results of a study accurately reflect the true relationship between variables, without the influence of confounding factors (Taherdoost, 2016; Singh, 2017). The study employed an established statistical design to calculate a sample size with sufficient statistical power, and randomization in sampling to allow generalization to similar settings. Calculations such as regression analysis and Chi Square which measure effect of variables and statistical significance were used.

3.12 Bias

Eliminating bias is important in research. This may take the form of questions that mislead the respondent or have the wrong order of questions resulting in the study objectives not being met. The questions used in this study were pretested as they were adopted from previous related studies. Sampling was random and designed to be representative of the target population.

3.13 Summary

This chapter outlined the rationale of the methods used in this study. A mixed quantitative and qualitative design with a positivist paradigm was used. Using both quantitative and qualitative methods allowed for the reduction of weaknesses in either method. The data was collected using focus group discussions where group members were selected randomly and key informant interviews where respondents were selected on the basis of their relevance to the objectives of the study. Questionnaires were also administered to individuals from randomly selected farming households and the methods used in the study aimed at ensuring high reliability and validity, while removing bias in the process of engagement with the respondents.

CHAPTER 4

ANALYSIS, INTERPRETATION OF THE DATA AND FINDINGS

4.1 Introduction

This chapter presents the results in the form of frequency tables, figures and bar graphs. The descriptive statistics for demographic information are presented with the overall description of the observations in the study area highlighted by the researcher. The themes emerging from the focus group discussions and key informant interviews were thematically analysed (Braun, et al 2014; Vaismoradi et al, 2016). The three themes were (i) challenges in the effectiveness of indigenous methods towards meeting food security; (ii) indigenous farming knowledge and modernized farming practices and (iii) Integrated farming management.

Challenges in the infectiveness of indigenous methods

This theme emerged from objectives one and two and highlighted the challenges encountered in the utilization of indigenous knowledge and the factors affecting the effectiveness of indigenous knowledge management in securing food security in the villages of Ndumo and Makhanisi respectively. The sub-themes identified were government assistance, high level of unemployment, and climate change Indigenous farming knowledge and modernized farming practices. This theme emerged from objective three. It compared the farming knowledge management systems. The respondents outlined various farming methods and knowledge systems based on indigenous practices and knowledge as well as modern scientific-based farming principles that they are currently using. The respondents were able to show how they perceive weaknesses and strengths in the use of both methods.

The sub themes were animal and plant breeding, water resource management, GMOs, substandard imported products, employment opportunities, cash outflow, markets, support services and various farming activities.

Integrated farming management

This theme emerged from objective number four. It highlighted farming activities and practices which utilize a combination of both indigenous knowledge management and scientific based modern farming methods. The sub themes identified were irrigation, climate change, support services and soil fertilizers. The theme also highlighted the advantages of combining these two systems.

The interviews were recorded, translated and then transcribed. This data was then analysed and general observations in the area also considered. Major themes were identified and sub themes listed and analysed. As previously indicated, the study was conducted in two villages namely, Mgedula and Ndumo in the Jozini Municipality. Presented also in this section is a scheme operating under modern agricultural practices in the rural setting and this is accompanied by an analysis of the quantitative data gathered.

4.2 Quantitative data from questionnaire

A total of sixty-six questionnaires were administered in Ndumo and Makhanisi villages. The results are introduced and discussed below.

4.3 Descriptive Statistics

The males formed the larger group of those who responded to the questionnaire, accounting for fifty- four percent (54%) of the study population while the women accounted for forty-six percent (46%) of the population.

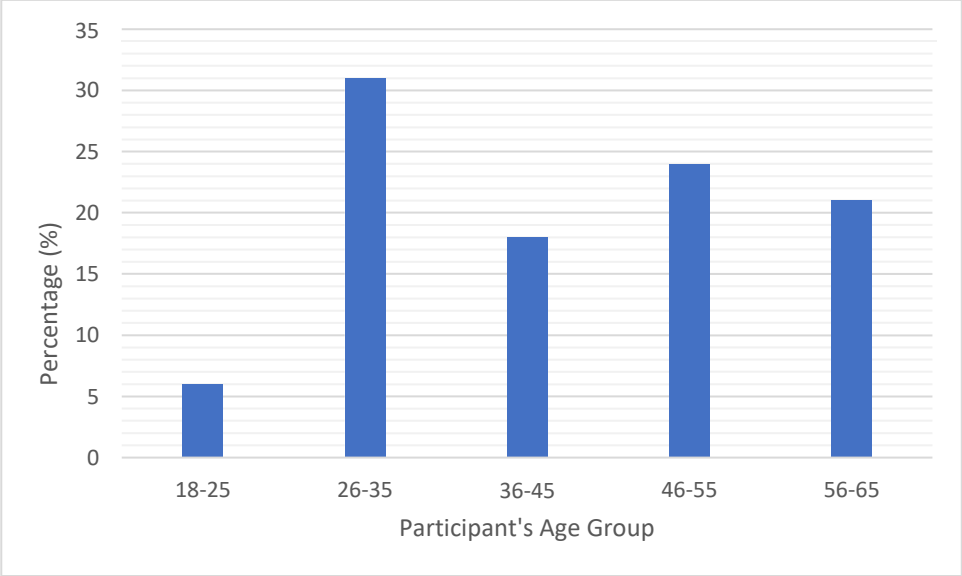

Figure 4.1 Study Respondents' Age Group

The dominant age group of the study population was the 26-35 years age group accounting for 31% of the study population followed by the 46-55 age group (Fig4.1).

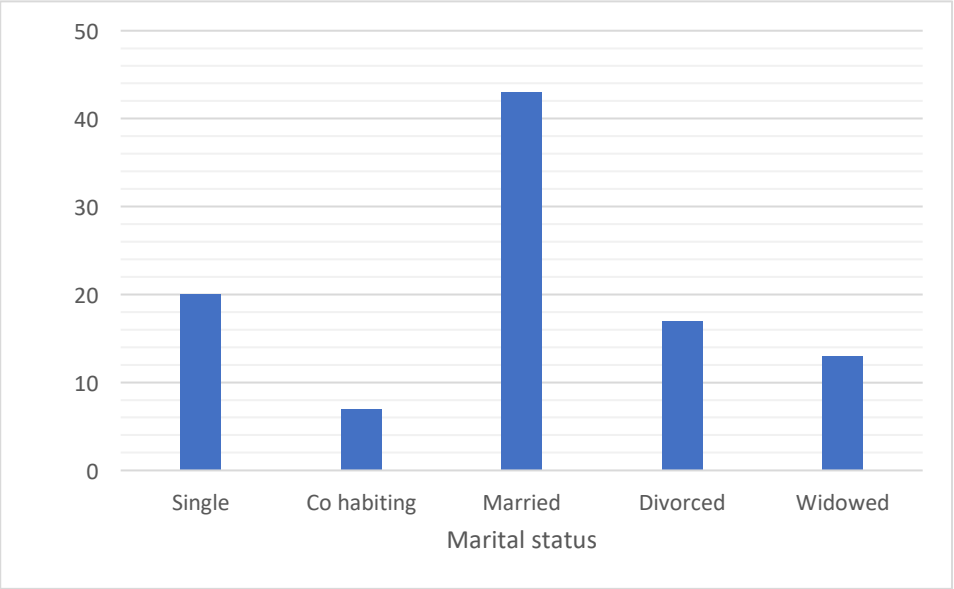

Figure 4.2 Study Respondents' Marital Status

In the combined study population from the villages of Mgedula and Ndumo, 20% of respondents were single, 7% were cohabiting, 43% were married, 17% were divorced, and 13% were widowed (Fig 4.2).

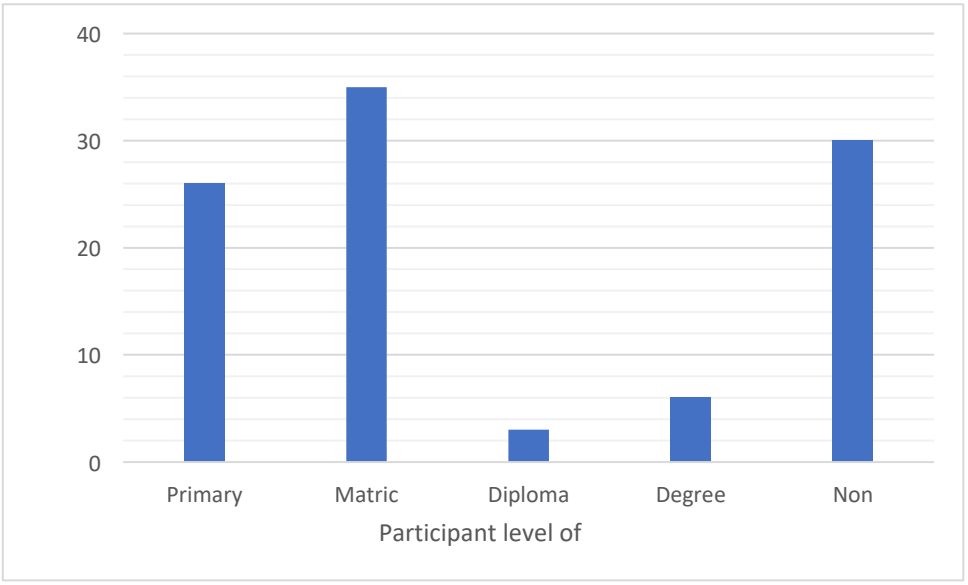

Figure4.3 Study Respondents's Level of Education

Thirty percent of respondents had no formal education, while 26% had completed primary education in South Africa. Additionally, 35% reported having obtained a matric certificate.

Three percent of respondents successfully completed a diploma, and 6% held a degree (Fig 4.3)

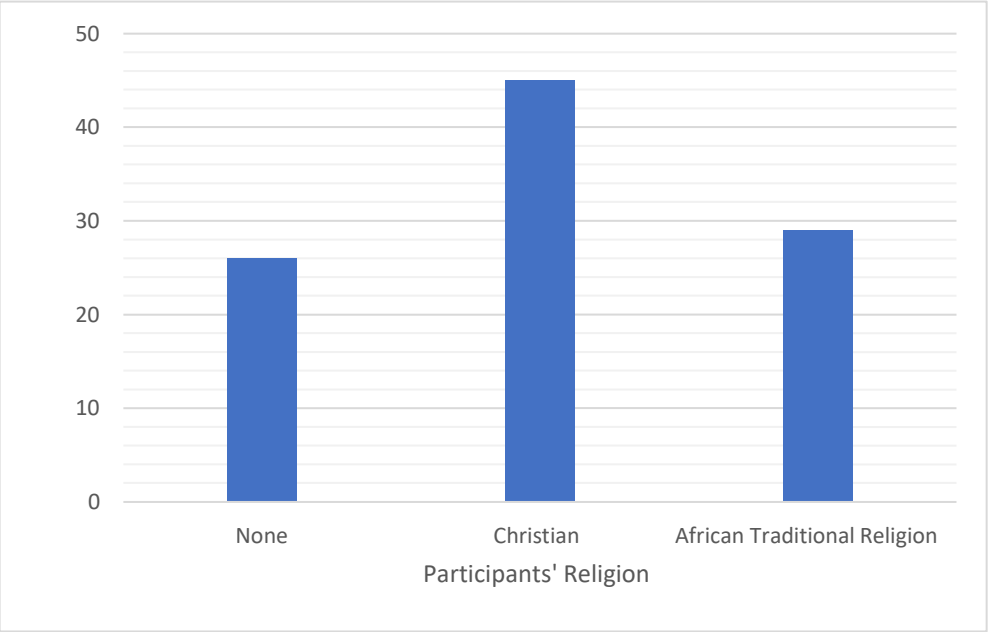

Figure 4.4 Study Respondents 'Religion

The data was combined for the two villages, Mgedula and Ndumo, Christianity was the major single largest religion (45%) while the remainder reported to have no religion and African traditional religion. However, some of the respondents reported that the practised both Aftrican traditional religion and Christianity (Fig 4.4).

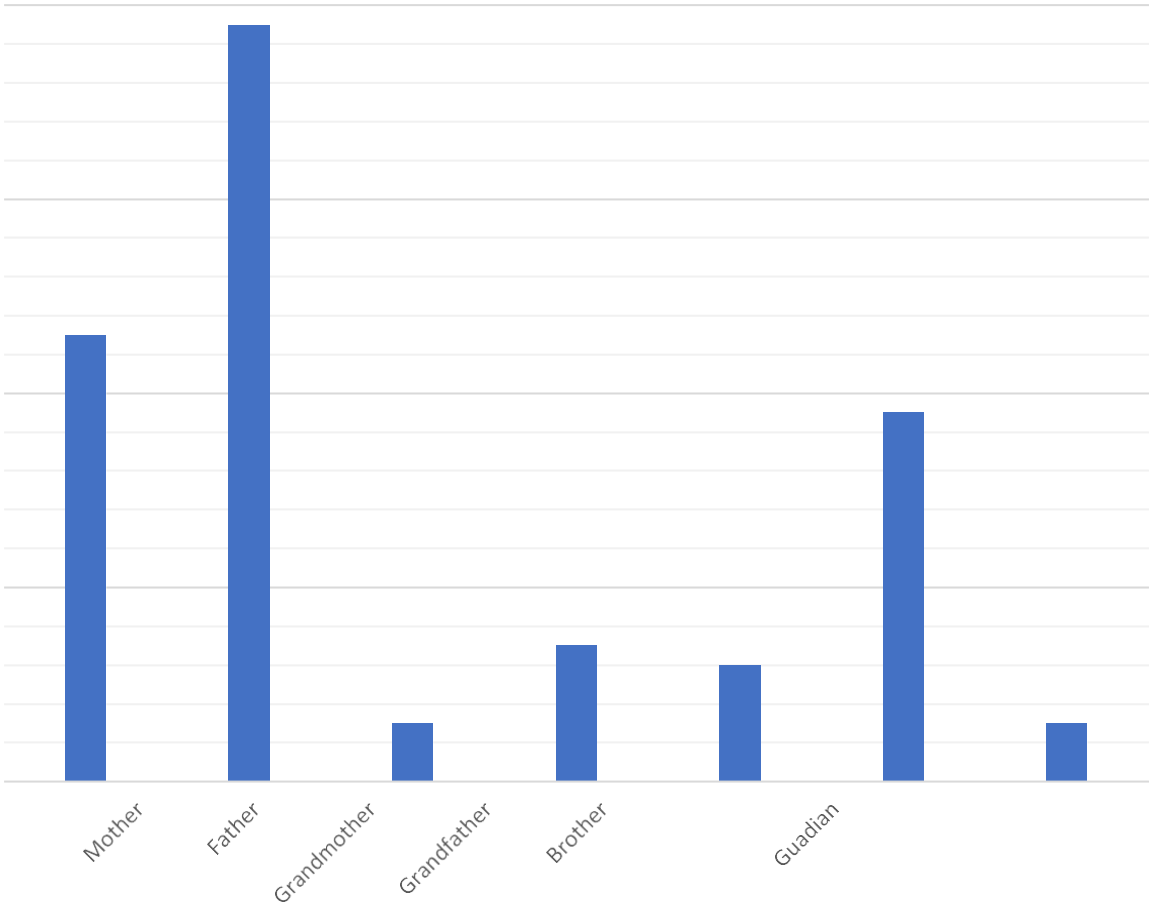

Figure 4.5 Household Head

The majority of the household heads were fathers (39%), mothers (23%) with extended family (grandparents, child headed and guardian) comprising the rest. The fathers are likely to have a position in the community (23%), and mothers (19%) with grandparents and children have lesser key roles (Fig 4.5). Eighty percent (80%) of the respondents reported that they were born in the area with and most of them have been living there from birth. Fifty-two percent (55%) of the respondents are unemployed while sixteen percent (16%) consider themselves self-employed. Forty-five percent (45%) reported that their dominant income is from government grants which included pension while 16% reported that the dominant income is from their self-employment. The rest get their dominant source of income from paid employment activities.

The above demographics show that the study population was fairly distributed for the age groups above 25 years of age (Fig 4.1). These are the age groups that seek to be financially independent and need to be engaged in income generating activities. Thus, it was important to note that at least 30% of the study's respondents do not have any schooling and that the majority did not study past the matric grade. This impacts on their chances of getting

employment in bigger cities and might be the reason accounting for why they stay in the rural areas in order to do self-help projects. The questionnaire showed that the majority of the respondents were not employed. This might push them to undertake agricultural projects for purposes of sustenance.

Most of the households were headed by the fathers and no child headed household was recruited for the study. This exclusion was informed by the fact that age is an important factor in understanding past traditions. A sizeable proportion of the respondents received grants from the government to afford them some form of financial security. This is important in agricultural uptake since an alternative source of income will result in the individuals not taking up back breaking enterprises.

4.3 Factors impacting the utilization of indigenous systems

The questionnaire was administered to determine the factors which impact negatively on the utilization of indigenous systems. This included factors which promote the utilization of these (indigenous) systems and those that discourage its (indigenous systems) use.

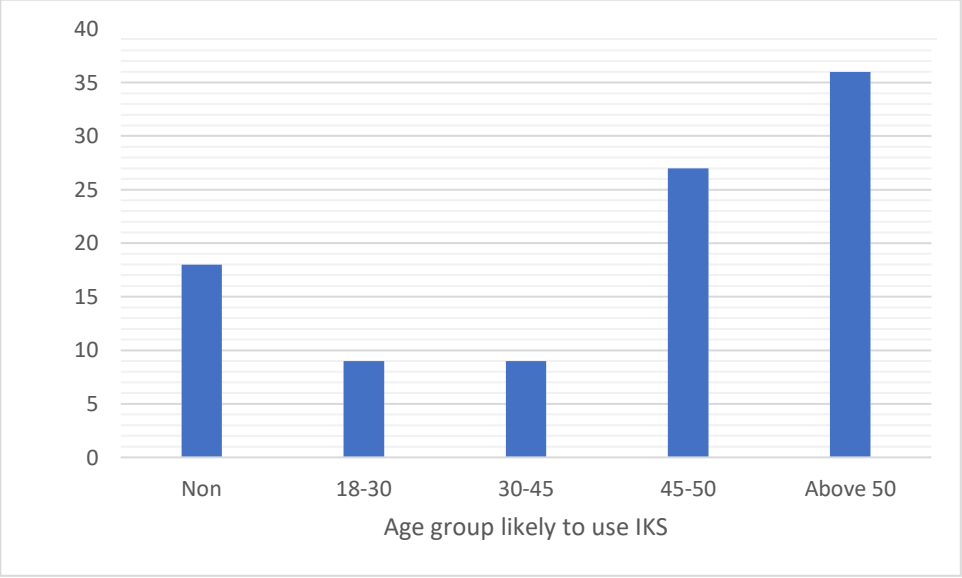

Figure 4.6 Age Groups and IKS Utilisation

The survey showed that members of the community aged above 45 years are likely to use indigenous farming methods compared to those between 18 and 45 years old. The survey also showed that 18% of the population did not use indigenous methods irrespective of age (Fig 4.6).

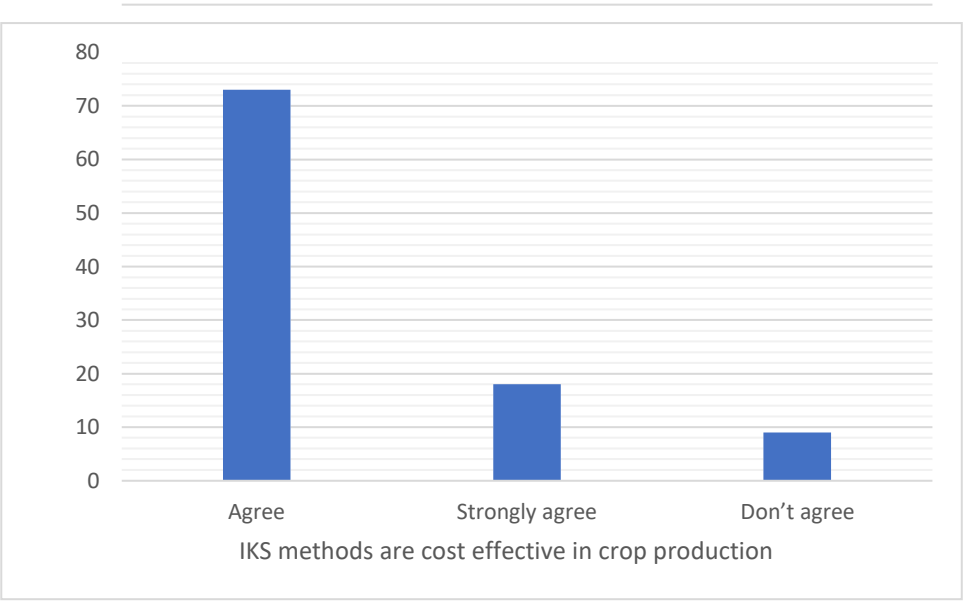

Figure 4.7 Study respondents' Perception of IKS Cost Effectiveness in Crop Production

Seventy-three percent of the study respondents agreed that they use indigenous methods because they are cost effective with a further 18% strongly agreeing. Nine percent of the respondents does not think that indigenous systems methods are cheaper than modern scientific based methods (Fig 4.7). None of the respondents were either neutral or strongly disagreed to the use of indigenous methods.

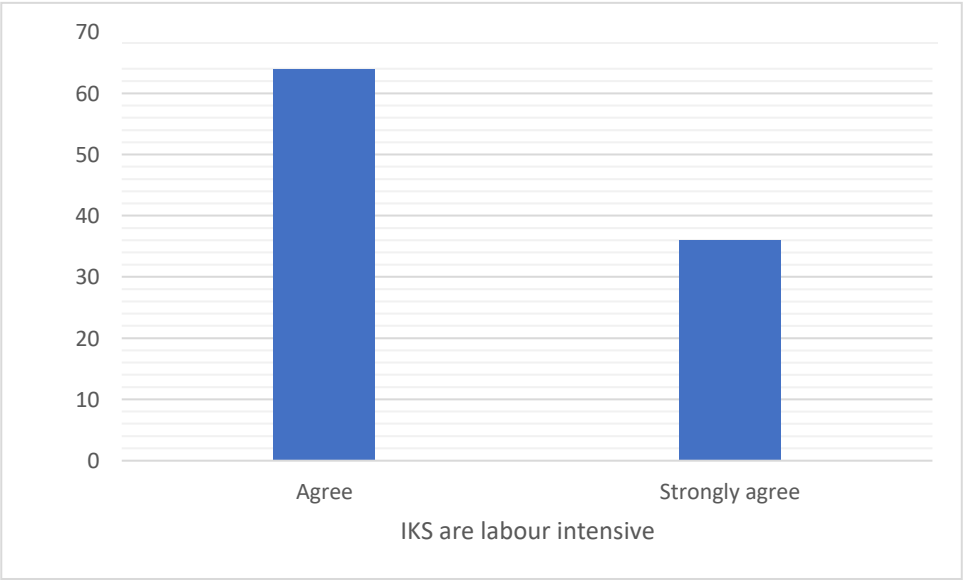

Figure 4.8 Study Respondents' Perceptions of IKS Labour Input

All the respondents are of the view that indigenous knowledge systems provide for

agricultural methods that are labour intensive with 64% showing that these methods are labour intensive and 36% strongly agreeing that these methods were labour intensive 9Fig 4.8). This has implications in the uptake and propagation of indigenous methods when users believe that there are user friendly available methods.

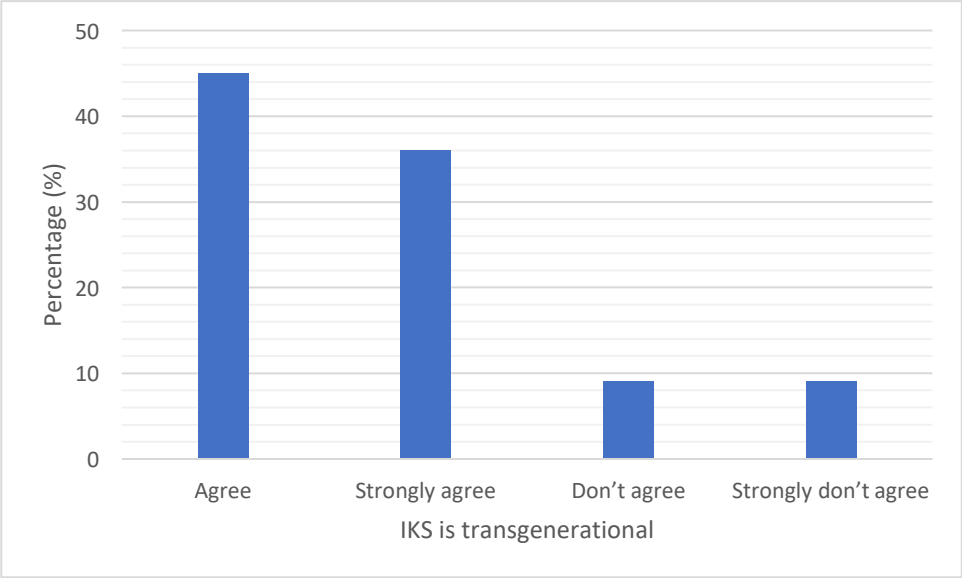

Figure 4.9. Perceptions of IKS Generational Acceptance

A higher proportion of the respondents agree that IKS is transgenerational. Forty-five percent agreed that it is transgenerational, 37% strongly agreed while nine percent did not agree and another nine percent did not strongly agree that IKS was transgenerational (Fig 4.9).

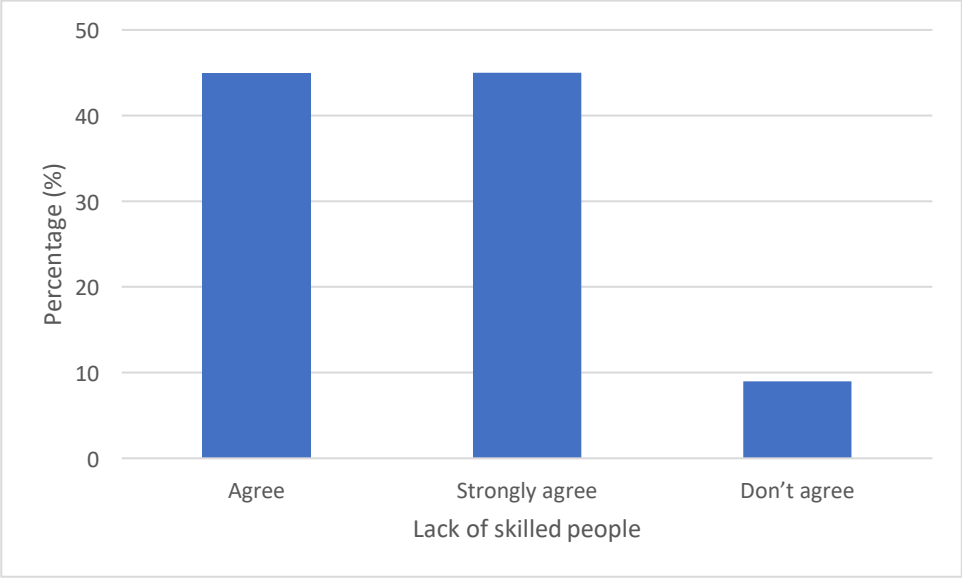

Figure 4.10 Impact of Availability of Knowledgeable Custodians of IKS on Utilization of IKS

The study looked at the availability of the skills in IKS. Based on a five-point Likert scale, 46% of respondents strongly agreed that there is a lack of individuals knowledgeable in IKS, while an additional 45% agreed. Conversely, 9% of respondents disagreed with this assessment (Fig 4.10).

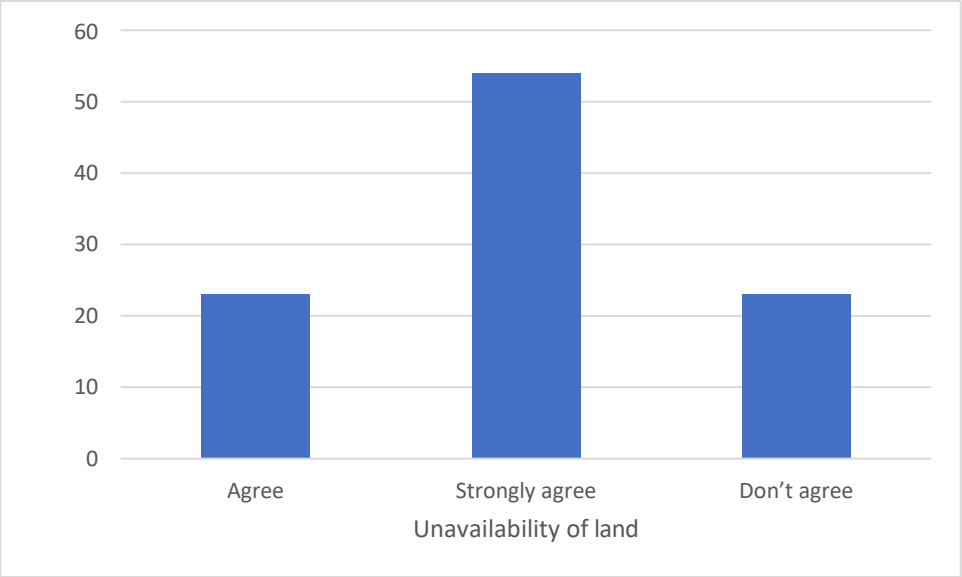

Figure 4.11 Effect of Land Unavailability on IKS utilization

The study revealed that land availability is a factor accounting for the non-utilization of indigenous methods in agriculture. About 20% agree with this notion and other fifty percent strongly agree. Slightly over 20% does not agree that availability of land is a factor impacting negatively on the utilization of indigenous methods in agriculture (Fig 4.11).

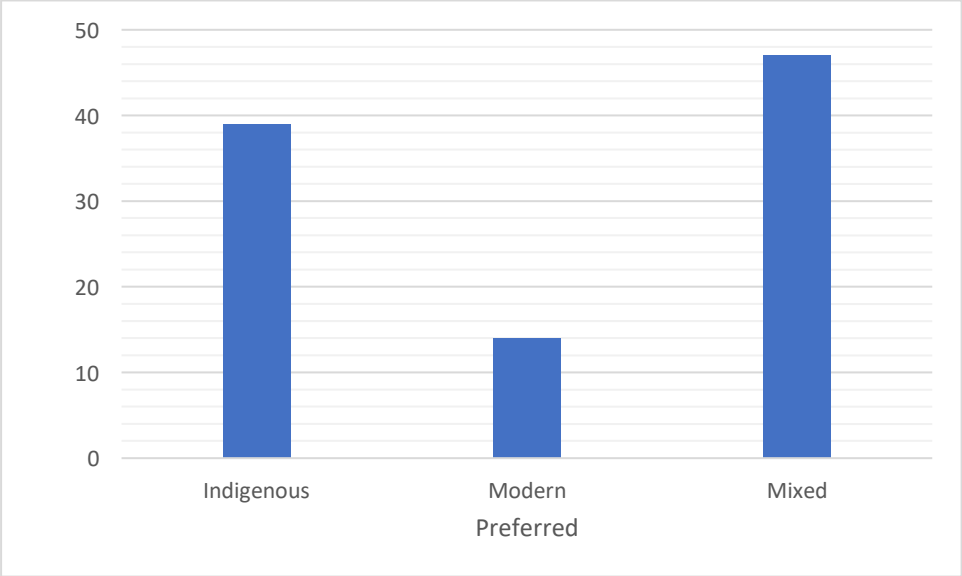

Figure 4.12 Study Respondents' Preferred Choice of Knowledge System

Most of the study's respondents (47%) indicated that they prefer mixed farming methods, while 39% preferred indigenous methods and only 14% preferred modern farming methods. It is important to note that the study area is one of the poorest regions of the country and access to inputs and high-end technology farming is out of reach and this influences the choices the respondents make (Fig 4.12).

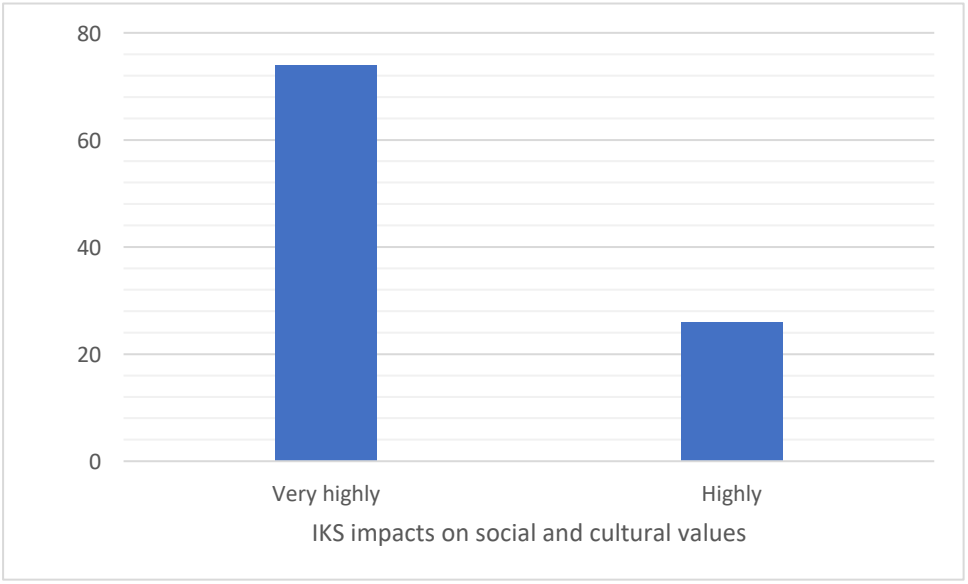

Figure 4.13 Indigenous Knowledge System Impact on Cultural Values

Seventy-four percent (74%) of the study respondents believe that indigenous knowledge positively impacts social and cultural values, rating it as "strongly" on the highest category of

a five-point scale that includes "strongly," "highly," "average," "poor," and "very poor." Additionally, 19% of respondents rated it as "highly" (Fig 4.13).

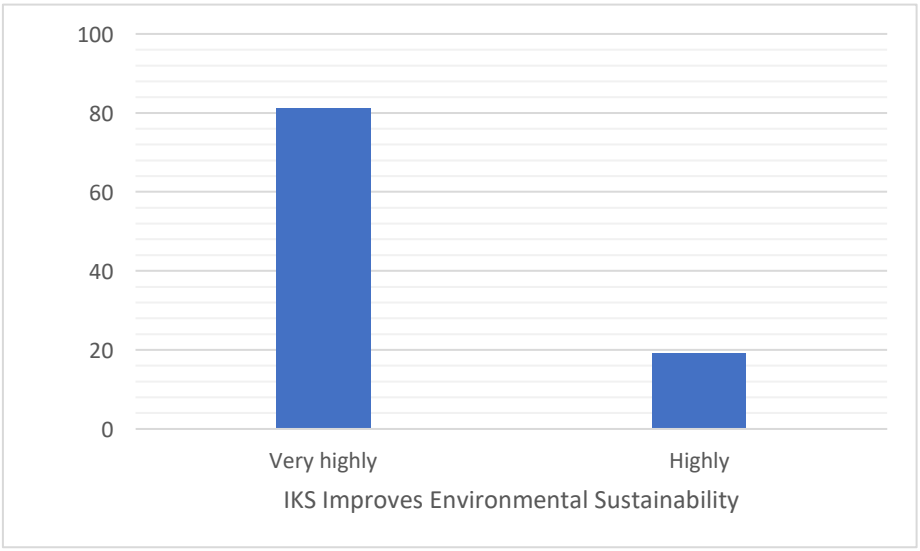

Figure 4.14 Indigenous Knowledge Systems Impact on Environment Sustainability

Eighty-one percent (81%) of respondents believe that indigenous knowledge systems enhance environmental sustainability, rating it as "strongly" on the highest category of a five-point scale that includes "strongly," "highly," "average," "poor," and "very poor." Additionally, 19% of respondents rated it as "highly." (Fig 4.14)

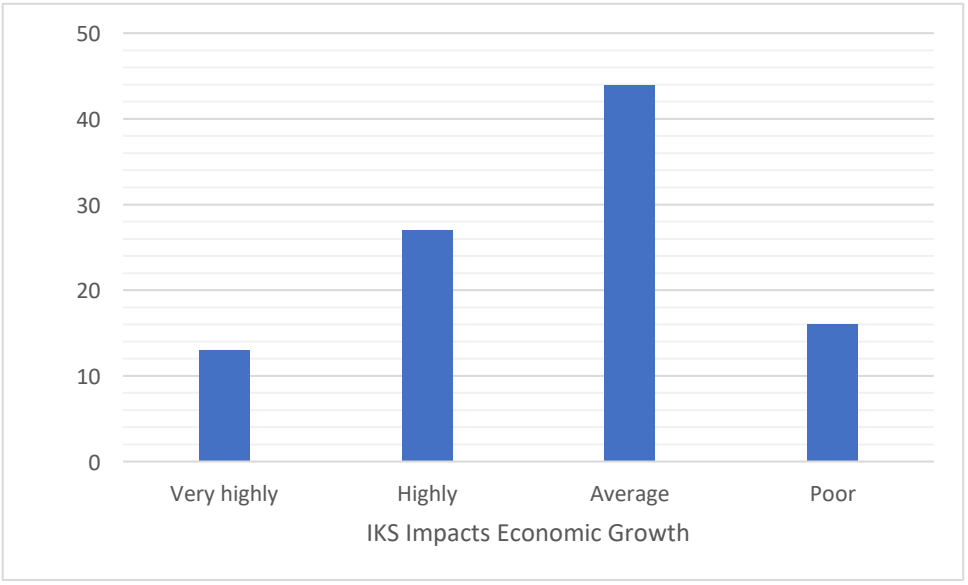

Figure 4.15. Indigenous Knowledge System Impact on Economy

The respondents have very diverse opinions on the impact of indigenous knowledge systems on economic growth. The study used a five scale of very highly, highly, average, poor and very poor. Thirteen percent (13%) of the respondents are of the view that indigenous methods impact negatively on the economic growth 'very highly', 27% highly, 44% average and 16% poor (Fig 4.15).

4.4 Odds ratio

Linear regression analysis revealed no statistically significant difference in the perceived importance of indigenous knowledge based on age, sex, or religion. However, individuals aged 46 to 55 and 56 to 65 were more likely to identify a specific area of importance, with odds ratios of 1.2 and 1.5, respectively, and a confidence interval of 0.05.

4.5 Farming Activities

The discussions, interviews and general observations showed that irrigation of gardens and agricultural activities are cantered on temporary streams that provide drinking water to humans, livestock and also water for household chores and limited gardening activities. Except for periods immediately after the rains, the surface water is limited to a few semi perennial rivers and streams which vary greatly in volume from time to time. During the dry season, these streams become much smaller and usually dry up completely. Ndumo villagers reported more access to piped water although this is not connected for agricultural purposes. Almost all the piped taps in Mgedula are dysfunctional. The Mgedula village have more communal gardens. These consist of fenced plots where individual families have a marked area for cultivation. The people from Mgedula reported that they have more crop fields than those at Ndumo. They are more likely to use animal drawn labour like ploughing and transportation. Donkeys are preferred more and they occasionally use oxen. The gardens are typically close to the river in their proximity and buckets are used to fetch water to irrigate vegetables. The gardens are cultivated during the rainy season when the rivers have flowing surface water and this cultivation is discontinued when the rivers run dry. The vegetables are mixed, traditional and exotic. In contrast, the people in Ndumo cultivate their field crops in the Pongolo plain. The Pongolo River flows from the Jozini River as an ecosystem control. The gates are opened from Jozini Dam annually and this creates a flood during which the main activity is fishing by the Ndumo villagers and some people from further areas. Once the

flood recedes, crop farming commences and vegetable gardens are set up and rely on residue moisture. There are few pump-fed irrigation schemes.

The Ngwavuma River is another major river running from Swaziland through both Mgedula and Ndumo. There is a lot of cropping along its banks and is a major source of fishing activities. This is the only perennial river in the area. The Focus group discussions showed that both villages place a high premium on domestic animals using free range rearing. Cattle are the most animals reared while donkeys, sheep, goats and poultry play an important role. Poultry is used for daily consumption or selling while goats are kept mostly for traditional ceremonies like cleansing, bridal celebration among others. Focus Group discussion 2 in the Mgedula village showed that pigs are also reared using the free-range method.. In both communities there is no confined intensive feeding of livestock relying on the free-range method.

Qualitative data from interviews and focus group discussions

The interviews were transcribed in isiZulu language and translated into English.

4.6 Themes emerging

The following emerging themes were identified and are presented for discussion below. These themes arose from the first two research objectives: (1) What factors limit the use of indigenous knowledge? and (2) How is indigenous knowledge management being applied in the agricultural sector? Challenges in effectiveness of indigenous methods meeting food security.

Objectives one and two highlighted the challenges in the utilization of indigenous knowledge and the factors affecting the effectiveness of indigenous knowledge management in securing food security in the villages in the study area. The sub-themes identified are climate change, government assistance, and high levels of unemployment.

4.6.1.1 Climate change

Climate change is a topical issue and came out strongly in both focus group discussions and key informant interviews indicating that it impacts negatively on in the farming practices of farmers in Mgedula and Ndumo villages. There is general agreement that average rainfall has decreased over the years and dry spells have become more common. The respondents are also of the conviction that flood events (flash floods) have increased over the last decades. They,

however, do not keep records of weather events like commercial farmers following modern methods. The changing seasons make it difficult to predict the length of the rainy season in relation to when to start planting and determining the level of cropping densities. As a result of this, the respondents usually mix crops in the field notwithstanding the fact that a drought year can impact badly on the high crop densities. It is notable, however, that despite these realities they rely on indigenous knowledge holders for most of their predictions and planning.

The indigenous knowledge holders give a hint on soil moisture and fertility using a combination of visual inspection and "touch and feel" methods. This is different from modern methods where instruments are used to determine moisture, soil composition and parameters related to soil fertility. These elders also do visual assessments of livestock for disease identification, mating and birthing. The focus group discussions also pointed out that the dry conditions in the area limit their farming options. This, they suggested, leads to the livestock rearing as the major source of income. They linked the droughts to climate change.

4.6.1.2 Government Assistance

The focus group discussions revealed that traditional grazing methods are insufficient in addressing feed shortages, particularly when livestock herds grow or when new diseases and parasites emerge.. They also suggested the importance of marketing their livestock to external markets to expand capital and the need to increase and improve extension services by bringing in new production skills or knowledge. They compared those farmers working on their own initiative and those on government-sponsored programs like the nearby Makanisi and Ndumo B irrigation schemes. These have ready markets for produce and have water throughout the year and access to extension workers and credit lines to expand. While the irrigation scheme is run by a community committee and wholly owned by the community, the government clears the land and provides the resources for fencing, and prepares the land for farming.

The government provides piped water from the Pongolo River to the fields to the beneficiaries free of charge. Furthermore, the government also provides the start-up inputs and avails technical expertise. The area is under overhead sprinkler irrigation. The members only pay for electricity and day to day running. This model contrasts sharply with the villagers who did not make it into the scheme. It is a green belt showcasing modern technology and farming practices and is run on commercial basis.

4.6.1.3 Employment

All the respondents reported that there is a high rate of unemployment in uMkhanyakude. This results in the younger men and women consider migrating to nearby towns and this impacts negatively on farming activities. Some of these young adults subsequently lose touch and interest in traditional farming methods. Traditional farming is mainly for subsistence and food security and does not satisfy some of the needs of these young adults who rely on cash for clothes, tertiary education and entertainment gadgets. The respondents also mentioned that due to the high rate of unemployment in Mgedula and Ndumo villages, many people in the villages resort to fishing in the rivers especially during the rainy seasons.

The Ndumo community mentioned fishing as a source of income more than the Mgedula community. Fishing utilizes a combination of traditional and modern methods. In the Pongolo river they utilize both motor powered boats and traditional canoes. They also use traditional nets and traps. The men are more likely to use the traditional canoes and motor-powered boats to venture deep into the river. The women use traditional trapping methods and nets to capture fish. The fish is for both household consumption and selling to local and external customers. Diseases and parasites of livestock are reported as the primary nemesis in both villages.

4.6.2 Comparison of indigenous farming knowledge and modernized farming practices

The comparison between indigenous farming knowledge and modernized farming practices highlights key differences and potential synergies between the two approaches. This theme arose from the third objective, which explored the knowledge gap between modernized agricultural practices and traditional indigenous knowledge systems. While traditional methods are deeply rooted in local ecosystems and cultural practices, modernized techniques often focus on technological advancements and efficiency. The study endeavoured to assess the extent to which these knowledge systems differ, identifying areas where a gap may exist, as well as opportunities for integration to enhance agricultural productivity and sustainability. The respondents outlined various farming methods and knowledge systems based on indigenous practices and knowledge as well as modern scientific based farming principles that they are currently using. The respondents were able to show how they perceive weaknesses and strengths in both methods. The sub themes were animal and plant breeding, water resource management, Genetically Modified Organisms (GMOs), substandard imported products, employment opportunities, cash outflow, markets, support services and various farming activities. Research has shown that indigenous knowledge on soil classification can complement scientific methods in soil resource management as there is consonance between indigenous farmers' assessment and scientific approaches (Manyevere et al 2020). Thus, in a study in the Eastern Cape, South Africa, the farmers classified the most productive soils as follows: *umhlaba omnyama* which is soils with mollic properties; *dongwe* (brown clays); *santi* (sandy soils); *isidhaka* (high activity clays); *umhlaba obomvu* (red clays) and *urhete* (stony soils). It is notable that this classification is corroborated by laboratory tests and thus underscores the need to combine indigenous and scientific approaches to render practical management interventions acceptable to farmers. In this study, farmers showed knowledge of soil types as has been described by Manyere et al (2020).

4.6.2.1 Genetically modified foods and imported poultry

The respondents also asserted that food from non-profit organizations and even those from established retail outlets, contained GMOs, which they view as causing community members to have a weak immune system and render people fall sick easily. Having asserted thus, they claimed that their food is healthier and makes their bodies more resistant to diseases.

4.6.2.2 Breeding

The Focus group discussions showed that there is local knowledge in animal and plant breeding. They are also aware of recent advances in scientific based breeding methods that result in improved crop yields, disease resistance and superior animal breeds including genetically modified plants and animals. The respondents pointed out that scientific methods are out of their reach due to financial and technical know-how issues. They therefore do not carry out these methods themselves. They, however, understand local varieties with disease resistance and yield potential for traditional vegetable varieties and crops. The Focus Group Discussion 2 showed that some superstition permeated on those perceived to have better varieties with one member saying *"some people use charms to have high yields"* and that it is common to share 'supper' varieties. There are elders and certain farmers who are custodians of these varieties and it is common for those without the know how to obtain plantlets and seeds from those perceived to have the know-how and stocks for high yields, drought tolerance and disease resistance.

The use of traditional soil fertility enhancement like manure is a common practice. Some traditional rituals were also reported to be able to boost harvests and protection of livestock and crops. For animals, it is common for owners to let heifers graze and mate with those whose bulls are perceived to have superior qualities. The discussions showed that there is planned breeding based on the animal's appearance and attributes. The farmers are well aware of animal pedigree. The physical appearance of the udder and teats, body size, and coat texture are considered to have a role in selecting the cattle. On buying bulls, selection is based on the size of their scrotum with larger scrotum denoting better fertility. The size and attributes of known offspring play a role in selection. These attributes include the length and size of the animal, shiny skin, and the ability to win fights. The farmers keep information of pedigree. For smaller ruminants and poultry, the selection was reported not to be so strict. There appeared, however, to be no planned breeding processes for the small ruminants as the males and females are not separated and are allowed to graze together.

4.6.2.3 Disease management

Local knowledge for disease management is more common for smaller ruminants and poultry compared with disease management for cattle. The respondents cited lack of funds to purchase medicines as the biggest challenge. However, they indicated that they use

herbal/plant remedies to cure their flocks. Aloe Vera is the medicine mainly used by farmers. Those with financial capacity use medicines from veterinary services and the farmers from both villages consider these to be more effective.

4.6.2.4 Roles and Record keeping

There is a clear demarcation of agricultural activities between sexes. The men are more concerned with livestock rearing especially cattle. The men herd cattle and as pastures dry up, they take the cattle to further areas that still have grazing grass. This also includes taking those livestock to the drying floodplains and river beds. The small ruminants are usually left to forage areas around the homesteads and streams unaccompanied. Arguably, this is different from those who utilize modern farming methods as pastures are irrigated or food is brought to farms. The women work on the gardens by irrigating these gardens with river water using buckets and also tend the crops and removing weeds. Also, the women harvest and sell the produce to other villages and occasionally to people working on provincial projects like road development and civil construction. Usually, they combine these tasks with laundry and work together with children.

In parts of the areas along the Pongolo River where water extraction is carried out using portable diesel-powered engines, the men participate more in the gardening and cropping systems compared to the women. The work is more labour intensive and involves changing the pipes and operating the pump. These gardens are more inclined for commercial selling than for food for the family. They are less likely to cultivate traditional vegetables and are more likely to cultivate cabbages, spinach, carrots and chilies. However, record keeping is not a priority compared to what happens in the modern farming methods. The farmers indicated off hand knowledge of the cattle herd (usually around 10- 20). However, they could not remember the number of goats and poultry offhand, preferring to say Focus Group Discussion 1“*many*” for small ruminants and “*very many*” for poultry. “*The hens are all over the yard*”.

4.6.3 Integrated farming management

The theme of integrated farming management stems from objective four, which seeks to determine whether an accessible and transferable knowledge management system for agriculture exists for community members. This theme explores the potential for combining

indigenous and modern agricultural knowledge into a cohesive system, one that enhances knowledge sharing, improves accessibility, and empowers local farmers through a holistic approach to sustainable agricultural practices. It highlighted farming activities and practices that utilize a combination of both indigenous knowledge management and scientific based modern farming methods. The sub themes identified are irrigation, climate change, support services and soil fertilizers. The theme also highlighted the advantages of combining these two systems. They acknowledged modern methods's superiority in animal and plant breeding. Since they have no technical expertise in these methods, they simply purchase superior plant varieties and animals. This they do with advice from government agricultural extension officers. They cited relying on modern scientific methods for serious diseases and ticks. For instance, cattle are dipped to avoid ticks and extension officers are usually consulted for cattle diseases as opposed for smaller ruminants and poultry. These respondents are of the view that the government can do more to assist them with superior plant varieties and animal breeds.

The study found that respondents adopt many strategies to cope with droughts and floods, such as vegetable farming and crop production in the floodplain in the Pongolo basin in Ndumo and Nsunduza Dam in Mgedula village using portable pumps to draw water from the Pongolo river. They also take local jobs that bring in wages, cultivation of drought tolerant varieties, planting late and livestock disposals. They use the cash from the part time jobs to buy better animal breeds and seeds for superior plant varieties.

4.6.4 The Ndumo B Irrigation Scheme: Its Ownership and Origin

The social status of the owners is that of business farmers. The project is owned by the local community members from Ndumo area and managed through a cooperative scheme. The members have an association that oversees the management of the land and address grievances and governance issues through the chairperson. The project started a long time ago with peasant farming which was conducted routinely by the local people who have allocated the portion of land amongst themselves for their own personal farming activities. The area where the irrigation is, was previously a heavily forested site which had few patches of land designated for farming activities. As time went on the villagers started clearing more and more of the land to expand their agricultural activities. In so doing, the area developed into a large farming area with subdivided land portions where family heads would then conduct their farming activities. However, due to the water woes the area was not very productive and the villagers had to rely on natural rain, hence making the farming there a seasonal exercise.

4.6.5 Source of Funding

Upon realizing the persistent water woes in the area, the local government representatives launched a program to facilitate the availability of water to the area. The local representative lobbied for funds to have water drawn from a river and brought to the area to facilitate the irrigation scheme as well as provide drinking water to the area. Hence, the government of South Africa, through the Department of Agriculture financed the irrigation scheme and is responsible for the maintenance of the irrigation facilities like piping, electricity, and motor pumps. The government also provided initial input for financing the fencing, storage facilities and setting up the scheme so as to benefit the local people. A pipeline connected to the Pongolo River brings water to the scheme.

4.6.6 Infrastructure

The area is fenced and contains a piping system that connects to all the fields within the fenced area of the scheme. The scheme is divided into two sections: the old phase and the new phase. The whole system is powered by an electrical pump that facilitates the movement of the water from the river and ensures a smooth up flow of the water towards the garden. The local farmers, however, come together to pay for the costs of the electric pump that drives the water irrigation. Other than the piping and water pump, the area also has storage facilities for

keeping farm implements such as racks and tractor hoes, as well as the tractors used at the scheme. These are housed at a nearby workshop situated on the site of the irrigation scheme. There are no visible signs of toilet facilities in the irrigation scheme.

4.6.7 Method of ploughing

Land preparation and seeding are done using government hired tractors that are available at the site. Weeding involves manual hand-held hoes, with labour provided by contracted local workers to manually work on the land. However, some crops are seeded manually by the hand planting method. The other means of cultivation or ploughing are then done using hoes and other tools usable for the same task. The researcher observed some workers doing ploughing on a paprika field using small hoes and were strategically arranged across the field to maximize the land covered.

4.6.8 Crop management

The most common means of crop management that the researcher discovered at the site was crop rotation by planting different crops in one field. The fields are basically subdivided into sections which contain different types of crops which are then rotated and have their position interchanged on the same plot of land. The crops are just planted regardless of their seasons and they are managed in a way that they can be protected from weather elements and harvested properly when they are ready. The researcher managed to count eleven different crops, tomatoes, maize (green mealies), paprika, spinach, chilies, beetroot, sugar beans, green paper, cabbage and lettuce. The farmers reported using organic fertilizers.

Although the respondents claimed that they knew indigenous cropping methods, they rely heavily on modern methods backed by scientific research. A cultural elder (Interviwee 2) suggested "we *cannot use traditional methods because the harvest is poor*". Another cultural elder from Ndumo (Interviewee 1) reported that"*local extension services personnel from the government come regularly to update them on current agricultural production practices and management. Occasionally, some members are sent to Jozini town for seminars and workshop by government agricultural services personnel. These then disseminate the required information to the rest of the group*". During focus group discussions, respondents reported that while the Department of Agriculture does feasibility studies and advises the people on what type of crops they can plant, the choice lies with individual farmers and that they do not necessarily plant the same crops at the same time.

4.6.9 Beneficiaries in the Project

The interviews and focus group discussions showed that the project benefits the owners of the land and those subletting. They carry out the farming, harvest and sell their crop for profit to the markets as far as Jozini and Richards Bay. Some customers come to the scheme to buy in bulk. Contracted labourers are paid salaries. The farming is run like a business. Most of the farms are run as family business with the family head, either mother or father in charge, working together with their children to manage the plots of land. In some cases, parents give land to their sons or daughters and these become beneficiaries as well.

4.6.10 Size and Allocation of the land

It was reported that the size of the plot was determined by the size of the land owned by the original owner. This differed in size, for example, sizes like 2 hectares, 5 hectares, 10 hectares or even 20 hectares and is that the land is not paid for. The land where the farmers do their farming is not bought or rented as it is cleared and allocated by the first people to do the farming before any irrigation began. The farmers who clear the land allocate it to themselves and share it accordingly. They remain the owners of the land by virtue of having taken the responsibility to clear it for farming purposes. However, due to the growing population and the emergence of younger generations, the heads of the families who own the fields allocate certain portions to their kin who are interested in doing some form of farming. The allocation is hence based on how much the family elder is willing to give the one requesting the land. But the ownership does not change. Those allocated the land are given it on a temporary basis. When the head of the family decides to expand his activities, he simply reclaims that borrowed portion.

4.6.11 Pest/Weed control

This is done effectively by using chemicals. Focus Group discussion 1 held in Ndumo showed that farmers spray chemicals to control weeds and pest. The chemicals used for the pest control are sourced by the farmers themselves and so are the crops that the farmers grow in their farms.

4.6.12 Type of irrigation

The farmers use mostly overhead irrigation and the dripping method. Flooding is not common because the water is in limited supply. Periods of irrigation can vary according to crops and the weather conditions.

The farming methods differed slightly by village. Focus Group Discussion1 in Ndumo showed that farmers were able to access the Pongolo river and some villagers utilised small mechanised (diesel pumps) irrigation equipment while Focus Group Discussion 2 in Mgedula showed that the villagers irrigated small gardens near seasonal rivers.

4.6.13 Perceptions

The interviews and discussions showed that rural-urban migration by the youth created a gap that reduced the effectiveness of the passing of indigenous knowledge from the elderly to the younger generation after them. This is exacerbated by the myths of modern farming which results in the reduced uptake of indigenous knowledge by most communities. The need to make a profit and the lure of modern lifestyles the youth are exposed to in town, television and radio have led the youth to shun the indigenous methods of farming. They consider these to be catering only for subsistence (food and shelter) needs.

Focus group discussions revealed that the limited potential of small-scale farming to uplift the youth from the villages has made agriculture an unpopular option among younger generations. Some participants mentioned that they would prefer working as casual labourers and earning a salary rather than viewing farming as a viable path to financial security. They pointed to contractual jobs in the booming construction and road development sectors around the Ndumo area as more attractive options than local agriculture. Additionally, some respondents did not prioritize food security through self-cultivation, preferring instead to earn a salary to purchase food. This perspective, they explained, is one reason for their lack of interest in investing in and utilizing indigenous agricultural knowledge. The exposure to basic education up to matric is considered as a step that should take the youth from the village to greater heights. It is notable, however, that the youths consider the Ndumo B irrigation scheme as a model that they would highly consider if the government availed it to them. All the respondents are of the view that indigenous farming methods are not attractive due to their labour-intensive nature.

4.7 Summary

This study was carried out in two villages, Mgedula and Ndumo, in uMkhanyakude District, KwaZulu-Natal province in South Africa. Five focus group discussions, six key informant interviews and sixty-six questionnaires were carried out to determine the farmers' knowledge and attitudes on indigenous farming methods and modern scientific based methods. The Mgedula village has more communal gardens and field crops than those from Ndumo. They are more likely to use animal drawn labour for ploughing and transportation. The gardens are typically close to rivers and are cultivated during the rainy season when the rivers have flowing surface water. The vegetables are mixed and as such comprise both traditional and

exotic crops. In contrast, the people in Ndumo cultivate their field crops in the Pongolo plain whose moisture regime lasts longer. The main activities include fishing, gardening and field crops.

Although the farmers acknowledged that traditional methods of farming are vital for food security especially for resource constrained farmers, they did indicate that some indigenous methods are now difficult to utilize due to droughts and this necessitates the introduction of engine powered irrigation. The Ndumo B irrigation scheme contrasts sharply with the surrounding farming activities. It is an all year green belt run using modern farming and business approach with access to extension workers and finance.

CHAPTER 5

Discussion

5.1 Introduction

This study sought to determine the use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in the province of KwaZulu-Natal. Thus, the study explored not only the underlying factors impacting the utilization of the indigenous knowledge system but also those factors which affect the effectiveness of indigenous knowledge management in the agricultural sector. During this investigative inquiry, a comparison between the modernized and the indigenous knowledge management in agriculture was carried out. An integrated agricultural system which can be more accessible and transferable to most parts of the rural community in combating poverty was also investigated. The study also gauged the farmers' knowledge and attitudes on indigenous farming methods and modern scientific-based methods.

The key themes of this study emanated from the data related to the objectives. Therefore, the data analyzed and interpreted contributed to the key themes. This chapter, therefore, presents not only the discussion of the findings of the study but also deals with the implications thereof. It has been established that the idea that indigenous knowledge is static and unchanging is difficult to sustain. This results in the overemphasis of erroneous notions such as the unchangeability of indigenous knowledge. This often leads to the rejection of the indigenous knowledge system when the much desired results are not obtained. It is important, therefore, to consider the indigenous knowledge system as fluid and constantly changing, reflecting renegotiations between people and their environments (Sillitoe, 1998). Bebbington (1993) demonstrated that knowledge acquisition is dynamic and constantly evolving, with people willing to embrace new ideas as long as they maintain control over how these ideas influence their modernization. This is particularly important in the context of globalization, where new approaches and innovations continually interact with indigenous knowledge systems.

5.1 Indigenous Knowledge Systems

This section discusses the findings and implications of the study. The discussion derives in particular from the scholarly insights drawn from the analysis of the data together with the literature reviewed. Thus, in the literature reviewed, the researcher probed into the nature of

indigenous knowledge systems especially when compared to scientific knowledge. It has been established that traditional modes of knowledge transfer in the communities which were under investigation in this study require direct contact between the person transmitting the knowledge and the person receiving it. Notably, this mode of knowledge transfer has been rendered minimally relevant as a result of the reduced one-to- one contact. In light of this, there is a need to preserve culturally unique knowledge for future generations (Reitsma et al, 2013).

It can be inferred from what has been said above that as a consequence of Indigenous Knowledge being not documented, "useful information that can be exploited to enhance, for example, food security, is lost from one generation to another" (Ponge, 2013 p31). Kamwendo and Kamwendo (2014) are of the view that since knowledge is being lost around the world and in particular in rural communities, there is an urgent need to conserve indigenous knowledge to help develop mechanisms to protect the earth's biological diversity. It is further argued that as communities we need to take cognisant of the dire social consequences of losing indigenous knowledge (Kamwendo et al, 2014). In light of this, therefore, there is an objective necessity that the dichotomous divide that currently privileges one knowledge system over the other be reoriented towards construing the two seemingly opposed theoretical models as complementary to each other.

Currently, oral tradition which is characteristic of indigenous knowledge systems is accorded an inferior status relative to the written tradition which is construed as being amenable to Western systematic scientific investigation (Kamwendo & Kamwendo, 2014). Thus, to forge the recognition of complementarity between these opposed epistemologies, the privileging of one mode of knowledge transmission needs to be negated. By so doing, an interface between the two seemingly diametrically opposed knowledge systems can be forged and recognized. As argued by Davis (2006 p157) "the divide-imagined, perceived or invented between indigenous knowledge traditions can be crossed by considering different ways of thinking, talking and writing about environmentally based practices". This has the potential of translating into recognizing the value of indigenous systems of knowledge and this in effect will be a critical step (if it materializes) towards greater appreciation of the plurality between and among different traditions (Dei et al, 2000) Advocacy of the plural approach to knowledge systems is best articulated by Shiva's (2000) argument that if this plurality and complexity are better understood and respected, bringing the gap between different knowledge systems is more likely to occur. In substantiating to recognize this plurality, Shiva (2000 p55), further asserts in no uncertain terms that:

‘It is now generally recognized that the chemical route to strengthening agriculture and health care has failed and must be abandoned. This provides us with an opportunity to re-evaluate indigenous knowledge systems and to move away from the false hierarchy of knowledge systems back toward a plurality. The pluralistic approach to knowledge systems requires us to respect different systems and to embrace their own logic and their own epistemological foundations’.

Thus, in further substantiating for the recognition of the plurality of knowledge systems, Shiva (2000) argues that it is essential to recognize that the Western system should neither be viewed as the sole scientific standard for all knowledge systems, nor should diverse systems be forced to conform to the framework and logic of Western knowledge..In this approach, therefore, adopting multiple epistemologies constituted of indigenous, western, scientific and others occupies the central position (Dei et al, 2000). Therefore, the development of recording devices that fit indigenous communities’ oral tradition is important since IKS is characteristic of indigenous knowledge and specific to a culture or community and that this consists only of currently relevant knowledge which is shared between successive generations in a socially segmented manner (Shiva, 2000). It is important to note that the reviewed literature points to numerous capacitating factors which influence sustainable agricultural development as explained by Li et al (2021) as follows:

(a) The Level of Economic Development: A low level of economic development in a country makes it difficult to provide sufficient support for the sustainable development of agriculture in terms of facilities, technology, and basic necessities.
(b) Financial Expenditure for Agriculture: Agriculture needs financial support from the government through subsidies, compensation, and other means.
(c) Agricultural Labour: Force Agricultural labour is the foundation of agriculture and the existence and development of the entire national economy and society.
(d) The Intensity of Agricultural research and development Investment: Technological advancement is important in in agricultural growth and development in environment, resource utilization, and protection. This is crucial in transforming traditional agriculture into a sustainable development mode.
(e) The Level of Agricultural Informatization: This is important in transforming agriculture from a traditional industry relying mainly on oral tradition and experience to modern industry relying on new technology. This will result in strategic adjustment of the rural economic structure, high agricultural production capacity and sustainable development capacity.

5.2 Ndumo B Irrigation

As noted from the literature reviewed in this study, agriculture has changed dramatically since the last few decades. Crop and animal production has increased significantly due to new technologies such as mechanization, increased chemical use, specialization and government policies that favoured the maximizing of production and the reduction of food prices (Clark, 2018). These have made it possible to produce more food at lower prices and smaller land areas. The South African Framework for the development of smallholder farmers through cooperatives' development suggests that smallholder agricultural growth will not be achieved without access to support services (DAFF, 2012). Thus, increasing agricultural productivity requires that all the problems existing at any given time simultaneously be addressed. The framework further suggests that farmers should be moulded into cooperatives through which growth in smallholder farming could be enhanced thereby creating long term food security, job opportunities and income to reduce poverty, unemployment and high levels of inequality with the view of accelerating empowerment and development for the benefit of the previously disadvantaged majority. These cooperatives will much easily share indigenous and modern knowledge systems (DFFF, 2012). The Ndumo B model suits the aims of the South African framework for the development of smallholder farmers the development of cooperatives.

5.3 Integrated Management

As stated earlier that the view of indigenous knowledge as an untainted, pristine knowledge system is unhelpful, it cannot be assumed that all indigenous knowledge will necessarily provide a sustainable answer to the production challenges in the poor rural communities. This study demonstrated the importance of both IKS and modern scientifically based methods of production. Notably, adoption is usually driven by cost, expertise and culture. In this study, age was shown to be a factor in driving adoption of a farming method. The survey showed that members of the community aged above 45 years were likely to use indigenous farming methods compared to those between 18 and 45 years old. While on the one hand it may mean that the older generation was more knowledgeable of indigenous methods, on the other hand it may be that the younger generation encountered modern methods in a particular educational curriculum.

In concluding this section, it needs to be noted that the focus of the discussion has been on the need to conceive of the two knowledge systems namely, the Western and the indigenous, as being complementary to each other. Thus, it is worth noting that the divide between the so-called Western, rational, instrumental and scientific discourses and actions and indigenous epistemologies has been based on a perceived dichotomy between the scientific and (Maila and Loubser, 2003) the indigenous approaches. It can be argued, therefore, that integrating or harmonizing the different traditions and epistemologies requires collective approaches to caring for, nurturing and maintaining land and ecosystems (Bohensky and Maru, 2011)

5.4 Summary

Indigenous knowledge is used at the local level by communities as the basis for decisions pertaining to food security, human and animal health, education, natural resource management and other vital activities. Indigenous knowledge is a key element of the social capital of the poor and constitutes their main asset in their efforts to gain control of their own lives. For these reasons, the potential contribution of IK to locally managed, sustainable and cost-effective survival strategies should be promoted in the development process (Gorjestani, 2000). Arguably, it can be an important tool towards ensuring the sustainability of the societal development of the local communities.

Well understood indigenous knowledge practices have many social and economic benefits. To this end, Information and Communications Technology (ICT) plays major roles in improving the availability of indigenous knowledge systems and enhancing its blending with modern scientific and technical knowledge (Hunter, 2005). Thus, proper application of ICT is essential in stimulating the flow of indigenous knowledge and the incorporation of modern scientific and technological understandings to traditional knowledge. The literature relevant to Indigenous Knowledge Systems demonstrates the importance of this knowledge and that although indigenous and scientific knowledge systems share certain characteristics, they also exhibit significant differences in various aspects (Mazzocchi, 2006). The differences between indigenous and scientific systems notwithstanding, there are certain identifiable characteristics said to be common to all types of indigenous knowledge. These include the following:

(a) The holding of communal rights and interests in knowledge.
(b) A close interdependence among knowledge, land, and spirituality.
(c) The passing down of knowledge through generations.
(d) Oral exchange of knowledge, innovation, and practices according to customary rules and principles.
(e) The existence of rules regarding secrecy and sacredness that govern the management of knowledge.

Thus, “the idea of a divide between indigenous knowledge and Western science has been founded on the view that Western science and allied systems of knowledge have formed a dominant discourse that has obliterated, marginalized or assimilated local, traditional and indigenous traditions and discourses.

The importance of indigenous knowledge has been demonstrated in previous studies despite mainstream academics continuing to assimilate it into Western perspectives of managing

nature (Mistry and Berardi, 2016). Of importance to note, therefore, is that involving local farmers in policy formulation for improvement of animal and crop production allows for these local farmers' experience, knowledge and practices to be integrated with modern scientific methods. This allows for the development of resources at their disposal. It is, therefore, crucial to encourage participatory research involving farmers for development of technologies, management innovations and the generation of new coproduced knowledge that can be adapted effectively at the local level (Nakashima et al, 2012). This study was embarked upon with the view of establishing the extent to which indigenous knowledge management systems and modern agricultural technology can be adopted as viable resources in combating poverty in rural community settings in uMkhanyakude District in the Province of Kwa Zulu Natal in the Republic of South Africa. Thus, suggestive arguments have been advanced to the effect creating a forum for interaction between scientists and indigenous knowledge holders with the view of tapping into this vast hotbed of knowledge while also demystifying conventional science is an objective necessity (Nkomwa et al 2014). This, it is argued, will capacitate indigenous knowledge holders to participate in agricultural development.

This study showed that farmers are aware of their situation and are capable of doing the Strengths, Weakness. Opportunities and Threat (SWOT) analysis for different farming methods. It is, arguably, important that any intervention or program aimed at improving their food security situation must be conducted with the local indigenous knowledge holders and community leaders be actively involved to encourage buy-in, trust and ownership at the local level as suggested by Westgate el al (2016). Both interviews and focus group discussions showed that older farmers were not happy with the situation where indigenous knowledge was shunned by the younger generation. The Department of Agriculture's extension workers are constantly reinforcing newer modern methods and do not give much time to individual farmers using small scale indigenous methods. This impacts severely on the uptake of indigenous methods by the upcoming generations. The indigenous methods mostly focus on food security by providing a source for food for the families carrying out the cropping ventures which have become a common practice. This fact notwithstanding, the focus group discussions showed, however, that younger people want something that had commercial benefits to give them access to other amenities. This includes, among other things, money to buy clothes, groceries, travel, medication and education. This renders the concept of subsistence farming associated with indigenous farming to be less attractive to the youth.

As it has been shown, high post-harvest food losses occur due to the limited food preservation capacity which impacts on the security of food and nutrition in the developing countries of Africa where seasonal food shortages and nutritional deficiency diseases are still a major concern (Okoye and Oni, 2017). In this study, while key informants knew about indigenous methods for food preservation, they attributed low uptake to loss of specific knowledge on some aspects of the methods in the younger generation. Reliance on easy access to refrigerated goods from shops was also cited as a factor. However, in these particular households, there is no connectivity to grid electricity and households can benefit immensely from traditional food preservation. However, indigenous knowledge need to be seen to be relevant to survive and perpetuate. It must be adapted to solve current problems. For example, the South African government notes that most small-scale farmers, the majority who use indigenous practices do it at a subsistence level and household consumption (DALRRD, 2023), However, current agricultural practices tend to involve a business component to attract money for day to day survival (Rubhara et al, 2020). Thus, indigenous agriculture must be repackaged to include a component of commercialization.

Given the health benefits associated with African diets, it is possible to have their products sold at a higher price to people who are conscious about their diets as it has been shown in organic marketing in the Western world. In this case, extensive marketing is important and the Department of Agriculture may be expected to shoulder the major overheads or coordinate the marketing. This is likely to allow a small product produced at a small area to acquire more value. The uptake of indigenous farming practices is also hindered by lack of popularity due its association with old age and illiterate aging parents. This is not attractive to the younger generation who went to school and learned about ‘sophisticated’ jobs that bring money and most youngsters wish to find a way out of the village. The curriculum needs to be repackaged and present the indigenous method in a ‘smart’ way as people in Western countries have packaged organic farming to make it attractive with the view of instilling confidence in African solutions and way of life.

The shifting climatic conditions and diseases have also been identified as making it difficult to continue and sustain indigenous farming methods. Droughts have become more common and diseases brought by exotic crops and density pressures on animals have increased at a pace faster than the farmers’ adaptation ability. This scenario opens for the blending of both indigenous and modern farming methods. For example, water-conserving methods like drip irrigation can be advocated in the traditional gardens. Water harvesting and storage techniques

can also be advocated for. This involves capturing rain water and having it stored in storage tanks near the gardens. Research into these possibilities is important and can be spearheaded by research institutions, universities, the department of agriculture with the participation of local farmers. Engaging farmers in data collection, known as citizen research, plays a crucial role in enhancing the understanding and application of indigenous science. This approach empowers local communities to contribute valuable insights, thereby strengthening the integration of indigenous knowledge with scientific methods to address agricultural challenges (Bonney et al., 2016).

This study highlights the importance of integrating modern scientific based and local indigenous farming methods as the respondents indicated that both have limitations and strengths. This has also been suggested by several studies (Ponge 2011; Notsi, 2012; Grey and Manyani, 2020). as being important for food security at the local level. Working with community members to collect research data is important in improving their research capabilities and being advocates of the new field called citizen research (Dickinson et al, 2012).

In 1997, a Malawian community nurse and a Canadian soil science student interviewed families whose children were admitted to the Nutrition Rehabilitation Centre at Ekwendeni Hospital. They wanted to learn what had led to the severe malnourishment of children in their region in northern Malawi. The stories they heard from the community had a similar refrain – families were no longer able to afford the rising prices of commercial fertilizers (Kerr et al 2012).

Arguably, the above statement rings well with the uMkhanyakude communities as it shows the difficulty of obtaining inorganic fertilizers for those who wish to use commercial fertilizers. This then necessitates that there be home grown alternatives. It is notable that although indigenous cropping systems make use of organic fertilizers like animal manure, they suffer from reduced crop density. Currently, the Ndumo B irrigation scheme cannot accommodate any more farmers and the only options are leasing, borrowing, and renting. Since such arrangements are generally informal, the farmers have no security of tenure.

Related studies conducted in Makhathini, approximately 50 km from Ndumo, found that agricultural producers in and around the two areas share similarities. The studies identified five distinct categories of farmers: scheme irrigators, independent irrigators, home gardeners, community gardeners, and non-irrigators, reflecting comparable agricultural practices in both regions (Phakathi and Wale, 2018; Chipfupa and Wale, 2018).

This partly explains why irrigated crop production was found to be the second most important source of income for the farmers sampled, with temporary employment, livestock, remittance, arts and craft, rain-fed crops and permanent employment being lower in the order of importance.

For home and community gardeners, farming is mainly a source of food as opposed to it being used for income generation purposes (Matthews, 2017). It is notable that achieving food security and empowerment will need several strategies which includes, among other things, government intervention. As in the Ndumo B scheme non-profit organizations this will motivate people and thus instill a deep desire in the people to develop themselves and their area as described by Matthews (2017). Thus, it bears repeating that according to Matthews (2017), "it is common knowledge that farmers working in the same community – with similar resource endowment and faced with similar institutional and infrastructural constraints adopt different strategies and thus respond differently to incentives which call for different interventions to achieve different livelihood outcomes. Of importance to note, therefore, is that while some take advantage of opportunities when they arise, others do not. It is also notable that while some wait and expect the government to do everything for them, others make their own effort and decide on their destiny, act and mobilize available resources. Furthermore, while some are confident in farming as a means of supporting household livelihoods, others are not with some giving up easily when faced with challenges as opposed to others that do not."

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The aim of this study was to determine the extent to which the use of traditional indigenous knowledge management and modern agricultural technology is a viable resource in combating poverty in two villages of Ndumo and Makhanisi of uMkhanyakude in the province of KwaZulu-Natal. The findings highlighted the underlying factors impacting on the utilisation of indigenous knowledge system and its effectiveness in the agricultural sector given the fact that the sector has undergone modernization. Thus, the study investigated the viability of an integrated agricultural system which can be more accessible and transferable to most parts of the rural community in combating poverty. The study also showed what knowledge the farmers have and their attendant attitudes towards indigenous farming methods and modern scientific based methods. This chapter, therefore, sums up the points raised by the research findings and thus draws conclusions based on the outcomes of the questionnaires, focus group discussions and interviews administered to the respondents.

The gradual waning of indigenous knowledge systems represents the basis for major rethinking towards harnessing indigenous epistemology that can potentially help with insights on how to alleviate food shortages in rural households (Garutsa & Nekhwevha, 2019). Western science has been identified as a factor informing the marginalization of local indigenous methods as it has been observed in a study that involved gendered indigenous knowledge utilization (Garutsa & Nekhwevha, 2019). This, therefore, necessitates that culturally unique knowledge be preserved for future generations (2013). Thus, as part of the response to this undesirable situation, there is need to seek out a new synthesis of traditional methods and modernist ones. This synthesis derives its support from the view, among others, that “overlooking indigenous knowledge of farming practices, processing, preservation and storage of crops may create negative attitudes towards modern methods” (Matsa et al, 2013 p244).

The significant role of traditional knowledge is acknowledged through its influence on agricultural science and natural resource management, as evidenced by the growing integration of traditional practices in modern ethno-science research. (Ihuah & Ojomo, 2022).

As such, the International Council for Science notes that traditional knowledge provides scientific insight into crop domestication, breeding and management (ICSU, 2002).

It is important to acknowledge that while indigenous knowledge has been recognized as a viable method for food preservation and storage, it is often regarded as inferior to modern techniques and technologies, such as chemical-based solutions, for instance, in Malawi, there is social stigma surrounding some traditional food preservation and storage practices. (Kamwendo & Kamwendo, 2014). In advocating for the usefulness of traditional knowledge it is argued that "using indigenous knowledge in food processing and preservation" and that "indigenous processed food products contribute to promote nutrient content and diversity and hence improve the health of rural populations" (Ibnouf, 2012 p244).

In this study, the participants did not show that they documented indigenous methods for their preservation, a concern reported in other studies (Ibnouf, 2012). Thus, while an element of mixing traditional methods and scientific based methods was observed, there were no structured attempts to study how the integration of scientific-based methods and those that have indigenous origins can be implemented. It appeared from the researcher's inquiry that cost was a major push for the choice of method by farmers.

Educational level was also a factor as newer scientific-based methods appear to have been picked up in school or other interactions and may have been used as a way to demonstrate social status. In terms of their nutritional value, indigenous foods are deemed to have the nutritional equivalent of introduced vegetables and cereals and in some cases are superior to them (Ibnouf, 2012, Matsa et al, 2013). Although gender relations and discriminatory traditional practices have been recognized as contributing to the decline of local indigenous methods, this study did not highlight gender as a theme and did not further exploration of this aspect was beyond the scope of this study.. As argued by Garutsa et al (2019), African epistemologies with the potential of improving the lives of Africans should be revisited and rebuilt.

Arguably, the Ndumo B irrigation scheme can serve as an information hub for modern scientific-based agricultural technologies accessible to the local farmers. The Department of Agriculture can lease demonstration plots that can be used to experiment and display both modern and indigenous farming practices side by side. This can be used as an informal training centre for new technologies and indigenous practices for farmers in the community. This is likely to have a buy-in from the community and can result in the documentation, preservation and promotion of indigenous methods and move away from the current dissemination of indigenous methods by word of mouth. The demonstration plots can also be

used for showcasing current and new technologies for sustainable farming that suite the area. For instance, demonstrating water-efficient irrigation technologies, such as drip irrigation, can significantly influence and encourage adoption in similar drought-prone areas like the surrounding villages in the Jozini area. Similarly, showcasing disease-resistant crop varieties could be equally impactful. Regular field days can further enhance the appeal of agriculture, particularly among youth who often view it as an outdated means of survival.

6.2 Integrated Management

The results emanating from this study support the suggestion that integrating local indigenous knowledge in developing localized relevant strategies in improving agriculture is important in rural communities such as those found in South Africa. Thus, indigenous farming methods must be promoted alongside scientific based methods in the cultivation of African indigenous vegetables and where these methods offer advantages in adaptability and sustainability. The extension services have to popularize agriculture by repacking the indigenous methods to be rendered relevant in the current situation. There is no doubt that the resources are poor as they still depend on small scale less intensive methods relying on indigenous knowledge base. Increasing access to these repackaged indigenous methods will boost production and increase food security which is currently threatened.

It is important to note that while there is no specific software designed for indigenous knowledge towards IKS's preservation and management as described by Stevens (2008), some attempts have been made by different projects to set open resource software tools to enable indigenous communities to protect their unique cultures and knowledge through digitization. While it is desirable to capture IKS using modern digital technology, not all aspects of living traditions of indigenous knowledge can be captured as 'artefacts' using digital devices. Drawing this discussion to a close, it can be summarized that indigenous knowledge systems play an important role in agriculture and food security. Additionally, it plays an important role in the life of farming rural communities where affected communities have been able to adapt both methods to suit their circumstances. Respect for local innovations and improving the exchange of traditional knowledge is essential.

6.2.1 Fourth Industrial Revolution

The duality between social and technological innovation and the discussion of social innovation in the context of 4IR is critical. This should shed light on its potential to contribute meaningfully to human life instead of focusing on the potential dark side of job

losses, human substitution by technological innovations, end of privacy and the potential loss of human control. The social perspective demonstrates that technical innovations are likely to positively affect the diffusion of social innovation and vice versa. Hence, ventures that succeed in Industry 4.0 will be those that offer both social progress and economic benefits (Morrar et al, 2017).

6.3 Recommendations

It is important to actively involve indigenous knowledge into extension programs. Participation of farmers in teaching and assisting their peers is part of Ubuntu and dates back to time immemorial. Agricultural extension workers should closely work with respected leaders in disseminating and strengthening indigenous farming knowledge infused with scientifically researched mainstream practices. This will allow for the effective adoption of information and technologies by taking advantage of already established cultural lines of communication where elders are looked up to for knowledge, advice and assistance.

According to Statistics South Africa (Stassa, 2023), 91% of the population in the UMkhanyakude district has mobile phones and 70% of the population has access to radio services. The central point, Ndumo business centre, has a library with free Wi-Fi and personal computers. It is desirable then to recruit and train volunteers from the community for effective implementation and adoption of sound and sustainable farming practices. Training farmers to carry out a SWOT analysis of both knowledge systems and be capacitated to make informed decisions on when to use either method or both and when to combine both methods will undoubtedly yield positive results. These areas include plant breeding, animal breeding, laboratory animal disease diagnostics, laboratory-based crop disease diagnostics, weather prediction and soil fertility and moisture measurements.

Thus, in light of the foregoing explication above, this study recommends that adaptation measures such as the cultivation of drought-resistant crop varieties and irrigation be implemented. We, therefore, recommend what Henning and Matthews (2022), suggested, that the mindset of young people toward farming must be transformed, and government policies should actively foster conditions that encourage their participation in farming, not just as labourers but also as entrepreneurs and owners of farming enterprises.

Hence, it is recommended that stakeholders should encourage and support the rural population to confidently use their indigenous knowledge and integrate it into policymaking and extension practice (Okoye and Oni, 2017).

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APPENDIX A

Informed Consent Letter Template

UNIVERSITY OF KWAZULU-NATAL
Graduate School of Business and Leadership

Dear Respondent,

M Com Research Project

Researcher: Dumisani Gininda [redacted]

Supervisor: Dr Hoque(0312608690)

Research Office: Ms Khanyo Mthethwa (031-2601383)

I, (Dumisani Gininda) am an (Masters in Commerce and leadership studies) student in the [Graduate School of Business and Leadership], at the University of KwaZulu-Natal. You are invited to participate in a research project entitled *(Exploring an integrated approach on food security using indigenous knowledge management in combating poverty).*

The aim of this study is to:

- The study explores the possibilities of finding synergies between indigenous knowledge and the scientific knowledge as a model to be used in combating poverty in rural areas of Kwa Zulu Natal.
- The study seeks to analyze the relationship between the modernized and the indigenous knowledge management system in agriculture.
- The study investigates an integrated agricultural system which can be used and be more accessible and transferable to most parts of rural community in combating poverty.

Through your participation I hope to understand multifaceted approach in dealing with societal challenges including poverty and other related social ills. The results of this survey is intended to contribute to contribute to poverty eradication.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this research project. Confidentiality and anonymity of records identifying you as a participant will be maintained by the [Graduate School of Business and Leadership], UKZN.

If you have any questions or concerns about participating in this study, please contact me or my supervisor at the numbers listed above.

It should take you about 10-15 minutes/s to complete the questionnaire. I hope you will take the time to complete the questionnaire.

Informed Consent Letter Template

Sincerely

Investigator's signature [redacted] Date_____

This page is to be retained by participant

Informed Consent Letter Template

Sincerely

Investigator's signature [redacted] Date_____

This page is to be retained by participant

APPENDIX B

Research Questionnaire

Research Topic: Exploring an integrated approach on food security using indigenous knowledge management tool as a viable resource in combating poverty unemployment.

Area of research: Rural area of uMkhanyakude

Research methodology: Quantitative research

Research Interview schedule: = 30 minutes

Items	**Allocated time**	**Conducted by**
Overall time for answering the questionnaire either written and oral	30 minutes	Researcher and the Research assistant
Introduction	5 minutes	Researcher and the Research assistant
interval (optional)	5 minutes	Researcher and the Research assistant
Closer including rapping up and thanking the participants	Last 5 minutes	Research assistant

CONTENT:

Indigenous Knowledge management questionnaire survey Consent Note

Good day, my name is..... and I am collecting data on behalf of Mr Dumisani Gininda who is a Masters student with the School of Business and Leadership at the University of KwaZulu-Natal. I am doing a study in uMkhanyakude area that aims to understand the existence, use and potential benefits of indigenous knowledge in agriculture. The study is being supervised by Dr Kader. It is my hope that the information generated from this study will be used in the thesis and helps improve the understanding of indigenous knowledge systems. Furthermore, the information will be useful to development agencies in the area in designing development programs.

Confidentiality of information will be maintained at all times. Your identity or that of your institution will be protected and anonymity maintained. The information you provide will be combined with that of others in the area who I am interviewing, hence it cannot be traced back to you. The questionnaires and other study material will be kept safe at all times by the researcher.

The study does not include any material that is unsafe to health and the high level of confidentiality will ensure your social safety.

Please would you be willing to answer some questions that will provide me with information for the study. Your honest answers to the questions will help us better understand utilisation of indigenous knowledge in agriculture. If at any point you wish to stop answering the questions, feel free to let me know and we will stop. The interview will take about 1hour, 30minutes. Should you agree to participate on the basis of having read and understood the nature and conditions of this research study, please sign the designated section below.

PARTICIPANT DECLARATION: I …….. (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project and I consent to participate in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Signature:……. Date:……..

Researcher's details:

Name: Dumisani Gininda

Contact number: [redacted]

Name of interviewer ……. Date ...../ ……/ …….

Location of interview (Ward) ……. (Village) …….

Study ID ……...

GPS coordinates/address: …… ……

Questionnaire checked by …… Date ...../ ……../ ……

Questionnaire entered by ……. Date ...../ ……/ ……

Section A: (Individual questionnaire) Socio-demographic data

A1. What is your gender?

1. Male □ 2. Female □

A2. What is your age?

1. 18 - 25 □ 2. 26 -35 □ 3. 36 - 45 □ 4. 46 -55 □ 5. 56 - 65 □

A3. What is your marital status?

1. Single □ 2. Co-habiting (including long term consensual) □ 3. Married □
4. Divorced/separated □ 5. Widowed □

A4. What is your highest qualification level?

1. Primary □ 2. Matric □ 3. Diploma □ 4. Degree □ 5. Non □

A4. What is your religion?

1. None□ 2. Christian□ 3. Muslim □ 4. Traditional African Religion□
   5. Other (Specify) -

A5. Who is the household head?

1. Mother□ 2. Father□ 3. Grandmother □ 4. Grandfather □ 5. Brother□ 6. Sister□
   7. Other (Specify) □

A6. Which of the family members hold any key position in the area?

1. Mother□ 2. Father□ 3. Grandmother □ 4. Grandfather□ 5. Brother□ 6. Sister□ 7. Other –

A7. Which position?

1. Leader of religious structure□ 2. Political leader□ 3. Social club□ 4. School teacher including principal□ 5. Sports structure□ 6. Business structures□ 7. Other (specify)

A8. How long have you lived in this village?

1. From birth □ 2. Less than 10 years□ 3. More than 10 years□
4. Less than 20 years□ 5. More than 20 years

A9. Where were you born?

1. In this Village □ 2. Out of this village

A10. What is your occupation?

1. Not employed □ 2. Self-employed □ 3. Employed □

A11. What is the dominant source of income?

1. Full time employment Salary□ 2. Self-Employment Salary □ 3. Government grants□ 4. Old Age Pension□ 5. Other (specify)

Section B:

Use of indigenous knowledge in agriculture

B1. Traditional practise in agriculture is still applicable

1 Strongly don't Agree ☐ 2 Don't agree ☐ 3 Don't agree ☐

4. Strongly don't agree ☐

B2. Traditional methods in agriculture are still relevant

1Stongly don't Agree ☐ 2 Don't agre ☐ 3 Agree ☐

4. Strongly agree ☐

B3. Which age group within the community still applies the traditional methods of agriculture (probe for category not names of people e.g. age group,)?

Age group between:

1. 18 - 30 ☐ 2.30- 45 ☐ 3. 45-50 ☐ 4. 50-above ☐ 5. Nor ☐

B3. What crops do you grow?

Crop	**Hectare(s)**	**How much do you use indigenous knowledge?**

		At the scale of 10
1. Dry crops	5-10 □	0-4 □ Not strong
	10-50 □	1-4 □ Weak
	50-100 □	4-6 □ Average
	100- above □	6-10 □ Very strong
2. Vegetable	5-10 □	0-4 □ Weak
	10-50 □	1-4 □ Not strong
	50-100 □	4-6 □ Average
	100- above □	6-10 □ Very strong

B4. Where do you apply indigenous knowledge i.e. At what stage?

Stage
Land preparation 1. Very little □ 2. Little □ 3. Highly □ 4. Very highly □ 5. Not applicable □
Seed 1. Very little □ 2. Little□ 3. Highly□ 4 Very highly □ 5. Not applicable □
Planting 1. Very little□ 2 Little □ 3 Highly □ 4 Very highly □ 5. Not applicable □
Weeding

1. Very little□ 2 Little □ 3 Highly □ 4 Very highly □ 5. Not applicable □
Soil nutrients 1. Very little□ 2 Little □ 3. Highly□ 4 Very highly □ 5. Not applicable □
Harvesting 1. Very little□ 2. Little□ 3. Highly□ 4 Very highly □ 5. Not applicable □
Storage 1. Very little□ 2. Little□ 3. Highly□ 4 Most highly □ 5. Not applicable □

B5. Ratio of impotency of scientific knowledge and indigenous knowledge in crop production. Score is from 1-3

Stage	**Importance (1 important 2 average 3 not important)**	
	Indigenous Knowledge	**Scientific Knowledge**
Land preparation		
Seed		
Planting		
Weeding		
Soil nutrients		
Harvesting		
Storage		

B7. How do you rate the usefulness of indigenous knowledge in crop production?

1. Very poor 2. Poor 3. Average 4 Highly 5. Very Highly

B8. Do you think that indigenous knowledge should be used in crop production currently?

1. No 2. Dont know 3. Yes

B9. Factors promote the use of indigenous knowledge in crop production?

Cost effective

1 Strongly don't agree 2 Don't agree 3 Aggre

4. Strongly agree

Trans generational

1 Strongly don't agree 2 Don'tagree 3 Agre

4. Strongly agree

Labor intensive (for job creation)

1Strongly don't Agree 2 Don't agree 3 Agre

4. Strongly agree

B10. What factors discourage the use of indigenous knowledge systems in crop production? Labor Intensive

1Strongly don't agree 2 Don'tagree 3 Agree

4. Strongly agree Lack of skilled people

1 Strongly don't agree 2 Don'tagree 3 Agree

4. Strongly agree

Unavailability of arable land

1Strongly don't agree ☐ 2 Don't agree ☐ 3 Agree ☐

4. Strongly agree ☐

B11. What type of livestock do you own?

Livestock	**Numbers**	**Use of traditional knowledge (Y/N)**	**If yes for what?**
Cattle			
Goats			
Pigs			
Chicken			
Ducks			
Rabbits			
Pigeons			
Sheep			
Guinea fowls			
Turkey			
Other specify …….. ……..			
Other specify …… ……..			

Other specify …… ……			
Other specify ……. …….			

B12. What indigenous knowledge do you use/used on each of these problems?

Issue/problem	**Used before**	**Currently being used**
To getting resistant breeds		
Parasites		
Tick related diseases		
Transmissible diseases e.g. foot and mouth		
Cleaning the stables/pens		
Slaughtering		
Preservation of livestock products		
Value addition on livestock products		
Other specify …….. …….		
Other specify …… …….		

B13. Reasons for the changes in the use of traditional knowledge in livestock management?

1. Lack of skills transfers 2. Generational gap 3.Advancement of technology 4. Access to information

B14. How do you rate the usefulness of indigenous knowledge in animal husbandry production?

1. Very poor 2 2.Poor 3. Average 4.Highly 5. Very Highly

B15. Do you agree that indigenous knowledge should be used in animal production today? 1 Strongly don't Agree 2 Don't agree 3 agree 4. Strongly agree B16. Can you rank indigenous knowledge and scientific knowledge in animal husbandry?

Issue/problem	**Importance (1 important 2 average 3 not important)**	
	Indigenous Knowledge	**Scientific Knowledge**
To getting resistant breeds		
Parasites		
Tick related diseases		
Transmissible diseases e.g. foot and mouth		
Cleaning the stables/pens		
Slaughtering		
Preservation of livestock products		
Value addition on livestock products		
Other specify …….. …….		

Other specify ……. …….		

Section C. institutional support and dynamics

C1. Are you aware of institutions that promote indigenous knowledge?

1. No 2. Yes 3. Do not know

C2. In your own assessment, how does the modern knowledge in agriculture impact on the following?

1. Economic growth
   1. Very poor 2. Poor 3. Average 4. Highly
   5. Very highly
2. Environment sustainability
   1. Very poor 2. Poor 3. Average 4. Highly
   5. Very highly
3. Social and cultural
   1. Very poor 2.Poor 3. Average 4. Highly
   5. Very highly

C3. In your own assessment, how does the indigenous knowledge in agriculture impact on the following?

1. Economic growth
   1. Very poor 2. Poor 3. Average 4. Highly
   5. Very Highly

2. Environment sustainability

1. Very poor ☐ 2. Poor ☐ 3. Average ☐ 4. Highly ☐

5. Very highly ☐

3. Social and cultural

1. Very poor ☐ 2. Poor ☐ 3. Average ☐ 4. Highly ☐

5. Very highly ☐

C4. Do you use indigenous as the first choice to modern scientific knowledge?

☐ 1. No ☐ 2. Yes ☐ 3. Do not know C7. Which knowledge system do you use?

☐ 1. Indigenous only ☐ 2. Modern ☐ 3. Mixed C5. How accessible are the two knowledge systems?

Access factors	**Rank (1 poor 2 average 3 good)**	
	Indigenous knowledge	**Scientific knowledge**
Cost		
Profitability		
Socially acceptable		
Institutional support		
Government support		
Technical help		
Reliability		

Comprehension/ understandability		
Other Specify ……..		

The End

APPENDIX C


Dumisani Gininda | MCLS
UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI
Use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in KwaZulu-Natal.
by
Dumisani Gininda
214582948
A dissertation submitted in partial fulfillment of the requirements
for the degree
of
Masters of Commerce in Leadership Studies
College of Law & Management Studies
Graduate School of Business and Leadership
Supervisor:
Dr. Xoliswa Majola
University of Kwa-Zulu Natal
2021
10
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APPENDIX D

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

06 May 2024

Dumisani Gininda (214502548)
Graduate School of Business & Leadership
Westville Campus

Dear D Gininda,

Protocol reference number: HSS/1066/017M
Project title: Exploring an integrated approach on food security using organic knowledge management tool as a viable resource in combating poverty and unemployment
Degree: Masters

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 03 May 2024 has now been approved as follows:

- Change in Supervisor
  Previous Supervisor: Dr Muhammad Hoque
  New Supervisor: Dr Xoliswa Majola

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

HSSREC is registered with the South African National Health Research Ethics Council (REC-040414-040).

Best wishes for the successful completion of your research protocol.

Yours faithfully

[redacted]

Professor Dipane Hlalele (Chair)

/dd

APPENDIX E

Letter to assist students in obtaining Gatekeepers Letters

UNIVERSITY OF
KWAZULU-NATAL

INYUVESI
YAKWAZULU-NATALI

July 6, 2017

To Whom It May Concern:

PERMISSION TO CONDUCT RESEARCH AS PART OF THE (*Masters in commerce and leadership studies*) QUALIFICATION

Name: Dumisani Gininda Student No: 214582948

Dissertation Topic: Exploring an integrated approach on food security using knowledge management as a viable resource in combating poverty and unemployment

We confirm that the above student is registered at the University of UKZN for the Masters in Commerce and Leadership Studies coursework (MCLS) Programme. It is a requirement of their Programme that the student undertakes a practical research project in his/her final year of study.

Typically this project will be a "practical problem solving" exercise, and necessitates data gathering through questionnaires or personal interviews.

Your assistance in permitting access to your organization for purposes of conducting the research is most appreciated. Please be assured that all information gained from the research will be treated with the utmost confidentiality. Furthermore, should you wish any result/s or findings from the research "to be restricted" for an agreed period of time, this can be arranged. The confidentiality of information and anonymity of personnel will be strictly adhered to by the student.

If permission is granted, kindly confirm this by signing off on the following:
"I am aware of the nature and extent of the document and I am satisfied with all the obligations imposed therein."

Please note that additional information or conditions can be supplied by you.

Name in Full: _____

Designation: _____

Company Name & Stamp: _____

Thank you for your assistance in this regard.

Yours sincerely

_____
Type title, initials and surname (Supervisor)

MNGOMEZULU TRADITIONAL COUNCIL

File No:

Inkomba:
Inquiries: Msuthu-wena ongalidli ijuba
Imibuzo:

P. O. BOX 412

INGWAVUMA 3968
Phone: [redacted]
Fax:

13 April 2017

LETTER OF AUTHORIZATION TO CONDUCT RESEARCH

This is to authorize Mr Gininda to conduct research.

Area of study: uMkhanyakude

Topic: Indigenous Knowledge Management on Food security.

Student Name: Mr Gininda Dumsani

Institution: UKzn

Course: Masters in Commerce and Leadership Studies.

How is the Study going to benefit UMkhanyakude?

By exploring other means to tackle poverty and unemployment.

Yours Sincerely

[redacted]

Inkosi M. Mngomezulu

KALANGA-
CONSULTANCY

Contact: [redacted]
Email: [redacted]
UNIT 69 SKHWAHLANE 4

KA LANGA
PRE-UNIVERSITY ACADEMY
School of Achievement

9 July 2021

REGISTRATION NUMBER: 2014/022144/07
(Incorporated in the Republic of South Africa)

TO WHOM IT MAY CONCERN

CONFIRMATION OF MASTER OF COMMERCE (LEADERSHIP STUDIES) EDITING: MR DUMISANI GININDA (214582948)

This serves to confirm that I, Dr Elijah Mkhatshwa, edited MR Dumisani Gininda's dissertation titled: *Use of traditional indigenous knowledge management and modern agricultural technology as viable resources in combating poverty in KwaZulu-Natal.*

The editing of the dissertation focused on the use of English language structures as they find application in the context of academic writing wherein primacy of clarity and precision of the communicative intent is accorded a high premium. So, the editor did not interfere with the presentation of the arguments in the dissertation as conceived, conceptualized and advanced by the researcher.

If need be, further particulars will be furnished upon request.

Yours sincerely,

[redacted]