EXPLORING AGRICULTURAL KNOWLEDGE SYSTEMS AND SMALLHOLDER FARMERS EMPOWERMENT: IMPLICATION ON HOUSEHOLD FOOD SECURITY

By

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ABSTRACT

The association between the various actors of knowledge and the generation of common knowledge is expanding in agricultural sector. Smallholder farmers engages in multiple informative networks both formal and informal knowledge systems. These heterogeneous networks exposes farmers to diverse agricultural knowledge. To assess their effect on the empowerment and food security of farmers, it is important to categorise the information and knowledge structures that are accessible to farmers. Firstly, the agricultural knowledge systems and the types of knowledge that occur in smallholder farmers. Secondly, by identifying the opinion leaders' social networks and their influence on the quality of agricultural knowledge. Thirdly, by assessing the agricultural knowledge systems in relation to farmers' empowerment levels and food security. The study was guided by the sustainable livelihood framework (SLF) and knowledge systems. The SLF identifies five capitals that can be classified as tangible and intangible and referred to as capabilities. The study argues that while building the smallholder farmers' asset base through existing systems, it is important to categorise active knowledge systems, identify opinion actors within these networks and measure the level of empowerment brought about through these systems. A purposive sampling method was employed to collect data from 219 smallholder farmers. A descriptive analysis was used, a Chi-square test and running ordered probit and multinomial models. The study indicated that knowledge systems at Bergville and Appelsbosch emerge from the bottom level to outside sectors. The participation level of farmers in local technical and scientific knowledge systems showed a positive statistically significant with regard to farmers' food security. The study further indicated that opinion leaders are from formal and informal systems and are currently working for local government and other farmers organisations and have years of farming experience. Not only do they have frequent contact with the farmers, but they also have other communicating channels they use for technical skills with farmers. The results revealed that farmers require leaders who can quickly access reliable and relevant information pertinent to their agricultural problems. These opinion leaders require continuous assessment to enhance and integrate their leadership skills and promote empowerment programmes for farmers. These facts explained why many of the farmers chose to seek information and advice from their opinion leaders. These research findings may help agents to develop their understanding of the dynamics of local communities and the social complexity that shapes farmers' environment and decisions.

The results also revealed that although the smallholder farmers were moderately and highly competent in areas of self-efficacy, sense of control, agricultural knowledge and food security, the majority of them had only low or moderate leadership skills. However, the significant number of severely food insecure farmers who regard themselves as having moderate or high self-efficacy still need to be improved. This implies that there is still work and improvement needed to reduce the number of food insecure farmers. While most programmes implemented by the Department of Agriculture and the private sector include the tangible empowerment of small-holder farmers, programmes should also focus on their psychological empowerment. As indicated by the results of this study, there is an association between knowledge systems, empowerment levels and farmers' food security status and the effectiveness of agricultural knowledge systems could, therefore, be augmented by improving farmers' psychological empowerment to enhance resilient agriculture and food production.

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I, Nthabeleng Tamako, declare that:

The research reported in this dissertation, except where otherwise indicated is my original research.

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CONTENTS

LIST OF ABBREVIATIONS AND SYNONYMS

AKS	**Agricultural knowledge systems**
COVID-19	**Coronavirus disease**
DAFF	**Department of Agriculture, Fisheries and Forestry**
FAO	**Food and Agriculture Organization**
FANTA	**Food and Nutrition Technical Assistance**
FLR	**Farmer-led research**
FFS	**Farmers Field School**
FG	**Farmers Group**
FGD	**Focus Group Discussion**
FWR	**Farmers' Week Report**
HFIAS	**Household Food Insecurity Access**
KZN	**KwaZulu-Natal**
MDG	**Millennium Development goals**
NGOs	**Non-Governmental Organisations**
SDGs	**Sustainable Development Goals**
Stats SA	**Statistics South Africa**
STATA	**Software for Statistics and Data Science**
SLF	**Sustainable Livelihoods Framework**
SPSS	**Statistical Package for Social Sciences**
UNDP	**United Nations Development Programme**

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CHAPTER ONE: THE PROBLEM AND ITS SETTING

1.1 Introduction

The country's population depends on agriculture (UNDP, 2012; Pienaar, 2013; FAO, 2017). Bagnall-Oakeley *et al.* (2004) posit that for rational decision-making, investors in the agricultural sector require access to several agricultural information services. Farmers need appropriate skills and technical knowledge to properly combine the three development factors, namely labour, entrepreneurial skills, and resources at the farm level (Wiesinger, 2007). More agricultural knowledge enables farmers to take part in decision-making and exchange ideas with other farmers and it is also significant for rural development (Mkenda *et al.*, 2017). Access to agricultural knowledge and information is necessary to enhance farm production and create capacity and resilience among farmers.

South Africa's agricultural sector has a network of government and private agricultural research institutes that share knowledge with farmers using several networks and various platforms (Pienaar, 2013). The South African Government has set up Farmers Field School (FFS) projects, Farmers Group (FG) self-help groups and cooperatives to develop awareness and enhance farmers' knowledge platforms and empower the farmers (DAFF, 2017). Such channels for knowledge and learning are embedded largely in farmers' self-organised and locally originating social structures (Lwoga *et al.*, 2013). Agricultural information structures have resulted in cooperation between peasants, local administration, and academics (Smedlund, 2008). The application of information at the individual level is therefore complex. The association between the various actors of knowledge and the generation of common knowledge is expanding and to assess their effect on the empowerment and food security of farmers, it is important to categorise the information structures that are accessible to farmers through their social capital.

Knowledge and skills are essential agricultural tools according to Lwoga *et al. (*2013) and technical knowledge is by far the most important aspect to ensure success for small-scale farmers, according to the Farmers' Week Report (2012). Farmers receive most of their technical know-how from the agricultural sector but as human beings they need to look beyond agriculture. Sveiby (1997) described knowledge as an ability to act and argued that knowledge is developed in the minds of people and that the capacity of humans to create knowledge is infinite.

In their community, farmers are not isolated individuals (Teilmann, 2012); they are part of numerous social networks. Farmers use a variety of sources of knowledge and learning to sustain their livelihoods and food security (Stats SA, 2014). Farmers in the KwaZulu-Natal Province have connections with people and organisations ranging from group members and merchants to family, neighbours, Non-Governmental Organisations (NGOs) and the government. Several government and private agencies work together to provide farmers with knowledge and information (DAFF, 2016).

However, farmers use various criteria to determine the value and accuracy of their sources of information and expertise (Teilmann, 2012). Agricultural information and knowledge sources include community leaders and rural elders, some of whom have considerable influence and power, religious institutions, and fellow farmers (Kaine *et al.,* 1999; Munyua, 2011). Good sources of information and advice for farmers are opinion leaders who are also local farmers (Haldar *et al.,* 2016). A network may improve its resilience or become weakened by involving various stakeholders with various types of information to share. It is therefore important to understand the farmers' knowledge systems to understand the functioning and effectiveness of these systems concerning the farmers' empowerment and food security.

Agricultural interventions need to map agricultural knowledge systems (AKS) and understand their role in a rural context. This will help to understand the mechanisms used by farmers in their information networks. Studies conducted by Demiryurek *et al. (*2008) and Mittal *et al.* (2018) mapped farmers' information and social networks and their structure in rural India. Thuo *et al.* (2013) examined the role of social networks in how groundnut farmers in Kenya and Uganda learned about new groundnut varieties and how their social ties related to groundnut productivity.

According to studies carried out by Awad and Ghaziri (2004) and Sutherland *et al.* (2017), information is considered to be social rather than personal. Tovey (2008) and Hart (2007) note that farmers' awareness is the result of the interest, imagination and efforts related to behaviour and social interactions. This implies that farmers' expertise is based on mental capacity and a set of manual labour skills that build learning skills. Similarly, Hartwich *et al. (*2007) stress that farmers' awareness comes from routine laboratory activities that contribute to learning skills. The farmer learns by doing and practicing in this way and as a result, their experience extends to the social and technological environments. Therefore, tapping into farmers' knowledge could ensure efficiency in smallholder farmers' agricultural empowerment. They

need to quantify, categorise and formalise their information. Therefore, it is important to understand what information farmers recognise, how it is shared and their social interactions in carrying out this mission. South Africa's rural livelihoods depend largely on the dualistic agricultural sector; it consists of a large-scale business sector and a small-scale subsistence sector (Thamaga-Chitja and Morojele, 2014). Before 1994, policy emphasised structured commercial agricultural development and support to the exclusion of a large number of smallholder farmers (Pienaar, 2013). Agricultural policies in 1994 in the form of grants for infrastructure, funding for development inputs and access to loans and extension services aimed to encourage smallholder farmers.

Smallholder empowerment has been part of the government's development agenda for years, as they are extremely vulnerable, food insecure and have restricted access to technology and information (FAO, 2017). New and innovative strategies to improve the situation have been established, such as the Sustainable Development Goals (SDG) and advances in food and nutrition safety. These strategies include increased investment in agricultural productivity by supporting smallholder farmers with the necessary resources, i.e., creating and accessing knowledge, credits and technology. Smallholder farmers around the world, including those in African countries, have poorly developed intangible assets, i.e., skills and knowledge (Thamaga-Chitja and Morojele, 2014; Murugani and Thamaga-chitja, 2016). Farmers have different needs for agricultural knowledge relevant to their daily involvement. To recognise the relevant knowledge at the right time, it is essential to upgrade social capital to improve agricultural knowledge among farmers.

Social capital has a long history in South Africa, having been promoted for different purposes by cultural leaders within communities and the national government (Edwards, 2013). In rural communities, social capital is the most important type of capital. Social capital has recently gained prominence among smallholder farmers as a medium and forum for agricultural development and programmes (Gallaher *et al.*, 2013; Fisher, 2013). This study adopted Grootaerts' (1998) definition of social capital as the complementary norms, principles, attitudes and beliefs regulating relationships among individuals and institutions and predisposing them to cooperation and mutual assistance. This description provides a useful theoretical framework for understanding how social capital leads to farmers' empowerment. Networks are social capital tools that are used to learn how to manage transition (Wambugu *et al.*, 2010). Such sources and outlets of information, however, are controlled and promoted by institutions, networks, norms, values, and trust, all of which are components of social capital (Yami and

van Asten, 2018). Institutions are structures that become mechanisms to communicate with people (Ramirez, 1993; Simpson and de Loë, 2017). Smedlund (2008) argues that generally, agricultural practices are regulated by formal written rules and informal unwritten codes of conduct and restrictions, such as behavioural norms and social conventions. The study measured and defined networks, organisations, opinion leaders and the attitudes of farmers towards agricultural knowledge to capture the intangible concept of social capital.

1.2 Important to the study

It is estimated that South Africa has four million people involved in smallholder farming for various reasons, including agriculture as an extra source of food and income generation (Aliber and Hart, 2009). Most of these smallholder farmers are poorly resourced in marginalised areas with low external inputs, poor soil and limited management capability (Hart, 2007). Smallholder farmers' development and empowerment were proposed as strategies for eradicating poverty and food insecurity. This was a priority for the SDGs and MDG's at the national and regional levels of government (FAO, 2017). High priority was given to empowering smallholder farmers because they can feed the growing population. Given the current Covid-19 pandemic, it is clear that the local food systems need to be overhauled to strengthen their capabilities, especially where smallholders operate. This study employed the definition of empowerment advanced by the World Bank as the process of growing individuals' or groups' capacity to make choices about desirable actions and results. The FAO study (2017) posits that the limited access to agricultural information has a significant impact on smallholder farmers.

Munyua and Stilwell (2013) assert that the key issue in pro-poor agricultural development is the restriction of knowledge among farmers and other sectors. For field demonstrations and group meetings, scholars and extension officers are among the most knowledge-intensive sources of agricultural knowledge (Allahyari *et al.*, 2017). Studies of how farmers acquire and share knowledge are useful for farming systems and farmers' willingness and ability to absorb and share incoming knowledge is key to their empowerment. Farmers employ logical, ethical, psychological and social factors to guide them in choosing which information to obtain, the sources they should pursue and the learning methods they follow through. Agricultural knowledge and information are key tools for enhancing the livelihoods of small-scale farmers. Farmer-to-farmer and farmer-to-sector social networks need to be analysed to create farmer-led research that empowers farmers. Farmer-led research (FLR) is also known as participatory

farmers' research; an approach that empowers farmers to gather information for their farms while working with other farmers and scientists to contribute to peer-to-peer learning and knowledge sharing (Zeweld *et al.*, 2017).

1.3 Problem statement

Farmers have a variety of networks and channels in their communities to learn and develop agricultural information, informed by existing community networks and institutions, i.e., regulations (Kauti, 2016). In South Africa, the Department of Agriculture, Fisheries and Forestry (DAFF) promoted the creation of cooperatives, self-help and extension officer engagement as strategies for motivating for information from smallholder farmers (Ngaka and Zwane, 2017). This has resulted in the creation of cooperatives, a community of farmers, the education of farmers and visits to sites. It is important to utilise social capital as the resource-poor's most valuable asset to meet the needs of this marginalised group. Knowing the dynamics of social capital within a society can, therefore, lead to a better understanding of the oppressed peasants and those that are disempowered.

It is important to determine how to use the existing social network and fora to enhance smallholder farmers' awareness. These observations led to the conclusion that knowledge and skills are essential resources for farming and studies on how farmers obtain and share knowledge could be valuable for research and by extension, informing policy pertaining to farming systems. Governments and development agencies have focused on empowering rural farmers and communities through collective action institutions by recognising such institutions as essential agricultural development partnership networks (Ngaka and Zwane, 2017). Agricultural development has focused largely on developing tangible assets that rely less on intangible assets such as the capacity of farmers. Among smallholder farmers, the role of knowledge systems for empowerment has not been fully investigated. Policy for rural development has developed mechanisms to help organise farmers into groups and farmers' associations to ensure focused service delivery. Farmers and farmers' groups collaborate with organisations, researchers, and the private sector to establish relationships with other farming systems. While farmers have operated information systems in general, the types of knowledge and systems use and knowledge sharing for empowering and maintaining their livelihoods have not been fully researched and reported to develop them. This research assessed the following:

1.4 Research objectives

To explore agricultural knowledge systems and smallholder farmer empowerment with a special focus on social capital and social learning platform.

1.4.1 Objectives

a) To describe the agricultural knowledge systems and the types of knowledge occurring in relation to food security.
b) To identify opinion leaders' social network and their influence on the quality of agricultural knowledge.
c) To assess the agricultural knowledge systems in relation to farmers' psychological empowerment level and food security.

1.4.2 Questions to be answered in the study.

a) Which agricultural knowledge systems do farmers participate on? What type of knowledge and information do you receive from these knowledge systems and what channels are used to share the information and knowledge from these knowledge systems?
b) Can you mention opinion leaders within these knowledge systems? Which characteristics are used to choose these opinion leaders? What is their influence on the quality of knowledge you receive as a farmer?
c) What is the level of farmers' psychological empowerment and food security status in relation to their participation in knowledge systems?

1.5 Summary of the Study Methodology

To explore the significance of knowledge systems and opinion leaders to farmers' psychological empowerment and food security, a quantitative and qualitative approach was used to analyse and assess these knowledge systems at farmers' level. A semi structured questionnaire was used to gather the information from the farmers. Focus group discussions (FGD) and key informant interviews were conducted to gather in-depth information. A purposive sampling method was employed to collect data from 219 smallholder farmers. To measure the objectives of the study, a descriptive analysis was used, a Chi-square test and running ordered probit and multinomial models. The relationship between variables was tested using effect descriptive statistics such as relative frequencies. The principal component

analysis (PCA) method was employed to generate the principal component (PC) of the perceived farmers' psychological empowerment level.

1.6 Thesis structure

The introductory chapter has given the general study background, motivated the research problem, and presented the objectives of the study. The second chapter provides a brief overview of the literature on agricultural knowledge systems (AKS) and small-scale farmers in South Africa. The review demonstrates the role that different actor, including small-scale farmers' group play in supporting agricultural development. The scope of the literature review aims to cover the knowledge flow of actors in agricultural systems, their sources of knowledge, linkages, and flows of knowledge, usage of information and knowledge, and existing knowledge management. Chapter three provides a detailed methodology of the whole study. Chapter four presents the knowledge systems utilised by smallholder farmers and explore the implications which are imposed by these knowledge systems on food security status of active farmers? Chapter five identifies the opinion leaders of smallholder farmers and measured the extent of their influence on the quality of these farmers' knowledge of agriculture. Furthermore, the study explored the reasons why farmers choose their opinion leaders. Chapter six investigates the levels of empowerment outcomes that smallholder farmers attained and food security level, as a way of evaluating and monitoring the progress made by the knowledge systems that were initiated and activated to empower the farmers. Chapter seven presents a summary of the study, discussing whether frameworks used, literature review, research questions asked and major findings correlate with literature and to the overall aim of the study. The chapter furthermore present recommendations and suggestions for future studies in the field.

1.7 Definitions of terms

Agricultural knowledge system (Hornidge *et al.*, 2016): An agricultural knowledge system is a system of beliefs, cognitions, models, theories, concepts, and other products of the mind in which the (vicarious) experience of a person or group with respect to agricultural production is accumulated.

Knowledge systems (Hornidge *et al.,* 2016): networks of linked actors, organizations, and objects that perform several knowledge-related functions that link knowledge and know-how with action

Empowerment (Ibrahim and Alkire, 2007): In agriculture, empowerment is generally defined as one's ability to make decisions on matters related to agriculture as well as one's access to the material and social resources needed to carry out those decisions.

Knowledge (Kaine *et al.,* 1999): defines knowledge as ―the facts or experiences known to a person or group of people.

Knowledge management (Chakraborty and Chaudhuri, 2018): Knowledge management facilitates the systematic creation, capturing, sharing, using, and recreating of knowledge and is about ―learning to know what we know.

Social capital Putnam (1993) defined social capital as the feature of the social organization including trust, norms, and networks that improve the effectiveness of the community, by helping its actions.

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CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of literature pertaining to Agricultural Knowledge Systems (AKS) and small-scale farmers in South Africa. This review explains the role that the various actors, including small-scale farmers' groups, perform in supporting agricultural development. The scope of the literature review was the stakeholders' in agricultural systems sources of knowledge, linkages and flows of knowledge, their utilisation of information and knowledge and existing knowledge management. There is currently a growing body of social science research being conducted to uncover the nature and complexities of farmers' knowledge. This research moved beyond the tendency in previous studies to focus on individual farmers' knowledge systems to ascertain the role that other stakeholders in relevant knowledge systems perform.

Gaps remain in the understanding of how learning networks operate to facilitate effective knowledge systems. In South Africa, both government and non-government organisations are involved in the provision of agricultural knowledge to farmers. Farmers have various agricultural knowledge needs that are relevant to their day-to-day work and they receive this knowledge from a variety of sources external to their organisation. These also serve as knowledge sources for other farmers within and outside the community. The key source of knowledge for farmers is other farmers because it is voluntarily available and its utilisation does not impose a high risk (Borgatti *et al.,* 2018). Daniel *et al.* (no date) state that knowledge sharing is simply the sharing of knowledge, but it is crucial to understand what type of knowledge is being shared and how is it being shared or not shared.

Agriculture is a vital component of every community, especially for rural livelihoods (Thamaga-chitja, 2014; Avelino *et al.,* 2020). Tepic *et al.* (2012) posit that agriculture is a social process. These authors indicate that an agricultural sector is a place where farmers and non-farming people meet and interact and where social capital is built. These networks and institutions provide platforms where members of society can interact despite their different backgrounds (Ginige *et al.,* 2020). Marie *et al.* (2016) posit that such platforms enable the sharing of knowledge and information among people.

2.2 Agricultural knowledge systems

Roling (1990) and Demiryurek *et al.* (2008) define an AKS as a system of beliefs, models, theories, concepts and other products of the mind in which the experience of a person with agricultural production is accumulated. Lubell *et al.* (2011; 2013) define an AKS according to four core concepts, namely program participation, social networks, belief systems and practice adoption. Foster and Rosensweig (1995) and Hoffman (2013) explain that the knowledge system supports three learning pathways, namely social learning, experiential learning and technical learning. An agricultural knowledge system (AKS) is a collection of actors such as researchers, advisors and educators working primarily in agricultural knowledge institutes (Chow and Chan, 2008; Demiryurek *et al.*, 2008). The emphasis is on these actors and the role of formal knowledge production in national agricultural research systems (NARS). This knowledge is then transferred to the agricultural sector through agricultural extension services and education programmes (Rudman, 2010). Knowledge is the product of processing information at a high level and it is long-lasting (Demiryurek *et al.*, 2008). Knowledge is in a person's mind and results from brain functions. Concepts, meanings and intellectual skills constitute a person's knowledge that can be developed through formal and informal learning experiences (Demiryürek, 2000). Individuals, non-government organisations and groups are members of a social system (of a society) and referred to as actors in the system (Chow and Chan, 2008; Carreón *et al.*, 2011). The roles of these actors in the system affect the exchange of information process and innovation. Farmers, researchers, advisors, policymakers and others have specific ways of engaging with the domain that are rooted in their everyday practice and the network that facilitates their interaction (Burton, 2004; Chow and Chan, 2008; Christensen and Christensen, 2014).

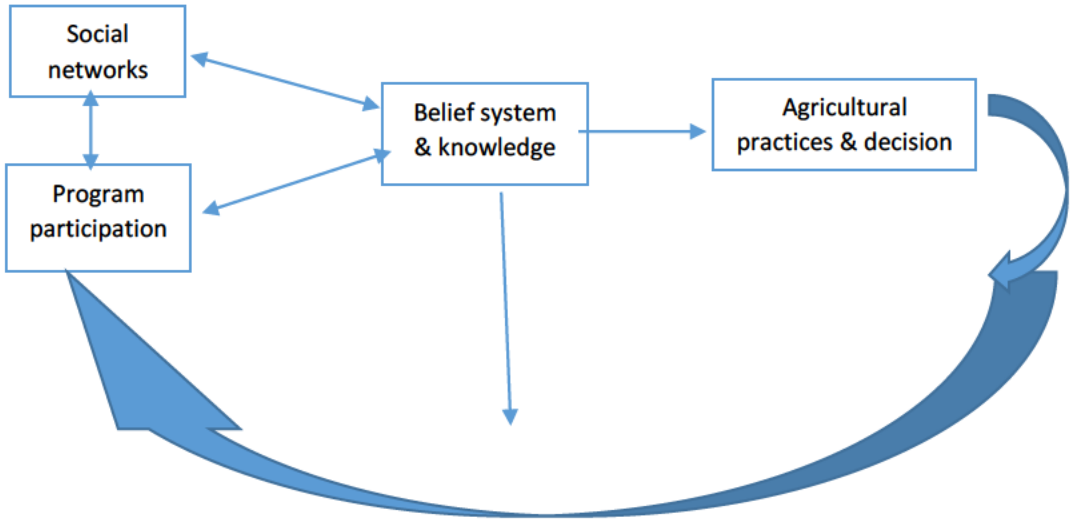

Figure.1: The conceptual model of agricultural knowledge systems (Hoffman, 2013)

At the centre of the model are individual belief systems and knowledge. The belief systems encode people's knowledge and perceptions of the world for decision making. According to Hoffman (2013), belief systems are shaped by individuals' social values and their understanding of social, economic, political and natural processes. The learning in the process produces changes in knowledge and over time can lead to convergence in the belief system of diverse sets of actors in the agricultural system. Hoffman (2013) explains that the various components of the knowledge system support three mutual learning pathways, namely technical, social and experiential learning pathways.

Participation in the extension program and services provides a technical learning pathway (Cabrera and Cabrera, 2005). This process is the traditional way of knowledge transfer to farmers and organisations involved in agriculture and scientific studies (Faure, 2015). The social learning pathway is based on social networks among farmers and other stakeholders, where farmers learn from one another and other actors within the system (Joseph *et al.,* 2016; Item, 2018). Participation in the program catalyses the formation of social networks by providing a platform for social interaction to occur (Fisher, 2013; Flora, 2014). According to Wenger (1998), social learning refers to learning from others, a social process of knowledge distribution among a network of individuals

who share a common set of practices and knowledge. Thus, knowledge networks are the social infrastructure that supports social learning.

The experiential learning pathway is activated when individual farmers and other actors adjust their behaviour over time to achieve observable outcomes of management practices (Hartwich *et al.,* 2007; Hermans *et al.,* 2015). Item (2018) states that experiential learning occurs at the individual level and that the knowledge gained from trial-and-error activity can be transferred through networks and be integrated into technical material. Studies conducted by Hartwich et al. (2007), Goulet (2013) and Hermans *et al.* (2015) explain that experiential learning is learning by doing, where knowledge is acquired through experiences, observations and engagement with the environment. Experiential learning is thus repeatedly shaped by a cycle of engagement in practice, reflection on the process and the outcomes thereof (Flora, 2014). According to Kolb (1984), experiential learning is a process whereby knowledge is created through the transformation of experience.

2.3 Sustainable Livelihoods Framework

The sustainable livelihoods framework (SLF) is an investigation framework that enables an understanding of the interacting factors that shape community behaviour in response to risk or stress (Morton, 2007). The SLF is mainly based on people and how their capitals enable them to achieve and improve their livelihood outcomes. The framework focuses on the key factors that configure livelihoods in an area and identifies factors that constrain and enhance access to other capitals (Morton, 2007). The present study was grounded in the sustainable livelihoods' framework. The SLF identifies five capitals that can be classified as tangible i.e., physical, natural and financial and these are known as assets and the intangible i.e., human and social that are known as capabilities (Scoones, 1998; Vorley *et al.,* 2012). Social relationships such as kinship, the community and friends constitute the various contributors to rural peoples' livelihoods and contribute to securing and sustaining the diversity of livelihood strategies. Livelihood activities depend on various forms of capital in contrast to the more traditional production-based approach that requires access to credit and the required skills. Households often implement more than one livelihood strategy and South African households often engage in several dynamic livelihood strategies.

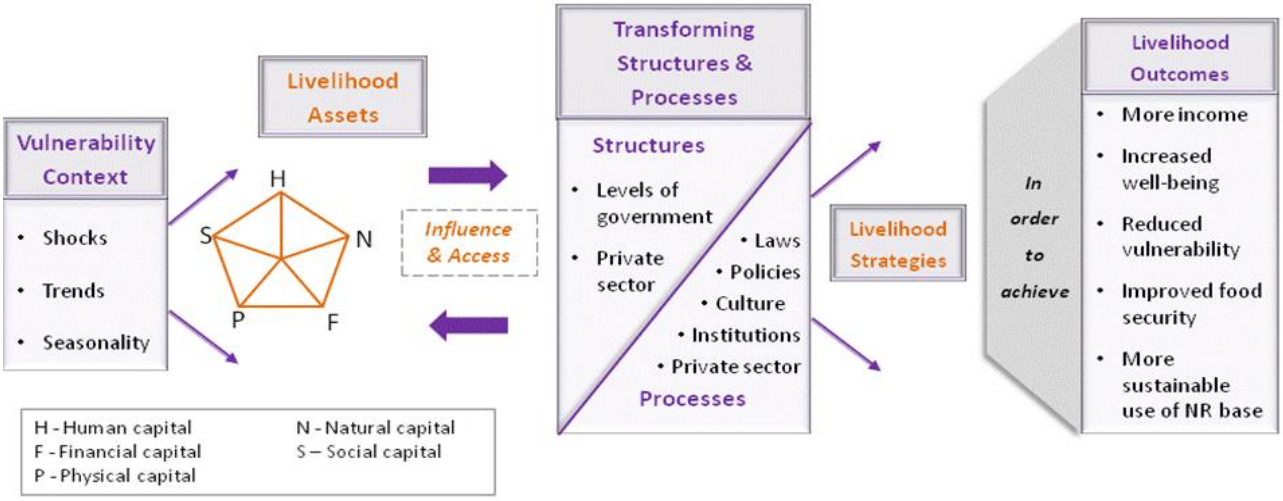

Figure 2: The sustainable livelihood framework (Scoones, 1998)

2.4 Agricultural knowledge Systems (AKS) in South Africa

According to Röling (1988), people have knowledge systems that include local knowledge and that affect their perceptions, learning and reasoning. Farmers are supported in their farm management by advisors from various professions who often form a network of advisors. Buntu (1986) identified five elements of AKS: the existing stock of knowledge; the means of increasing knowledge; the means of testing and developing knowledge; the practical application of knowledge and the dissemination of knowledge (educational training and extension). Kaine *et al.* (1999) emphasise the importance of understanding the knowledge systems at the local level before deciding on any systems to utilise and improve. This study aimed to understand and categorise the agricultural knowledge systems of smallholder farmers in Appelsbosch, KwaZulu-Natal in South Africa and the linkages between the various actors. These interactions and learning systems of farmers build social knowledge networks with multiple heterogeneous communities of knowledge producers. Furthermore, this leds farmers to develop their distinctive learning pools and social knowledge systems within and outside their communities. However, the effectiveness of these knowledge systems at the farmers' level for capacity development has not been studied. The

research objective is to describe the knowledge systems existing in the selected study areas, and how farmers are associated with these networks. The study asks the fundamental questions of what and how information/knowledge is delivered by the networks to the farmers.

2.4.1 Research institutions

Agricultural researchers such as Research Institutes, Universities, NGOs, Private companies and farmers are systems and consists of actors in the knowledge systems (Lwoga *et al.*, 2013). Research institutions assist to solve specific scientific challenges and inform politicians of methods and tools to assist in developing policy. Studies such as those conducted by Liu *et al.* (2017) and Leta *et al.* (2018) reveal that expansion and farming are becoming more participatory and developing models of cooperative research involving an increasing number of participants, i.e., Farmers Field School (FFS). Nevertheless, as Lele *et al*. (2010) illustrated, work alone does not encourage the growth of agriculture. Research and development activities, therefore, have to be systematic and build farmers' awareness. A study undertaken by Rees *et al.* (2000) found that farmers are interested in learning through direct interactions with researchers and expansion within their societies.

2.4.2 Private sectors

Nakazi *et al.* (2017) found that some private sector actors are key actors engaged in production, agro-processing, marketing and the delivery of agricultural knowledge. The private sector agents such as multinational and national agribusiness firms and small and medium enterprises are important in agricultural knowledge systems. Matthewson (2014) posits that these actors are directly involved in the delivery of agricultural knowledge, while others have a role in policy formulation and link the private sector with farmers and agricultural production processes. Scholars such as Matous (2015) and Mckitterick *et al.* (2016) argue that the private sector has an important role in the food and agricultural processing sectors and improve smallholder farmers' livelihoods. It is therefore necessary to establish linkages between the private sector and farmers to ensure farmers' access to resources.

2.4.3 Society and Non-Governmental Organisations (NGOs)

NGOs, associations and groups are important actors in providing agricultural knowledge to small-scale farmers (Mkenda *et al.*, 2017). NGOs have been at the forefront of providing inputs and

advisory services to farmers and empowering them to undertake collaborative activities such as analysing problems, sharing information and making decisions jointly (Petersen, 1997). NGOs have also been involved in promoting development activities, especially by providing training for farmers' organisations in rural communities.

2.4.4 Smallholder farmers' groups, organisations, and networks in rural communities

Pretty and Wesseler's (2004) study revealed that for a long-time people have been working together to share resources, labour and expertise. Such alliances and associations have been institutionalised into local organisations, communities, self-help groups and groups of farmers (Mckitterick *et al.,* 2016). Some of the groups are formal and others are informal and more flexible. Formal organisations are registered with the framework of governance and the laws or constitutions governing the groups. The size of the group also varies; some may have 20 or 30 members. Numerous organisations have external funding to support their work, while others rely on members' donations. Such groups meet at various public places such as colleges, community centres and churches. South Africa has a long history of encouraging and mobilising local communities through unions, associations, farmers' groups, social groups, cooperatives and committees to participate in agricultural activities. The nature of the various networks and the types of benefits they provide depend on their members. The findings of studies conducted by the FAO (2015) indicate that rural development policies have established mechanisms to assist in organising farmers into cooperatives, associations and groups. This framework was designed to ensure targeted delivery services and collective actions to access inputs, group training and knowledge.

LEISA (2007) argues that community ties, traditions, trust and obligations are found among farmers' groups and that these ties bind farmers together. Groups of farmers create social capital that facilitates group bonding and links agricultural service providers (Wood *et al.,* 2014). Groups of farmers share common interests, concerns and data and support each other socially, thus enhancing group dynamics. Sligo (2002) and Smedlund (2008) highlighted the need to reinforce organisations and groups of farmers to facilitate communications and interaction between farmers and other actors in the knowledge systems.

Farmers' networks facilitate intergroup social connections and provide mechanisms for exchanging knowledge (Tenkasi and Chesmore, 2003; Smedlund, 2010). Farmers in communities engage with one another in formal and informal interactions to help or be helped. Through this commitment, social networks, associations and platforms are established to facilitate goals and rules (Yu and Zhou, 2017; Zeweld *et al.,* 2017). These guidelines and goals include the means to ensure transparency through behavioural norms and rules. Such organisations assist networks to provide schedules, narratives and guidelines on how to do things. Wiedzy *et al.* (2015) and Yu and Zhou (2017) posit that farmers occupy space in society with issues of control, trust and hierarchy that need to be examined as the social locus of action. Several farmers' social learning systems allow for more communication with other farmers within and between them (Waters-bayer *et al.,* 2015; Tregear and Cooper, 2016). There is a need to understand the various forms of interactions and institutions beyond the extension level.

2.5 Leadership and the quality of knowledge shared among farmers

Leadership plays an important role in promoting the sharing of knowledge (Von Krogh *et al.,* 2012). A leader is responsible for building trust between employees and inspiring them to share and transfer their expertise (Nakazi *et al.,* 2017). Rural leaders serve as mouthpieces for extension workers. Leaders use their authority and ability to bring together and inspire community members to work for their growth (Van Eck *et al.,* 2011). Most scholars agree that social interaction and relational networks of formal and informal leaders (elected leaders and leaders of opinion) are crucial and that they perform an important role in the dissemination of information and knowledge in the agricultural community (Saad *et al.,* 2018). The social infrastructure of the community, which encompasses the rules, organisational structure and procedures, has a significant influence on the efficiency and effectiveness of networks and community standards (Leta *et al.,* 2018).

The concept of leadership is identified as a key enabler for sharing knowledge (Argote and Fahrenkopf, 2016). Vazquez *et al.* (2009) found that leadership empowerment has a significant impact on members' knowledge-sharing behaviour in a system. Local leaders who interact with farmers daily have an impact on their behaviours and perceptions and influence a community's overall capacity (Von Krogh *et al.,* 2012). Although the importance of social effects has been acknowledged, measuring the extent of influence on farmers' knowledge has not been fully

explored. This study posits that the effective manner to progress towards sustainable agriculture in rural communities is through institutional and social leaders and their influence over their followers must therefore be established and understood. These influential people affect others through persuasion, by providing information and by serving as an example for people in their community. They have been variously labelled by researchers as opinion leaders, informal leaders, information leaders, influencers, and gatekeepers (Hartwich *et al.*, 2007; Goulet, 2013).

Opinion leaders can convey knowledge convincingly to their peers, especially if they use the same language (Saad *et al.,* 2018). Lamm *et al.* (2016) describe these key actors as the farmers' mouthpiece before extension agency/advisor and can elaborate on the needs of local farmers. Hence, farmers approach and consult with these farmers to learn their opinions and to receive their advice (Niewolny & Lillard, 2010). Thus, the farmers' actions and decisions are greatly influenced by the opinion leaders from whom they sought advice. Numerous studies have attempted to identify the characteristics of opinion leaders (Echetama *et al.,* 2017). Although the importance of opinion leaders has been acknowledged, there have not been many attempts to measure and explore the extent of their influence on their fellow farmers. This study aimed to fill this gap and explore the reasons that motivate farmers to choose their opinion leaders.

Leadership and culture are critical for group development and support. Rogers (1995) claims that opinion leadership is the degree to which a person can influence the actions and attitudes of others and opinion leaders are therefore creative agents of change in a social system. Opinion leaders can be representative of norms and attitudes in the traditional social system (Weimann *et al.*, 2007; Matous and Wang, 2019). Various literature sources emphasise leadership as the main link and developer of social capital with organisational and leadership connections (Sligo, 2002; Sligo and Massey, 2007). The key contributions of group leaders are to promote engagement and provide encouragement and direction.

The definition of an opinion leader refers to the ability of a person to exert control in a social network (Rogers, 1983). Aalbers and Dolfsma (2011) posit that local farmers are good sources of new information and advice for the community, although Chen *et al.* (2015) indicate that in a broader context, some farmers may be opinion leaders and others may have leadership roles confined to specific issues. A study conducted by IFPRI (2008) suggests that opinion leaders are

not inherently revolutionary but more evaluators whose decisions their follower's trust. Thus, opinion leaders can also be non-farmers in a farming community who are experts in another field or that have a professional career (Abdel-Ghany, 2012). Leaders of opinion have the opportunity to exercise authority, as some people in their community regard them as consultants and believe that their opinion matters (Weimann *et al.*, 2007; Matous and Wang, 2019). People also consult those who have a significant influence over other community members before making any decisions. Typically, these types of leaders are informal and may not be in group leadership roles. Knowing farmers' knowledge systems requires an understanding of the social framework used by farmers to disseminate agricultural information and knowledge.

Rogers (2003) emphasises the importance of opinion leaders in the distribution of new information and knowledge and their impact on others. Authors including Lamm *et al.* (2016) have researched the effect of opinion leaders in the field of agriculture and have ascribed various terms to these people, e.g., prominent, influencers and leaders of opinion. According to Weimann *et al.* (2007), in all occupations, age groups and races, opinion leaders occur at all social levels. Opinion leaders are described according to their characteristics, such as strong personality and numerous social contacts. Katz and Lazarsfeld indicate that opinion leaders in their field may be specialists, while others may be experts in multiple fields. Opinion leaders are typically among the first to adopt a new product, according to Oleas *et al.* (2010) and use word-of-mouth communication skills to affect other people's behaviour. Tuan *et al*. (2010) identified that opinion leaders' interactions are mostly informal. According to Jungnickel (2018), opinion leaders have greater access to mass media and interpersonal networks than their followers. Chau and Hui posit that opinion leaders can influence their peers in three ways: they act as role models who inspire imitation, they disseminate information via word of mouth, and they provide advice to others.

Three main methods are utilised to identify opinion leaders and measure opinion leadership, namely the socio-metric technique, which consists of asking group members whom they go to for advice and information; key informants, whereby informants are selected as the people likely to know who the opinion leaders are in the community and the self-designating technique, which involves asking a respondent a series of questions to determine the degree to which they perceives themselves to be an opinion leader (Abdel-Ghany, 2012; Goldberg, 2014). Some researchers use traditional features of opinion leaders generalised by multiple studies that have asked who opinion

leaders are in a social system (Echetama *et al.,* 2017). As opinion leaders influence their followers through personal contact, a critical task in identifying opinion leaders is to examine communication networks in a social system. Social network research has unique advantages in recognising opinion leaders in an institutional or social system (Aalbers and Dolfsma, 2011). The study of social networks is a tool to evaluate interpersonal communication patterns based on information indicating who communicates with whom and who affects whom (Madukwe, 2016). This indicates the direction in which people communicate in a social system. It also produces different maps of social networks showing communicative relationships between members of a social system. Matous (2015) claims that leadership is important, as leaders of their organisations have an impact on the course and efficacy of knowledge management. To gain access to relevant knowledge, the leader must establish conditions that allow individuals to use their knowledge manipulation skills. Leadership practices, however, can pose significant barriers to farmers' information development or acquisition (Matous and Wang, 2019).

2.6 Diversity and Sources of agricultural knowledge for smallholder farmers

Numerous studies (Wiedzy *et al.,* 2015; Tregear and Cooper, 2016) explain that farmers use various criteria to determine the value of sources of knowledge and the usefulness thereof, such as significance, readability, reliability, availability, etc. However, their studies suggest that most smallholder farmers receive agricultural information and knowledge from a variety of sources. These knowledge and information sources are associated with informally and formally (Sligo and Massey, 2007). According to Achora *et al.* (2016) the informal sources of information and knowledge diversify the farmers' knowledge, grow their trust and enhance their ability to act, which is, therefore, a form of knowledge. This knowledge may be communicated through individual or collective mechanisms (Simpson and de Loë, 2017). This can also be accomplished by interpersonal relationships such as those with friends, family members and community leaders and the awareness and experiences of the farmers themselves (Ramirez, 2014; Pratiwi and Suzuki, 2017). A study conducted by Rees *et al.* (2000) describes the diverse and varied sources of information identified by farmers through conferences, acquaintances, families, neighbours and women's groups such as community-based organisations. A similar study conducted by Boz and Ozcatalbas (2010) also reported that the main sources of information for Turkish farmers are their family members, neighbouring farmers, extension services, input suppliers and mass media.

Farmers also gain structured information from government departments such as the Farming and Ministry Extension Services (Tovey, 2008). Certain outlets include formal and informal cooperatives, non-government organisations, associations and researchers (Rankoana, 2017). Knowledge is also transferred and channelled across various channels that include radio, videos, web-based sources, site visits, field experiments and printed media (Niewolny and Lillard, 2010; Rahutami and Kekalih, 2012). A study conducted by Daudu *et al.* (2009) reported that farmers were using farm extension staff, posters, television and radio as their sources of knowledge.

To meet their complex knowledge needs, farmers utilise and incorporate information from various sources (Ramirez, 1993, 2014; Rankoana, 2017). Farmers have historically used their families, other fellow farmers and friends as their sources of information. Studies have shown that farmers regard their colleagues as trustworthy because of their practical experience under different environmental conditions (Nordström and Ljung, 2005; Niewolny and Lillard, 2010; Simpson and de Loë, 2017). Farmers also utilise the expertise of formal agricultural institutions to provide training courses, agricultural exhibitions, field days and demonstrations (Rahutami and Kekalih, 2012; Mtega *et al.*, 2016; Mkenda *et al.*, 2017). The role of formal AKS organisations in the system of regional knowledge and learning differs. The diversity of sources of knowledge contributes to awareness and networks and systems are often combined. Studies undertaken by Macdonald (2012), Lwoga *et al.* (2013) and Madukwe (2016) indicate that farmers utilise overlapping formal and informal networks and forums in multi-stakeholder information networks. The study conducted by Lubell *et al.* (2014) reveals that farmers gain knowledge by engaging in heterogeneous networks (Klerkx and Proctor, 2013). Although Liu *et al.* (2017) recognise the presence of various types of farmers' networks, limited attempts have been made to study the effects of these networks and platforms on the capacity and willingness of farmers to share or not share and use information embedded in these networks and platforms.

Social networks are structures that link individuals with social interaction patterns and social identities (Hornidge *et al.*, 2016; Liu *et al.*, 2017) and may be formal or informal, horizontal or vertical (Hart, 2007; Jennex and Assefa, 2018). Informal networks are described as face-to-face interactions between a limited numbers of people who know one another (Achora *et al.*, 2016). Friendship and kinship can also tie them together. Informal networks are also known as horizontal social networks that bring together people with a relatively similar status or power in the

community (Goulet, 2013; Hermans *et al.,* 2015; Hornidge *et al.,* 2016). In contrast, asymmetric relationships of hierarchy and dependence are vertical or formal social networks (Blore, 2015).

African communities are structured around family relationships and the role of families in an individual's social life is significant (Hermans *et al.,* 2015). Family ties are considered the primary and most essential layer of the network when examining social networks (Chow and Chan, 2008). Many people in a village or community are related to one another and belong to broad kinship groups that are particularly important for gaining access to knowledge (Hartwich *et al.,* 2007; Flora, 2014). Kinship networks, therefore, function in the family as sources of informal information and interaction (Edwards, 2013). Research conducted by Rogers (1983) emphasises the importance of knowledge sharing and communication between adjacent networks and explains that if individuals regularly engage in local networks, they are likely to exchange knowledge and data and will likely observe one another's behaviour. Relationships with neighbours are highly regarded by rural households (Cole, 2002; Chow and Chan, 2008).

2.7 Channels of communication between systems as linkage mechanisms

Rogers (1983) describes a channel of communication as the manner in which messages are transmitted from one individual to another. Agricultural information and knowledge flow across various channels, including private sector companies, universities and non-government organisations and among farmers. Some networks serve as linking structures for accessing and sharing knowledge by agricultural sectors and farmers (Demiryurek *et al.,* 2008; De *et al.,* 2013; Edwards, 2013). Each of these channels has an impact on smallholder farmers' sharing and acquiring knowledge in rural communities (Demiryurek *et al.,* 2008; Hartwich *et al.,* 2007; Goulet, 2013; Flora, 2014). Individuals with the greatest impact as linking structures are those who have direct contact with small-scale farmers (Goulet, 2013). These include transition agents, field workers and officers for extensions, facilitators and teachers. Such people have a strong responsibility to act as channels for communication. Local authorities, agricultural unions and associations of farmers can also be channels for interconnection.

2.8 Food security and smallholder farmers

There is a long history of social relationships in agricultural communities (Achora *et al.,* 2016) where everyone usually meets and knows everyone else in that community. Environmental changes, increased demand for food supply and production and new and diverse knowledge systems have emerged (Brown and Sonwa, 2015). Agricultural information and knowledge are essential inputs for sound farming decisions, increased income and improved food security. The structure of the agricultural sector in South Africa is dualistic (Thamaga-Chitja and Morojele, 2014). Agriculture plays an important role in South Africa as it ensures food security, enhances living conditions and serves as a tool to generate income for numerous households (Hart, 2007; Carreón *et al.,* 2011; FAO, 2017). Agriculture contributes significantly to the South African economy and has the potential to create close to an estimated one million new jobs by 2030 (Stats SA, 2014). It is also important to note that agriculture contributed 33.6% to the GDP growth of 2.5% in the second quarter (Stats SA, 2014). In South Africa, approximately 20.7% of all households engage in agriculture, which is equivalent to approximately three million households (Stats SA, 2010). Smallholder farmers are expected to play a significant role in both poverty alleviation and rural development in South Africa (Teilmann, 2012).

Small-scale farmers perform a key role in agricultural production by contributing to food production and increasing food security (Smedlund, 2010). Access to education is one of the basic preconditions of poverty alleviation. For households and individuals, the quality, adequate supply, accessibility and proper use of food are correlated with food security (FAO, 2017). Poor households are dependent on social connections to mobilise the resources needed to access food (Faure, 2015). It is, therefore, essential to understanding how people use their networks to access resources and knowledge. Agricultural knowledge deals with agricultural productivity and affects it in a variety of ways. Agricultural production can be increased by relevant knowledge systems that provide relevant, accurate and useful information and knowledge (Goulet, 2013) and the functions of agricultural information and knowledge systems, therefore, need to be understood. Knowledge that is valid and timely helps farming communities to make appropriate decisions. The use of knowledge in the agricultural sector increases smallholder farm productivity (Hart, 2007). The role of knowledge and information in agriculture is therefore perceived to be extensive and multifaceted. Agricultural extension has a key role in the transfer of information and knowledge

(Hartwich *et al.*, 2007); however, there is limited coverage of the programs. Evidence suggests (FAO, 2014) that increased autonomy could have positive effects on several significant development outcomes, such as household productivity in agriculture and food and nutrition security.

With relevant, reliable and useful information and knowledge, it is possible to improve the productivity of these other factors (Hornidge *et al.*, 2016). The supply information from the extension, research, education and others must therefore be accessed by farmers to enable them to make informed decisions (Huggins *et al.,* 2012; Jennex and Assefa, 2018). Besides studies of the extension services and social information networks for farmers, there have been minimal studies of agricultural knowledge structures. Agriculture is a complex living environment based on nature and the primary source of income for farmers, especially in developing countries (FAO, 2014).

An effective and efficient information delivery system thus performs a critical role in providing reliable and useful information to farmers. Rural communities have visible and invisible interrelated interaction routes between the farmers and the network of social communication that must be explored (Maatman *et al.,* no date; Kigatiira *et al.,* 2018). Smallholder farmers play a role in ensuring food security, especially in developing countries and the success of these smallholder food farmers depends on their knowledge-based increased productivity. The South African Government has applied various strategies to tackle hunger and food insecurity (Ngaka and Zwane, 2017) by establishing several food security institutions, programs and support for farmers as tools for improving agricultural production.

2.9 Empowerment of smallholder farmers

Empowerment is a multidimensional social process that assists people to gain control over their lives (Page and Czuba, 1999). According to Alsop (2006), empowerment is the capacity of a group or an individual to make effective choices, i.e., make choices that lead to desired actions and outcomes. There are various definitions of empowerment (Ibrahim and Alkire, 2007; Tengland, 2008). Kabeer (2001) concluded that an individual's ability to make choices consists of three interrelated elements, namely resources (as conditions), organisation (as process) and performance (as results). Empowering processes for individuals might include learning decision-making skills, managing resources and working with others (Van Grinsven and Visser, 2011).

Farmers are farm and community-level social and cultural links (Tregear and Cooper, 2016). Their decision making is therefore a social process, formed by social group dynamics that include other farmers. Khwaja (2005) defines empowerment across two aspects, namely control and data; enabling individuals to communicate their preferences and effectively impact decisions. Nonaka and Takeuchi (1995) posit that knowledge is a process, a flow of information. However, many authors have indicated that knowledge is an asset and an active process of relating (Cabrera and Cabrera, 2005; Blore, 2015). The awareness of farmers is built through their social networks of critical thinking, on-farm tasks and interaction. It is widely recognised that smallholder farmers' success depends on their ability and the social networks in which they are embedded (Yuesti and Sumantra, 2017).

Farmers have access to information structures that can be either formal or informal (Yami and Van Asten, 2018). From an agricultural perspective, to achieve food security and improve the livelihoods of farmers, it is important to combine informal and formal information (Avelino *et al.*, 2020). The combination of knowledge systems allows farmers to access useful and reliable information and knowledge that leads to empowerment. Roberts and Coutts (2007) characterise a motivated farmer as one who will identify his/her challenges and opportunities within his/her farm system and pursue ways of solving them. Knowledge and skills are essential tools for agriculture. Technical knowledge is by far the most important aspect to ensure success for small-scale farmers, according to the Farmers' Week Report (2012). Farmers receive most of their technical know-how from agricultural sectors but as human beings, there is a need to explore beyond these sectors. Sveiby (1997) describes knowledge as the capacity to act and emphasises that intelligence is developed in people's brains and that the potential of man to build knowledge is infinite. Studies based on how farmers gain and share knowledge are useful for agricultural systems (Sligo, 2002; Smedlund, 2008; Simpson and de Loë, 2017) and farmers' willingness and ability to absorb and share knowledge is key to their empowerment. Farmers have motives and values that are logical, ethical and emotional social factors that direct them in choosing which information to obtain, the sources they pursue and the learning methods they follow (Tenkasi and Chesmore, 2003; Sligo and Massey, 2007; Teilmann, 2012). If a farmer has no such experience, gaining and integrating new information properly will be difficult and empowerment could remain beyond their reach. Multiple knowledge systems exist in farming communities, which provide farmers with a range of

benefits, including knowledge, skills, the control of resources, input supply and market information (Dolinska, 2016). However, studies that explore the outcomes of empowerment through existing knowledge systems are particularly limited. According to Khushk *et al.* (2016) outcomes are specific changes in attitudes, knowledge, skills and levels of functioning from participating in a program. According to Cheung *et al.* (2012), the empowerment outcomes that are close to power include knowledge, skill, strength, control and self-efficacy. The psychological empowerment of farmers is defined and measured as the individual's belief that they can influence others and have a significant impact on their farming community. The study was based on the argument that psychological empowerment positively influences farmers' decisions and performance.

Information can be either implicit or explicit (Sligo, 2002; Tovey, 2008). Tacit expertise, according to Smith (2001), is pragmatic, action-oriented, practice-based know-how learned through personal experience and often resembles instinct. Tacit as well as explicit knowledge can be further divided into three distinct groups, namely human knowledge, social knowledge and formal knowledge. Human intelligence is what people know or know how to do. This knowledge incorporates both explicit and implicit knowledge (Nordström and Ljung, 2005). In relationships between individuals or within communities, another form of information that is known as social knowledge occurs. Mostly implicit, this information is shared among members of training groups or societies. Standardised knowledge requires standardised and formalised rules and rules-based processes and practices that are deeply rooted in an organisational environment (Sligo, 2002; Nordström and Ljung, 2005; Nabavi, 2014).

2.10 Conclusion

This chapter presented a review of literature pertaining to the key AKS concepts. It explored the relationship between knowledge management and AKS. The roles of key actors, including small-scale farmers and farmers' groups were discussed. This chapter also covered the theories that focus on the sources of knowledge for smallholder farmers and AKS; the linkages flow of knowledge between the AKS actors and social learning platforms; the role of social capital and social learning platforms in AKS and the utilisation of agricultural knowledge.

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CHAPTER THREE: METHODOLOGY

3 Methodological approach and data collection

3.1 Introduction

This chapter presents a description of the research process. It provides information concerning the method that will be used in undertaking this research as well as a justification for the use of this method. The Chapter also describes the various stages of the research, which include the selection of participants, the data collection process, and the process of data analysis. The Chapter ends with a discussion of validity and reliability in qualitative research in the current study. The research plan, including the methodology, study participants, procedures, analysis method, and ethical concerns were also primary components of this chapter. The study explores agricultural knowledge systems and smallholder farmer empowerment with a special focus on social capital and social learning platform.

The study uses a mixed-methods approach, qualitative and quantitative approaches. The qualitative research method was developed in the social sciences to enable researchers to study social and cultural phenomena: observe feelings, thoughts, behaviours, and the belief of the mass society (Hussein, 2009). Qualitative data sources include observation and participation observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Meinzen-Dick *et al.,* 2004). For this research, methods of interviews, and questionnaires were used. Interviewing of selected individuals is a very important procedure to enable the researcher to find out what is on the participant's mind, what they think, and how they feel. Qualitative research approaches use focus group discussions and key informant interviews to collect information and usually pose open-ended questions to interviewees.

As outlined by Creswell (2013), a quantitative approach is appropriate when a researcher seeks to understand relationships between variables. The distinction between these quantitative and qualitative research approaches lies in their difference in the research methods used and the type of data gathered. Quantitative research is usually conducted scientifically with the main focus on gathering numerical data that can be subjected to complex statistical analysis (Marcarty, 2011). Whereas the qualitative approach allows the researcher to study selected issues in depth.

3.2 Site selection and sampling

According to Hussein (2009), sampling is the process of selecting a group of subjects for a study in such a way that the individuals represent the larger group from which they were selected. During the process, the researcher makes decisions concerning the relevance of the population; sampling strategies; the sampling frame, and sample size to be drawn. Sampling is the statistical process of selecting a subset of a population of interest for purposes of making observations and statistical inferences about that population (Bhattacherjee, 2012). In this study, the researcher employed the purposive sampling method for the selection of the participants. Purposive sampling refers to intentionally chosen samples according to the needs of the study (Palinkas *et al.,* 2015). This means the researcher selects participants because they have indicated their willingness to participate in the study. Purposive sampling is a type of non-probability sampling and is useful when the researcher targets a particular group, in this study we targeted active smallholder farmers. This strategy enables the researcher to collect relevant and useful information for answering the research question.

3.3 Description of the study area

The study was conducted in two District Municipalities (uMtshwathi and Ukhahlamba) in Kwa-Zulu Natal Province as shown in the figure below. A purposive sampling technique was used to sample active smallholder farmers who are linked to the Kwa-Zulu Natal Department of Agriculture and Rural Development (DARD). Data were collected from November 2019 until February 2020 from a sample of 219 smallholder farmers. The livelihoods at Appelsbosch are largely derived from subsistence farming, which includes cropping and livestock farming IDP, 2016/17. Farmers in the area grow maize, beans, sweet potatoes, *Amadumbe* and a few grow sugars canes which a favourable under humid climate, with rainfall 500 to 800 mm/annum. Farmers at Appelsbosch are engaged in different types of social groups to sustain their livelihoods. The focus was also on the Okhahlamba Local Municipality (OLM) smallholder farmers, mainly engaging in maize, vegetable, and livestock production occupy the marginal areas in Bergville. Also, smallholder farming is very important in the province, as it is the backbone of its rural households. Smallholder farmers were purposively selected from farming households. These social capital types include farmers' groups, burial societies, and grocery/money savings club (stokvel). These social groups have both economic and social benefits for households. The economic benefit of the

social group includes the promotion of income security while the social benefit includes social support. All these social groups contribute to household livelihood (IDP, 2016/17).

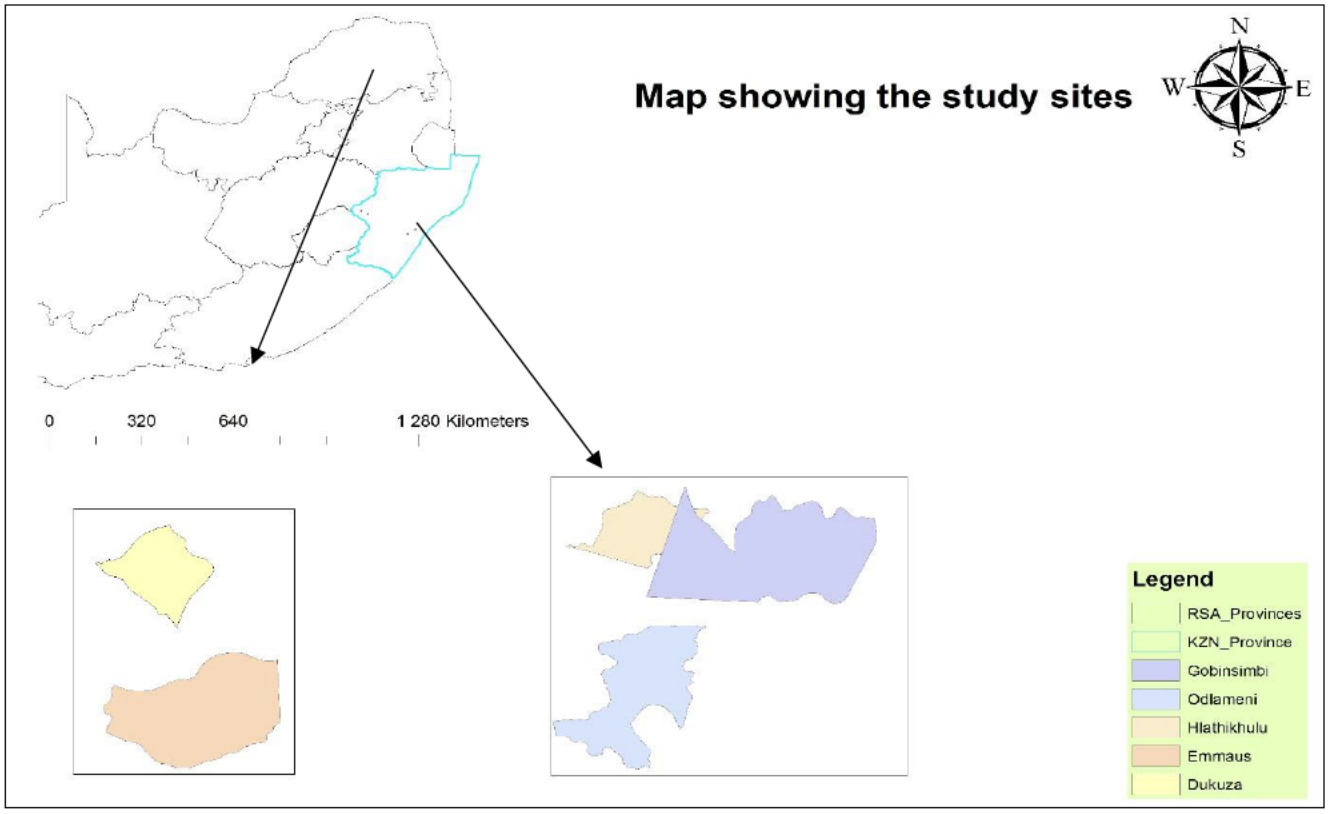

Figure 2: A map showing the study sites of uKhahlamba and uMtshwathi Municipality

3.4 Data collection procedure and tools

3.4.1 Structured questionnaires

A survey questionnaire was employed in the study to gather information on farmers' understanding of knowledge systems, social networks, and platforms that they used in farming activities. The structured questionnaire included both open-ended and closed-ended questions. Open-ended questions allowed participants to provide in-depth information on their feelings, experiences, and perceptions on social capital, networks, and learning platforms. The questionnaire comprised of four sections. Section A sought general information about the respondents. Section B consisted of the conversion of knowledge, gather relevant information on the transfer of knowledge, and sought to provide relevant information relating to the application of knowledge. Section C gather information on social networks and platform used by farmers to gain and share agricultural

knowledge, Section D food security questions.

3.4.2 Focus groups

The study employed focus group discussions (FGD) to generate meaningful discussions to gain an understanding of social capital and knowledge systems (Meinzen-Dick *et al.*, 2004). The focus groups are a form of in-depth group interviews, which provides information on topics specified by researchers (Noble and Smith, 2015). Focus groups provide researchers with direct access to the language and concepts respondents use to structure their experiences and to think and talk about a designated topic (Noble and Smith, 2015). Thus, focus groups move beyond the level of the individual and examine cultural knowledge that is shared among group members. Three focus group discussions were conducted. Focus group discussions were involving farmers with farming experience which were purposively chosen among those who were involved in the questionnaire survey.

3.4.3 Key informant interviews

3.4.3.1 Interview methods

Key informant interviews aim at obtaining a general idea regarding the knowledge systems used by farmers within and outside their community to acquire and share knowledge. Each of the interviews were conducted by the researcher in a face-to-face. The interview questions were open-ended, including indirect questions to obtain information about the attitudes and beliefs based on knowledge systems. The interview method is one of the ways to obtain primary data. The questions to ask the interviews were prepared as written questions.

3.5 Data collection and Analysis

3.5.1 Sub-problem 1

Data collection was conducted between November 2019 and March 2020, using structured household questionnaires, held focus group discussions (FGD), and key informant interviews. A structured questionnaire was utilized to collect household demographics and socio-economic characteristics; income sources and amounts; access to institutional support services and membership in farmer organisations, information on social capital, and participation in group activities. Food security information was collected using a validated Household Food Security

Scale (HFIAS). A descriptive analysis of all the variables was carried out. Farmers' responses on various agricultural information services were analysed with simple statistical techniques such as descriptive analysis using SPSS software. The ordered probit regression model was used to determine farmers' characteristics and knowledge systems that predict farmers' household food security through STATA software.

3.5.2 Sub-problem 2

Socio-metric methods were used to trace communication patterns among members of a group. Data is typically obtained by interviewing participants and asking them to whom they go to for advice, guidance on why this person is considered a useful source of information, and channels of communication with the identified individual. The study carried out descriptive statistics using SPSS software and STATA software to analyse all the variables of interest in the study. A Multinomial Logistic (MNL) Regression model was used to analyse farmers' socio-economic characteristics and their chosen opinion leaders.

3.5.3 Sub-problem 3

Applying empowerment theory and previous studies to our scenarios we identified five empowerment outcomes: decision making, increased self-efficacy, increased knowledge, leadership and competence. These psychological dimensions were compiled following (Khushk *et al.*, 2016; Ani *et al.*, 2018). With the data collected, each farmer responded rating their level using the five-point Likert scale. The data collected in this questionnaire was largely quantitative. Psychological empowerment dimensions were calculated to show the empowerment levels of the different farmers. The expected range of scores on the variable was from '10' to '50'. Higher scores indicated higher self-esteem and vice versa. Each dimension was added up and divided by the number of questions in each dimension. Furthermore, the Principal Component Analysis (PCA) was used on the questions representing the psychological empowerment to generate dimensions contributing to the principal component. The dominant PCs with greater Eigen values than one using the Kaiser criterion were retained in each dimension. An in-depth description of the analysis processes performed is presented in Chapter six.

3.6 Ethical considerations

3.6.1 Informed consent

Participants for the interview were briefed on the purpose and conduct of the research. It was made very clear to them that participation was voluntary, and they could withdraw from the project at any stage without penalty. Data collection and analysis was described clearly to the participants so that they know what they were doing. As mentioned above, this study was exploring with knowledge systems in agriculture with a focus on social capital and social learning platforms. As mentioned by Creswell (2013), the researcher should consciously consider the ethical issues which involve issues of maintaining confidentiality, protecting the anonymity of individuals and seeking consent, all of which the participants were informed of.

3.6.2 Privacy

All personal information of the participants were treated as confidential and remain confidential throughout the study. Once the thesis is compiled, the information would remain under the institution's collection. Personal data such as recordings of the interviews and photo captured would also be kept under the institution collection.

3.7 Conclusion

This chapter focused on the research methodology, design, and sampling procedures. The chapter gives an overview of the methodology that was used for this study. The methods used to collect and analyse data were reviewed. The data collection procedures are also discussed.

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CHAPTER FOUR: AGRICULTURAL KNOWLEDGE SYSTEMS AND THEIR IMPLICATIONS ON FOOD SECURITY OF SMALLHOLDER FARMERS

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Abstract

In exploring and understanding knowledge systems of smallholder farmers, there is a need to critically understand these questions: the study asks the fundamental questions of what and how information/knowledge is delivered by the networks to the farmers. What implications are imposed by these knowledge systems on food security status of active farmers? In the agriculture sector, there is intense emphasis on information and knowledge as an important decision-making tool to the farmer for their livelihoods and knowledge empowerment. Thus, an effective information system and supportive ongoing services to agriculture in communities are crucial to the needs of marginalised farmers. To achieve the aim of the study, purposive sampling was conducted to sample 219 active smallholder farmers in Appelsbosch and the Bergville area, in KwaZulu-Natal Province. The study used both a qualitative and a quantitative approach. The overall results demonstrated that agricultural knowledge flows through various channels including farmers' local networks, the private sector, NGOs, and research Institutions. The participation level of farmers on local knowledge systems shows a significant impact on farmers' food security status. Farmers state that the technical knowledge received during training and demonstration helps them to improve their skills of conducting and performing field activities which improve their crop productions. The KwaZulu-Natal Department of Agriculture and Rural Development (DARD) and various non-government agencies need to have access to updated information for transformative initiatives and platforms that intend to transform and empower farmers through local and private networks.

Keywords: Knowledge systems, food security, smallholder farmers

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Manuscript has been submitted to a journal and is under review

4.1 Introduction

This paper seeks to augment the understanding of knowledge systems in a community of smallholder farmers, arguing that rural communities contain dense systems, connected systems and different actors which might be the receivers or sources of knowledge. Moreover, these systems further intersperse with groups of actors that share one or more similar goals. In South Africa, agricultural knowledge and information are created conjointly by agricultural universities, agricultural colleges, research institutes, the Ministry of Agriculture and different actors concerned in agricultural production and farmers, forming knowledge systems (Pienaar, 2013). This knowledge which is created and shared with farmers includes analytical skills, critical thinking, and the ability to make better decisions. According to Kaine *et al.* (1999), a knowledge system is a network of actors connected by formal and informal social relationships.

In the context of agriculture, scholars have emphasised information and knowledge as an important decision-making tool to the farmers for their livelihoods and knowledge empowerment (Mckitterick *et al.*, 2016; Mkenda *et al*., 2017). Thus, effective communication, by creating an information system and supporting the ongoing services to agriculture in communities, is crucial to the needs of isolated and marginalised farmers. Jennex and Assefa (2018) emphasised that an integrated approach for farmers and knowledge empowerment should incorporate mutual learning between formal and informal knowledge systems. Therefore, there is a need to upscale, and institutionalise the knowledge systems and the platforms farmers utilised as these paradigms of systems grow among farmers and communities of South Africa. This will help to understand why some farmers can solve local farming issues and progress while some fail, yet they are in a close geographical space.

In rural communities of the KwaZulu-Natal Province, comprising of active farmers, have self-organised by forming networks with formal and informal actors within agricultural systems (Tamako and Thamaga-Chitja, 2017). Furthermore, farmers actively share and source agricultural knowledge through interpersonal communication, including social gathering, farmers' groups, village-leaders, input suppliers, extension officers, agricultural exhibitions, and NGO networks. The daily and frequent social interaction among farmers and other social interacting platforms of farmers provide many opportunities for farmers to learn from one another (Lwoga *et al.*, 2013;

Kunda *et al.,* 2018). Simpson and de Loë (2017) point out that informal institutions and socio-cultural events are the main platforms of interactions between farmers, which eventually become agricultural learning opportunities.

Additionally, Zeweld *et al*. (2017) conclude that farmers play an important role in disseminating agricultural knowledge because they see knowledge in practice and have new knowledge that they can share through farmer social networks. These interactions and learning systems of farmers build social knowledge networks with multiple heterogeneous communities of knowledge producers. Furthermore, this led farmers to develop their distinctive learning pools and social knowledge systems within and outside their communities. However, the effectiveness of these knowledge systems at the farmers' level for capacity development has not been studied. The research objective is to describe the knowledge systems existing in the selected study areas, and how farmers are associated with these networks. The study asks the fundamental questions of what and how information/knowledge is delivered by the networks to the farmers.

Knowledge and skills are essential resources for farming (DAFF, 2010). The majority of smallholder farmers in the developing countries, especially South Africa rely on knowledge and skills they informally acquire (Blore, 2015). At local levels, there are experts i.e., farmers who work in professional jobs, who provide agricultural advice to other farmers and shape their knowledge (Cabrera and Cabrera, 2005; Chakraborty and Chaudhuri, 2018). Also, the active support of NGOs and government departments through different development projects provides all kinds of agricultural knowledge to farmers. This is further illustrated by DAFF (2011) and FAO (2015) reports, which show rural development frameworks. The framework is designed to ensure targeted delivery services and collective actions to access inputs, group training, and knowledge for farmers. The South African knowledge systems apply a combination of government with local farmers' associations and cooperatives, with government support systems (Rankoana, 2017). Thus, the agricultural knowledge system is organised through a complex network of agricultural ministries, agricultural universities, and farmers. According to Macdonald (2012); Lwoga *et al*. (2013) and Madukwe (2016) studies, they revealed that farmers operate in multi-actor knowledge networks which consist of overlapping formal and informal networks and platforms. According to

Lubell *et al*. (2014) and Klerkx and Proctor (2013), farmers obtain knowledge through their participation in heterogeneous networks.

Understanding the knowledge pools of individual farmers and actors holding the information and knowledge within and between the knowledge systems of farmers is important. An investment in existing agricultural knowledge systems is essential to fight poverty and to empower farmers who constitute the majority in developing economies with knowledge (Beaman and Dillon, 2018). Small-scale farmers play a key role in food production and can enhance food security (Smedlund, 2010). Allahyari *et al*. (2017) argue that in agriculture, productivity is greatly determined by the amount of information available to farmers. This is furthermore supported by Chakraborty and Chaudhuri (2018); and Cofré-bravo *et al*. (2019) who state that to enhance the production and productivity of agriculture, farmers should have access to well organised and relevant information. Dolinska's (2016) put more emphasis on the lack of skills and competence to perform agricultural activities by farmers which result in poor production. Additionally, Madukwe (2016) argues that the lack of capacity, knowledge, and skills development for farmers are some of the reasons responsible for ineffective and disempowering systems. The production and circulation of knowledge within and among groups of farmers have been an interest in the agricultural world. The study objectives are a) to identify the theoretical framework that guided the study; b) to report on the demography of the study; c) to identify the knowledge system utilized by small holder farmers. d) To identify the type of knowledge transferable through local knowledge systems. e) To identify how farmers participate in knowledge system and food security.

4.2 Theoretical framework

The study uses Lubell *et al.* (2011; 2013) Agricultural Knowledge Systems definition, which is explained based on four core concepts: Program participation, social networks, belief systems, and practice adoption. Foster and Rosensweig (1995) and Hoffman (2013) further explained that the knowledge system supports three learning pathways: social learning, experiential learning, and technical learning. AKS (Agricultural Knowledge System) is a collection of actors, such as researchers, advisors, and educators, working primarily in agricultural knowledge institutes (Chow and Chan, 2008; Demiryurek *et al.*, 2008). Hoffman (2013) further explains that the different components of the knowledge system support three mutually learning pathways: technical learning

pathways, social learning pathways, and experiential learning pathways. Pretty and Wesseler (2004), study outlined that for years, farmers have been working together to share resources, labour associations, and expertise. These alliances and associations created have been institutionalised into local organizations, communities, self-help groups, and groups of farmers (Mckitterick *et al.*, 2016). These networks and relationships have specific ways of engaging with each other which is rooted in their everyday practice and hence brings interaction among each participant and network system. The present study is also grounded in the Sustainable Livelihoods Framework (SLF). The SLF identifies five capitals, which can be classified as tangible i.e., physical, natural, and financial, and these are called assets and intangible i.e., human and social which are called capabilities (Vorley *et al.*, 2012, Scoones, 1998). Social relations like kinship, the community, and friends, are different contributors to rural peoples' livelihoods. In addition, contribute to secure and sustain the diversity of livelihood strategies

4.3 Methodology

4.3.1 Site selection

The study was conducted in KwaZulu-Natal Province, under the Okhahlamba and uMshwathi Local Municipality. The uMshwathi Municipality has thirteen wards and the south-eastern area of the municipality, which is made up of rural areas that are mainly dominated by subsistence farming. Smallholder farmers exist on their traditionally controlled land along the edges of good arable land reserved for sugarcane and forestry farming. The land is characterised by steep hills and rugged terrains which are less suitable for farming, from which they grow several crops such as maize, beans, potatoes and vegetables. Therefore, the main economic driver in the rural component of the municipality is agriculture. The focus was also on the Okhahlamba Local Municipality (OLM) smallholder farmers, mainly engaging in maize, vegetable, and livestock production occupying the marginal areas around the town of Bergville. In both areas, smallholder farming is very important in the province, as it is the backbone of its rural households. Smallholder farmers were purposively selected from farming households.

4.3.2 Data collection and sampling tools

Data collection was conducted between November 2019 and March 2020, using structured household questionnaires, focus group discussions (FGDs), and key informant interviews. A structured questionnaire was utilised to collect household demographics and socio-economic characteristics, access to institutional support services and membership in farmer organisations, and participation in group activities. The FGDs and key informant interviews were used in addition to structured questionnaires to provide in-depth issues. Two focus group discussions were conducted from the selected study site, each with seven members. Three *Zulu-speaking* enumerators administered the questionnaire to the farmers. The Bergville and Appelsbosch farmers were purposively selected for the study. The reason for this purposive sampling was that the farmers were involved in agricultural activities and knowledge systems. A sample of 219 smallholder farmers was selected and interviewed.

4.3.3 Measuring Food Security

Food security information was collected using a Household Food Security Scale (HFIAS), which captures the occurrence of food insecurity and frequency of occurrence. Several tools can be used to measure respondent food insecurity, but for this present study, HFIAS is the most appropriate to assess specific conditions associated with food insecurity and the frequency of occurrence patterns for 30 days (FAO, 2018). The HFIAS was developed by FANTA to reflect three universal domains of the experience of inadequate household-level food access, namely anxiety and uncertainty about the household food supply, insufficient quality and insufficient food intake and its physical consequences (Ballard *et al.,* 2011; FAO, 2018).

The HFIAS utilises nine occurrence questions that ask whether a condition related to the experience of food insecurity has happened during the past four weeks or 30 days, with responses coded as 1=yes and 0= no (USAID, 2007; Ballard *et al*., 2011). Each occurrence question is then followed by a frequency-of-occurrence question, which inquires how often a reported food insecurity condition occurred during the past four weeks (with three response options: 1= rarely, 2 = sometimes, and 3 = often) (USAID, 2007). For this paper, based on the respondent's answer to each question, the HFIAS score was calculated. A total score of 27 represents the most food-insecure household whereas a lower score represents a more food-secure household. Finally, each

household was classified into one of four categories: food secure, and mildly, moderately, or severely food insecure.

The study used an Ordered Probit Model, where:

Farmers' household food security = f (gender, age, educational level, marital status, monthly household income, agriculture as Career, Agriculture Learning Platform, Participation level on local knowledge systems, Participation level on technical knowledge systems, and Participation level on scientific knowledge systems). …….....[1]

The respective category for food security is unobserved and is denoted by the latent variable qi*. The latent equation below models how qi* varies with personal characteristics.

qi* = Xi ……..…… [2]

Where variable qi*measures the utility derived by individual

i from either food secure or mildly food secure or moderately food insecure or severely food insecure. *i* = 1, 2, 3……. *n*)

n represents the total number of respondents. Each individual *i* belongs to one of the four food security groups.

X is a vector of exogenous variables listed in table 4.1 below.

Table 4.1: Description of independent variables used in the Ordered Probit Model

Variables	**Measures**	**H_0 sign**	**Rationale**
Gender of respondent (GEN)	1= male; 0 = female	+/-	More female dominates agriculture in the world
Age of respondent (AGE)	Number of years	+/-	Older farmers are more engaged in farming and interested in learning
The educational level of respondents (EDUC)	Number of years in school	+/-	Educated respondents are highly exposed to opportunities, more likely to be food secure.
Marital status of respondent (MARST)	1=married;0= single	+/-	Households with married spouses can be food secure
Monthly household income	Rands (R)	+/-	Higher-income can increase farmers' engagement in knowledge systems, and food security

Agriculture as Career	1=Yes, 0=NO	+/-	Farmers with career/business motives will engage in more farming knowledge systems
Agriculture Learning Platform	1=Yes, 0=NO	+/-	Farmers with learning motive will socially interact with more actors to increase their knowledge
Participation level on local knowledge systems	1=low, 2=high	+/-	High participation will increase farmers' knowledge and improve food security
Participation level on technical knowledge systems	1=low, 2 =high	+/-	High participation will increase farmers' knowledge and improve food security
Participation level on scientific knowledge systems	1=low, 2=high	+/-	High participation will increase farmers' knowledge and improve food security

4.3.4 Data Analysis

This study utilised quantitative and qualitative methods. A descriptive analysis of all the variables was carried out. Farmers' responses on various agricultural information services were analysed with simple statistical techniques. The descriptive analysis involved looking at means, frequencies, and standard deviations of the variables.

4.4 Results and Discussion

Table 4.2 presents the demographics and socio-economic characteristics of the sample of 219 smallholder farmers. The majority of 66.2% of respondents were female farmers and 33.8% were male farmers. This result agrees with Thamaga-Chitja and Morojele's (2014) findings which show the significant presence of women in agricultural production in most rural communities.

4.4.1 Age

According to the survey, 12.9% of the respondents were between 21-35 years of age, followed by 11% of respondents between 36-45 years of age. Most respondents were 56-65 years old, contributing 29.2% of the sampled size, followed by 25.6% of respondents aged 46-55; the remaining 22.4% were respondents older than 65 years. This indicates that most of the respondents were older, which is supported by the Integrated Development Planning, (IDP, 2018), which reported that the average age of the smallholder was between 45-60 years, with the youngest

reported as 26 years old. This is a common trend of many rural communities in Sub-Saharan Africa where people retire from urban life to settle in rural communities (FAO, 2018).

4.4.2 Marital status

The results show that 23.7% of farmers were single, 63% married, 1.8% divorced and 11.4% widowed. The respondents who were not yet married occupied the youth age group. Findings reveal that most farmers were married couples; thus, their participation in agricultural production is mostly to feed their families.

4.4.3 Educational level

Most farmers from the sampled population had achieved a high school level of 34.7% of education, followed by the second group of farmers, 27.4%, who had attended primary schooling. About 23.7% of farmers did not attend any formal or informal schooling and could not read nor write. The incapability to read and write restricted the opportunity of smallholder farmers to learn new farming techniques. Only a few of the respondents had further studies in diploma and degrees, 0.9%, and 1.4% had participated in vocational training. The poor formal education for smallholder farmers in rural areas affects the willingness and motivation to know and learn about agriculture. Furthermore, low levels of education hinder the farmers' ability to access relevant information, improve farming methods, and sustain their food production. These results are further supported by Mkeni *et al*. (2010) study, which showed a high level of illiteracy among smallholder farmers in rural areas of South Africa. Farmers' performance is directly linked to their human capital endowment. In South Africa, various forms of formal and informal training are designed and organised to enhance and expand farmers' human capital (DAFF, 2011).

4.4.4 Monthly household income

Farmers from the survey earned different amounts of income. A total of 21.0% of the farmers earned less than R1000, while 27.4% of farmers earned between R1001-1500 and 47.5% earned between R1501-3500; only 4.1% earned above R3501. Forty-eight-point four percent shows a significant number of farmers who received a pension grant due to their age.

Table 4.2: Farmer's Demographics

Sample characteristics	*Categories*	*Frequency*	*Percentage%*
Gender	Female	145	66.2
	Male	74	33.8
Age	21-35	26	11.9
	36-45	24	11.0
	46-55	56	25.6
	56-65	64	29.2
	>65	49	22.4
Marital status	Single	52	23.7
	Married	138	63.0
	Divorced	4	1.8
	Widowed	25	11.4
Education	None, can't read and write	52	23.7
	None can read and write	26	11.9
	Primary school (1-7)	60	27.4
	High School (8-12)	76	34.7
	Vocational training	3	1.4
	Diploma/degree	2	0.9
HH Income	Less than 1000	46	21.0
	1001-1500	60	27.4
	1501-3500	104	47.5
	3501 and more	9	4.1

n= 219 Source: A household survey (2020)

Table 4.3 below shows multiple sources used by farmers to sustain their household. Majority of farmers 57.1% depend on pension grants as their source of income and followed by 26.9% farmers who receive government social grants to sustain their household. This supports the majority of farmers having household income ranging from R1500-R3500 per month from government grants and pension (SASSA, 2020/2021). About 21.9% of farmers depend on freshly produced sale of their products to retails and community.

Table 4.3: Farmers' sources of income

Source of income	Respondents frequency (n=219)	Percentages %
Remittance		
No	*190*	*86.8*
Yes	*29*	*13.2*
Government grants		
No	*160*	*73.1*
Yes	*59*	*26.9*
Pension		
No	*94*	*42.9*
Yes	*125*	*57.1*
Farm Produce sale		
No	*171*	*78.1*
Yes	*48*	*21.9*
Salary/wages		
No	*204*	*93.2*
Yes	*15*	*6.8*

Note multiple responses by farmers

4.4.5 Knowledge systems utilised by smallholder farmers

The study demonstrates that farmers operate and integrate with multi-actors within knowledge systems, consisting of local, scientific, and technical knowledge systems. Local knowledge systems (LKS) of smallholder farmers consists of savings clubs, farmers group and unions, cooperatives, farmers labour association, middlemen and fellow farmers in the community. These systems are used by farmers to acquire and share information on fertilizers, insecticide spraying techniques, seed variety, planting schemes and new techniques. These knowledge systems consist of institutional communication channels such as Department of agriculture (DARA), radio programmes, and fellow farmers. Moreover, they are led and driven by farmers through directing knowledge flow of agrarian between farmers and other agricultural organisations and are held together by regulations, trust and values shared by farmers. These set of social relationships and social bonds help farmers to frame their knowledge systems. Through this system, the experience and knowledge of farmers is exchanged and transferred through their scheduled meetings, field day visits and discussions mechanisms to integrate their theoretical knowledge with practical knowledge. This system show that farmers are receivers and holders of knowledge since an intense circulation of knowledge produced and exchanged among farmers' knowledge pools and niches. This system illustrates social learning path, which is based on social networks among farmers as

explained by the conceptual model of agricultural knowledge systems (Hoffman, 2013). According to Landini *et al.* (2017), social learning involves a process of exchanging and reflecting experiences, values and ideas to search for solutions through understanding their problems.

Scientific knowledge systems of smallholder farmers consist of research institutions and Non-governmental organisations. These systems work with farmers and collaborate with their local knowledge systems building a socio-technical system which provides technical knowledge to existing and new production farming processes. This system consists officials from higher up in the hierarchy to facilitated and govern the procedures of the system. This system provides a technical learning pathway to farmers through the extension and research institution services highlighted by Hoffman (2013).

4.4.6 Local knowledge systems

Farmers employed various ways of receiving and sharing information and build knowledge with each other and with external information and knowledge providers. The various ways are through farmers' group associations and unions, fellow farmers, cooperatives, middlemen, community labour organisations and committee for agriculture, and financial saving clubs.

4.4.6.1 Farmers group associations

About 99.5% of farmers participated in farmers' groups/associations for agricultural knowledge. They formed farmers' groups so that they could easily access agricultural extension and education services from providers. Most people in rural communities are related to one another, belonging to a few kinship groups, and these kinship networks are particularly important for gaining access to knowledge. Farmers hold monthly meetings and participate in field visits with an agricultural advisor and their fellow farmers for learning and observation for technical skills. In these meetings, farmers discuss issues ranging from seed variety, fertilisers and soil preparation. Farmers explain that the topics discussed have improved their yields, and they have sufficient produce for both consumption and selling to generate income. These farmers' associations have branches at village levels where they provide participation in governmental programmes and development projects targeting smallholder farmers. These findings were in agreement with Rahutami and Kekalih (2012); Mtega *et al*. (2016) and Mkenda *et al*. (2017), who showed that farmers also use knowledge

from formal agricultural institutions which provide training courses, advice, field days, and demonstrations.

4.4.6.2 Fellow farmers

About 86.3% of respondents indicated that farmers interact with other fellow farmers regarding agricultural information and knowledge. Rogers (1983) explains that when people interact frequently in local networks, they are more likely to exchange knowledge and observe each other's behaviour. Farmers further explained during *FGD,* through consultations and visiting other farmers' fields, that they gain more information through challenges faced by their fellow farmers and how they have overcome such issues. These fellow farmers are open to other farmers who want to learn. Successful farmers, by their influences, can transfer knowledge more convincingly to their peers (Saad *et al*., 2018). Klerkx and Proctor (2013) highlight that the farmers consider their successful colleagues as trustable due to the practical experience they see in a similar environmental condition.

4.4.6.3 Cooperatives

In addition, 48.4% of the farmers indicated that they engage in the farmers' cooperatives as their knowledge platform. Apart from being members of the village farmer groups, farmers participate in other formal and informal social arrangements and gatherings. These active cooperatives provide farmers with an expanded analytical tool to achieve better yield production. Furthermore, these social relations allow farmers to actively share information among themselves. During focus group discussion *(FGD),* farmers clarified that through their cooperative, they attend monthly meetings with extension advisors. These are arranged through cell-phone conversation and are followed by attending field demonstration. During the meetings, farmers discuss inputs, such as seed varieties, fertilisers, and pesticides to apply during planting session. Further, they discuss harvesting methods and receive market information.

4.4.6.4 Middlemen

About 23.3% of farmers indicated having interactions with market middlemen where they sell their produce. The middlemen often arrive in small vans known as 'bakkies" to collect produce at farm-gate. Other actors were buyers of agricultural produce/products who bought their harvests and

were the source of income for farmers. The middlemen were mentioned by farmers as important sources of information, especially the pricing and the best season of harvesting of their produce. During FGD, farmers explained that they talked with their traders about what the market needs and when best to harvest their fresh produce. During harvesting season exporters and traders visit their fields.

4.4.6.5 Community labour organisation and committee

Only 6.4% of farmers shared engaging in a labour organisation of farmers within their community, with 20.5% of farmers indicating interactions with the local committee for agricultural knowledge. Farmers explained that this committee channels the information to the village authorities; the community meeting is scheduled for the information to reach the farmers within organisation and outsiders. The people who hold these positions include the village heads, retired educators and representatives of mass organisations i.e., farmers' association and cooperatives. These individuals share their experiences, and information gained through their personal networks outside the community. This platform allows farmers participating and not participating in farmers group to engage in a community association which share labour unity and resources i.e., tractor organization and schedule during planting session.

4.4.6.6 Financial saving clubs (*stokvels*)

A small percentage of 5.0% of farmers engaged in saving club (financial clubs) in the community. They were also mobilised to form savings and credit associations so that they could easily get capital for their agricultural activities. These clubs consist of farmers within the village who meet monthly to discuss technical information and investment matters regarding agriculture. Farmer revealed that these financial clubs provide opportunities for learning skills with credit access, inputs, and social support to minimise input costs. Furthermore, the platform is used to save money for buying agricultural inputs and pay the organised tractor using planting session. According to the FAO report (2017), African communities are organised around family relations and families play an important role in agriculture, and this structure is observed with smallholder farmers in KwaZulu-Natal Province. The knowledge systems of farmers at Bergville and Appelsbosch revolves around community farmers, department of agriculture, fisheries, and forestry (DAFF) and private sector. A similar study by Boz and Ozcatalbas (2010), also revealed that family members,

neighbour farmers, extension services, input providers, and mass media were key sources of information for Turkish farmers.

4.4.7 Technical knowledge systems

Farmers need skills and knowledge about agriculture and agricultural processes to enable them to build resilience and sustainable farming. According to Murugani and Chitja (2019), skills are ingredients of productivity in farming. Thus, when farmers acquiring technical skills triggers development and innovation of farming.

4.4.7.1 Field demonstration/visits

Field visits were selected by an overwhelming 98.2% of the respondents. Farmers gain information on agricultural matters by taking part in field demonstrations which are organised by development agencies, agricultural advisors, and fellow farmers. Field demonstrations appear to be the main occasions that allow farmers to obtain technical agricultural information. Farmers explained that farm demonstrations/ visits give farmers the tangible evidence of each other's successes and failures. There is further benefit in that during discussion they acquire and share with each other about farming problems, and they visit each other and exchange ideas and experiences. These results show that learning of farmers through frequent visits of farms is valuable to the farmers.

4.4.7.2 Television and Radio Programmes

Just over thirty-two-point nine percent (32.9%) of respondents shared listening to radio and watching television stations which broadcast some agricultural programmes to farmers. Both these sources broadcast programmes on agriculture with guest speakers such as agricultural specialists and successful farmers sharing their knowledge. From these programmes and media shows, farmers are able to listen to other successful farmers sharing their farming journey and their different speciality, organised for special talks. However, learning through these platforms was utilised less frequently by farmers. A study conducted by Daudu *et al.* (2009) reported that farmers use posters, television, and radio as their knowledge sources, especially the local media stations which use the local language.

4.4.7.3 Agricultural Exhibitions

About 44.3% of respondents indicated engaging and using agricultural exhibitions to acquire and gain knowledge. The attendance of agricultural exhibitions appeared to be a source of technical extension information used by farmers. Farmers explain that attending the agricultural exhibitions contributes to their understanding of new information i.e., skills and technology. The Farmers' Weekly report emphasises that through attending these shows, farmers are able to learn from their colleagues with tackling farming challenges. This learning platform is powerful because conclusions drawn by farmers, based on their own experiences, tend to have a significant impact.

4.4.7.4 Booklets and Pamphlets

While 64.4% indicated that they use booklets received to share and acquire agricultural knowledge. Farmers further explained during group discussions that they participate in extension activities such as training and arranged demonstrations, where they receive written information. Some of these booklets consist of instructions and application procedures. A study by Daudu *et al*. (2009) illustrated that farmers are users of agricultural extension staff and posters as their source of knowledge.

4.4.8 Scientific knowledge systems

Scientific knowledge help farmers to sufficiently understand the techniques and reasons for continues evolving farming methods. This results in farmers integrating different systems to acquire scientific knowledge and information. The scientific knowledge systems of farmers include research and educational institutions, and non-governmental organisations (NGO).

4.4.8.1 Research institutions

Surprisingly, 24.2% of farmers shared engagement in educational platforms provided by educational institutions i.e., agricultural research institution and universities. While 21.5% of respondents' revealed active engagement with the health department to learn about producing nutritional crops which are essential for the body systems. About 59.4% of respondents indicated taking part in training and workshops. During the focus group discussion, farmers revealed that not every farmer gets a chance to take part in training arranged by these research institutions, but they tend to select farmers to participate in training and then arrange a demonstration with the

farmers to transfer the information obtained from the training. This limited use of research institutions by farmers was also observed by Metelerkamp *et al.* (2020), where farmers only made a few references to an accredited training institution as the direct knowledge learning network.

4.4.8.2 Non-governmental institutions (NGO's)

Non-government organisation (NGO) includes experts from private and public departments related to agricultural sector. The NGO have also been used by farmers especially with new technology, water irrigation, variety of seeds and fertilisers. About 18.7% of respondents shared engagement with NGOs. During group discussions, farmers stated that NGOs provided several services, including agricultural extension and education services to farmers, through training of farmers. Those who were trained had to train other fellow farmers in their communities. Farmers further explain that they get guidelines on a variety of seeds, new techniques and inputs by attending a training course. Farmers explain that Non-Governmental Organisations are active when introducing a new farming method, and a variety of seeds to farmers. Farmers gain information on agriculture through participation in meetings organised by development agencies (NGOs). The NGOs normally consist of specialised independent advisors who provide information on goods and services such as selling feed, pesticides, and fertilisers to farmers. However, NGOs and private sector input suppliers are rarely in contact with farmers. These results show that the knowledge systems at Bergville and Appelsbosch materialise from the bottom-up level to outside established sectors.

Table 4.4: Knowledge types and knowledge sources of farmers

	N=219	%	Knowledge Forms
Farmers group	218	99.5	Local knowledge
Fellow farmers	189	86.3	Local knowledge
Cooperatives	106	48.4	Local knowledge
Trade business	51	23.3	Local knowledge
Labour organization	14	6.4	Local knowledge
Local committee	45	20.5	Local knowledge
Financial credits clubs	11	5.0	Local knowledge

Field visits	215	98.2	Technical knowledge
TV/Radio	72	32.9	Technical knowledge
Agricultural Exhibitions	97	44.3	Technical knowledge
Booklets	141	64.4	Technical knowledge
Educational groups/Institutions	53	24.2	Scientific knowledge
Health Programme	47	21.5	Scientific knowledge
DAFF Training/workshops	130	59.4	Scientific knowledge
NGO's	41	18.7	Scientific knowledge

Note multiple responses

4.4.9 Type of knowledge transferred through local knowledge systems

Agricultural knowledge flows from different systems and actors of knowledge. Farmers were asked to list and rank agricultural information discussed through these systems from which they access farming knowledge. Table 4. 5 below summarises the agricultural issues discussed, and information received through the mentioned systems. Farmer arranged the topic from highly prioritised issues and their activities from both local and scientific knowledge systems. Farmers explained that facing growing water scarcity, degradation and climate change, the technical knowledge and skills for soil preparation is very important to achieve better productivity. Moreover, the scientific knowledge on seed variety and crop variety is also important especially with the changing climate and their household food demands. The types of fertilizers and herbicides have positive significance to their crops and reduce production loose from insects feeding on crops. According to Tamako and Chitja (2017), climate change has significant impact on agriculture, thus, discussions on adaptation strategies and building resilience are very important for agricultural production.

Table 4.5: Ranked agricultural topics discussed through knowledge systems of farmers

Local systems topic	***Ranking***	***Scientific systems***	***Ranking***
Soil preparation	1	Climate change and adaptation	1
Crop variety	2	Soil preparation	2
Seed variety	3	Crop variety	3
Herbicides and pesticides	4	Seed variety	4
Climate change and adaptation	5	Markets and prices	5
Crop harvesting methods	6	Herbicides and pesticides	6
Markets and prices	7	Crop harvesting methods	7

Farmers also showed increased of their agricultural knowledge since their participation in the mentioned knowledge systems. The majority of farmers agreed and strongly agreed with increased knowledge on soil preparation, crop harvesting/storage, crop variety, market information, and the application of pesticides. Thus, their production has increased as a result of this knowledge, further improved household food supply. According to Khushk *et al.* (2016) when a farmer has the information, knowledge and skills to do the work, their performance is positively significant.

Table 4.6: Increased agricultural knowledge of farmers in frequencies (%)

Agricultural knowledge	**Strongly disagree%**	**Disagree%**	**Indifferent%**	**Agree%**	**Strongly agree%**
Soil preparation	2.7	6.8	12.3	55.7	22.4
Crop harvesting/ storage	2.7	9.6	11	45.7	31.1
Crop variety	4.1	10	10	50.7	25.1
Market information	6.4	14.6	8.2	50.2	20.5
Herbicides and pesticides application	7.3	11.4	10.5	50.7	20.1

The chi-square results indicate whether or not there has been an association between household food securities with different socio-economic parameters. The average HFIAS ranged from 0 to 27 for the farming households represented by the study respondents, (higher scores implying greater food insecurity). About 29.7% of the interviewed farmers' households were food secure,

whereas 17.8% were mildly food-insecure households, moderately food insecure households 29.2%, severely food insecure households and were 23.3%.

Table 4.7: Farmers' household food security category

categories	**N=219**	**%**
Food secure	65	29.7
Mildly food secure	39	17.8
Moderately food insecure	64	29.2
Severely food insecure	51	23.3

4.4.10 Farmers' participation in knowledge systems and food security

The chi-square results indicate whether or not there has been an association between household food securities with different socio-economic parameters. Chi-square tests were carried out to determine whether the observed variables are statistically significant in table 4.8 below. The survey showed no association between gender, educational level, motive of producing for consumption, and motives of participating in agriculture for career purposes.

The results reveal a significant relationship between the marital status of farmers and household food security ($p<0.02$). This suggests that married farmers can financially and socially support their families because of multiple sources of income in their household.

The results show that most farmers participate in agriculture with the motivation to learn ways of producing food. Farmers' motivation and attitude to participate in agriculture are very important as they affect the extent and effort applied to achieve the activity. Chi-square tests reveal a significant relationship between farmers whose participation in agriculture is based on learning and household food security ($p<000$). Farmers elaborate that their motivation to learn about agriculture pushes them to acquire diverse information to improve their household food security. Therefore, the mind-thinking of a farmer is crucial to the amount of effort applied to the activity. According to Lubell *et al*. (2014), mind-set and attitude affect farmers' motivation to undertake initiatives and perform the task. Further, they state that knowledge and skills encourage an individual to learn, acquire more and increase participation.

The chi-square results in table 4.8 indicate a statistically significant relationship between household food security and level of participation in local knowledge systems of farmers ($p<0.03$). Farmers explain that local knowledge is based on the practical skills and experience of the farmers. Nordström and Ljung (2005); Niewolny and Lillard (2010) and Simpson and de Loë (2017) in their studies show that farmers regard their fellow farmers as trustworthy because of their practical experience. Thus, their opinion and agricultural performance trigger others to imitate and learn from the fellow farmers. From the results, the study argues that farmers who are socially active can gain more agricultural knowledge through their interactions, and this improves their knowledge. These social relations help to provide useful capital resources to their fellow farmers.

The chi-square results in table 4.8 further show a statistically significant relationship between household food security and level of participation in technical knowledge systems of farmers ($p<0.000$). Farmers state that the technical knowledge received during training and demonstration helps them to improve their skills of conducting and performing field activities which improve their crop productions. Learning may take place in the field, garden, and community halls.

The chi-square results in table 4.8 reveal a statistically significant relationship between household food security and level of participation in scientific knowledge systems by farmers. Scientific knowledge systems provide farmers with new information and skills. Farmers explain that environmental conditions are changing; therefore, new information and knowledge are crucial for building resilient agriculture.

Table 4.8: Association between socio-economic and food security parameters of smallholder farmers

Variables	**Category**	**Food Secure**		**Food Insecure**		**N**	**P-value**
		Food secure (n=65) %	*Mildly-food secure (n=39) %*	*Moderately food insecure (n=64) %*	*Severely food insure (n=51) %*		
Gender	Female Male	17.8 11.9	13.2 4.6	20.1 9.1	15.1 8.2	145 74	ns
Education	Formal Informal	17.4 12.3	11.9 5.9	20.1 9.1	15.1 8.2	141 78	ns
Marital status	Single Married	5.0 24.7	3.7 14.2	11.0 18.3	4.1 19.2	52 167	**
Producing for consumption	No Yes	3.7 26	2.3 15.5	2.3 26.9	1.8 21.5	22 197	ns
Engage in Agriculture for learning	Yes No	18.3 11.4	16 1.8	16.9 12.3	14.6 8.7	144 75	***
Engage in Agriculture with business motives	Yes No	18.7 11	12.3 5.5	22.4 6.8	15.1 8.2	150 69	ns
Local knowledge participation level	Low High	0 29.7	0 27.8	0.5 28.7	0 23.3	1 218	**
Technical knowledge participation level	Low High	0.5 29.2	5.9 11.8	8.2 21.1	7.8 15.5	49 170	***
Scientific knowledge participation level	Low High	24.2 5.5	16.4 1.4	23.7 5.5	15.5 7.8	175 44	**

Note: *** and ** means significant at 1% and 5% levels of significance, respectively. ns= not statistically significant. Source: Study Household Survey (2020)

4.4.11 Association between food security and socio-economic parameters of smallholder farmers

Before running a model to test for the relationship between social capital and food security status, we computed a linear regression to test for multicollinearity among the independent variables. The following independent variables had significant tolerance values and were included in the model: participation level on local knowledge systems, technical knowledge systems, and scientific knowledge systems; sex and educational level of farmers, household income, marital status, and

motivation for participation in farming. Then Ordered-Probit regression was computed to establish the relationship between food security and knowledge systems with other capitals. In the Tobit model, the reciprocal of the tolerance value which measures the impact of collinearity among variables (VIF), in table 1 (Appendices page). There was low correlation among variables as the VIFs were in acceptable ranges.

The Ordered-Probit regression model was used to determine farmers' characteristics that predict farmers' household food security. The results reveal that all the estimated coefficients are statistically significant since the LR statistic has a p-value of less than 1%. The pseudo R2 value is about 8% indicating suitability for the model. The model results in Table 4.8 above indicate that the farmers' characteristics, such as gender, educational level, production for household consumption, and motives for agriculture as a career are not statistically significant determinants of farmers' household food security.

The model outcome shows that the monthly income of the farmers is significant with food security ($p<0.02$). The study reveals that the majority of farmers 47.5% earn between R1501-3500 which consists of farmers who receive government and pension grants. A unit increase in household income increased the probability of farmers' household being food secure and mildly food secure by 8.5% and 1.7%, respectively and decreased the probability of being moderately food insecure and severely food insecure by 3.0% and 7.2%. The study revealed that majority of farmers are dependent on government pension and social grants. These sources of income play a massive role in rural household of South Africa i.e., buying food, contribution fee for saving clubs (*stokvels*) and other social activities including funeral burial societies to cover the family members (SASSA, 2020/2021).

The model indicates that the participation of farmers on local knowledge systems has a significant impact on farmers' household food security ($p<0.02$). The participation level in the local knowledge systems variable was model as 1=low, 2=high. Unit increase on farmers with participation on local knowledge systems increased farmers' household being food secure and mildly food secure by 17.9% and 3.6% respectively. However decreased farmers' household being moderately food insecure and severely food insecure by 6.3% and 15.2%.

The model indicates that the participation of farmers in technical knowledge systems has a significant impact on farmers' household food security ($p<0.01$). The participation level on the

local knowledge systems variable was modelled as 1=low and 2=high. Unit increase on farmers with participation on technical knowledge systems increased farmers' household being food secure and mildly food secure by 19% and 3.9% respectively, however decreased farmers' household being moderately food insecure and severely food insecure by 6.8% and 16.2%. Farmers explain that the NGO's training and field demonstration by extension advisors on the adoption of improved farming methods has improved their production and food security. Furthermore, the farmers explained that agricultural training provides detailed information on fertilizer and pesticide applications which improve their yield. Scholars including Ingram (2018) argue that farmers' productivity not only depends on mental capacity but also on practical and physical skills of performing the task.

The model indicates that the participation of farmers in scientific knowledge systems has a significant impact on farmers' household food security ($p<0.01$). The participation level on the local knowledge systems variable was modelled as 1=low and 2=high. Unit increase on farmers with participation on scientific knowledge systems decreased farmers' household being food secure and mildly food secure by 29.8% and 6.1% respectively, however, increased farmers' household being moderately food insecure and severely food insecure by 10.6% and 25%. During focus group discussions, farmers explained that their participation in the scientific knowledge system exposes them to additional soft skills, new ideas and experiences to integrate into their local knowledge. According to Rangarajan and Chitja (2020), the empowerment of farmers through local and scientific knowledge creates an opportunity for farmers to use experience and skills gained through solving their problems as their confidence in what they have experienced and know is validated. Studies argue that technical and scientific knowledge needs continuous updating with changing environmental conditions and food supply-demand (Castella *et al.,* 2006). The results also show the access of farmers to different knowledge mediators demonstrates the integration of their knowledge system. This reveals that at an individual level, farmers can successfully integrate available knowledge from scientific to their experiential knowledge.

Table 4.9: Association between food security and socio-economic parameters of smallholder farmers

	Coefficients			**Marginal Effects**			
				Food secure		***Food insecure***	
	Value	***Robust St. Error***	***P>z***	***Food secure***	***Mildly food secure***	***Moderately food insecure***	***Severely food insecure***
Gender	-0.152	0.154	0.325	0.0525	0.0097	-0.0191	-0.0422
Age	-0.084	0.075	0.260	0.0281	0.0057	-0.0100	-0.0238
Education	0.004	0.158	0.982	0.0105	0.0021	-0.0038	-0.0089
Marital status	0.008	0.205	0.970	-0.0078	-0.0016	0.0028	0.0065
Income	-0.227	0.100	0.024	0.0854**	0.0175**	-0.0305**	-0.0725**
Producing for consumption	0.165	0.247	0.506	-0.0668	-0.0103	0.0265	0.0507
Engage in Agriculture for learning	0.212	0.158	0.182	-0.0622	-0.0149	0.0209	0.0552
Engage in Agriculture as career	0.160	0.165	0.336	-0.0645	-0.0147	0.0215	0.0578
Local knowledge participation level	-0.449	0.183	0.015	0.1794***	0.0368**	-0.0639**	-0.1522***
Technical knowledge participation level	-0.533	0.132	0.000	0.1904***	0.0390***	-0.0679***	-0.1616***
Scientific knowledge participation level	0.766	0.198	0.000	-0.2988***	-0.0612***	0.1065***	0.2535***
/cut1 2.984221 .6210631 /cut2 2.436341 .6130995 /cut3 1.535098 .6061646							

N =219 LR X2 = ***; Pseudo R2=0.08; Log likelihood = 274.73

Note: *, **, ***, means the coefficient is statistically significant at 10%, 5%, and 1% levels, respectively: Household Survey (2020)

4.5 Conclusion and Recommendations

The study sought to describe active agricultural knowledge systems used by smallholder farmers of the KwaZulu-Natal Province and their implication on food security. The study reveals that farmers at *Appelsbosch* and *Bergville* are actively engaged in a variety of local systems, technical and scientific knowledge systems that often serve multiple purposes, including acquiring information and addressing production and marketing needs. The study shows that knowledge

systems at Bergville and Appelsbosch emerge from the bottom-up level to outside established sectors. The partnerships and collaboration of knowledge systems utilised by farmers bring together people with different capacity which widened range of skills acquired by farmers within these systems, which enhance individual and community capacity. There is no single system that can adequately serve the agricultural information and knowledge need of small-scale farmers. Therefore, it becomes important to have transformational systems of agricultural information for effective and efficient information delivery to farmers. Considering that small-scale farmers in rural communities are mostly illiterate adults and of older age, farmers interact with extension officers in the form of attending farmers' meetings, and field day demonstrations to understand the technical knowledge and skills which play an important role. These knowledge systems have common motives of providing farmers with narrative agricultural knowledge, and ways of doing things in agriculture. The two studied areas show a visible interrelated interaction route of farmers with formal and informal knowledge systems which are guided by rules, goals and norms to ensure transparency and govern these active knowledge systems as revealed by farmers through discussions. Farmers are dependent on social and personal connections to access and mobilise the resources needed to improve their household food security. Thus, knowledge within these systems is important and needs to be understood. The knowledge systems strength and weakness are dynamic and valuable as explored especially on delivering transformative knowledge to improve food security of farmers. Therefore, these weakness and strength needs to be assessed as they affect the extent and effort applied to achieve the activity.

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CHAPTER FIVE: THE INFLUENCE OF FARMERS' SOCIO-ECONOMIC CHARACTERISTICS ON THEIR CHOICE OF OPINION LEADERS

Abstract

Social knowledge systems for smallholder farmers are evolving in the way they connect key actors within and outside their knowledge systems. These key actors, who are farmers, play a vital role in the dissemination of agricultural information among their followers and other farmers. Such key farmers can better navigate the complexity of communities, the dynamics of organisations, and they are able to effectively influence the community. This study identified the opinion leaders of smallholder farmers and measured the extent of their influence on the quality of these farmers' knowledge of agriculture. Furthermore, the study explored the reasons why farmers choose their opinion leaders. A structured questionnaire was administered to 219 purposively selected smallholder farmers in the Bergville and the Appelsbosch areas in the province of Kwa-Zulu Natal, South Africa. Data were captured, coded and analysed using the Statistical Package for Social Sciences (SPSS) version 26 software and STATA. Descriptive statistics and the chi-square were used in the analysis. There was a significant difference between the frequency of interactions, the channels of communications and the extent of knowledge satisfaction given by the above-mentioned leaders. Issues related to accessibility, availability and quick feedback regarding farmers' problems emerged, which seemed to influence farmers' choice of an opinion leader. Furthermore, the results revealed the statistical significance of the gender ($p<0.05$) of farmer group leaders with a positive coefficient. The variable of the marital status of a farmer was also found to be statistically significant ($p<0.01$) with a positive coefficient. These facts explain why many farmers chose to seek information and advice from their opinion leaders. These findings may help agents to develop a better understanding of the dynamics of local communities and the social complexity that shape farmers' environment and decisions.

Keywords: opinion leaders, knowledge, knowledge systems, smallholder farmers

5.1 Background of the study

Knowledge in agriculture is a stimulating factor that increases farmers' productivity through the better utilisation of resources. Thus, the evaluation of the role of human capital in agricultural growth is important, as it corresponds with other capital involved in the improvement of food production. Although transferring agricultural knowledge has been the responsibility of extension agents (Freeman and Qin, 2020), farmers also acquire knowledge from other sources. This shows a significant transformation and emerging of farming systems in the agricultural sector. This study argues that farmers' knowledge and empowerment cannot only be achieved through integrating the institutional channels and active social systems in their environment but also opinion leader within the communities have significant influence on their fellow farmers (Goswami and Basu, 2011; Gomila, 2020).

Emerging social knowledge systems consist of key actors connecting farmers within and outside their local knowledge systems (Goswami and Basu, 2011; Galaso, 2018). In farming communities, these key individuals are held in high esteem by farmers who accept and follow their opinions (Spielman *et al.,* 2011). Goulet (2013) argues that smallholder farmers do not simply adapt expert advice. Instead, they are highly influenced by their fellow farmers through behaviour and attitudes, thus, shaping their decision-making. Studies including those conducted by Lamm *et al.* (2016); Kansanga (2017); Jungnickel (2018), as well as Matous and Wang (2019) have given different names to these individuals within farming systems. These names include opinion leaders, model farmers, influencers, change agents and gatekeepers, for example. Moreover, these studies show that there is a strong emphasis on the role of opinion leaders.

In the province of KwaZulu-Natal, active smallholder farmers have self-organised, forming networks with formal and informal actors within agricultural systems (Tamako and Thamaga-Chitja, 2017). These farming systems contain experts, who are professional farmers and who provide agricultural advice to other farmers, thus shaping their knowledge and showing shifting roles of farmers being teacher, learner and networker (Rangarajan and Chitja, 2020). The identification of these opinion leaders is important for understanding the nature of their work and furthermore strengthen the human capacity and professional development of these opinion leaders who are connect with farmers regularly. Furthermore, these key farmers are effective navigators in complex communities, where they successfully exert an influence from within the organisational

dynamic. The presence of opinion leaders explains why some farmers progress further than their peers do. To tap and utilise opinion leaders, it is important to know their profile characteristics and the extent of their influence on farmers. Several studies including those of Katz and Lazarsfeld (1952), Rogers (2003), Abdel-Ghany (2012) as well as Goldberg (2014) are in agreement regarding the importance of opinion leaders in the agricultural sector for the flow of knowledge and information to improve farmers' skills as a pathway towards poverty reduction.

In previous years, smallholder farmers directly depended on radio, television, and extension agents as knowledge sources. However, some farmers were unable to access these sources. Mehra *et al.* (2006), Millar and Choi, (2009), Newman, *et al.* (2014), Mittal *et al.* (2018), as well as Mogues (2019) argue that communities have complex networks of social relationships with various socioeconomic groups and experience different power relations across farming systems. In fact, all these aspects might shape farmers' decisions regarding opinion leaders. Moreover, according to Ngaka and Zwane (2017), the physical accessibility of resources has been challenging for geographically dispersed smallholder farmers. Ngaka and Zwane (2017), argue that farmers' easy and timely access to opinion leaders enables them to expand and improve their knowledge. However, they maintain that the absorption of knowledge is dependent on certain prerequisites, such as the farmer's age and level of education. Therefore, an understanding the impact of socio-economic factors is needed in determining farmers' choice of opinion leaders.

Farmers are experimental people, who believe in physical observations and outcomes (Safford *et al.,* 2017). Farmers are inspired through collective learning and acquiring resources to improve their knowledge and agricultural production. Within farming communities, consisting of social systems, some farmers have more experience in agriculture and leadership qualities than others (Newman *et al.,* 2014). The number of experienced farmers in a rural area determines the depth and strength of the relationship between these farmers and other farmers' knowledge and decision-making. Key individuals in such areas are knowledgeable and their opinion is highly valued by their fellow farmers. This argument is further supported by Chen *et al.* (2015) who point out that some farmers may be opinion leaders, while others may have leadership roles limited to specific issues. This is consistent with the opinion of Aalbers and Dolfsma (2011) who observe that local farmers are sufficiently valuable sources of new information and advice for the community. Before making decisions, a farmer often seeks advice from their opinion leaders to validate their

knowledge with them. Smith (2005) maintains that it is important for farmers to 'know what they know' (human capital) and 'to know whom they know' (relationship capital). Both these capitals ensure a successful outcome and create trust (social capital).

Through their influence, leaders can convey knowledge convincingly to their peers, especially if they use the same language (Saad *et al.,* 2018). Lamm *et al.* (2016) describe these key actors as the farmers' mouthpiece before extension agency/advisor and can elaborate on the needs of local farmers. Hence, farmers approach and consult with these farmers to learn their opinions and to receive their advice (Niewolny and Lillard, 2010). Thus, the farmers' actions and decisions are greatly influenced by the opinion leaders from whom they sought advice. Numerous studies have attempted to identify the characteristics of opinion leaders (Echetama *et al.,* 2017). Although the importance of opinion leaders has been acknowledged, there have not been many attempts to measure and explore the extent of their influence on their fellow farmers. This study aimed to fill this gap and explore the reasons that motivate farmers to choose their opinion leaders. In other words, to utilise existing opinion leaders effectively, it was necessary to have a clear understanding of the nature of opinion leadership among the farmers in rural settings. This research aimed to be helpful in the assessment of the role played by opinion leaders in agricultural development. Furthermore, the study aimed to add knowledge to the existing literature on opinion leadership and the extent of the influence of opinion leaders in the agricultural sector. The objectives of the paper are a) to identify the conceptual framework about opinion leaders. b) To explore the role played by opinion leaders in agricultural knowledge system. c) To identify the characteristic of opinion leaders.

5.2 Conceptual framework

The opinion leadership theory of Katz and Lazarsfeld guided the present study. According to Katz and Lazarsfeld (1955), opinion leaders are individuals who receive information from the media and pass it along to their peers in the environment. This theory suggests that opinion leaders aggressively seek information and knowledge as well as frequently discussing issues they encounter (Shahidi and Waseem, 2013). These opinion leaders are found in every social group, regardless of level, in various age groups and in all professions. However, Shahidi and Waseem (2013) maintain that effective opinion leaders tend to be slightly higher than their followers are in terms of status, asset ownership, income, and educational level. According to Rogers (2003),

opinion leaders are individuals who are more active in social activities/organisations and who uphold positions in their network systems. Burt (1999) observes that opinion leaders are, more precisely, opinion brokers who carry information across the social boundaries between groups. Opinion leaders can influence their peers in several ways. Chau and Hui (1998) identify three ways in which opinion leaders exert influence on the decisions of others. They act as role models who inspire imitation; they spread information via word of mouth; and they give advice (Shikuku, 2019; Shrivastava *et al.,* 2020). These ways in which opinion leaders exert influence have been observed among smallholder farmers in the province of KwaZulu-Natal. Farmers in their communities are vehicles of power and their behaviour and social relations are deeply linked to power. Farmers follow and trust the opinion of those whom they perceive to be successful in their farming and tend to associate with them to learn more about farming.

5.3 Methodology

5.3.1 Study site

The study was conducted in KwaZulu-Natal in the *Okhahlamba* Local Municipality (*Bergville area*) and the *uMshwathi* Local Municipality (*Appelsbosch area*). In both areas, smallholder farmers mainly engage in crop production, which is the backbone of their households' income. The *uMshwathi* Municipality has thirteen wards and the south-eastern area of the municipality is made up of rural areas that are mainly dominated by subsistence farming. Smallholder farmers exist on their traditionally controlled land along the edges of arable land reserved for sugarcane and forestry farming. The land in these regions is characterised by steep hills and rugged terrains that are less suitable for commercial farming, and it is where smallholder farmers grow crops, such as maize, beans, potatoes, vegetables. Hence, the main economic driver in the rural component of the municipality is subsistence agriculture. The smallholder farmers of the *Okhahlamba* Local Municipality (OLM) mainly engage in maize/vegetable production, and livestock production occupies the marginal areas of the Bergville area. Thus, smallholder farming is very important in KwaZulu-Natal, as it is the backbone of its rural households.

5.3.2 Sampling technique and sample size

The study used a mixed-method approach of data collection whereby qualitative and quantitative data were collected. The data used in the study were obtained from both primary and secondary sources. Purposive sampling was used to select 219 active smallholder farmers who would participate in the study that focused on farmers actively engaged in knowledge systems. These farmers were expected to provide the relevant information needed for the study. Data were collected by means of a structured questionnaire comprising both open-ended and close-ended questions. To have an in-depth understanding of the study area, two focus group discussions were conducted with farmers. The researcher facilitated the discussions and made detailed notes of the conversations. The focus group discussions were conducted in the local language, *isiZulu*, to encourage the participation of the members. Key informant interviews were conducted with 6 extension advisors. Field research assistants selected from the survey areas were trained about the study before the scheduled interviews with the farmers. They were trained on the contents of the questionnaire, its interpretation, data recording, general behaviour, and personal security during the survey. The secondary data was collected through journals, the Internet, and the Department of Agriculture.

5.3.3 Analytical techniques and methods

5.3.3.1 Approach

Socio-metric methods were used to trace communication patterns among the group members, which allowed for the systematic mapping of the member interactions. The survey began with asking selected farmers to provide names of individuals to whom they went for information and advice. Farmers were also asked to respond to questions addressing the frequency of interaction and the channels of communications used with these individuals. Through these questions, we hoped to trace the directions of the communication flow and the communication structures of the social systems used by the farmers.

5.3.3.2 Descriptive statistics

The study used descriptive statistics to analyse all the variables of interest. The descriptive analysis involved looking at means, frequencies, the standard deviations of the variables and chi-square

tests. Quantitative research was used to deal with the problem by generating numerical data or data that could be transformed into usable statistics (Creswell, 2013). The qualitative data gathered from the focus group discussion was analysed in the form of themes. Thus, the content and concepts acquired from the discussion topics and answers to the questions could be explained and used as supporting information for the survey. The software that was used to analyse data was the Statistical Package for Social Scientists (SPSS) IBM version 20 and STATA. This software analysed common patterns of variables and their relationships, thus generating descriptive statistics.

5.3.3.3 Multinomial Logistic (MNL) Regression model

The raw data set consisted of values that were ordinal and nominal. Multinomial logistic regression is used when the dependant variable has more than two nominal or unordered categories. There is no natural ordering in the independent variables. One of the assumptions of the MNL Regression model is that the dependent variable cannot be perfectly predicted by the independent variables for any case.

$$Pij = \frac{e^{x_i' \beta_j}}{\sum_{l=1}^{m} e^{x_i' \beta_l}} \qquad \text{j= 1,..., m} \qquad (1)$$

1, 2, 3,..., m were supposed for y and the explanatory variables were defined as X. M = 5 outcomes farmers' group leader, farmers group member, extension advisors, Farmers Support Group (FSG) &Non-Governmental Organisations (NGOs) and extension advisors.

A set of coefficients, $\beta 2, \beta 3, \beta 4,$ and marginal effects were estimated corresponding to each result of the following probabilities for each case of the value of the dependent variable (choice of opinion leaders): farmers' group leader, farmers group member, extension advisors, FSG&NGO's and extension advisors set as a base):

$$\Pr(y=1) = \frac{e^{x\,\beta(1)}}{e^{x\,\beta(1)} + e^{x\,\beta(2)} + e^{x\,\beta(3)}} \quad (2)$$

$$\Pr(y=2) = \frac{e^{x\,\beta(2)}}{e^{x\,\beta(1)} + e^{x\,\beta(2)} + e^{x\,\beta(3)}} \quad (3)$$

$$\Pr(y=3) = \frac{e^{x\,\beta(3)}}{e^{x\,\beta(1)} + e^{x\,\beta(2)} + e^{x\,\beta(3)}} \quad (4)$$

$$\Pr(y=4) = \frac{e\mathcal{X}\beta(4)}{ex\beta(1) + ex\beta(2) + ex\beta(3)\ldots} \quad (5)$$

Table 5.1: Description of independent variables used in the MNL Regression Model

Variables	**Measures**	**H_0 sign**	**Rationale**
Gender	Binary, 1 if the farmers are male and 0 if female	+/-	More female dominates agriculture in the world
Age	Continuous, age of the respondent in years	+/-	Older farmers are more engaged in farming and interested in learning
Marital status	Categorical, marital of the respondent	+/-	Married farmers can acquire from multiple knowledge systems and share information
Educational level	The categorical, education level of the respondent in the year	+/-	Educated farmer is more likely to learn and acquire information
Monthly Household Income	Categorical, household income per month ZAR (Rand)	+/-	More income can increase farmers' engagement on knowledge systems, also as they can get remittances and pension;
The participation level of farmers	Continuous, respondents' number of knowledge systems	+/-	High participation from knowledge systems increase farmers' knowledge
Taking agriculture as a career	Binary, 1 if yes and 0 if No	+/-	Farmers with career motive will engage in more farming systems
Taking agriculture as a learning platform	Binary, 1 if yes and 0 if No	+/-	Farmers with learning motive will socially interact with more actors to increase their knowledge

5.4 Results and discussion

According to the classification of opinion leaders by smallholder farmers shown by Figure 1 below, 53% of the farmers mentioned agricultural advisers as their opinion leaders. These agricultural advisors formally represented the local Department of Agriculture and Rural Development (DARD) working with smallholder farmers. These advisors had formal qualifications i.e., a degree or diploma in agriculture (education, farming training). This highlights a strong relationship between farmers and extension advisors. These results are concurrent with the findings of studies conducted by Rahutami and Kekalih (2012), Mtega *et al.* (2016), as well as Mkenda *et al.* (2017) that show that farmers also use the expertise from formal agricultural institutions to provide training courses, agricultural exhibitions, field days and demonstrations in many instances. Secondly, 29.7% of the farmers mentioned fellow farmers (the farmers' group members) as their opinion leaders. Furthermore, the farmers mentioned that these opinion leaders were farmers who held administrative positions within their farmers' group owing to their years of farming experience. Moreover, they mentioned that these opinion leaders were located within the community.

The time and energy spent by farmers building social relationships with these opinion leaders reflected the accumulation of information and resources that they had gathered. These results are supported by Aalbers and Dolfsma (2011) who report that local farmers are sufficiently good sources of new information and advice for the community. The results of the study described in this article revealed that 13.2% of the farmers indicated group leaders as their only opinion leaders. Moreover, they availed themselves of the information to which these leaders had access. These leaders were selected by group members to represent their farmers' group, and they were chosen based on their farming experience. The opinion leaders held positions of status, which made it easy for them to infiltrate and influence others around them. They were located within the community, and thus, their followers (farmers) could observe their agricultural actions and outcomes. Furthermore, they could remind others of the technical specifications they used during meetings and field demonstrations.

The social status of opinion leaders within local hierarchies played an important role in their being selected as possible leaders. Moreover, as the study results disclosed, the proximity of the opinion leaders to other farmers meant that there was physical accessibility with regard to the knowledge

source, which was crucial for the smallholder farmers. About 2.3% of the group of farmers mentioned extension officers, who were in the nearest town and who were the farmers' group leaders of their association. This confirmed that some farmers had more than one opinion leader within their knowledge system.

5.4.1 The extent of opinion leadership

The results revealed that the farmers nomination of an individual reflected the amount of influence that individual had on them. This was shown by the number of farmers who nominated extension advisors as their opinion leaders, which revealed the extent of their influence and leadership. The probable reason could be that the extension advisors had more access to resources and to other knowledge systems. Moreover, they were more socially active with the farmers. However, in the study, the Farmers' Support Group (FSG) and Non-Governmental Organisations (NGOs) showed a lower number of nominations by farmers, which indicated the weaker extent of their leadership.

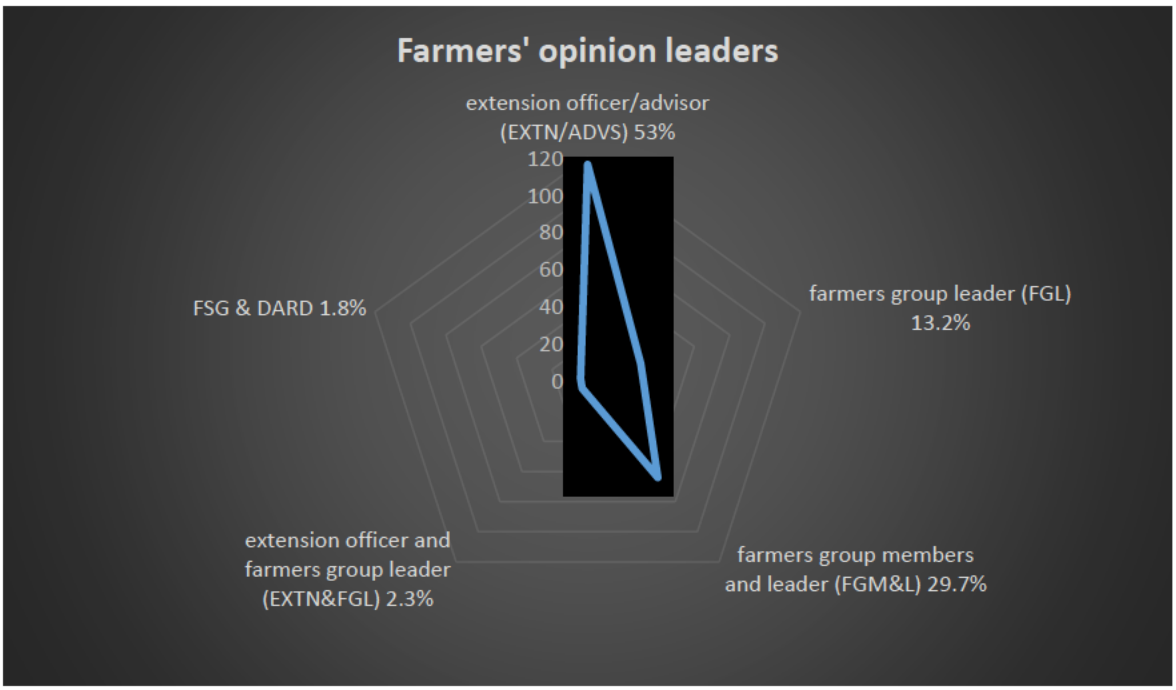

Figure 1: Classification of Opinion leaders Source: Author's Computation (2020)

5.4.2 Characteristics of the opinion leaders selected by smallholder farmers.

The characteristics of opinion leaders that were collected from the farmers included the channel of communication, the frequency of meetings, the capacity of satisfaction, the consultation structure,

and the system of the farmers with their opinion leaders. The findings relating to these characteristics are discussed and presented in Table 5.2 below.

5.4.3 Channels of communication used by farmers with their opinion leaders.

The respondents were asked to indicate the channels of communication used by their opinion leaders. Of the 53% of the farmers who had identified extension advisors as their channel of communication, 16.3% interacted with extension advisors through attending and participating in farmers' group meetings. In this way, they learned from the extensions advisors whilst sharing their individual experiences and addressing common problems. Moreover, 15.7% of 53% of the respondents used cell phones to communicate with agricultural advisors, to arrange meetings and to follow-up on various matters regarding agriculture. About 12.1% of the respondents revealed that they participated in field demonstrations with agricultural advisors for learning and observing technically transferred skills. Out of 13.2%, 4% of the farmers admitted that they used cell phones to communicate with farmers' group leaders, to participate in farmers' group meetings and to discuss agricultural matters. About 3% of the farmers attended community meetings where they interacted with farmers' group leaders. About 9% of the farmers indicated that they used cell phones to communicate with group members and group leaders. Furthermore, 8.5% of the respondents attended farmers' group meetings to learn and communicate with group members and group leaders who were the opinion leaders. About 7.9% of the farmers participated in field visits (demonstrations) to observe and learn from other group members and group leaders. Moreover, 0.7% of the farmers used cell phones to arrange meetings and acquire information. These farmers participated in field visits and attended farmers' group meetings to communicate with agricultural advisors and group leaders. During the focus group discussion, farmers explained that they used cell phones to arrange meetings with extension officers and fellow farmers. After attending the meetings, field learning, and demonstrations were conducted to deal with the practical aspects of the agricultural topics that had been discussed. Field visits were conventional communication channels that were frequently used by farmers. Communication through farm visits was considered practical as they made the information easier to understand.

5.4.4 Frequency of interactions of farmers with opinion leaders

The farmers were asked to indicate the frequency of their interaction with their opinion leaders. The findings shown in table 5.2 indicate that 47.9% of the farmers met monthly with agricultural advisors. Moreover, 27.9% of the farmers met monthly with farmers' group members and 12.8% of the farmers met with group leaders monthly. This was in line with the constitution of the farmers' group organisation that advocates a compulsory monthly meeting of group members. Lastly, 0.9% of farmers held monthly meetings with both extension advisors and group leaders. However, a few farmers, 4.1% met weekly with extension advisors and other opinion leaders. These findings confirmed the role played by opinion leaders in the farmers' knowledge flow. In addition, the findings showed that interaction could be a crucial element of knowledge and learning for farmers. The statistical analysis revealed that there was a statistical significance in the number of frequent meetings/interactions with the farmers' opinion leaders. This showed that the farmers required a consistent flow of material resources and knowledge.

5.4.5 The capacity of satisfaction of farmers in their opinion leaders

Farmers were asked whether they were satisfied with the role of opinion leaders. The majority of the farmers (51.6%) said that they were satisfied, whilst 1.4% of farmers were not satisfied with the agricultural knowledge received from an agricultural advisor. However, 29.7% of the farmers were very satisfied with the knowledge gained from farmers' group members, whilst 13.2% of the respondents said they were satisfied with the knowledge received from farmer group leaders. Thus, the study confirmed that most respondents (98.6%) were satisfied with the role of their opinion leaders.

5.4.6 Consultation structure and system of farmers with their opinion leaders

With regard to the extent of the consultation structure and system of the farmers with their opinion leaders, the result of the survey showed that 53% of the respondents consulted as a group with extension advisors. However, 29.7% of the farmers held individual consultations with other group members and farmers' group leaders. About 13.2% of the farmers held individual consultations with farmers' group leaders. Only a few farmers (2.3%) consulted through the organised group structure with extension advisors and held individual consultations with the farmers' group leaders. This shows that the majority of the farmers preferred the group consultation setup with their

opinion leaders for acquiring knowledge and learning. The group consultations provided a space to meet other farmers and to re-engage with farmers. The statistical analysis revealed that the consultation structure used by farmers to meet with their opinion leaders was statistically significant.

Table 5.2: Characteristics of mentioned opinion leaders by farmers

	Opinion leaders mentioned by farmers						
Characteristics of mentioned opinion leaders	**Extension officers (%)**	**Farmers Group Leader (%)**	**Farmers Group Member (%)**	**Extension officers &Farmers Group Leaders (%)**	**Farmers Support Organisation & NGO's (%)**	**(n)**	**F significance**
Channels of communication						**219**	
Cell phone	15.7%	4%	9.0%	0.7%	0		****
WhatsApp	2.3%	1.1%	1.8%	0%	0		
Field visits	12.1%	3%	7.9%	0.7%	0.9%		
Community meetings	6.4%	1.1%	2.5%	0.2%	0		
Farmer group meetings	16.3%	4%	8.5%	0.7%	0.9%		
Total	**53%**	**13.2%**	**29.7%**	**2.3%**	**1.8%**		
Frequency of interaction							
Weekly	4.1%	0.5%	1.4%	0.5%	0		**
monthly	47.9%	12.7%	27.8%	0.9%	0.9%		
Quarterly	0.9%	0	0.5%	0.9%	0.9%		
Total	**53%**	**13.2%**	**29.7%**	**2.3%**	**1.8%**		
Extent of satisfaction							
Not satisfied	1.4%	0	0	0	0		**ns**
Very satisfied	51.6%	13.2%	29.7 %	2.3%	1.8%		
Total	**53%**	**13.2%**	**29.7%**	**2.3%**	**1.8%**		
Consultation types							
Group	53%	0%	0	0	1.8%		**
individual	0%	13.2%	29.7%	0	0		
Group and individual	0%	0%	0	2.3%	0		
Total	**53%**	**13.2%**	**29.7%**	**2.3%**	**1.8%**		

***Note** means significant at 5% levels of significance, respectively. ns= not statistically significant.*

5.4.7 Factors that shape and influence farmers to choose these opinion leaders

In this section, we summarise the answers to the open-ended questions about the farmers' reasons for their choice of opinion leaders. Issues related to accessibility, availability, and quick feedback regarding problems from leaders emerged as seeming to influence the farmers' choice of opinion leaders. Out of 53%, 20.1% of the farmers who identified extension advisors as their opinion leaders maintained that their selection was based on the language *(isiZulu)* used in their interactions and on the proximity of the physical location of the meetings. Out of 13.2%, 4.1% of the farmers selected Farmer's Group Leaders (FGL) because they were physically located in the community. Moreover, 7.3% of 29.7% of the farmers selected Farmers' Group Members (FGM) because feedback was easily assessed and there was easy access to the farmers, as they were in the same community. This shows that the farmers required leaders who could quickly provide reliable and relevant information about their agricultural problems, thus building trust and relationships along with further interactions. Furthermore, the farmers explained during focus group discussion (FGD) that because of differences regarding age and farming experience, having farmers who advised them had helped them to improve their agricultural methods. Therefore, it appeared that accessibility to sources of knowledge and feedback were crucial to the smallholder farmers included in the study.

Table 5.3: Reasons that shape and influence farmers choice of the mention opinion leaders

Factors are given by farmers	**Extension officer %**	**Farmers Group Leader %**	**Farmers Group Member %**	**Extension officer &Farmers Group Leader %**	**Farmers Support Organisation& NGO's %**	**N**	**F significance**
Feedback easily accessed	7.3%	1.4%	3.7%	0	0	219	0.056*
Easy to access the source	6.4%	3.2%	6.4%	0	0		
The source is nearby	6.4%	4.0%	3.7%	0.5%	0		
Cheap to access the source	3.2%	1.4%	2.7%	0	0		
The language used & the source nearby	20.1%	1.4%	5.9%	0.5%	0.9%		
All the above	9.6%	1.8%	7.3%	1.3%	0.9%		
Total	**53%**	**13.2%**	**29.7%**	**2.3%**	**1.8%**		

Note * means significant at 10% levels of significance, source: author's computation (2020)

5.4.8 Perception of farmers on the quality of knowledge received from their opinion leaders.

Quality of knowledge was measured according to the following categories: reliability; usefulness and relevance (See Table 1, Appendix 2). A high proportion (87.2%) of the farmers indicated that opinion leaders were highly reliable, compared with 12.8% of the farmers who indicated that their opinion leaders were reliable regarding the knowledge received from them. These results revealed that many farmers viewed their opinion leaders as highly reliable in their knowledge of relevant topics. A high proportion (90.4%) of the farmers indicated that their opinion leaders' knowledge was very useful, compared with 9.6% of the farmers who indicated that their opinion leaders' knowledge was useful. In addition, table 1 shows that none of the farmers indicated that their opinion leaders' knowledge of relevant topics was not useful. Table 1 reveals that many farmers used the agricultural knowledge of their opinion leaders. The highest proportion (94.1%) of the farmers indicated that their opinion leaders' knowledge was highly relevant, compared with a mere 5.9 % of the farmers who indicated that their opinion leaders' knowledge was relevant. None of the farmers indicated that the opinion leaders' knowledge was not relevant. The results revealed

that many farmers viewed their opinion leaders' knowledge as highly relevant. This suggests that the information they were receiving was of a high quality and could assist them in agricultural decision-making.

5.4.9 Farmers' socio-economic characteristics and their opinion leaders

The demographic characteristics of farmers that were collected included age, marital status, educational level, and monthly income together with the type of opinion leader mentioned. These were subjected to the Multinomial Logistic (MNL) Regression model. The presence of a relationship between the dependent and combination of independent variables was based on the statistical significance of the final model chi-square in Table 3. In this analysis, the distribution revealed that the probability of the model chi-square was 0.000, less than the level of significance of 0.05 ($P<0.05$). A multicollinearity test for the variables was carried out, showing a variance inflation factor (VIF) for each variable (see table 5.4). VIF shows there was a moderate correlation between variables.

Table 5.4: Collinearity statistics of independent variables for MNL Regression Model

Variables	**Collinearity statistics**	
	Tolerance	**VIF**
Gender	0.926	1.080
Age	0.588	1.701
Educational level	0.805	1.242
Marital status	0.943	1.060
Monthly household income	0.915	1.093
The participation level of farmers	0.743	1.346
Taking agriculture as a career	0.749	1.336
Taking agriculture as a learning platform	0.940	1.064

Marginal effects (ME) measure how a unit change of the average value of the independent variables affects the proportion of chosen opinion leaders. The results in Table 5.4 indicate that all estimated coefficients are statistically significant, as reflected by the significant Chi-square value ($p<0.01$). The pseudo R2 value is about 17%.

The variable gender was statistically significant ($p<0.05$) with the Farmer group leader with a positive coefficient. The marginal effect displays that one-unit change in gender causes a 14.6% change, in a change of farmers choosing a Farmers' group leader as their opinion leaders. The variable number of farmers who take agriculture as a career was found to be statistically significant ($p<0.01$) with a positive coefficient of Farmers' group leader as their opinion leaders. The marginal effect displays that one-unit change, in farmer taking agriculture as a career, causes a 21% change, in the chance of choosing a farmers' group leader.

The education level variable of the farmer was found to be statistically significant ($p<0.1$) with a positive coefficient of Farmer's group members as an opinion leader. The marginal effect displays that a one-unit change in educational level causes a 2.8% change, in the chance of farmers choosing Farmers' group members as their opinion leader. The demographic data showed that many of the farmers had a secondary level of education. This seems to show that by a narrow margin most farmers are literate from the studied area. Despite the (IDP, 2017) report of literate smallholder farmers u*Mtshwathi* municipality, there is also a significant population of illiteracy smallholder farmers.

The variable, marital status of a farmer was found to be statistically significant ($p<0.01$) with a positive coefficient. The marginal effect displays that a one-unit change in years of education causes, 7% of farmers to choose farmers' group members as their opinion leader. This suggests that most farmers may have sufficient knowledge as the farmers and spouses engage with different opinion leaders.

The variable number of farmers who take agriculture as a learning platform was found to be statistically significant ($p<0.01$) with a negative coefficient. This implies that the number of farmers who took agriculture as a career decreases the probability of choosing farmers' group members as an opinion leader. The marginal effect displays that one-unit change in understanding agriculture as a learning platform causes a -10.8% chance in choosing farmers' group members. The variable gender was statistically significant ($p<0.01$) with NGO's (FSG) with a negative coefficient. The marginal effect displays that one-unit change in gender causes a - 16% change, in a change of farmers choosing NGO's and FSG.

The results showed that there was a significant difference in choosing FSG and NGOs as an opinion leader and the marital status category. Married farmers have a 7.7% chance of choosing

FSG and NGOs as the opinion leaders. The model results also indicate that age, household monthly income, and participation level of farmers are not significant determinants of farmers' choice of opinion leaders.

Table 5.4: Farmers' socio-economic characteristics and their chosen opinion leaders

Variables	**Coefficients**			**Marginal Effects**			
	value	Std error	P(z)	Farmers Group Leaders (FGL)	Farmers Group Member (FGM)	Extension advisor &Farmers Group Leaders FGL	Farmers Support Organisation &NGO's
Gender	-0.352	0.146	0.017	0.146**	0.026	-0.169***	-0.003
Age	0.029	0.068	0.674	-0.024	0.0012	0.015	0.007
Education level	-0.141	0.060	0.020	0.024	0.0284*	-0.0527	0.001
Marital status	-0.140	0.091	0.128	0.014	0.0712***	-0.077*	-0.008
Monthly Income	0.087	0.091	0.336	0.0015	-0.0712	0.0277	0.004
Participation level	-0.131	0.127	0.304	0.0908	-0.0159	-0.0861	0.0011
Agriculture as career	-0.429	0.150	0.003	0.215***	-0.0382	-0.1711***	-0.006
Agriculture learning platform	0.189	0.144	0.191	0.035	-0.1078***	0.0734	-0.0003

*N =219 LR X2 = ***; Pseudo R2=0.17; Log likelihood = -203.157*

*Note: *, **, ***, means the coefficient is statistically significant at 10%, 5% and 1% levels.*

5.5 Conclusion and recommendations

The study revealed that the farmers' personal sources of knowledge dominated their agricultural knowledge and information systems. Although there was a large number of extension agents and

advisors who assisted them, the farmers still valued their opinion leaders in farming. These opinion leaders were used to share new information with other farmers in their social network systems, as they were progressive opinion farmers. Some opinion leaders were significant in the extent of their offering opinion leadership, which showed that they were very valuable to their network system. Thus, they could be exploited by system agents in the formation of knowledge.

It can be concluded that opinion leaders played a major role in updating farmers and helping farmers with their problems. Farmers received and trusted advice from farmers within their communities. In the case of *Bergville* and *Appelsbosch*, opinion leaders were from formal/informal systems or were currently working for local government. Moreover, they had acquired a significant amount of farming experience over the years. Not only did they have frequent contact with the farmers, but they also had other channels that they used to communicate with farmers. They disseminated information through farmers' group meetings. However, some farmers consulted fellow group members and farmers group leaders individually. There was a statistical difference between the geographical locations, the frequency of interaction, the social position held by the farmers' leaders mentioned and their level of education/training. The study showed that the accessibility of the knowledge source and feedback were crucial to farmers. Thus, we can conclude that the accessibility of the opinion leaders was considered when choosing the knowledge adviser on the part of the farmers. We observed that frequent interaction between farmers and opinion leaders influenced the farmers' decision. Furthermore, the farmers who participated in the study accessed agricultural knowledge by means of group consultations, which allowed them to learn and exchange ideas, especially with regard to issues already experienced by their fellow farmers. These facts explained why many of the farmers chose to seek information and advice from their opinion leaders. These research findings may help agents to develop their understanding of the dynamics of local communities and the social complexity that shapes farmers' environment and decisions.

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CHAPTER SIX: AN ANALYSIS OF THE EFFECT OF KNOWLEDGE SYSTEMS ON EMPOWERMENT LEVELS AND FOOD SECURITY

Abstract

The link between knowledge systems and the empowerment of farmers has been proven in many studies. However, the measurement of empowerment levels in terms of outcomes that focus on the psychological dimension of their participation in knowledge systems is limited in the agricultural sector. Smallholder farmers have engaged in multiple knowledge systems to improve their farming knowledge and to be empowered. Thus, the effectiveness of these knowledge systems needs to be evaluated and assessed in terms of the outcomes gained by farmers, including intangible skills and food security. Knowledge systems in KwaZulu-Natal Province provide useful information and help smallholder farmers to improve their knowledge and skills. These systems empower farmers to access intangible and tangible resources that affect them psychologically, socially, physically, and so on. The intangible assets gained by farmers through their participation in knowledge systems are valuable for their decision-making and performance. Thus, it was crucial for the study to investigate the levels of empowerment outcomes that smallholder farmers attained and food security level, as a way of evaluating and monitoring the progress made by the knowledge systems that were initiated and activated to empower the farmers. A purposive sampling technique was used to select 219 smallholder farmers who are linked to the KwaZulu-Natal Department of Agriculture and Rural Development (DARD). Applying empowerment theory and previous studies to our scenarios, we identified four empowerment outcomes: decision-making, increased self-efficacy, increased knowledge and competence. The principal component analysis method (PCA) was employed to generate the principal component (PC) of the perceived farmers' psychological empowerment level. In the study, the measurement of household food insecurity involved the use of the Household Food Insecurity Access Scale (HFIAS). The results showed that smallholder farmers were moderately and highly competent. They had a sense of self-efficacy, a sense of control, agricultural knowledge and food secured. However, the majority of these farmers felt moderately proficient with regard to leadership skills. Moreover, the significant number of farmers experiencing severe food insecurity who regarded themselves as moderately and highly self-efficacious cannot be ignored. These results suggest the need for interventions that will address and work to improvement these food insecure farmers.

Keywords: knowledge systems, psychological empowerment, food security

6.1 Background of the study

Smallholder farmers play a very important role in agriculture, especially in food production and their country's economy (FAO, 2017). Various knowledge systems contribute to the sustainable and resilient farming of smallholder farmers through new ways of doing, organising and gaining farming knowledge. Therefore, relevant and effective knowledge systems are crucial to the achievement of farmers' empowerment. The main purpose of these knowledge systems is to build the capacity of farmers to improve their production, identify problems, search for possible solutions and adapt practices suitable to their farming (Beaman and Dillon, 2018). Chiu and Chen (2016) argue that farmers engage in knowledge systems with the motive of developing their ability to make critical and informed decisions that improve their productivity and carry out resilient farming. In an agricultural context, these intangible outcomes are crucial for the human capital involved in physical farming. One of the intangible outcomes of the farmers' participation in knowledge systems is psychological empowerment. In other words, enriched with knowledge and skills, farmers become independent and gain confidence in decision-making. Thus, Ibrahim and Alkire (2007) argue that the empowerment of farmers not only depends on the quality of knowledge and skills they possess but also on their mental capacity, which enhances their human capital and influences their decisions regarding farming. This is emphasised by Murugani and Thamaga-Chitja (2019), who state that interventions tend to focus on farmers' tangible assets and overlook the intangible ones. The problem investigated in this paper is the inadequacy in exploring the psychological dimension of farmer empowerment. The literature has emphasised the importance of empowerment; however, it has inadequately explored the underlying psychological dimension in the analysis of the process of the empowerment of farmers.

The theory of empowerment includes both the process and outcomes of empowerment (Van Grinsven and Visser, 2011). Avelino *et al.* (2019) maintain that empowerment is a condition for and an intended outcome of social relations and dominant institutions within a social structure. Therefore, the outcomes of empowerment are a result of the processes. In agricultural contexts, this means that farmers' activities and agricultural programmes facilitate the empowering process. Thus, the results of these processes are the outcomes that can be measured according to the farmers' level of empowerment (Kabeer, 2001; Ibrahim and Alkire, 2007). Hence, it is crucial to unpack the psychological level of empowerment and the transformation of farmers after the

empowerment process. According to Kabeer (2001), the psychological dimensions of empowerment is experienced at an individual level, but it is established through the collective action and practice of farmers. Avelino *et al.* (2019) stresses the importance of understanding the systems that build empowerment. Furthermore, these systems provide access to resources and inputs, and shift the role of power to collective actions and vice versa.

Spreitzer (1995) explains that the psychological empowerment of people is based on their belief in their ability to influence and have a significant impact on their work, thus allowing them to control their own decision-making. Quisumbing *et al.* (2005) emphasise that the learning and training provided by Agriculture Knowledge Systems allows farmers to build up their skills for their intrinsic value and increase their self-esteem. Thus, evaluating empowerment outcomes is crucial for the systems designed to empower farmers to continue evolving effectively. Zimmerman *et al.* (1995) highlight that empowerment is an umbrella concept on an intrapersonal level.

The study described in this paper was based on the argument that it is important not only to understand the economic and agrarian implications of the knowledge systems used by the farmers, but also their effect on farmers' personal lives; hence, the study investigated levels of the psychological empowerment of farmers. Therefore, to understand how farmers feel about themselves because of participating in these knowledge systems, it is important to evaluate the categories of effective and empowering knowledge systems. Individuals participate in agriculture because of their families or friends, while others participate because of their competence, knowledge and skills (Kan and Faculty, 2020). Knowledge and skills encourage an individual to learn, to acquire more and participate (Karimiha 2020). Khushk *et al.* (2016) emphasise that when farmers have knowledge and skills pertaining to their work, they are empowered to perform significantly well. This study aimed to investigate the levels of empowerment demonstrated by the farmers who participated in the study. The objectives of the paper are: a) to provide a framework of empowerment. b) To explore the impact of these levels of empowerment on the farmers' food security status.

The study described in this paper was based on the premise that knowledge systems are expected to play a role in empowering farmers. In other words, the creation and integration of knowledge systems provide farmers with relevant agricultural knowledge. However, studies including those conducted by Landini *et al.* (2014), as well as Batool and Ahmed (2019) argue that psychological

empowerment is necessary for all other dimensions of empowerment to take place. According to Al-Amin *et al.* (2013), psychological empowerment is a development of self-confidence and self-esteem that motivates people to act. Ginige and Richards (2012) identified four empowerment outcomes: a sense of control, increased self-efficacy, increased knowledge and competence. Ginige *et al.* (2020) consider the individual's level of empowerment in terms of a sense of control, competence, self-efficacy and motivation. According to Dop *et al.* (2016), empowerment outcomes that are related to power include knowledge, skill, control and self-efficacy. Blissett *et al.* (2004) and Schroeder *et al.* (2013) also investigated the psychological empowerment of farmers. Several indicators of psychological empowerment, such as self-confidence and self-esteem, are commonly used as indicators in Table 1 (Ibrahim and Alkire, 2007; Ginige and Richards, 2012; Batool and Ahmed, 2019).

Engagement with knowledge systems encourages farmers' interest and motivates them to improve their agricultural knowledge and business skills as part of the empowerment process. The knowledge systems used by the smallholder farmers in KwaZulu-Natal (DAFF, 2011) who were the focus of the study described in this paper provided useful information and helped these farmers to improve the knowledge and skills that met their particular farming needs. Moreover, they were psychologically empowered through and after their participation in these knowledge systems. In other words, this study was based on the argument that all the intangible assets brought about by psychological empowerment are useful for farmers' decision-making and performance with regard to improving their food and nutrition security. Thus, it was crucial to investigate the levels of empowerment outcomes of the smallholder farmers who participated in the study, as a way of evaluating and monitoring the progress made by knowledge systems in empowering them in their farming communities.

Multiple knowledge systems exist in farming communities, which provide farmers with a range of benefits, including knowledge, skills, the control of resources, input supply and market information (Dolinska, 2016). However, studies that explore the outcomes of empowerment through existing knowledge systems are particularly limited. According to Khushk *et al.* (2016) outcomes are specific changes in attitudes, knowledge, skills and levels of functioning from participating in a program. Hence, the study was based on the proposed framework depicted in the diagram below (*Figure 6.1*), which explains the psychological dimension of the farmers'

empowerment through their participation in knowledge systems. Farmers who have self-confidence persevere; they generate different pathways to accomplish farming goals. The stronger the self-efficacy, the more persistent are the farmers' efforts Landini *et al.* (2014). Learning skills to accomplish a task could increase self-efficacy, promote action, and allow farmers to gain further practical experience.

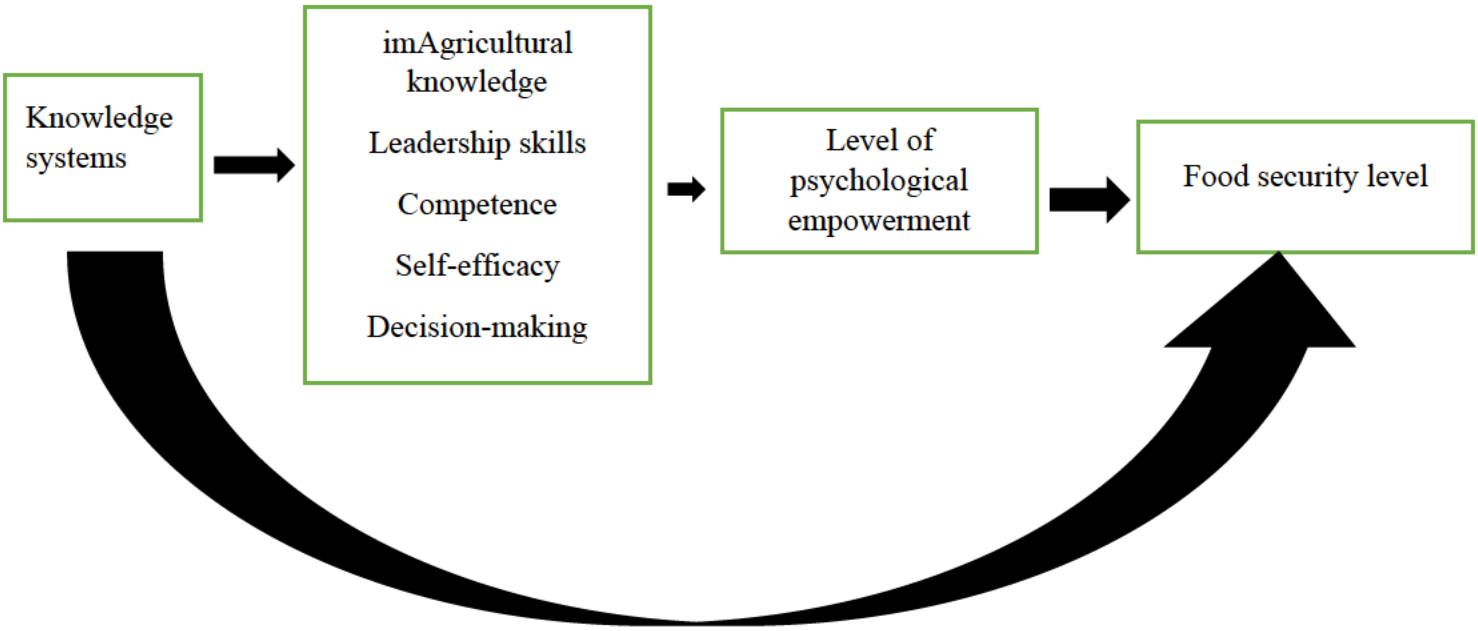

Figure 1: Proposed framework used to conceptualise farmer psychological empowerment levels adapted from (Spreitzer, 1996 and Cheung *et al.,* 2012)

6.2 Conceptual framework

According to Alsop (2006), empowerment is the capacity of a group or individual to make effective choices. In other words, empowerment involves making choices and then turning them into desirable actions and results. Kabeer (2001) concludes that an individual's ability to make choices consists of three interrelated elements: resources (as conditions), organisation (as process) and performance (outcome). According to Cheung *et al.* (2012), the empowerment outcomes that are close to power include knowledge, skill, strength, control and self-efficacy. The psychological empowerment of farmers is defined and measured as the individual's belief that they can influence others and have a significant impact on their farming community. The study was based on the argument that psychological empowerment positively influences farmers' decisions and

performance. Khushk *et al.* (2016) and Ani *et al.* (2018) highlight that psychologically empowered people feel a positive change in their attitude, behaviour and cognition that leads them towards innovative ideas. Psychological empowerment has been shown to have a positive impact on commitment and quality of service (Ginige and Richards, 2012; Ginige *et al*., 2020). Ibrahim and Alkire (2007), Landini *et al.* (2014), as well as Ani *et al.* (2018) argue that for behavioural action to occur, the individual needs both a sense of control, self-efficacy and confidence.

6.3 Research methodology

6.3.1 Data

The study was conducted in two districts: the uMtshwathi Municipality and the Ukhahlamba Municipality that are situated in the province of KwaZulu-Natal. A purposive sampling technique was used in the selection of smallholder farmers who were linked to the KwaZulu-Natal Department of Agriculture and Rural Development (DARD). Data were collected between November 2019 and March 2020 from a sample of 219 smallholder farmers. A pre-tested structured questionnaire was used to investigate these farmers' perceptions of knowledge systems and of their empowerment. The questionnaire explored demographic characteristics, farming knowledge systems and empowerment dimensions. To gather in-depth information, focus group discussions with the farmers and interviews with key informants were also conducted (Leibbrandt *et al.,* 2009).

6.3.2 Empowerment level analysis

To design and measure empowerment, empowerment outcomes were considered. Applying empowerment theory and previous studies (Spreitzer 1996) to our scenarios, the study uses five empowerment outcomes to measure: decision-making, increased self-efficacy, increased knowledge, leadership skills and competence. According to Zimmerman (1993), the components of the psychological empowerment of farmers involve intra-personal, interpersonal and behavioural components. Zimmerman (1993) explains that the intra-personal component refers to peoples' beliefs, motivations and perceived control, whereas the interpersonal component refers to what people understand about their environment. In agricultural activities, these components include educational experience, communications skills, information exposure and agricultural

activities (Suksod *et al.,* 2019). The behavioural component refers to participation in social/group activities. However, Avelino *et al.* (2017) argue that the key to understanding empowerment is through three basic psychological needs, including autonomy, competence and relatedness, which are explained by the self-determination theory. Furthermore, Avelino *et al.* (2017) explain that autonomy refers to the ability to choose individual actions

The questionnaire was divided into five domains: self-efficacy, competence, leadership, sense of control, and agricultural knowledge. Assessment was based on a five-point Likert-type scale (1 = Strongly Disagree, 5 = Strongly Agree). The expected range of scores on the variable was from '10' to '50'. Higher scores indicated higher self-esteem and vice versa. Each dimension was added up and divided by the number of questions in each empowerment dimension (Spreitzer 1996; Spreitzer and Qunn, 2001) as shown in table 6.1 below. Scores ranging from 0 to 1 were described as low levels of each psychological empowerment dimension, 2 to 3 as moderate levels and 4 and above as high levels.

Table 6.1: The psychological empowerment categories and levels

Sum score	**Categories**
0-1	Low
2-3	Moderate
4 and above	high

6.3.2.1 Self-efficacy

The measurement of psychological empowerment in terms of the farmers' self-efficacy was crucial. The empowerment dimension analysis examined the participants' belief in the following: their ability to do any agricultural activity; their ability to do things as well as most other people do in the community; and their having good qualities to share with the community members. The items were measured according to a five-point Likert-type scale (1 = Strongly Disagree, 5 = Strongly Agree). The higher scores of this measurement indicated higher levels of self-efficacy.

6.3.2.2 Competence

The farmers' competence was explored in the questions on psychological empowerment that measured their confidence. These items included questions related to the following: their skills in

negotiating with other farmers; their increased participation skills; whether they could influence and decide on implementing an activity; and whether participation in crop-maximisation projects increased their agricultural knowledge. The questions also explored whether they were provided awareness regarding agriculture; whether they knew to whom they should refer when problems occurred; and their ability to identify and determine the priority of issues in farming. Items were scored on a five-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree).

6.3.2.3 Decision making (sense of control)

Sense of control was another dimension included in the questionnaire. The questions investigated the following items: the ability of farmers to use their experience to make decisions; their ability to use other people's information to make decisions; and their ability to decide on the price of their produce. Items were scored on a five-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree).

6.3.2.4 Agricultural knowledge

The measurement of the farmers' agricultural knowledge was based on whether their knowledge had increased or not. This knowledge involved the following topics: soil preparation; crop harvesting/storage; crop variety market information; and herbicides/pesticides application. Items were scored on a five-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree) according to whether there was any increase/improved or not.

6.3.2.5 Leadership

The measurement of the psychological empowerment of the farmers included an examination of their leadership skills using the scale developed by Avelino *et al.* (2019). This scale included questions on the following: the farmers' inclination to share agricultural knowledge; their tendency to listen to friends' ideas and to try to convince them of their own ideas; and whether they were generally regarded as a good source of advice about agricultural knowledge. These questions captured the farmers' perception of the leadership skills that they acquired through their participation in knowledge systems. The items were scored on a five-point rating scale ranging from 1 (strongly disagree) to 5 (strongly agree).

6.3.3 Data collection with regard to food security

In the study, household food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS). The HFIAS consists of 9 items/questions that capture the occurrence of specific food insecurity during the four weeks prior to the application of the test (Ballard *et al.,* 2011). In the study, each participant indicated whether they had encountered any of the experiences/occurrences included in the 9 items. Each occurrence question was then followed by a frequency-of-occurrence question, which inquired how often a reported food insecurity condition occurred during the past four weeks (with three response options: 1= rarely, 2 = sometimes, and 3 = often). For this paper, we have used the total score (9-items based on the frequency score). Based on the respondents' answers to each question, the HFIAS scores were calculated. For each farmer, the HFIAS score reflected the continuous measure of the degree of food insecurity in the household in the past four weeks. A total score of 27 represented the most food-insecure household, whereas a lower score represented a more food-secure household.

6.3.4 The empirical analysis

6.3.4.1 Principal component analysis

The principal component analysis (PCA) method was employed to generate the principal components (PC) of the perceived farmers' psychological empowerment level (competence, sense of control (decisions) self-efficacy, agricultural knowledge and leadership). PCA is a multivariate data analysis and a statistical approach used for reducing the number of variables into a reduced number of dimensions, without losing the information (Liton *et al*., 2013; Yobe *et al.,* 2019). The purpose of using this factor analysis for the study was to reduce the number of variables collected into smaller factors.

Farmers were asked to respond by indicating their perception of the statements covering all the empowerment dimensions. The farmers' perceptions were assessed and rated according to the extent to which they responded, "Strongly disagree" or "Strongly agree". The rating had the value of 1 when the farmers strongly disagreed with the statement and went up to 5 when the farmers agreed with the statement. The Likert scale with 5 categories was recommended and used to capture the farmers' perceptions regarding their empowerment. A description of all the psychological empowerment dimensions' explanatory variables was used in the PCA, which is the

empirical model shown in Table 6.2. The Kaiser–Mayer–Olkin (KMO) and Bartlett's sphericity tests were used to assess the suitability of the psychological empowerment variables for PCA, and according to Hair *et al*, (2006) suitable KMO values are those greater than 0.5. Bartlett's sphericity test was statistically significant at p <0 .01. A reliability test (Cronbach alpha = 0.965) showed that the variables were acceptable measures of the same construct. The approach used to identify the level of empowerment of the farmers included five dimensions of psychological empowerment: competence; self-efficacy; a sense of control (decision-making); agricultural knowledge; and the farmers' leadership skills. These psychological dimensions were compiled according to those outlined by Landini *et al.* (2014). The data collection required the farmers to rate their level using the five-point Likert scale. After the data collection, the PCA was used on the questions representing psychological empowerment to generate dimensions contributing to the PC.

The principal component (PC) of a given dataset of P numeric variables can be presented mathematically as:

$PC_n = f\ (a_{ni}\ X_i, \ldots\ldots\ldots\ldots\ldots a_{1j}X_j)$ …… (1)

Where PC is the principal component,

n …….represents a number greater than one.

a_{1j}…….. The regression coefficient for the j^{th} variable and it is known as the eigenvector of the covariance matrix between variables.

X_j is the value of the j^{th} variable.

Explicitly the equation can be written as:

$PC1 = a_{11}X_1 + a_{12}X_2 + \ldots\ldots a_{1j}X_j$ …….. (2)

Where PC1 = the first principal component.

X_1 and X_2 are the first and second independent variables of PC1 in the linear additive model needed to derive the principal component

a_{11} and a_{12}..... are coefficient (component loadings) associated with the X1 and X2 variables.

6.4 Results and discussions

Before conducting the PCA, the suitability of the model was tested by applying Kaiser-Meyer-Olkin (KMO) and Bartlett's test of Sphericity for the different sub-dimensions of empowerment. The Kaiser Meyer Olkin (KMO) test was about 89.2 percent, which indicated that the PCA was appropriate for the analysis. Bartlett's test of Sphericity was significant at 1% (p-value (0.000), df =55, $\chi 2$=81,012.90). Thus, the PCA was appropriate for measuring empowerment.

The application of the PCA to the psychological empowerment dimension variables produced results that had Eigen values greater than the one using the Kaiser Criterion test. The total variance explained by the PCA was observed. The first component explained about 48.7% of the total variance, while the second components explained 10.7%. The third and fourth components explained 7.2% and 5.3%. Lastly, the fifth component explained 5.2% of the total variance of the empowerment of the smallholder farmers of Bergville and Appelsbosch. The principal components were labelled as shown in table 6.2 titled: *A principal component of farmers' psychological empowerment*. To achieve labelling, the PC pattern matrix was conducted. The variables with high values were the most important factors, and the negative and positive signs indicated the directions of their impact on the components.

The first PC best described agricultural knowledge and the competence empowerment dimension. This indicated that competence in agricultural knowledge was the most important factor in the smallholder farmers' empowerment. This PC accounted for 48.7% of the total variation.

Based on the dominant component loaded, the second PC best described the leadership and decision-making (sense of control) dimensions. This PC showed that farmers could use their experience to make decisions and could give agricultural information to others. This represented the leadership and decision-making (sense of control) dimensions. This PC was explained by 10.7% with estimated coefficients above 0.3. Leadership is a very important skill for farmers to have when building up their resilience, empowering themselves and engaging in transformative agriculture. Studies argue that there is a need to develop farmers who can first lead themselves, then lead others to practise resilient agriculture and achieve food security.

The third PC was the highest with regard to farmers sharing information with a circle of friends and the ability to negotiate with others. This PC was explained by 7.2%. This best represented the

empowerment of smallholder farmers with regard to self-efficacy. The fourth PC was the highest with regard to increased harvest and storage knowledge; the farmers' ability to use their experience and make decisions; and their confidence in their agricultural knowledge. This PC revealed the farmers' empowerment pertaining to agricultural knowledge and competence. The last PC was the highest with regard to farmers being regarded as good knowledge sources by their fellow farmers. This indicated the farmers' empowerment pertaining to agricultural knowledge and information. This PC was explained by 5.2%.

Table 6.2 A principal component of farmers' psychological empowerment

	Components				
	competence	**leadership and decision making**	**self-efficacy**	**competence** & **agricultural knowledge**	**agricultural knowledge &information**
Indicators	*PC1*	*PC2*	*PC3*	*PC4*	*PC5*
Can provide agricultural awareness	***.854***	*.003*	*-.058*	*-.174*	*-.072*
Can Influence decisions	***.844***	*-.098*	*.012*	*-.298*	*.064*
Know who go to for advice	***.841***	*.247*	*-.212*	*-.146*	*.075*
Identify and determine problems	***.821***	*.310*	*-.244*	*.031*	*.055*
Confidence with my agricultural knowledge	***.813***	*-.144*	*-.060*	*-**.409***	*-.053*
Participate Crop max	*.806*	*.287*	*-.214*	*-.076*	*.048*
Increased Competence	*.804*	*.286*	*-.275*	*.126*	*.059*
Increased knowledge of herbicides and pesticides	*.770*	*-.141*	*.001*	*-.470*	*.064*
Increased market Information	*.749*	*.289*	*-.244*	*.237*	*.034*
Increased seed variety	*.736*	*-.424*	*.024*	*.009*	*.004*
Increase harvest and storage knowledge	*.735*	*.106*	*.117*	***.367***	*-.230*
Can use experience & make Decision	*.726*	*-.003*	*-.212*	***.350***	*.087*
Can decision on prices	*.666*	*-.598*	*.123*	*.130*	*-.054*
I have good leadership qualities	*.553*	*.328*	*.237*	*.222*	*-.170*
Can work with other People	*.537*	*.374*	*.415*	*.087*	*-.212*
Can giving agricultural Information	*.618*	***-.624***	*.082*	*.255*	*.112*
Can use my experience to make a decision and influence others	*.593*	***-.616***	*.072*	*.174*	*.121*
Can share information with a circle of friends	*.458*	*.107*	***.693***	*-.129*	*-.110*

Can Negotiate with others	*.469*	*.268*	***.541***	*-.026*	*.154*
I'm regarded as Good Source	*-.038*	*.195*	*.235*	*.077*	***.902***
Summary indicators					
Eigen values	*9.745*	*2.141*	*1.436*	*1.057*	*1.045*
% of Variance	*48.723*	*10.705*	*7.178*	*5.287*	*5.227*
Cumulative %	*48.723*	*59.428*	*66.605*	*71.893*	*77.120*
Kaiser-Meyer-Olkin	***.892***				
Bartlett's Test of Sphericity	***.000***				
Cronbach's alpha	***.965***				

Source: field survey 2020

Appendix section 3, Table 3.1 represents the farmers' responses according to each empowerment dimension and their rating of each item using the Likert scale which ranged from strongly disagree to strongly agree (*in frequency %)*. The table indicates the number of responses by the farmers under each dimension. The analysis of the results pertaining to leadership skills showed that many farmers strongly agreed with the leadership items of empowerment. However, a significant number of farmers disagreed with one indicator of the leadership dimension.

Based on the competence empowerment dimension, many farmers responded agree and strongly agree with all the competence items listed, which included negotiation skills, the ability to influence other farmers, knowledge of where to seek advice/knowledge and the ability to identify and prioritise critical issues in which to invest regarding their farming. All these skills are crucial for farmers' critical thinking and decision-making and build empowered and transformed smallholder farmers. Thus, participating in these knowledge systems rewards farmers with both tangible and intangible skills in the form of input resources and motivation. This gives farmers control over their farming activities. Knowledge and the options of gaining knowledge and advice facilitate their efforts to be effective farmers. Suksod *et al.* (2019) maintain that farmers who seek and implement innovations are innovative farmers who contribute to agricultural transformation. This is proven by the participation of farmers in farmers' group meetings, community projects and interaction with agricultural agencies.

Many of the farmers agreed and strongly agreed with the item indicating self-efficacy, with a high score for their response to the items on confidence in doing an agricultural activity, working with other fellow farmers, and sharing good qualities. These responses reflected the high level of confidence of the farmers, their strong social relations with other farmers, their efficacy in

collective work and effective skills in knowledge sharing with other farmers. It was important to understand the farmers' performance of actual skills and their perceptions of the skills acquired. This was shown by the farmers' participation in farmers' groups and associations to acquire and share their knowledge and agricultural experience gained through years of farming.

Many farmers agreed and strongly agreed with the notion of using both their knowledge and information gained from fellow farmers to decide on the price of their produce. A similar pattern emerged regarding the agricultural knowledge gained by farmers. Many farmers agreed with the items indicating increased knowledge of soil preparation, crop harvesting/storage, crop variety, market information and the application of pesticides.

6.4.1 Psychological empowerment level and food security of smallholder farmers

A descriptive analysis of the variables that included food insecurity and levels of psychological empowerment is summarised below. The farmers' household food security was measured, and the results of the study are presented in table 6.3 below. The results showed that a larger proportion of farmers were food secure (29.7%), when compared to the proportion of farmers who were severely food insecure (23.3%). Moreover, the results revealed that 17.8% of the farmers' households were mildly food insecure and 29.2% of the farmers' households were moderately food insecure.

Table 6.3: Food security status of farmers' household

Categories	**N=219**	**%**
Food secure	65	29.7
Mildly food secure	39	17.8
Moderately food insecure	64	29.2
Severely food insecure	51	23.3

The study analysed the levels of psychological empowerment dimensions in relation to the food security of the farmers' households. In determining the levels of the components of the farmers' empowerment, responses fell into low, moderate and high levels. A Chi-square x^2 test was used to measure the association between the level of empowerment and the food security category.

6.4.1.1 Competence

In addition to the PCA results, we have analysed the level of empowerment using the five dimensions of Psychological empowerment. Table 6.4 presents statistically relationship of the association between food security and competence level of farmers at ($p<0.01$). The results further revealed that 34.2% farmers were moderately competence and 65.8% highly competence. These results are supported by the high number of farmers who agreed and strongly agreed with competence items in Appendix section 3, table 3.1. The study concludes that farmers participating in the described knowledge systems demonstrated moderate and high levels of competence, which was one of the empowerment dimensions. Roberts and Coutts (2007) characterise motivated farmers as having a high level of competence, who can identify their challenges and opportunities within their farm system and pursue ways of solving them. According to Ginige and Richards (2012), competence is defined as a person's confidence and ability to perform activities. Thus, a high level of competence is crucial for farmers if they are to use the knowledge they gain and to perform better in their agricultural activities. These results of the study were similar to those of the study conducted by Ghulam *et al.* (2016) that indicated a moderate level of self-efficacy and competence among smallholder farmers. Their study revealed that farmers' participation in projects built their confidence in dealing with farming issues.

The aspect of farmers' autonomy also affects their intention to be efficient farmers because it can inspire motivation and performance due to behaviour change. From the moderately competent proportion of farmers, 11.9% were food secure, 9.6% mildly food secure, 8.2% moderately food insecure and 4.6 % severely food insecure. This shows a positive trend whereby the majority of farmers fell into the food secure proportion and only small groups were moderate and severely food insecure. However, of the 65.8% of highly competent farmers, 17.8% were food secure, 8.2% were mildly food secure, a shocking 21% were moderately food secure and 18.7% were severely food insecure. This implied that even though these farmers regarded themselves as highly competent in terms of psychological empowerment, there was room for improvement in reducing the number of severely food insecure farmers.

6.4.1.2 Self-efficacy

A similar pattern was shown by the results regarding the farmers' level of self-efficacy. About 2.3% of the farmers revealed a low level of self-efficacy, 33.8% of the farmers were moderately self-efficacious, while 63.9% of the farmers were highly self-efficacious. The results were statistically significant with $p<0.01$ between the self-efficacy and food security variables. The analysis presented in Appendix section 3, Table 3.1 with regard to self-efficacy showed that most farmers agreed and strongly agreed in their response to the items on self-efficacy. Ginige and Richards (2012) point out that self-efficacy influences the individual's ability to know what resources are required as well as what path to follow to access them. The results showed a high level of self-efficacy on the part of the farmers. Thus, we could conclude that these farmers were motivated to pursue their farming goals. These results were similar to Ginige and Richard's (2015) findings that showed high values regarding farmers' ability to organise and take actions reflecting their self-efficacy. Scholars, including Khushk *et al.* (2016) and Ani *et al.* (2018) emphasise that when farmers are self-efficacious and confident, they are more likely to set high goals and be ambitious in their work.

Owing to their self-efficacy, which refers to their belief in their ability, the farmers in the study felt capable of accessing the required agricultural information/knowledge that positively influenced their motivation to improve their farming. The results of the study revealed that out of the 2.3% of the farmers who demonstrated a low level of competence, 0.9% were mildly food secure and 1.4% were moderately food insecure. Moreover, the results revealed that out of the 33.8% of the farmers who indicated a moderate level of self-efficacy, 12.8% were food secure, 8.7% were mildly food secure, 7.3% were moderately food insecure and 5% were severely food insecure. This showed a positive trend, whereby the majority of farmers fell into the food secure group and a small number fell into the moderate and severely food insecure group. However, out of the 63.9% of the farmers demonstrating a high level of self-efficacy, 16.9% were food secure, 8.2% were mildly food secure, 20.5% were moderately food insecure and 18.3% were severely food insecure. This study concluded that many farmers in both Bergville and Appelsbosch were moderately and highly self-efficacious as well as being food secure. Furthermore, the study suggested that these farmers could make decisions and carry out actions to improve their agricultural productivity and food security. However, we cannot ignore the significant number of

severely food insecure farmers (23.3%) who regarded themselves as moderately and highly self-efficacious. This suggested that there was still more work to be done and improvement was needed to reduce the number of food insecure farmers.

6.4.1.3 Sense of control

There was a significant relationship between the farmers' food security and their sense of control ($p<0.01$). A mere 2.3% of the farmers demonstrated a low level of sense of control, 35.2% exhibited a moderate level and 62.5% were highly in control of their decision-making. Ani *et al.* (2018) observe that decision-making usually requires relevant information and competence. This is further illustrated by the results presented in appendix section 3, Table 3.1 which shows that most farmers agreed and strongly agreed with the notion of using both their knowledge and information gained from fellow farmers to make price decisions with regard to their produce, thus demonstrating a strong sense of control. This would have promoted cooperation and the sharing of agricultural knowledge among the farmers, leading to the development of collaborative problem-solving skills. Furthermore, the results revealed that these farmers had control over their decisions and the initiative to acquire the resources needed to improve their farming. Thus, the farmers of Bergville and Appelsbosch could use their experience to bargain with other fellow farmers.

The results also revealed that of the 2.3% of the farmers who demonstrated a low level of sense of control, 0.9% were mildly food secure and 1.4% were moderately food insecure. Out of the 35.2% of the farmers who demonstrated a moderate level of sense of control, 13.3% were food secure, 7.6% were mildly food secure, 7.3% were moderately food insecure and 5% were severely food insecure. This revealed a positive trend, whereby the majority of the farmers fell into the food secure group and a small number were moderately and severely food insecure. However, of the 62.5% of the farmers who demonstrated a high level of self-efficacy, 16.4% were food secure, 7.3% were mildly food secure, 20.5% were moderately food insecure and 18.3% were severely food insecure. This revealed that there was a need to focus on the large proportion of farmers (23.3%) who were severely food insecure and demonstrated moderate and high levels of sense of control.

6.4.1.4 Agricultural knowledge

A similar pattern was shown by the results regarding the levels of the farmers' agricultural knowledge. A mere 2.7% of the farmers demonstrated a low level of increased agricultural knowledge and information, 34.3% exhibited a moderate level, while 63% revealed a high level. The analysis of increased agricultural knowledge presented in appendix section 3 Table 3.1, showed that there were several items/categories of knowledge to which the farmers agreed and strongly agreed, including soil preparation; crop harvesting/storage; crop variety; market information; and the application of pesticides. The items that explored the farmers' increase in agricultural knowledge included indicators of empowerment such as "know how" and "why". The study's findings were similar to those of Somboonsuke *et al.* (2001) that showed when comparing smallholding systems, that the smallholder farmers had a high level of knowledge and skills in farming practice owing to the variety of their food production activities. The farmers' responses that indicated increased access to sources of knowledge concerning agricultural production were expected to indicate improved food security conditions on the part of these farmers.

The study showed a statistical significance at ($p<0.01$) between increased agricultural knowledge/information and the farmers' food security status. Moreover, the results revealed that of the 2.7% of farmers with a low level of agricultural knowledge and information, 0.9% were mildly food secure and 1.8% were moderately food insecure. However, of the 34.3% of farmers with a moderate level of agricultural knowledge and information, 13.3% were food secure, 9.1% were mildly food secure, 6.9% were moderately food insecure and 5% were severely food insecure. This revealed a positive pattern, whereby the majority of farmers fell into the food secure group and a small number were moderately and severely food insecure. However, out of the 63% of farmers with high self-efficacy, 16.4% were food secure, 7.8% were mildly food secure, 20.5% were moderately food insecure and 18.3% were severely food insecure. This revealed a need to focus on the large number of farmers (23.3%) who were severely food insecure but demonstrated moderate and high increased levels of agricultural knowledge and information.

6.4.1.5 Leadership

The chi-square results presented in Table 6.4 indicated a statistically significant relationship between the farmers' food security and their level of leadership ($p<0.05$). Furthermore, the results

showed that 36.1% of the farmers with leadership skills demonstrated a low level of empowerment, while 55.7% of the farmers with leadership skills exhibited a moderate level of empowerment and 8.2% of the farmers with leadership skills indicated a high level of empowerment. The results also revealed that of the 36.1% of farmers with low leadership skills, 12.8% were mildly food secure, 9.6% were mildly food secure, 1.8% were moderately food insecure and 5.1% were severely food insecure. This shows a positive pattern, whereby the majority of farmers fell into the food secure group and a small number were moderately and severely food insecure. Out of the 55.7% of farmers who demonstrated a moderate level of leadership empowerment, 15.1% were food secure, 7.3% were mildly food secure, 16.3% were moderately food insecure and 16.4% were severely food insecure. However, of the 8.2% of farmers with high leadership skills, 1.8% were food secure, 0.9% were mildly food secure, 3.7% were moderately food insecure and 1.8% were severely food insecure. These results revealed a need to focus on the large proportion of farmers (23.3%) who were severely food insecure but fell into moderate and high levels of leadership skills. Even though many farmers showed moderate to high levels of empowerment with regard to competence, self-efficacy, a sense of control and agricultural knowledge, the majority of these farmers felt moderately proficient in leadership skills. This reveals a need to work on these skills to enable the farmers of this study to lead themselves and other farmers.

Table 6.4: Food security profile and psychological empowerment level of farmers

Variables		***Food secure***		***Food insecure***		
	n	*Food-Secure (%)*	*Mildly food secure (%)*	*Moderately food insecure (%)*	*Severely food insecure (%)*	X^2
Competence						***
moderate	*75 (34.2%)*	*11.9*	*9.6*	*8.2*	*4.6*	
high	*144(65.8%)*	*17,8*	*8.2*	*21*	*18.7*	
Total %		***29.7***	***17.8***	***29.2***	***23.3***	
Self-Efficacy						***
low	*5(2.3%)*	*0*	*0.9*	*1.4*	*0*	
moderate	*74(33.8%)*	*12.8*	*8.7*	*7.3*	*5*	
high	*140(63.9%)*	*16.9*	*8.2*	*20.5*	*18.3*	
Total %		***29.7***	***17.8***	***29.2***	***23.3***	
Sense of control						***
low	*5(2.3%)*	*0*	*0.9*	*1.4*	*0*	
moderate	*77(35.2%)*	*13.3*	*9.6*	*7.3*	*5*	
high	*137(62.5%)*	*16.4*	*7.3*	*20.5*	*18.3*	
Total %		***29.7***	***17.8***	***29.2***	***23.3***	
Agricultural knowledge						***
low	*6(2.7%)*	*0*	*0.9*	*1.8*	*0*	
moderate	*75(34.3%)*	*13.3*	*9.1*	*6.9*	*5*	
high	*138(63%)*	*16.4*	*7.8*	*20.5*	*18.3*	
Total %		***29.6***	***17.8***	***29.2***	***23.3***	
Leadership						**
low	*79(36.1%)*	*12.8*	*9.6*	*8.7*	*5.1*	
moderate	*122(55.7%)*	*15.1*	*7.3*	*16.8*	*16.4*	
high	*18(8.2%)*	*1.8*	*0.9*	*3.7*	*1.8*	
Total %		***29.7***	***17.8***	***29.2***	***23.3***	

Note: *** and ** means significant at 1% and 5% levels of significance, respectively. Source: household survey (2020).

6.5 Conclusions

The knowledge of the farmers who participated in this study was the result of their interaction with public and private knowledge systems that were initiated to improve their productivity and to empower them. These systems not only empowered the farmers with tangible assets, but also intangible outcomes as shown in the results of the study. These intangible outcomes were examined in terms of the farmers' levels of competence, self-efficacy, sense of control, increased

agricultural knowledge and leadership skills, which made up the empowerment dimension of the study. However, the outcomes regarding the level of the empowerment gained by the farmers varied according to their context. The results showed that the overall empowerment among the farmers was at a moderate to high level with respect to competence, self-efficacy, a sense of control and agricultural knowledge. However, concerning leadership skills, a significant proportion of the farmers fell into the low and moderate categories. The results of the analysis of leadership skills showed that many farmers strongly agreed in their responses to the items of the questionnaire that dealt with leadership empowerment. However, a significant number of farmers disagreed with one indicator of the leadership dimension.

The moderate and high levels of competence, self-efficacy, sense of control, agricultural knowledge and leadership demonstrated by the farmers was mainly due to their participation in multiple knowledge systems and programs conducted by different specialists in relevant agricultural fields. Thus, we can conclude that the Appelsbosch and Bergville farmers achieved an overall moderate level of empowerment through their participation in agricultural knowledge systems. Across groups of farmers, it is reasonable to assume that the knowledge systems produced increased feelings of competence, self-efficacy, sense of control and agricultural knowledge. Furthermore, the results showed that smallholder farmers in Bergville and Appelsbosch who demonstrated moderate and high levels of competence, self-efficacy, sense of control and agricultural knowledge were food secure. However, there was a lack of empowerment in leadership skills amongst the farmers of the study, as the majority felt moderately proficient in leadership skills. This finding suggests the need to improve the empowerment of these farmers in leadership skills. Moreover, we cannot ignore the significant number of farmers (23.3%) who were severely food insecure and who regarded themselves as moderately and highly self-efficacious. This indicates the need to focus on working to reduce the number who indicated that they experienced food insecurity.

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CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

While farmers have operated information systems in general, the types of knowledge and systems use and knowledge sharing for empowering and maintaining their livelihoods have not been fully researched and reported to develop them. Given the current Covid-19 pandemic, it is clear that the local food systems need to be overhauled to strengthen their capabilities, especially where smallholders operate. This study explored agricultural knowledge systems and smallholder farmers' empowerment with a focus on social capital and social learning platforms, firstly, by describing the agricultural knowledge systems and the types of knowledge occurring. Secondly, by studying identified opinion leaders' social networks and their influence on the quality of agricultural knowledge and thirdly, by assessing the agricultural knowledge systems in relation to farmers' empowerment levels. A purposive sampling method was employed to collect data from 219 smallholder farmers. A descriptive analysis, a Chi-square test and running ordered probit and multinomial models were utilised. Chapter 7 presents the conclusion of the study and advances recommendations based on the results. Gaps in current knowledge are identified and topics and issues for future studies are suggested.

The study was guided by the sustainable livelihoods framework and knowledge systems. The SLF identifies five capitals that can be classified as tangible and intangible, the latter of which is known as capabilities (Scoones 1998; Vorley *et al.*, 2012). The study posits that while building smallholder farmers' assets through existing systems, it is important to categorise active knowledge systems, identify opinion actors within these networks and measure the level of empowerment brought about by these systems.

7.2 Conclusions

7.2.1 Sub-problem1: Agricultural Knowledge Systems and their implications on Food Security of smallholder farmers

The study described the active agricultural knowledge systems utilised by smallholder farmers in the KwaZulu-Natal Province and their implications for food security. It was necessary to categorise the information structures accessible to farmers through their social capital to assess

their effect on farmers' empowerment and food security. The study revealed that farmers at Appelsbosch and Bergville were actively engaged in a variety of local systems and technical and scientific knowledge systems that often serve multiple purposes, including disseminating information and addressing production and marketing requirements. The study indicated that knowledge systems of farmers emerge from the bottom-up level to outside established sectors. The partnerships and collaboration of the knowledge systems utilised by farmers bring together people with a variety of capacities to broaden the range of skills acquired by farmers within these systems that enhance individual and community capacity. The findings indicated the three learning pathways described by Hoffman (2013) through knowledge systems theory, namely technical learning pathways, social learning pathways and experiential learning pathways. There is no single system that can adequately serve the agricultural information and knowledge needs of small-scale farmers and it is therefore important to have transformational systems of agricultural information for effective and efficient information delivery to farmers. Considering that small-scale farmers in rural communities are mostly illiterate adults of advanced age, farmers interact with extension officers when attending farmers' meetings and field day demonstrations to understand the technical knowledge and skills that are important to them. These knowledge systems have common motives for providing farmers with agricultural knowledge and efficient ways of farming. The two studied areas indicate a visible, interrelated interaction route for farmers with formal and informal knowledge systems that are guided by rules, goals and norms to ensure transparency. Farmers are dependent on social and personal connections to access and mobilise the resources needed to improve their household food security. Thus, knowledge within these systems is important and needs to be understood. Farmers' motivation and attitude towards participating in agriculture is important, as these factors affect the extent of the effort applied to achieve agricultural production.

7.2.2 Sub-problem2: Do Farmers' Socio-Economic Characteristics Influence Farmers' Choice of Opinion Leaders

The study posits that farmers' easy and timely access to opinion leaders enables them to expand and improve their knowledge. However, the absorption of knowledge depends on the farmers' age and level of education. Therefore, identifying opinion leaders and understanding the socio-economic impact of a farmer's choice of an opinion leader is important. In the case of Bergville and Appelsbosch, the opinion leaders were from formal and informal systems and some were

employed by local government and others had years of farming experience. Not only did they have frequent contact with the farmers, but they also employed various channels of communication. The study revealed that the farmers' sources of information dominated the agricultural knowledge and information systems. Although there were large numbers of extension agents and advisors, farmers still valued their opinion leaders. These opinion leaders are used to share new information with other farmers in their social network systems as they are progressive opinion farmers. Some opinion leaders have a high extent of opinion leadership and are therefore valuable in their network system. They can be exploited by formation knowledge system agents. The results indicated that farmers require leaders who can quickly access reliable information to address their agricultural problems. The accessibility of knowledge sources and feedback are crucial to smallholder farmers. Farmers consult through group settings, which allows them to learn from one another, especially with regard to issues already experienced by their peers. These facts explain why numerous farmers choose to seek information and advice from their opinion leaders.

7.2.3 Sub-problem3: Analysis of Empowerment Level of Smallholder Farmers and food security of smallholder farmers through Knowledge Systems.

This study argued that in the context of agriculture, these intangible outcomes are crucial for farmers' human capital to carry out physical farming. There are also intangible outcomes from their participation in these knowledge systems i.e., psychological empowerment. This study also explored the impact of farmers' empowerment on their food security status. The results indicated that the farmers' overall empowerment was at a moderate level with a high level of empowerment regarding competence, self-efficacy, sense of control and agricultural knowledge. With regard to leadership skills, a significant proportion of the farmers had low and moderate leadership skills. The results of the analysis of the farmers' leadership skills revealed that many of them strongly agreed with the leadership items of empowerment, although a significant number of them disagreed with one indicator of the leadership dimension. It was reasonable to assume that the knowledge systems produced increased feelings of competence, self-efficacy, sense of control and agricultural knowledge. The results indicated that although the smallholder farmers in Bergville and Appelsbosch were moderately and highly competent with regard to self-efficacy, sense of control and agricultural knowledge and enjoyed food security, most of these farmers felt only moderately proficient with regard to their leadership skills. However, we cannot ignore the

significant number of severely food insecure farmers (23.3%) who regard themselves as moderately and highly self-efficacious. This suggests that work must be done to reduce the number of farmers that suffer from food insecurity.

7.3 Policy recommendations

The study confirmed the effectiveness of agriculture knowledge systems and opinion leaders' ability to empower smallholder farmers with knowledge in rural communities. However, the classification and assessment of these knowledge systems and opinion leaders requires continuous remodelling and reforming. There is a need to understand the structures and functional relations of these knowledge systems and their impact on farmers' participation levels. This will be crucial to understand the pulling factors and farmers' perceptions of empowerment and agricultural development initiatives. The KwaZulu-Natal Department of Agriculture and Rural Development (DARD) and various non-government agencies need to have access to updated information for transformative initiatives and platforms that intend to transform and empower farmers through local and private networks. The agricultural extension and agricultural production enhancement programmes must recognise the active opinion leaders within communities to develop and strengthen the efforts and impact of these programmes for more resilient outcomes. Progressive and effective of these opinion leaders need a constant continuous assessment to increase and integrate leadership skills on empowerment programmes of farmers. In light of the findings, it is suggested that efforts to improve farmers' active knowledge systems and access to the opinion leaders within these active knowledge systems should take into consideration the socio-economic factors that influence farmers' choices and participation. While most programmes implemented by the Department of Agriculture and the private sector include the tangible empowerment of small-holder farmers, programmes should also focus on their psychological empowerment. As indicated by the results of this study, there is an association between knowledge systems, empowerment levels and farmers' food security status and the effectiveness of agricultural knowledge systems could, therefore, be augmented by improving farmers' psychological empowerment to enhance resilient agriculture and food production. It is also suggested that programmes should focus on investing in human resources and intangible skills that can advance farmers' informal education and thus build their human and collective capacities.

7.4 Areas for further study

Further research can be conducted on how opinion leaders can be integrated and institutionalised at both the local and district levels and integrate psychological dimensions into every development initiative and programme offered to farmers.

Appendix Section1

```
Ordered probit regression                         Number of obs     =        219
                                                  LR chi2(11)       =      47.80
                                                  Prob > chi2       =     0.0000
Log likelihood = -275.39956                       Pseudo R2         =     0.0799
```

CATEGORIES	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sex	-.1691555	.1629117	-1.04	0.299	-.4884567	.1501456
Age	-.097205	.0770008	-1.26	0.207	-.2481238	.0537137
Educations	.019626	.1686287	0.12	0.907	-.3108802	.3501322
MaritalS	.0553111	.2126656	0.26	0.795	-.3615057	.472128
HHIncome	-.2661425	.1061883	-2.51	0.012	-.4742678	-.0580172
providingforfamily	.1721386	.2628816	0.65	0.513	-.3430998	.687377
learningaboutagric	.0991317	.1657865	0.60	0.550	-.225804	.4240673
agricultureascareer	.125613	.1729355	0.73	0.468	-.2133344	.4645603
LocalLevel	-.532798	.2013713	-2.65	0.008	-.9274784	-.1381175
Technicalevel	-.3774012	.0950153	-3.97	0.000	-.5636277	-.1911746
Scientificlevel	.4443322	.1096453	4.05	0.000	.2294314	.659233
/cut1	-2.984221	.6210631			-4.201482	-1.76696
/cut2	-2.436341	.6130995			-3.637994	-1.234688
/cut3	-1.535098	.6061646			-2.723159	-.3470375

```
. mfx,predict(outcome(1))

Marginal effects after oprobit
      y  = Pr(CATEGORIES==1) (predict, outcome(1))
         =  .26964114
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
Sex*	.0567763	.0555	1.02	0.306	-.051996	.165549		.3379
Age	.032119	.02545	1.26	0.207	-.017756	.081994		4.39269
Educa~ns*	-.0064961	.05591	-0.12	0.908	-.116082	.10309		.643836
MaritalS*	-.0184364	.07149	-0.26	0.797	-.158559	.121686		.762557
HHIncome	.0879403	.03517	2.50	0.012	.018999	.156882		2.34703
provid~y*	-.0591404	.09354	-0.63	0.527	-.242477	.124196		.899543
learni~c*	-.0324311	.0536	-0.61	0.545	-.137487	.072624		.342466
agricu~r*	-.040891	.05541	-0.74	0.461	-.149496	.067714		.315068
LocalL~l	.17605	.06718	2.62	0.009	.044376	.307724		2.26027
Techni~l	.1247029	.03166	3.94	0.000	.062653	.186753		2.55251
Scient~l	-.1468187	.03662	-4.01	0.000	-.218598	-.075039		1.40183

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx,predict(outcome(2))

Marginal effects after oprobit
      y  = Pr(CATEGORIES==2) (predict, outcome(2))
         =  .20404036
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
Sex*	.0105765	.00985	1.07	0.283	-.008727	.02988		.3379
Age	.0065758	.00555	1.18	0.236	-.00431	.017461		4.39269
Educa~ns*	-.0013178	.01124	-0.12	0.907	-.023353	.020718		.643836
MaritalS*	-.0035975	.01331	-0.27	0.787	-.029685	.02249		.762557
HHIncome	.0180041	.00885	2.04	0.042	.000665	.035344		2.34703
provid~y*	-.009448	.0114	-0.83	0.407	-.031785	.012889		.899543
learni~c*	-.0069691	.01231	-0.57	0.571	-.031088	.01715		.342466
agricu~r*	-.0089896	.01326	-0.68	0.498	-.034986	.017006		.315068
LocalL~l	.0360429	.01678	2.15	0.032	.003149	.068936		2.26027
Techni~l	.0255306	.00972	2.63	0.009	.006475	.044587		2.55251
Scient~l	-.0300584	.01128	-2.67	0.008	-.052164	-.007953		1.40183

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx,predict(outcome(3))

Marginal effects after oprobit
      y  = Pr(CATEGORIES==3) (predict, outcome(3))
         =  .32452271
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
Sex*	-.0208508	.02156	-0.97	0.333	-.063099	.021397		.3379
Age	-.0113347	.00937	-1.21	0.227	-.029708	.007039		4.39269
Educa~ns*	.0023029	.01991	0.12	0.908	-.036727	.041333		.643836
MaritalS*	.0066555	.02639	0.25	0.801	-.045062	.058373		.762557
HHIncome	-.0310339	.01434	-2.16	0.030	-.059137	-.002931		2.34703
provid~y*	.0229602	.03943	0.58	0.560	-.054315	.100235		.899543
learni~c*	.0111388	.01809	0.62	0.538	-.024322	.0466		.342466
agricu~r*	.0138498	.01819	0.76	0.446	-.021799	.049499		.315068
LocalL~l	-.0621276	.02767	-2.25	0.025	-.116352	-.007903		2.26027
Techni~l	-.0440074	.01499	-2.94	0.003	-.073385	-.01463		2.55251
Scient~l	.0518119	.01748	2.96	0.003	.01755	.086073		1.40183

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx,predict(outcome(4))

Marginal effects after oprobit
      y  = Pr(CATEGORIES==4) (predict, outcome(4))
         =  .20179579
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
Sex*	-.0465021	.0438	-1.06	0.288	-.132347	.039343		.3379
Age	-.0273601	.0217	-1.26	0.207	-.0699	.01518		4.39269
Educa~ns*	.005511	.04724	0.12	0.907	-.087082	.098104		.643836
MaritalS*	.0153784	.05842	0.26	0.792	-.099122	.129879		.762557
HHIncome	-.0749105	.03013	-2.49	0.013	-.133965	-.015856		2.34703
provid~y*	.0456282	.06538	0.70	0.485	-.082514	.17377		.899543
learni~c*	.0282614	.04787	0.59	0.555	-.065566	.122089		.342466
agricu~r*	.0360309	.05059	0.71	0.476	-.063125	.135187		.315068
LocalL~l	-.1499653	.05716	-2.62	0.009	-.261995	-.037936		2.26027
Techni~l	-.1062262	.02746	-3.87	0.000	-.16005	-.052402		2.55251
Scient~l	.1250651	.03166	3.95	0.000	.063006	.187124		1.40183

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Appendix Section 2

Table 1 Agricultural knowledge topics and rate of knowledge

Knowledge topic	***Highly reliable %***	***Reliable %***	***Neutral %***	***Not reliable %***
Soil preparation	87.2	12.8	0	0
Harvesting	84.9	12.8	0.5	1.8
Crop variety	88.1	11	0.5	0.5
Markets	85.8	11	3.2	0
Herbicides	86.3	12.8	0.5	0.5
Seed variety	84.9	12.3	0.9	1.8
Climate change	84	12.3	1.4	2.3
	Very useful %	***Useful %***	***Neutral %***	***Not useful %***
Soil preparation	90.4	9.6	0	0
Harvesting	89.5	8.7	1.8	0
Crop variety	89.5	9.1	0.9	0.5
Markets	88.6	8.7	1.4	1.4
Herbicides	90.9	8.7	0	0.5
Seed variety	90	8.7	0.5	0.9
Climate change	88.1	8.7	0	3.2
	Highly relevant %	***Relevant %***	***Neutral %***	***Not relevant %***
Soil preparation	94.1	5.9	0	0
Harvesting	92.7	5.9	0	1.4
Crop variety	93.6	5.9	0	0.5
Markets	91.8	5.9	0	2.3
Herbicides	93.6	5.9	0	0.5
Seed variety	92.7	5.9	0	1.4
Climate change	89.5	5.9	0	4.6

Multinomial logistic regression — Number of obs = 219
LR chi2(32) = 86.11
Prob > chi2 = 0.0000
Log likelihood = -203.15704 — Pseudo R2 = 0.1749

OpinionLeader	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ExtensionL	(base outcome)					
FarmerGLeader						
Sex	-.0112069	.4853118	-0.02	0.982	-.9624006	.9399869
Age	.038423	.2237958	0.17	0.864	-.4002087	.4770548
Education	.2766988	.2221376	1.25	0.213	-.1586828	.7120804
agricultureascareer	-.8738742	.5011204	-1.74	0.081	-1.856052	.1083038
learningaboutagric	-1.407749	.590095	-2.39	0.017	-2.564314	-.2511842
MaritalStatus	.6920957	.2766001	2.50	0.012	.1499694	1.234222
HHIncome	-.3063548	.2924653	-1.05	0.295	-.8795763	.2668667
ParticipationLev	.2125817	.1076394	1.97	0.048	.0016122	.4235511
_cons	-3.889464	1.617091	-2.41	0.016	-7.058904	-.7200246
FarmersGmember						
Sex	-.9052133	.3794506	-2.39	0.017	-1.648923	-.1615039
Age	.0566388	.1666493	0.34	0.734	-.2699879	.3832655
Education	-.2236542	.1485397	-1.51	0.132	-.5147866	.0674783
agricultureascareer	-1.079406	.3902445	-2.77	0.006	-1.844271	-.3145412
learningaboutagric	.1356575	.3488219	0.39	0.697	-.548021	.8193359
MaritalStatus	-.2439348	.236426	-1.03	0.302	-.7073212	.2194516
HHIncome	.0963513	.2220786	0.43	0.664	-.3389147	.5316173
ParticipationLev	.0160012	.0874301	0.18	0.855	-.1553587	.1873611
_cons	.4986384	1.093355	0.46	0.648	-1.644298	2.641575
Extension_GroupL						
Sex	-.5221638	1.077068	-0.48	0.628	-2.633178	1.588851
Age	.9700289	.6102855	1.59	0.112	-.2261086	2.166166
Education	.0306002	.449093	0.07	0.946	-.849606	.9108063
agricultureascareer	-1.156988	1.258352	-0.92	0.358	-3.623312	1.309337
learningaboutagric	.0263265	1.063875	0.02	0.980	-2.058829	2.111482
MaritalStatus	-1.002394	.8988245	-1.12	0.265	-2.764057	.7592702
HHIncome	.5060487	.7942186	0.64	0.524	-1.050591	2.062689
ParticipationLev	.2103245	.249114	0.84	0.399	-.27793	.6985789
_cons	-8.25996	4.427475	-1.87	0.062	-16.93765	.4177327
FSG__DARD						
Sex	-69.64668	17343.26	-0.00	0.997	-34061.81	33922.51
Age	-15.22755	4507.231	-0.00	0.997	-8849.238	8818.783
Education	-99.55875	12237.16	-0.01	0.994	-24083.95	23884.83
agricultureascareer	-151.2575	25366.51	-0.01	0.995	-49868.7	49566.19
learningaboutagric	85.73481	18826.07	0.00	0.996	-36812.68	36984.15
MaritalStatus	-20.66423	18867.58	-0.00	0.999	-37000.45	36959.12
HHIncome	7.936924	35239.84	0.00	1.000	-69060.88	69076.75
ParticipationLev	16.86316	3408.565	0.00	0.996	-6663.801	6697.527
_cons	39.68576	103951.9	0.00	1.000	-203702.3	203781.7

Note: 4 observations completely determined. Standard errors questionable.

Marginal effects after mlogit
y = Pr(OpinionLeader==ExtensionL) (predict, outcome(1))
= .58057252

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sex*	.1537258	.07358	2.09	0.037	.00952	.297932	.3379
Age	-.0184929	.03598	-0.51	0.607	-.089016	.05203	4.39269
Educat~n	.0226485	.03229	0.70	0.483	-.040643	.08594	2.80822
agricu~r*	.2367034	.07052	3.36	0.001	.098493	.374914	.315068
learni~c*	.0484294	.07712	0.63	0.530	-.102716	.199575	.342466
Marita~s	.0077231	.05014	0.15	0.878	-.090548	.105994	2.00913
HHIncome	-.001759	.04749	-0.04	0.970	-.094842	.091324	2.34703
Partic~v	-.0169949	.0185	-0.92	0.358	-.053252	.019262	6.17808

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Marginal effects after mlogit
y = Pr(OpinionLeader==FarmerGLeader) (predict, outcome(2))
= .10395658

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sex*	.0262762	.0462	0.57	0.570	-.06427	.116823	.3379
Age	.000683	.02018	0.03	0.973	-.038864	.04023	4.39269
Educat~n	.0328201	.0191	1.72	0.086	-.004609	.070249	2.80822
agricu~r*	-.0454077	.03822	-1.19	0.235	-.120318	.029503	.315068
learni~c*	-.1176136	.03839	-3.06	0.002	-.192857	-.042371	.342466
Marita~s	.0733308	.02398	3.06	0.002	.026323	.120339	2.00913
HHIncome	-.0321626	.02594	-1.24	0.215	-.083004	.018679	2.34703
Partic~v	.0190562	.00951	2.00	0.045	.000419	.037693	6.17808

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Marginal effects after mlogit
y = Pr(OpinionLeader==FarmersGmember) (predict, outcome(3))
= .30453286

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sex*	-.1772762	.06686	-2.65	0.008	-.308329	-.046224	.3379
Age	.0075481	.03411	0.22	0.825	-.059316	.074412	4.39269
Educat~n	-.05623	.03036	-1.85	0.064	-.115744	.003284	2.80822
agricu~r*	-.1840159	.06632	-2.77	0.006	-.313996	-.054036	.315068
learni~c*	.0679806	.0732	0.93	0.353	-.07549	.211452	.342466
Marita~s	-.0702351	.04759	-1.48	0.140	-.163518	.023047	2.00913
HHIncome	.0284195	.04549	0.62	0.532	-.060736	.117575	2.34703
Partic~v	-.0040416	.01786	-0.23	0.821	-.039049	.030966	6.17808

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Marginal effects after mlogit

y = Pr(OpinionLeader==Extension_GroupL) (predict, outcome(4))

= .01093804

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
Sex*	-.0027258	.01064	-0.26	0.798	-.02359	.018138		.3379
Age	.0102618	.00696	1.47	0.140	-.003383	.023907		4.39269
Educat~n	.0007614	.00479	0.16	0.874	-.008621	.010144		2.80822
agricu~r*	-.0072798	.01115	-0.65	0.514	-.029125	.014565		.315068
learni~c*	.0012036	.01156	0.10	0.917	-.021453	.02386		.342466
Marita~s	-.0108187	.01068	-1.01	0.311	-.031757	.01012		2.00913
HHIncome	.005502	.0085	0.65	0.517	-.011152	.022156		2.34703
Partic~v	.0019804	.00276	0.72	0.473	-.003429	.00739		6.17808

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Appendix Section 3

Table 3:1 The psychological empowerment responses of farmers (in frequency percentage%)

leadership	strongly disagree %	disagree%	indifferent%	agree%	strongly agree %
Share some agricultural knowledge	0	1.8	0	0.5	97.7
Do you listen to your friends' ideas & try to convince them of your ideas	1.8	21.5	0	40.6	36.1
Generally regarded as a good source of advice about agricultural knowledge	0	0.9	0	0	99.1
Competence					
I can negotiate with other people	1.8	0	5.9	58.4	27.4
Increased my competence regarding crop production	4.6	0	8.7	52.1	34.7
I can influence and decide on implementing an activity	2.3	1.8	10.5	57.1	28.3
Participation in crop-maximization project increased my agricultural knowledge	4.6	5.0	10	47.9	32.4
Provided awareness regarding agriculture	2.7	3.2	15.5	52.1	26.5

I know to whom I should refer when problems happen	2.3	2.7	15.1	51.6	28.3
I can identify and determine the priority of issues	2.7	2.7	16.4	50.2	27.9
Self-efficacy					
I have the confidence in doing any agricultural activity	2.3	2.3	16.9	45.7	32.9
I'm able to do things as well as most other people do in the community	3	6	16	46	29
I feel that I have good qualities to share with the community members	2.3	5.5	17.4	45.7	29.2
Decision making					
I can use my experience to make decisions	2.3	5	18.3	47.9	26.5
I can use other people information to make decisions	3.7	6.8	13.2	48.9	27.4
Decision on price	1.8	5.5	13.2	51.6	27.9
Increased Agricultural knowledge					
Soil preparation	2.7	6.8	12.3	55.7	22.4
Crop harvesting/ storage	2.7	9.6	11	45.7	31.1
Crop variety	4.1	10	10	50.7	25.1
Market information	6.4	14.6	8.2	50.2	20.5
Herbicides and pesticides application	7.3	11.4	10.5	50.7	20.1

Appendix Section 4

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

11 September 2019

Ms Nthabeleng Tamako (210526551)
School of Agricultural, Earth & Environmental Sc
Pietermaritzburg Campus

Dear Ms Tamako,

Protocol reference number: HSS/0488/019D
Project title: Explore agricultural knowledge systems and smallholder farmer empowerment with special focus on social capital and social learning platform

Approval Notification – Expedited Application

In response to your application received on 04 June 2019, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the 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.

The ethical clearance certificate is only valid for a period of 1 year from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours f[redacted]

.....
Dr Rosemary Sibanda (Chair)

/ms

Cc Supervisor: Dr Joyce Chitja and Professor Maxwell Mudhara
cc Academic Leader Research: Professor Trevor Hill
cc School Administrator: Ms Marsha Manjoo

Questionnaire

Name of the farmer……

1. Sex of Farmer 1. Male 2. Female

2. Age of Farmer

1.<25 yrs.	2. 26-35 yrs.	3.36-45 yrs.	4. 46-55 yrs.	5.56- 65 yrs.	6.> 65 yrs.

3. Respondent's Educational Level

1.None, can't read and write	2.None, but can read and write	3.Finished primary school	4.Finished Sec school	5.Finished high school	6.Vocational training	5.Other (Specify)

4. Sources of Monthly Income

1.Pensions	2.Remittances	3.Wages	4.Farm Harvest	5.Casual Income	6.Government Grants	7.Others (Specify)

5. What motivated you to participate in agriculture?

a) My friends are involved in agriculture	c) My friends encouraged participation
b) My family wanted me to participate in agriculture	d) providing for your family (feeding)

6. In your opinion, would you say?

a) interested in working in agriculture	b) interest in learning about agriculture
c) I am interested in agriculture as a career	

7. Marital Status of farmer

1. Never Married	2. Married	3.Divorced	4.Widowed

8. How much income does the household receive per month?

1.500 and less	2. 500-800	3. 900-1000	4. 1000 and more

Section B

1. What organizations do you as a producer participate in and get information from?

Types of organisations	**Do you take part and engage? Yes/No**	**How often do you go? 1 week, 2 months, 3 times a year, 4 times a year 5or twice per month?**	**What did you choose to take part? 1 The language used is simple 2 The answers are simple 3 The source is easily accessible 4 The source is located nearby and at home 5 It is too late to find the source**
Farmers group			
Trains / workshops			
Co-operatives			

Trade or business			
The labor organization			
Local committee			
Visiting the garden			
Tv/radio			
fellow farmers			
Agricultural exhibitions			
Pamphlets/booklets			
Financial, credits and savings club			
Education groups			
health			
NGO projects			

2. Whom do you go to for information or advice when you have a farming question within your area?

Source of knowledge	Name/tick	And how often? 1Weekly, 2monthly, 3bi-monthly, 4three times a year, twice a year)?	How do you value this knowledge received? **1 not useful 2 useful 3 very useful**	How reliable is the knowledge you get from the systems mentioned?**1 not reliable 2 reliable 3 very reliable**
1Village leaders				
2Extension agent				
3Rural experts				
4Neighbours				
5Friends				
6Farmers				

3. From the above information, what channels of communication used and what type of information/knowledge do you receive?

Channels of communications	**Village leaders**	**Extension agent**	**Rural experts**	**Neighbours**	**Friends**	**Farmers**
face to face oral						
voice calls						
village meetings						
Leaflets/brochures						
radio and TV sets						
trainings, workshops						

Field visits/demonstration						
Farm visits						
local leaders						
Type of information						
seed sowing techniques						
post-harvest practices						
agricultural marketing and credits						
farm preparation						
land preparation						

4. How is the information/ knowledge delivered to you from the above mentioned sources?

Sources of knowledge	Who provides the information Or Tick	**How often do interact**? 1Weekly, 2monthly, 3bi-monthly, 4 three times a year, 5twice a year)?	Do you use it? Yes/No	Are you satisfied? (Yes/No)	Do you understand it? Not at all=0 Somewhat=1 Absolutely=2
Extension and DAFF					
Buyers of agricultural produce					
Input suppliers					
NGO's projects					
Research institutions					

5. From the above information, what channels of communication used and what type of information/knowledge do you receive?

Channels of communications	**Extension and DAFF**	**Buyers of agricultural produce**	**Input suppliers**	**NGO's projects**	**Research institutions**
face to face oral					
voice calls					
village meetings					
Leaflets/brochures					
radio and TV sets					
trainings, workshops					
Field visits/demonstration					
Farm visits					
local leaders					
Type of information					

seed sowing techniques					
post-harvest practices					
agricultural marketing and credits					
farm preparation					
land preparation					

6. Who, in your opinion (2), are the most knowledgeable and influential persons in your village?	
7. How often do you interact with this farmer about agricultural problems/activities?	1) Weekly 2) Monthly 3) Quarterly

8. What nature of problems do you usually communicate with this fellow farmer?

Problems	tick	How reliable is the knowledge/information? **1very reliable,2,3,4,5 not reliable**	How do you value this knowledge received? **1 not useful 2 useful 3 very useful**	Relevance of information? **1Very relevant,2,3,4,5 not relevant**
Soil preparation				
Crop harvesting/ storage				
Crop variety				
Market information				
Herbicides and pesticides				
Seed varieties				
Climate and weather information				
Post-harvesting strategies				

9. What makes you consider this fellow farmer?

1Simple language used	3Easy to access the source	5 Source is cheap to access
2Feedback easily accessed	4 Source found near to home	

10. Are you satisfied with the level of communication between you and the fellow farmer mentioned?

1) Yes 2) No

If yes, to what extent were you satisfied? 1= not satisfied 2 =highly satisfied

11. Which channels of communications do you use to interact and share knowledge with this fellow farmer?

Channels	Tick
1. Cell-phone call/SMS	
2. WhatsApp Calls	
3. Field visit	

4. Community meetings	
5. Farmers group meetings	

12. How competence are you with using the mentioned (ticked) channels to interact with fellow farmers?

Channels	poor	Basic	Good	Very good	Excellent
1. Cell-phone call/SMS					
2. WhatsApp Calls					
3. Field visit					
4. Community meetings					
5. Farmers group meetings					

13. What are the reasons for using the mentioned channels?

Channels	Cheap access	Cheap to use	Language used	nearby
1. Cell-phone call/SMS				
2. WhatsApp Calls				
3. Field visit				
4. Community meetings				
5. Farmers group meetings				

Section C

Food Security questions

1 = rarely (once or twice in the past four weeks), 2 = Sometimes (three to ten times in the past four weeks), 3 = Often (more than ten times in the past four weeks).

Scenarios	No/Yes	Rarely	Sometimes	Often
1. In the past four weeks, Did you worry that your household would not have enough food? **0 = No (skip to Q2) 1 = Yes** 1 a How often did this happen?				
2. In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?				
3. In the past four weeks, did you or any household member have to eat a limited/few variety of foods due to a lack of resources?				
4. In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?				
5. In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?				
6. In the past four weeks, did you or any household member have to eat fewer meals in a day i.e. skip meal because there was not enough food?				

7. In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?				
8. In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?				
9. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food				

2. Household Dietary Diversity Score (HDDS). Would like to ask you about the foods and drinks you or anyone else in the household ate or drank yesterday during the day and at night in the home. Did you or anyone in the household drink or eat:

Food group	**Examples**	**Yes**	**No**
Cereals	Bread, noodles, biscuits and Cornflakes		
Vitamin A Rich Vegetables And Tubers	Pumpkin, carrots, or sweet potatoes plus other locally available vitamin-A rich vegetables		
White Tubers And Roots	White potatoes or foods made from roots		
Dark Green Leafy Vegetables	Green/leafy vegetables (Rape, tomatoes and onions)		
Vitamin A Rich Fruits	Oranges, mangoes, paw-paws, other locally available vitamin A-rich fruits		
Meat	Beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds or other blood based meat.		
Eggs	chicken, duck, guinea hen or any other egg		
Fish	Fresh or dried fish or shell fish		
Legumes, Nuts And Seeds	beans, peas, lentils, nuts, seeds or foods made from these		
Milk And Milk Products	milk, cheese, yogurt or other milk products		
Oils And Fats	fats or butter added to food or used for cooking		
Sweets	sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies		
Spices and Caffeine or Alcoholic Beverages spices	spices, coffee, tea, alcoholic beverages or local examples		

Section D Opinion leadership

Opinion leadership assessment (Scale to measure)

Questions	**Answers**
In general, do you like to talk about agricultural knowledge/information with your friends?	1. Yes_____ 2. No_____
Would you say you give very little information, an average amount of information, or great deal of agricultural knowledge/information to your friends?	1. You give very little agricultural information? 2. You give an average amount of agricultural knowledge/information? 3. You give a great deal of agricultural knowledge/information?
During the past six months, have you told anyone about some agricultural knowledge?	1. Yes_____ 2. No_____
Compare with your circle of friends, are you less likely, about as likely, or more likely to be asked for advice about agricultural knowledge/information?	1. Less likely to be asked _____ 2. About as likely to be asked _____ 3. More likely to be asked _____

If you and your friends were to discuss agricultural knowledge/information, what part would you be most likely to play?	1.Would you mainly listen to your friends' ideas or 2. Would you try to convince them of your ideas?
Which of these happens more often?	1.You tell them about agricultural information 2.They tell you about some _____
Do you have the feeling that you are generally regarded by your friends and neighbours as a good source of advice about agricultural knowledge/information?	1. Yes_____ 2. No_____

Section E: Empowerment

With knowledge systems that you engaged with; would you say that you can

Competence	strongly disagree	disagree	indifferent	agree	strongly agree
I can use my experience to bargain with other people					
I can use my experience to give opinion					
I can negotiate with other people					
Increased my competence regarding crop production					
I can influence and make decision in implementing an activity					
Participation in crop-maximization project increased my overall agricultural knowledge					
After participation in crop-maximization project, I know about my own needs					
Provided awareness regarding agriculture					
I know to whom I should refer when problems happen					
I can identify and determine the priority of an issue/problem					
Self-efficacy					
I have the confidence in doing any agricultural activity					
I can lead and guide in implementing any agricultural activity					
I'm able to do things as well as most other people do in the community					
I feel that, I have number of good qualities to share with the community members					
I can usually think of a solution to a problem					
I learned how to find several solutions to a problem					
Decision making					
I can use my experience to make decisions					
I can use other people information to make decisions					

Increased knowledge					
Soil preparation					
Crop harvesting/ storage					
Crop variety					
Market information					
Herbicides and pesticides application					
Seed varieties					
Climate and weather information					
Post-harvesting strategies					