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Opportunities and constraints of communication tools in the dissemination of Integrated Soil Fertility Management (ISFM) to smallholder farmers in Malawi: A case study of ISFM project in Ulongwe EPA, Balaka district.

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Declaration

I, Cecilia Munthali, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

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Abstract

Agricultural productivity is low in Malawi because of poor soil fertility, climate change effects and lack of agricultural inputs. Integrated Soil Fertility Management (ISFM) project has been implemented to improve soil fertility through intercropping maize with legumes. ISFM improves crop productivity and food security. However, adoption of ISFM practices has been low due to farmers lack of information and awareness of the potential of ISFM. Agricultural information is transferred to farmers through appropriate communication channels. The study investigated the impact of communication tools in the dissemination of ISFM. The research analysed the role of diverse sources of information and the effectiveness of the communication channels in the dissemination of ISFM. The study also examined farmers' perceptions of the communication tools used by the ISFM project. The study took place in Ulongwe Extension Planning Area (EPA), Balaka district. Data was collected using household surveys, key informant interviews and focus group discussions. Data was analysed with descriptive statistics and coding. A total of 89 farmers were interviewed, 54 ISFM project members and 35 non-members.

The findings of the study showed that use of diverse sources of information in ISFM project promoted farmers implementation of the ISFM practice. Trusted sources of information encouraged farmers to disseminate and adopt ISFM. The communication channels used were extension officers, lead farmers, radios, videos, learning centres, mobile phones and print media. Farmers identified the public and ISFM extension officers and lead farmers as the most effective communication tools. Farmers preferred interpersonal communication tools because of the possibility of getting feedback, which allowed farmers and extension officers to exchange ideas and develop appropriate approaches that suit individual farmer's needs. Radios, learning centres, videos and mobile phones were used as complementary communication tools to the extension and lead farmer. However, the study showed that print media such as leaflets were least preferred by farmers due to high illiteracy levels. From the results, the use of diverse sources of information, communication tools and frequent training of farmers were most effective for the diffusion of ISFM in Balaka. The study found a number of limiting factors of the communication tools, which included high illiteracy levels, lack of motivation and lack of electricity. Therefore, the government should promote collaboration of the ISFM project and other organisations in the area to harmonise the practices for better implementation and adoption of ISFM packages.

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List of acronyms

ACB	Agriculture Communication Branch
ADC	Area Development Committee
ADMARC	Agricultural Development Marketing Cooperation
AEDC	Agriculture Extension Development Coordinator
AEDO	Agriculture Extension Development Officer
AICC	African Institute of Corporate Citizenship
ASWAp	Agriculture Sector Wide Approach
BES	Block Extension System
CABMACC	Capacity Building for Managing Climate Change
CADECOM	Catholic Development Commission Malawi
CBO	Community Based Organisations
DADO	District Agricultural Development Officer
DAES	Department of Agriculture Extension Services
DEC	District Extension Committee
EPA	Extension Planning Area
FAO	Food and Agriculture Organisation
FFS	Farmer Field School
FISP	Farm Input Subsidy Program
FVR	Farmer Voice Radio
GDP	Gross Domestic Product
GHG	Greenhouse Gases
ICRISAT	International Crops Research Institution for Semi-Arid Tropics
ICT	Information and Communication Technology
ISFM	Integrated Soil Fertility Management
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MWA	Malawi Women Association
NGO	Non-Governmental Organisation
NSO	National Statistics Office
PCI	Project Concern International
PV	Participatory Videos
SAP	Structural Adjustment Program
SHA	Self Help Africa
SP	Starter Pack
T&V	Training and Visit
TLC	Total Land Care
VDC	Village Development Committee

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CHAPTER ONE

1.0 INTRODUCTION

Agriculture is the main source of livelihood for smallholder farmers in Malawi. However, increasing population, poverty, lack of markets, and climate change are some of the threats impeding agricultural potential. Agriculture needs to increase food production to feed the growing population (Giller*, et al*., 2011). A major challenge that exists is that the soils in Malawi are heavily eroded and nutrient deficient with low moisture content as a consequence of poor soil management practices such as continuous monoculture that contributes to soil degradation. Approximately 85% of lands in Malawi are degraded by soil erosion and low input use, which reduces crop yields (Sauer, Tchale and Wobst, 2007). Therefore, demand is high for sustainable agricultural practices that ensure crop productivity and environmental sustainability such as Integrated Soil Fertility Management (ISFM). ISFM integrates organic and inorganic fertilizers to improve soil fertility and use improved germplasm to suit specific conditions (Vanlauwe, *et al.,* 2015). Organic inputs applied include crop residues, animal manure and green manure from intercropping with legumes (Place, *et al.,* 2003).

Generally, ISFM increases crop productivity, resilience and adaption to climate change. ISFM also contributes to food security, income and yield stability in rain-fed agricultural systems (Giller, *et al.,* 2011). Despite the benefits, adoption of ISFM principles has been limited and incomplete in smallholder farms in Malawi. This is due to inadequate extension services, high price of fertilisers, lack of awareness and information about the ISFM practice, farmers' perceptions and risk aversion, delayed outputs, lack of organic residues and lack of scientific research (Kundhlande, *et al.*, 2014). The government provides agricultural extension services, such as access to information, in order to reduce adoption barriers to agricultural innovations. However, extension services in Malawi experience poor funding and limited capability to disseminate agricultural innovations. The increasing growth of different information and communication tools has the potential to increase the dissemination of agricultural knowledge and reach beyond the targeted groups. This can be done through modern communication tools such as mobile phones, radios, televisions and social media. Combination of extension service with different communication tools can facilitate the widespread adoption and dissemination of ISFM in Malawi. The ISFM project in Balaka provides information to farmers to increase their capabilities in improving soil fertility.

This study was part of a scaling out of ISFM project in Balaka district in Malawi under the Capacity Building for Managing Climate Change in Malawi (CABMACC) Programme. The aim of the ISFM project was to strengthen the capacity of farmers and extension service by generating relevant knowledge about the best fit ISFM approach for the area. This study assessed the potential of different communication tools used in the project in transmitting information about ISFM and the constraints that limit the diffusion of agricultural knowledge. This research also explored farmer's perception towards the communication tools used for the diffusion of ISFM practices in Balaka and their preferred communication tool. The study also analysed the role of different sources of knowledge in the adoption of ISFM packages. Generally, the study tried to understand the role of communication tools in enhancing farmers knowledge on ISFM that contributed to the adoption and dissemination of ISFM in Balaka.

1.1 Problem Statement

ISFM has been implemented in Malawi to improve food security and ultimately reduce poverty. However, adoption of ISFM packages has been low among farmers making it difficult to reap the benefits accrued by the use of various ISFM packages. The main barrier to the adoption of agricultural innovations has been lack of information, which has contributed to poor implementation and rejection of the innovation. Smallholder farmers lack information and understanding of the ISFM technologies to implement in their farms. Moreover, investment in extension services is usually low in most ISFM projects, which contributes to the poor adoption of the technology. The adoption barriers can be resolved by extension services that use appropriate communication tools and multiple sources of information to diffuse information about the ISFM practices. Agricultural information is important for farmers to make informed decisions about their farming activities and increases their confidence in the promoted agricultural innovations.

Increasing communication among farmers and extension agents would probably increase adoption of ISFM in Malawi. The right communication tools have the potential to spread ISFM information to a wider population at a low cost. Previous studies have examined communication channels like the public extension, mobile phones, radios and farmer to farmer extension but have hardly been studied together. Therefore, this research study assessed the role of different sources of information in the adoption of ISFM project. The study evaluated the effectiveness of the communication tools (interpersonal and electronic) used by the Balaka scaling out ISFM project in spreading information and awareness of ISFM practices. In addition, this study also looked into women involvement in the

use of the communication technologies to disseminate ISFM practices. The study used both quantitative and qualitative methods of data collection and analysis to make a valid interpretation of farmers' perceptions towards communication channels to disseminate ISFM technology.

1.2 Aim of the study

The aim of the study was to analyse the opportunities and constraints of communication tools in the dissemination of ISFM practices to smallholder farmers in Balaka, Malawi.

1.2.1 Specific Objectives

1. The study was specifically conducted in order: To investigate the impact of communication tools in the dissemination of ISFM.
2. To analyse the role of diverse sources of information.
3. To find out the effectiveness of the communication channels in the dissemination of ISFM.
4. To examine farmers' perceptions of the communication tools used by the ISFM project.

Research questions

The study had the following research questions:

1) How are different sources of information contributing to the adoption of ISFM practices in Balaka?
2) How effective are the communication tools in the dissemination of ISFM technologies?
3) What are farmer's perceptions towards different communication tools used in the ISFM project?

CHAPTER TWO

2.0 BACKGROUND

2.1 Agriculture in Malawi

Malawi population continues to grow rapidly contributing to deforestation and soil degradation. Agriculture is the main source of food and income to most Malawian households. Thierfelder, *et al.* (2013) pointed out that agriculture contributes to 35% of Malawi's Gross Domestic Product (GDP) and 80% of the labour. Furthermore, Malawi is one of the poorest countries in the world and with a population of approximately 18 million in 2017 (Worldometers, 2017). Most farmers have small farm sizes with maize (*Zea mays L.*) as a staple food grown for subsistence (Chinangwa, 2006). Because of population pressure, the most common agricultural practice is continuous cropping of maize, which has contributed to the declining soil fertility. This is supported by Vanlauwe, *et al.* (2012) who reported that continuous cropping with low inputs contributes to nutrient mining that leads to low crop yield. Maize yields declined in Malawi from 1995 and 1999 (Kanyama-Phiri, Snapp and Wellard, 2000). The decline in yields was an outcome of Structural Adjustment Programs (SAP) that encouraged countries to remove input subsidies (Masangano and Mthinda, 2012). In addition, devaluation of the Malawi currency (Kwacha) also contributed to increased input prices (Sauer, Tchale and Wobst, 2007). As a result, food and fertilizer prices increased making farmers unable to access fertilizer input. Malawian farmers' application of inorganic inputs is still low contributing to the loss of soil fertility as nutrients are mined through harvesting.

The Malawian government assigned the national agricultural research institutions to develop hybrid varieties to support the hungry population. Maize varieties such as MH17 were produced to grow under limited inputs that exacerbated nutrient depletion (Thierfelder, *et al.,* 2013). Furthermore, farmers that afford fertilizers preferred applying to tobacco and cotton because of the economic value. The government in an initiative to improve food production reintroduced the fertilizer subsidy program known as fertilizer Starter Pack Program (SP) in 1998 (Sauer, Tchale and Wobst, 2007). SP included fertilizers and seeds that were distributed to poor households. Evaluation of the program indicated that 40% of the farmers receiving the subsidy invested in their farms by buying inorganic inputs (Vanlauwe, *et al.,* 2012). However, the evaluation also showed that yields decreased due to inappropriate application of fertilizers. The ministry of agriculture introduced Farm Input Subsidy Program (FISP) (Heerink, 2005). This has led to increasing in maize production in Malawi.

The government, Non-Governmental Organization (NGOs) and other agencies are promoting sustainable agricultural practices including agroforestry, conservation agriculture and ISFM (Ngwira, Thierfelder and Lambert, 2013). ISFM intercrops maize with legumes (groundnuts, pigeon peas and cowpeas) to improve soil fertility and ensures efficient use of inputs and water for robust output (Kanyama-Phiri, Snapp and Wellard, 2000). Legume demands have increased, which creates an opportunity for smallholder farmers to invest in their farms and take advantage of the legume market niche. However, to ensure sustainability of the ISFM in Malawi, farmers need to be aware of the associated benefits and understand the practices for proper adoption. This can be done through the use of appropriate communication tools and diverse sources of information that farmers trust. The next section will discuss the flow of information to farmers in Malawi.

2.2 Agricultural extension system in Malawi

Agricultural extension is responsible for the transfer of agricultural knowledge to farmers to improve farm productivity to achieve food security and reduce poverty. The extension system in Malawi continues to change in order to sufficiently meet farmers' needs. The extension approach shifted from master farmer system used during the colonial times to more participatory farmer to farmer extension approach (Masangano and Mthinda, 2012). One of the extension approaches used was individual extension that was supposed to be supplemented by using the radio and puppet shows to promote cash crops. This approach was abandoned due to high costs and low number of extension agents. The government introduced group approaches such as Block Extension System (BES) that used Training and Visit system (T&V) (Lwesya and Vedeld, 2008). The block extension service involved dividing sections into subsections called blocks that were used to train farmers in groups. The system focused on food crops to improve farmers' livelihoods. T&V system was a top-down approach and resource-poor farmers were left out. In order to incorporate poor farmers, the government introduced on-farm demonstrations on farmers' fields. However, this approached became expensive to sustain because it required more extension officers. The approach was later abandoned but some concept of T&V and block extension still remains in the participatory approaches promoted today (Vanclay, 2004).

The government of Malawi established the Malawi Agricultural Sector Wide Approach (ASWAp) to improve agricultural growth and reduce poverty in 2011. One of the components of the ASWAp was to improve support services in agriculture such as technology generation and dissemination of components (ASWAp, 2011). The supporting services include information and technology transfer to farmers. The government of Malawi communicate to farmers through the Ministry of Agriculture,

Irrigation and Water Development (MoAIWD). MoAIWD comprises of seven technical departments and the communication part falls under the Department of Agriculture Extension Services (DAES) (Masangono and Mthinda, 2012). The DAES uses Agricultural Extension Development Officers (AEDOs) to transfer information to farmers. In most parts of Malawi, the primary source of agricultural information is the extension officers (AEDO). In each Extension Planning Area (EPA), the government has allocated AEDOs to communicate with farmers on appropriate farming practices. Each AEDO is responsible for approximately 25 villages (Fisher, Holden and Katengeza, 2017).

The DAES communicates with farmers using various means such as village meetings, field visits, print media, electronic as well as farmer to farmer extension. Farmer to Farmer Extension includes the use of lead farmer approach, where lead farmers from each village receive intensive training to improve their capabilities for wider dissemination of improved farming practice (Government of Malawi, 2010). According to Khaila *et al.* 2015, the DAES encourages participatory approaches to improve community awareness and build the capacity of the farmers. The DAES recognises the opportunity of using different sources of information to increase the adoption of sustainable agricultural practices.

2.3 The CABMACC- ISFM project in Balaka district in Malawi

The ISFM project was implemented in Balaka district under the Capacity Building for Managing Climate Change in Malawi (CABMACC) program. The project has been established in Ulongwe Extension Planning Area (EPA), Balaka. Balaka district is characterised by continuous cropping and drought that contributes to decline in soil fertility affecting crop productivity. Furthermore, small farm size and lack of access to inputs such as improved seeds, pesticides, organic and inorganic fertiliser constrain crop production. Although maize yields had increased under FISP in Malawi, crop yields still remain low.

The CABMACC project was introduced in 2015 with the main goal of increasing crop productivity and improve food security of smallholder farmers. The aim of the project was to increase knowledge and capacity of farmers, extension officers and policymakers to develop context-specific ISFM practices that are resistant to different climate under different agroecological conditions (Chilongo, Kabambe and Ngwira, 2017). Balaka district is located in the rain shadow area, prone to drought and erratic rainfall patterns (Kabambe, 2015). Therefore, the project used ISFM practices to enhance the adaptation of agriculture to extreme weather events.

The project involved the participation of the District Extension Committee (DEC), District Agricultural Development Officer (DADO) and all EPA staff. Ulongwe EPA was selected as the study site of the project due to its location and diversity (Kabambe, 2015). Four sections were chosen including Chitseko, Chibwanansamala, Hindahinda and Mulambe section. The project established learning centres for farmers to acquire training tools and knowledge about the different ISFM technologies that could be implemented. The goal was to introduce the best fitting crop management practice for enhancing yields and improving adaptation to climate change in drought-prone Balaka district. The project also aimed at assessing the current knowledge and adoption potential of the smallholder farmers and measure the performance of the ISFM technology.

Focus group discussions and staff meetings were held with farmers to decide on appropriate entry point for the ISFM project. After discussions, pigeon peas, cowpeas and groundnuts were selected. Nine lead farmers were identified from each section and each had 10 follower farmers. Lead farmers were supposed to train follower farmers on the best ISFM practice through learning centres (Kabambe, 2015). Lead farmers also collected data on weather conditions and farming activities. Different communication tools such as radios, digital storytelling, field visits and brochures were introduced for further dissemination of the project. The project beneficiaries were the farmers, extension officers and researchers. As part of gender mainstreaming, the project targeted female lead farmers and encouraged the participation of youths under 25 years. The scaling out ISFM project in Balaka district also aimed at improving farmers access to credits and provided inputs to farmers.

CHAPTER THREE

3.0 Theoretical Framework

There are many theories on communication with farmers for diffusion of agricultural innovations. This study used the diffusion of innovation theory and the constructivism learning theory.

3.1 The diffusion of innovation theory

Diffusion of innovation theory was developed by Everett Rogers in 1983 in his book, "Diffusion of Innovation". Rogers defined "*diffusion as the process in which a new technology or idea is communicated through certain channels over time among members of a social system*" (Rogers, 2003). The theory is comprised of four elements of diffusion, which includes the innovation, communication channels, time and social system. These elements contribute to the diffusion of agricultural innovations as well as the rejection of an innovation. The theory defines communication as a process of creating and sharing of information with one another (Sahin, 2006). Communication channel refers to means of transferring a message from the source (message originator) to receiver. Rogers states that diffusion is a social process that involves interpersonal communication interactions. Therefore, interpersonal channels are very important for creating or changing strong attitudes. Other communication channels relevant for diffusion of an innovation are mass media. The theory states that diffusion takes an S-shaped curve because some innovations have slow uptake than others. Farmers adopt new innovations at different times and require different attributes to adopt. Rogers categorized farmers as innovators (lead farmers), early adopters, early majority, late majority and laggards (sceptical to change). The theory states that any innovation will be initially adopted by a group of innovative farmers and later diffused to the others (Stephenson, 2003). The theory runs under the assumption that the most influential source of information on new innovations is fellow farmers through interaction and observation.

Furthermore, Rogers identified characteristics of the innovation that contributes to diffusion and adoption of the innovations such as relative advantage, compatibility, complexity, trialability and observability (Fig 1). These factors reduce the uncertainty of potential adopters leading to adoption of an innovation (Rogers, 2003). According to Rogers, relative advantage is the best predictor of adoption of an innovation. Relative advantage implies the degree to which an innovation is considered

better off than the previous innovation. Generally, an innovation has a potential of being adopted faster if it offers more relative advantage, compatibility, simplicity, trialability and observability (Pannell *et al*., 2006). Therefore, this theory was relevant for the study because it allowed the researcher to test whether the communication channels used by the project encouraged farmers to adopt the ISFM practice. Furthermore, the theory assisted the researcher to analyse and interpret the characteristics of the farmers and ISFM packages in contributing to the diffusion of ISFM.

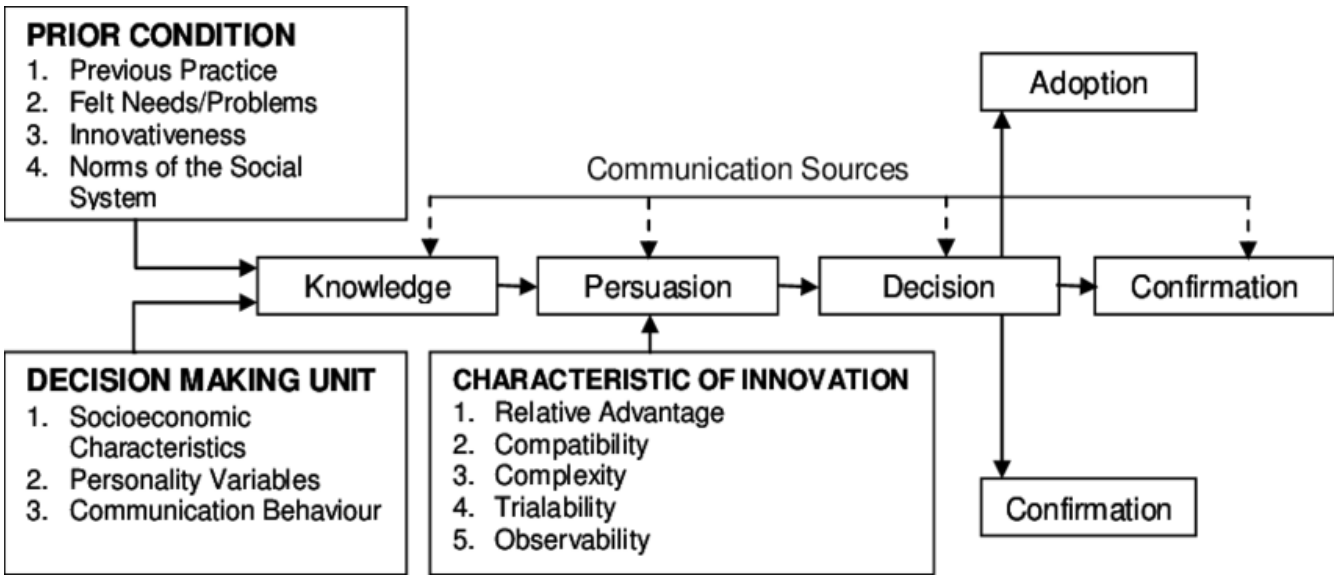

Figure 1. Diffusion of innovation theory (Rogers, 2003)

Although the diffusion of innovation theory was more applicable for the study, it had limitations in understanding human behaviour after receiving information, how farmers learnt and interpret the message and did not consider participatory approaches to adoption. Therefore, the study used constructivism learning theory to assess human behaviour, farmers knowledge and how farmers interpret information they learn.

3.2 Constructivism learning theory

Learning theories describes the capture, process and preservation of knowledge during learning. The three main learning theories are behaviourism, cognitivism and constructivism. The study used constructivism theory of learning to understand farmers perceptions. Constructivism theory was developed by Jean Piaget during his study in epistemology. Constructivism involves active learning

to create own knowledge from experiences (Schunk, 2012). Learners use prior knowledge to assist them to understand the information they are receiving. According to the theory, learning combines the background knowledge and new information to improved knowledge and to make sense of the new concepts. Learners interact with diverse sources of information to allow them to construct their own knowledge.

Constructivism consists of several principles of learning. These include; learning as an active process, learning involves language, and action of constructing meaning is in the mental implying that practical experience is crucial for learning as well as activities that stimulate the mind (Hein, 1991). Other principles include learning as a social activity meaning that learning is influenced by the interaction with communities, teacher, friends, family and extension workers. Therefore, social interactions are crucial for learning and adopting agricultural innovations. Learning is contextual depending on the believes, fears, bias and background knowledge. Furthermore, time needs to be considered during learning. Sufficient learning needs time to revisit ideas (repetition) and frequent exposure to the idea to reinforce the knowledge. The other component of constructivism is motivation. The motivation of learning something new assists in understanding farmer's decision to adopt agricultural practices. Lack of motivation can lead to farmers not using the knowledge obtained through learning.

Constructivism learning theory encourages participatory approaches to learning through active involvement of learners to enhance their knowledge. This theory was applicable to the study because constructivism theory helped to understand farmers perceptions, quality of knowledge obtained and interpretations of the information. The theory also provided insight into which communication channels were appropriate in facilitating learning of the ISFM principles. Constructivism theory was relevant for the study because it helped the researcher to identify factors that influenced the diffusion of agricultural information in Ulongwe EPA.

CHAPTER FOUR

4.0 LITERATURE REVIEW

Opportunities of ISFM to improve livelihoods in Malawi are many. ISFM increases crop resilience to climate change through the selection of early maturing seeds and precision planting and fertiliser application (Giller, *et al.,* 2011). ISFM mitigates GHG emissions by reducing the loss of Nitrogen (N) and soil Carbon (C). ISFM has the potential to increase crop productivity and farmer's income. Generally, ISFM enhances social capital, rural development and food security (Snapp, *et al*. 2002). However, the benefits of ISFM are realised after some years. Sauer and Tchale (2007) stressed that poor farmers tend to resume to conventional agricultural practices that damage soil quality due to delayed output of new agricultural innovations. Furthermore, adoption of ISFM in Malawi has been limited because of poor understanding of the practice, poor extension services and lack of information at local and national level (Ngwira, Thierfelder and Lambert, 2012). Therefore, comprehensive examples are needed from successful projects to show farmers that the ISFM principles work and has potential to improve their livelihoods. This can be done through the implementation of appropriate communication tools by extension services, which has the opportunity to improve farmers knowledge about the ISFM practices. Social capital and diverse communication tools are important for disseminating ISFM because farmers share experiences and seeds with each other.

4.1 The role of communication in the adoption of agricultural innovations

Adoption of agricultural technologies relies on farmers' attitudes towards that particular technology (Age, Obinne and Demenongu, 2011). Appropriate communication tools can help in improving farmers attitudes towards agricultural innovations. Haug (1999) referred to communication as a mutual understanding where participants exchange ideas, information and share meanings. Agricultural communication focuses on information sharing among agricultural stakeholders. According to Labarthe, *et al.* (2013) adopting agricultural interventions requires the transfer of information to farmers through different communication channels. The agricultural extension service uses both interpersonal and mass media to communicate with farmers. Communication tools currently used in agricultural extension include radio, television, audio-visuals and mobile phones (Aker, 2011). Communication sensitises and enhances farmers interests to adopt new agricultural practices.

Traditionally, the most common agricultural extension approach has been Training and Visit (T&V) and Farmer Field School (FFS). T&V involved the extension officer training farmers and visit the communities through face to face interaction (Aker, 2011). The approach was expensive to maintain and used top-down communication, which was highly criticized by participatory advocate agencies. Farmer Field School (FFS) are participatory means of exchanging information through learning and farmers experiment (Stephenson, 2003). FFS is one of the most effective extension tools in agriculture, where farmers are trained in good agricultural practices that empowers smallholder farmers. FFS were introduced in Africa in the mid-1990s. Farmers were encouraged to conduct their own research and diagnose problems to increase their knowledge.

The Malawi government introduced the pluralistic extension service delivery approach and demand-driven services such as model village approach, frontline extension, farmer to farmer extension and FFS. Farmer to farmer extension (lead farmer approach) proved to be effective in ensuring sustainability, community empowerment and increasing adoption of innovation (Masangano and Mthinda, 2012). The challenges of the pluralistic approach were lack of coordination of policies and approaches, lack of incentives, privatization and poor health (HIV/AIDS). The results further stated that organisations mainly used top-down approaches when implementing the practices despite advocating for community empowerment and participatory measures of extension. Generally, the findings of Masangano and Mthinda (2012) on pluralistic extension system in Malawi suggested that despite have many players in agricultural extension, the public extension services are still powerful.

Traditional agricultural extension has been criticised for its failures for decades. The criticism includes poorly motivated extension officers, poor planning and transportation, low coverage, weak linkage with researchers, top-down approaches and lack of political commitment (Asenso-Okyere and Mekonnen, 2012). Public spending on agricultural extension reduced because of the SAPs that contributed to the failure of the extension services in most developing countries (Davis, Franzel and Spielman, 2016). Studies show that in Cameroon only 30% of the farmers had contact with the extension officers (Haug, 1999). Most extension agents in Cameroon lacked transportation, experienced culture barriers and poor communication skills. According to Lwesya and Vedeld (2008) extension officers in Kasungu, Malawi reported that there was lack of in-service training, diseases such as HIV/AIDS and high malnutrition levels, low literacy and low participation of farmers.

Pannell, *et al*., (2006) stated that the main role of extension officers was to raise awareness and change perception of farmers towards agricultural innovation. The services of extension officers include

advisory, human resource development, linking researchers to farmers for proper implementation of new agricultural technologies Therefore, farmer to farmer extension is crucial in places where the government extension officers are ineffective due to the low funding. In addition, the recent spread of information and communication tools in developing countries provides new opportunities for agricultural extension programs.

To move forward, it has been proposed to better understand the social nature of farming in order to increase adoption of new technologies (Vanclay, 2004). The key principles that agricultural extension efforts need to take into consideration in order to ensure effective dissemination and adoption of agricultural innovations are; farming is a socio-cultural practice, farmers are not homogenous (farmers have different priorities), adoption is a socio-cultural process (farmers sharing ideas), economic gains are not the only driving force of farmers, farmers motivations, women are an integral part of farming, non-adoption is not the cause of degradation, farmers attitudes are not the problem, top down extension approaches, science and extension agents do not have automatic legitimacy and credibility, representation is not participation, the best extension method is multiple methods, and farmers need to be appreciated. Understanding these principles would assist both the public extension and organisations promoting adoption of agricultural innovations in order to properly implement the innovations for wider dissemination and adoption (Vanclay, 2004).

4.2 Information and Communication Technologies (ICT) in agricultural communication

Agricultural knowledge and information assist farmers in making informed decisions about their farms (Ali and Kumar, 2011). Governments are promoting innovative information delivery systems to improve farmers livelihoods. In most poor countries, the government extension services are the main source of information for smallholder farmers (Lwoga, Stilwell and Ngulube, 2011). However, government extension services have failed to meet the dynamic needs of farmers. Information and Communication Technologies (ICTs) in Africa are growing at a rapid rate and provide an opportunity for transferring agricultural information. Asenso-Okyere and Mekonnen (2012) highlighted some of the potential ways to disseminate agricultural information to a wider population are mobile phones, innovative community radios, television programs, video shows, farmer call centre, offline multimedia CDs, open distance learning. ICT-based extension has the potential to empower farmers. With increasing use of ICT, the need for more extension officers is not required. Furthermore, the use of ICT eliminates the illiteracy factor that limited farmers from taking advantage of the diverse source of information available to them. In Africa, the social systems increased knowledge sharing and

access to mobile phones contributed to farmers sharing of agricultural knowledge in their local network (Asenso-Okyere and Mekonnen, 2012).

Aker (2011) assessed the ICTs used for agricultural extension in developing countries. As of 2008, there were 4 billion mobile phones worldwide and 374 million of the subscribers were in Africa. Approximately 60% of the population had access to mobile phones in Africa, Asia and Latin America in 2009 (Aker, 2011). Mobile phones have a potential to reduce information costs for farmers and increase geographical coverage, which increases farmer's access to information on agricultural technologies. Mobile phones also provide information on market prices, weather, transport and agricultural technique.

Extension officers travelling to other areas to obtain information is very costly and waste time because distributing information with mobile phones is easier and faster. Cost of sending information through SMS is cheaper than extension visit and use of radio (Aker, 2011). Decreasing the cost of dissemination of agricultural information increases the capacity of extension officers and facilitates communication between the extension officers and farmers. Mobile phones are cost-effective, improves access to information and encourages coordination among extension agents. Therefore, mobile phones facilitate extension officers (Aker, 2011).

Mobile phones are also used to transfer money by using services such as mobile banking. Mobile banking such as M-PESA in Kenya and MAKWACHA system in Malawi enables farmers to purchase farm inputs and receive payments on their mobile phones (Nyirenda-Jere, 2010). Mobile money services can promote the development of other services to farmers such as access to credits.

The challenge with mobile phones (text message) is that it holds limited information and requires users to have reading and writing skills and technological knowledge. Voice based services require a good understanding of the language of the communities. Initiatives have been made in Kenya, Uganda and Zimbabwe to upload audio files to farmers mobile phones (Aker, 2011). Mobile phones are increasingly being adopted by both urban and rural people in Africa (Aker, 2011). Therefore, the ICT-based extension has the potential to change the way agricultural information reaches the farmers in rural areas thereby improving access to information of farmers.

Radios can be used across all segments of the population. Over 55% of people in Africa listen to the radios, which can play a crucial role in distributing agricultural technologies (Aker, 2011). Asenso-

Okyere and Mekonnen (2012) found that the percentage of people who listen to the radio was higher than the ones that own radios in Mozambique and Zambia. Asenso-Okyere and Mekonnen (2012) also found Farmer Voice Radio (FVR) as important disseminator of agriculture information in Africa. FVR is a radio extension service operating in Kenya, Malawi, Tanzania, Mali, Ghana and Zambia that provide agricultural information to smallholder farmers. The agricultural extension officers of FVR regularly visits the villages, provide on-site training to farmers, which are broadcasted on the radio for wider dissemination (Asenso-Okyere and Mekonnen, 2012).

Studies conducted in Tanzania, Malawi, Mali, Mozambique, Ghana, and South Africa indicated that radios with creative programs such as dramas and radio programs fitting local communities' needs were effective in disseminating agricultural information. Results from Malawi found that farmer behaviour changed from listening to the radio through crop diversification, soil improvement, use compost manure, tree planting, environmental conservation, home economics and nutrition (Chimutu, Kapyepye and Ndlhovu, 2006). The study also showed that farm radio was more effective when linked with other information and communication technologies (ICTs). This is supported by Lwoga, Stilwell and Ngulube (2011) that radios and cell phones supported the government extension officers in transferring agricultural information to farmers in Tanzania. Although radios cover a large area in disseminating agricultural information, it lacks feedback. Print media cannot be used by illiterate populations. Access to internet, e-mail and fax machines are limited in Africa. Lwoga, Stilwell and Ngulube (2011) stated that use of internet, e-mails and print media were low in Tanzania despite being available for farmers in the communities.

Generally, information and communication tools increase awareness and knowledge of sustainable agricultural practices and farmers attitudes. Smallholder farmers need to improve their agricultural practices through sharing of information and knowledge. Agricultural extension services provide farmers with information and knowledge to improve crop productivity and livelihoods (Rezaei-Moghaddam and Karami, 2008). It is crucial to supplement agricultural extension services with modern communication tools to facilitate dissemination of ISFM practices. However, modern communication tools are limited because of lack of infrastructures in rural areas such as telecentres, televisions and internet. It is important to assess the available infrastructures in the rural areas to implement appropriate communication tools for agricultural extension services. Mobile phones are appropriate communication tool in rural areas because of limited infrastructure requirements.

Evidence from India showed that poor farmers gained more from using mobile phones than wealthier households (Fu and Akter, 2012).

In Macedonia, farmers preferred a wide range of information delivery systems such as on-farm demonstration, local education meetings and farmer participation, despite having access to sophisticated communication tools (Anastasios, Koutsouris and Konstadinos, 2010). The issue with modern communication tools is that the farmers might not accept the technology. Farmers without modern communication tools could be excluded in the agricultural extension activities, which increases inequality. These issues should be critically examined during the implementation of the new innovation. It is important to assess farmers needs before implementation. Generally, adoption of communication tools depends on the socioeconomic status of the farmers such as farm size, production type, income, age and education. Additionally, farmers that lack understanding of operating the communication tools feel excluded from agricultural activities and other social events (Anastasios, Koutsouris and Konstadinos, 2010). Establishment of modern communication tools in rural areas should be planned and evaluated with farmers involvement. This enhances local knowledge through interactions with local communities on and off the farm.

Agricultural extension approaches used in Africa involve a combination of government-led, participatory and private extension (Age, Obinne and Demenongu, 2012). Increasing development of the internet, telecommunication and mobile phones in African countries improve the accessibility of agricultural information in remote areas. Kalusopa (2005) highlighted the main challenges facing the use of ICT in agriculture are technical infrastructure, weak human capital, lack of national information policy and lack of coordinated support system for farmers in Zambia. Agricultural information delivery systems still receive minimum attention from the government, despite the importance of agricultural information in enhancing farmers livelihoods.

Generally, ICT based extension supports the extension officers because farmers prefer face to face interactions. Extension officers show farmers how to operate the new innovation and share different types of information during village meetings and group discussions. ICTs are good for dissemination of simple agricultural technologies. Complex innovations require face to face training by extension officers for better understanding and implementation of the technology.

4.3 Gender relations in the adoption of agricultural innovations

Gender plays a significant role in the adoption of ISFM approaches in Malawi. Low participation of women contributes to the limited adoption of the ISFM practices. Women are the major contributors to food production but remain excluded from training and access to appropriate information to improve food production (Vanclay, 2004). This is due to cultural barriers, lack of empowerment and lack of participation in rural areas (Lwesya and Vedeld, 2008). Therefore, extension agents need to recognise the role of women and consider addressing women's needs. This has a potential to diversify farm activities, empower women and improve farmer's livelihoods (Ellis, 2000).

Empowering women through training and education, access to capital and market information has been shown to increases crop productivity (Damisa and Igonoh, 2007). Projects that actively integrated women, have reduced household poverty and resulted in adoption of new agricultural practices (FAO, 2014). Furthermore, gender-balanced households contribute to better decision making about agricultural practices that increase productivity and nutrition (Chilongo, Kabambe and Ngwira, 2017). Local women's agricultural groups are a good platform for improving access to agricultural information and credits. A study by Ogunlela and Mukhtar (2009) in Nigeria showed that women organisations were trained in the use of information and communication tools in rural areas. They introduced a weekly radio program where rural women shared information about their farming practices in their local language.

A study by Lwesya and Vedeld (2008) assessed the livelihood, social institutions and adoption of treadle pumps in Kasungu, Malawi. The results of the study indicated that the process of introducing treadle pumps was top down as the farmers were neither informed nor consented about the types of the treadle pumps to introduce. The results also indicated that most of the farmers, especially women, found operating the treadle pumps difficult because of the high physical energy requirements. Most women preferred using the watering can and did not participate in the treadle pump programs. They also found that women participated better when they were in groups. They highlighted that two-way participatory communication is important for the farmers to understand the agricultural innovation being implemented. Thus, two-way participatory communication empowered farmers to actively participate on deciding on the type of agricultural technology suitable to the local needs (Lwesya and Vedeld, 2008).

From the studies above, it is clear that agricultural information is essential for improving farmers livelihoods. Appropriate communication channels contribute to the efficient transfer of agricultural message. Farmers involvement in deciding on the communication tools to use is important to address their needs and preferences. Therefore, it is important to evaluate the different communication channels and their effectiveness in disseminating ISFM practices. This research study investigates the opportunities and constraints of communication tools in the dissemination of ISFM practices in Ulongwe EPA, Balaka District, Malawi.

CHAPTER FIVE

5.0 METHODOLOGY

This was an embedded mixed method study which used both qualitative and quantitative research approach. The mixed method approach was chosen for this study to achieve triangulation (Creswell, 2014). The mixed method approach is becoming increasingly accepted as a better way to conduct research.

In this study, data was collected using qualitative research methods such as semi-structured interviews, participatory observations and focus group discussions to assess farmer's perception and effectiveness of the communication tools used by the CABMACC project in Ulongwe EPA in Balaka district. Qualitative research is an appropriate approach for the study because it allowed the researcher to collect in-depth information about the farmers' perceptions towards the use of different communication tools in the dissemination of the projects (Creswell, 2014). According to Berg and Lune (2012), qualitative research is used to understand respondents' reasons and motivations. Therefore, qualitative research helped to assess the potential of communication tools to disseminate the ISFM practice and the potential of using different sources of information to increase adoption of ISFM practice. For the purpose of this study, qualitative research was the best option because it provided diverse information and understanding of farmer's perception towards communication tools. This assisted in analyzing the strengths and weaknesses of different communication tools used in the ISFM project.

Quantitative survey was conducted in order to collect data relating to household and demographic characteristics, and socioeconomic status of the respondents. These include the following: age, gender, farm size, fertilizer and labor use, education and household income. This was done to examine farmer's accessibility to modern communication tools used in the project including radios, brochures, videos and mobile phones. Generally, quantitative data assists in predicting outcomes through models while qualitative data helps in building theory (Bryman, 2012). Therefore, both methods were relevant for investigating the role of communication tools in the adoption of ISFM practices.

The use of mixed method approach to data collection ensures that those inherent limitations that are associated with qualitative methods are minimized through the use of quantitative methods. Such issues as low levels of validity and reliability of the findings and the fact that qualitative research cannot be generalized to the entire population were resolved by the use of quantitative survey to offer

complementarity and triangulation (Bryman, 2012). Additionally, validity and reliability of the findings was ensured by the use of different sources of information from interviews, secondary sources and participatory observation in a process called triangulation (Bryman, 2012).

Data was collected using household surveys with questionnaires that contained both open and closed-ended question, semi-structured interviews with key informants, lead farmers, Agriculture Extension Development Officer (AEDO), project leaders and Agriculture Extension Development Coordinators (AEDC) and focus group discussions with both CABMACC participating members and non-members. This was done to understand the quality of information reaching the farmers, knowledge sharing in the community and the role it can play in building the capacity of farmers to disseminate ISFM practices in the absence of the project. Data was collected from January to February 2017 in Balaka district, which is the area of focus of the CABMACC ISFM project and a semi-structured interview was done in Lilongwe, the capital of Malawi with the ISFM project coordinator.

5.1 Study Populations

5.1.1 Farmer groups

In this study, two farmer groups were identified to assess the opportunities and constraints of communication tools and accessibility of information on ISFM practices. These groups were defined depending on the last growing season.

a) CABMACC members: CABMACC members have different characteristics within the group depending on the type of legumes they grow on their trial farms. CABMACC ISFM project in Balaka encouraged the intercropping of legumes with maize, crop residue retention and precision application of pesticides to improve soil fertility and increase yields. The legumes recommended by the project were Pigeon Peas (PP), Cow Peas (CP) and Groundnuts (G/nuts). Each of the legume types in every section has a lead farmer and follower farmers. Within CABMACC members, there are PP farmers, CP farmers and G/nuts farmers that have incorporated the particular legume in their farming system.

b) CABMACC members that were provided with inputs in the initial phase in 2015 of the project and in 2017 were supposed to implement the practice in their fields without the support of the CABMACC project. The aim of the project is to build the capacity of farmers and these

farmers were supposed to be the model for the other following farmers for sustainability of the practice.

c) Non-members: These were farmers in the sections that have never been trained by the project about ISFM practice. However, some receive the information from AEDO (extension officer) from the agriculture department during community training but most have not yet implemented the practice on their fields.

5.2 Research area

The study area was Balaka District, which is in the Southern region of Malawi. Selection of the study area depended on the location of the ISFM project. Balaka district has a population of approximately 310,000 and covers about 2,198 square Km (National Statistics Office, 2015). The district is located 130 Km North of Blantyre and 200 Km South of Lilongwe (Fig 2). In addition, the dominant tribes in Balaka are the Yao and Ngoni tribes. Balaka district is part of the rain shadow area that faces erratic rainfall and droughts as well as poor crop productivity (NSO, 2015). Ulongwe Extension Planning Area (EPA) was the area of focus for the study. Four sections in the EPA were selected, the Chitseko, Chibwana, Hindahinda and Mulambe section. Furthermore, the villages where interviews and focus group discussions took place were suggested by the AEDO together with the CABMACC extension officer as the ideal places for the meetings of the people from the sections. These villages were Hindahinda, Namunde, Chibwana and Nsima. Each section comprises of approximately three villages and after careful consideration, we agreed on selecting one village from each section as the meeting point to conduct the interviews, household surveys and focus group discussion. The AEDO and CABMACC extension officer also assisted in the sampling of the farmers for the study.

The majority of people in Balaka have low education levels with no formal employment. Balaka is one of the poorest districts in Malawi and agriculture the main source of income. Another source of income is remittance as most of the young people from this area migrate to South Africa and other parts of Malawi to improve and support their families. A small percentage of the farmers own livestock and depend on manual labour with conventional hoes as their main farming tool.

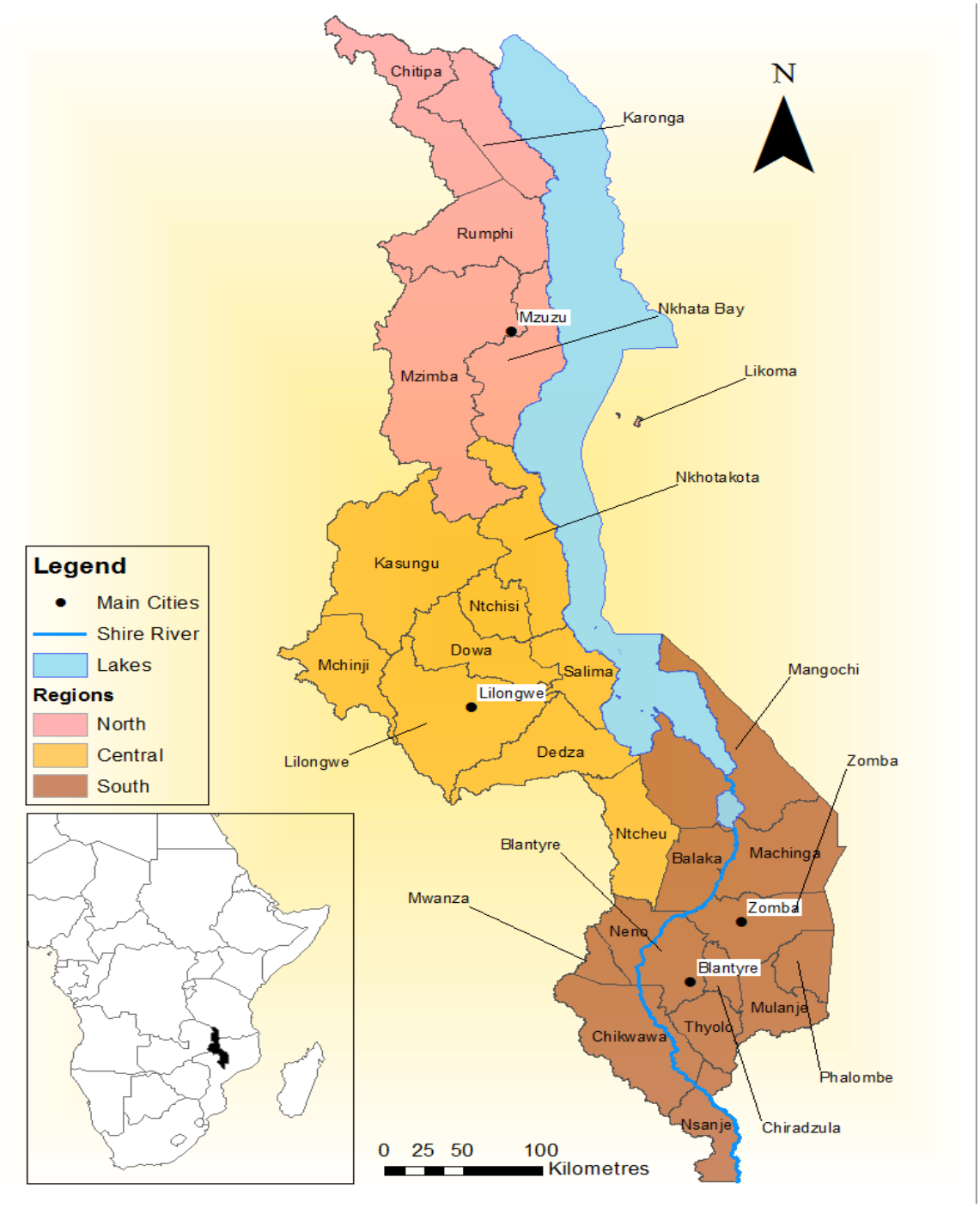

Figure 2. District map of Malawi

5.3 Data collection and analysis

5.3.1 Household survey

Sampling is important in research because it helps in making inferences of the population (Fields, *et al.*, 2012). Quantitative research uses probability-sampling approach, which considers everyone in the population and is a representative of the whole population thereby minimizing bias (Fowler, 2009). The quantitative part of the study used stratified sampling. Stratified sampling involves dividing the population into subgroups and a sample is selected from each group (Bryman, 2012). In the study, the subgroups were the farmers from the four sections where CABMACC project was implemented.

Identification of the respondents was done with the help of the project coordinator that provided the list of CABMACC member in Ulongwe EPA and the AEDO who made the list of farmers in the focus area. From each section, 25 farmers were selected both CABMACC and non-members making a total of 100 farmers that were supposed to be interviewed. The researcher managed to interview 89 farmers. The remaining interviews were not conducted because of two missing questionnaires and personal problems of the selected farmers such as farming activities and funerals. A total of 54 CABMACC members and 35 non-members were interviewed.

The household survey was conducted from mid-January to early February with a questionnaire that comprised of 47 questions both open and closed-ended. Before conducting the study, the questionnaire was pre-tested on a CABMACC member to ensure that there was no repetition of questions and the answers provided were relevant to the study. Pre-testing was done to make sure that the interview flowed smoothly and questions were properly understood by farmers. After pre-testing the questionnaire, some questions were removed due to repetitions and some modified for clarity.

Figure 3. A research assistant interview with a farmer in Namunde

The farmers were asked to meet in one village in each section on the day for data collection and these spots were Hindahinda, Namunde, Nsima and Chibwana. The data were collected with the help of the research assistants (Fig 3). Farmers were organized by the AEDO (extension officer) who informed the Village headmen and lead farmers about the researcher's intentions in the area. Individual interviews were held with the help of the research assistant.

The collected data were entered into MS Excel to prepare for analysis. Data analysis for the study used statistical analysis software R by uploading the MS Excel workbook into R commander for analysis of closed-ended questions. Descriptive statistics were used such as percentages, means, standard deviations and standard error to assess socioeconomic status of farmers and farmers perception toward different communication tools. Furthermore, contingency tables (cross-tabulations) were used to analyze the relationship between categorical variables by using chi-square, degrees of freedom and p-value to explain the statistical significance of the correlation. Level of statistical significance was set at $p<0.05$. Open-ended question used qualitative data analysis methods such as coding into themes and categories to detect trends and latent attitudes of farmers toward the ISFM practice (Creswell, 2014).

5.3.2 Semi-structured interviews

Qualitative research uses non-probability sampling that focuses on respondents that have information about the topic. This is one of the limitations of qualitative research because it is subjected to bias (Bryman, 2012). The qualitative part of the study used purposive sampling strategy where the choice of the sample was influenced by the research questions (Berg and Lune, 2012). Purposive sampling targeted farmers that were involved in CABMACC project and non-participants with relevant information to answer the research questions. Key informants were interviewed to obtain information about the role of different communication tools used to support the adoption of ISFM practice. Identification of key informants from each section was done with the help of the AEDO (extension officer) in Ulongwe EPA to identify farmers that had relevant information about the communication tools used in agriculture extension.

Key informant interviews were done throughout the data collection period with the aim of acquiring in-depth knowledge and challenges that farmers are facing. These interviews helped to assess the quality of information and potential recommendations to improve the communication process with farmers. The key informants were village headmen, elders in the villages both women and men, AEDO, CABMACC extension officer and the project coordinator. These semi-structured interviews from different sources were done to understand the respondent's perceptions of communication tools in agriculture. Interviews also assessed the use of different sources of information from a different perspective and at different qualification levels. Key informant interviews were done face to face and each interview took approximately one hour using interview checklist. Transcription of interviews was done for coding analysis to identify key categories and to support information collected from household surveys

5.3.3 Focus group discussion

Focus group discussions were done from each section. Four focus group discussions comprising of farmers with similar characteristics were arranged to gain more information about farmer's views. These groups were lead farmers, follower farmers, non-members from all age groups both men and women to discuss the challenges that farmers face with access to information and the ISFM project. The AEDO of the section assisted in organizing the farmers for the focus group with a planned number of 10 farmers. However, more farmers were willing to participate and came from far for the discussions. In the end, a total of 16 farmers actively participated in the focus group discussions. Although the number of participants was high, the interaction between farmers was smooth and easy

to control. The focus group discussions also followed a list of guidelines to steer the discussion in the right direction. The discussions were recorded and transcribed for data analysis. The aim of the focus group discussion was to observe farmers interactions and to explore their attitude and perceptions towards ISFM project from a group point of view to support the semi-structured interviews and household surveys. Focus group discussions provided a broader perspective about the relevance of different modes of communication in transferring agricultural information.

However, focus group discussions experienced limitation in terms of the domination of some of the farmers during discussions. This is one of the limitations of focus group discussions because the dominant character's views are mostly heard than the quiet ones. For the study, the researcher tried to control such characters from steering the discussion. Another limitation is that with many people participating in the discussion, the data recorded was too much to transcribe.

5.3.4 Field observations

Field observation were conducted using participant observations from each section because most of the trial farms were located near farmers' homes. These field observations were done to reflect farmer's acceptance of the practice and whether the information provided during training was properly implemented such as manure and crop residue management, legume intercropping and crop rotation with maize (Fig 4). On one occasion, the researcher observed a CABMACC extension officer training the farmers. From this, the researcher was able to observe the interaction between the extension officer and farmers.

Figure 4. ISFM demonstration plot in Hindahinda

5.3.5 Secondary data

Secondary data was collected to acquire information about the current Malawi government policies and recommendations on improving communication between farmers and extension officers for better adoption of agricultural innovations. In addition, secondary data was collected to understand the role of communication tools in agricultural interventions to improve crop productivity in Malawi. Secondary sources such as Malawi Agricultural Sector Wide Approach (ASWAp), data from the project and National Statistical Office (NSO) data was used.

5.4 Research Assistants

Research assistants helped during data collection. The research assistants were recommended by the AEDO so that the data collection process goes smoothly and for the farmers to be comfortable with the researcher. They suggested someone that farmers were familiar with from the EPA. The assistants were trained about the aim of the research study and how to administer the questionnaire. The assistants were given step by step training of the questions and time to familiarize themselves with the questionnaire.

5.5 Research Ethics

Ethical considerations are important, especially during data collection. The researcher should always make sure that they are aware of own and other people's bias when interacting with the respondents (Singh, 2007). Research process inevitably creates power imbalance between the researcher and the respondents. Respondents' opinions about the researcher may affect the quality of data. It is crucial for the researcher to be aware of these biases to improve quality of information (Bryman, 2012). Generally, the research should not harm respondents and it is the responsibility of the researcher to protect the respondents. Therefore, ethical issues need to be observed throughout the research process. Ethics can be observed through informed consent before data collection and providing respondents with clear information about the study, purpose, and use (Berg and Lune, 2012). This is done to avoid misunderstandings between the researcher and respondents. In this study, it was clearly explained to farmers about the aim of the study and the intended purpose of the results. Information about the researcher was also provided to the farmers prior to data collection. They were also informed about the rights to refuse to participate and answer questions that they did not feel comfortable to answer. Verbal consent was provided by the farmers before data collection. In addition, respondents were informed about confidentiality. This was done to allow respondents to provide appropriate information without being worried about the government or the project.

5.6 Limitations

Challenges in field research studies are unavoidable. In this study, challenges were experienced in terms of losing data and lack of experience. For instance, conducting the interviews and focus group discussions on a single location and on the same day led to exhaustion by the farmers, the researcher and the assistants. This was done because data was collected during the rainy season and most farmers were occupied with farming activities and it would have been difficult to go door to door because most of the farmers were in their fields. Miscommunication between the AEDO and the lead farmers about the time of arrival and the program delayed the process.

Lack of familiarity in such studies made the researcher rely on the AEDO and CABMACC extension officer more than intended because their presence might have influenced farmers responses to the questions. In addition, identification of the respondents prior to data collection might have contributed to respondents providing information they thought the researcher needed to hear instead of being

honest about their experience with the project. The use of different data collection methods (triangulation) helped in assessing farmers true perceptions towards ISFM project.

Collection of some data was difficult, especially data on crop yields, fertilizer usage and amount earned from selling crops. This was due to lack of records and the data relied on farmers recall from last year's output. Thus, the reported data might be either an overestimation or underestimation of the actual amounts. And these results were based on the estimation of the amounts used. However, farmers were able to provide more information on crop yields, fertilizer use and crops sold during the qualitative interviews. Furthermore, errors during data collection, data entry, and data analysis are expected in these kinds of studies.

CHAPTER SIX

6.0 RESULTS AND DISCUSSION

Small-scale farmers need information to improve, sustain as well as diversify their farming systems. Communication tools play an essential role in the dissemination of agricultural information among the farming communities. The CABMACC project in Balaka district promotes the use of interpersonal communication and electronic communication tools (radios, videos, digital storytelling, mobile phones) in the diffusion of ISFM information in Ulongwe EPA. Interpersonal communication includes the use of extension officers, lead farmers, learning centres and field days. According to Chilongo, Kabambe, and Ngwira (2017), the objective of the CABMACC project was '*to enhance knowledge and capacity of small-scale farmers and extension officers in the use of ISFM packages that are resilient to the varying climate under different clusters of soil types and resources'*. To ensure effective dissemination of ISFM package, the CABMACC project actively collaborated with the Agriculture Communication Branch (ACB) in the Department of Agriculture Extension Services (DAES). This was done to take advantage of the already existing extension structures and for social acceptability of the project. Social acceptability is relevant for the sustainability of the project in the area (Lwesya and Vedeld, 2008). With the help of the extension officers, the project was implemented in areas recommended by the Ulongwe EPA based on the project requirements.

The main communication tools used by the CABMACC project for dissemination were extension officers and lead farmers. Lead farmer approach was the recommended approach suggested by the government to NGOs, programs and projects as an effective method of disseminating agricultural innovation in Malawi (Khaila *et al.,* 2015). The CABMACC project information was transferred by training the extension officers on the ISFM practice in Ulongwe EPA. After training, the extension officer and the ISFM project implementers facilitated the selection of lead farmers and follower farmers by fellow farmers from each village with the support of the village headmen. The project aimed at effectively training lead farmers on the ISFM practice. Each lead farmer trained follower farmers about ISFM. The follower farmers were supposed to learn, implement the practice in their farms and share knowledge and seeds with other farmers so that in the long run, the ISFM practice can be adopted by the wider community.

The CABMACC project provided lead farmers with radios for easy access and wider dissemination of relevant ISFM information. The purpose of the radios was to complement lead farmers and extension officers in information transfer. Farmers were supposed to form radio listening clubs and discuss the information they obtained from the radios. Use of mobile phones, digital storytelling, videos, field days, learning centre and print media were also promoted by the project to assist knowledge sharing about ISFM. However, some communication tools introduced were more relevant in information transfer than others.

The effectiveness of communication tools depends on the socioeconomic characteristics of the households. The households in this area were poor with no electricity, low income levels and small farm size, which made implementation of videos and digital storytelling difficult. Few people had access to mobile phones (text message) and print media due to low-income and literacy level. Therefore, this section aims at discussing the appropriate and preferred communication channels for sufficient information transfer in the area for the sustainability of the ISFM project. This section will discuss household and farm characteristics to understand the socioeconomic status of the households. Socioeconomic status determines the farmers' preferred mode of communication for better uptake of the ISFM information. Therefore, socio-economic factors such as education, income levels and farm sizes are crucial in influencing farmers' decision-making capabilities. It is important to develop communication systems that suit farmers socio-economic status.

6.1 Household characteristics

Table 1 represents the number of farmers interviewed. As stated in the methods chapter, the study planned to interview 100 farmers for the household survey. I managed to interview 89 households. The households were selected from the villages in the four sections of Ulongwe EPA. Table 1 indicates the names of the villages selected from each section and the percentage of farmers interviewed from each village.

Table 1. Household distribution by section and village

Section	Village	Number of households	Percentage
Chibwanansamala	Chibwana	2	2
	Chombe	13	15
	Chombe 2	11	12
Hindahinda	Chipyali	3	3
	Milambe	6	7
	Hindahinda	11	12
Mulambe	Namunde	19	21
	Chakwiya	3	3
Chitseko	Nsima	12	14
	Ntelera	5	6
	Kalembo	1	1
	Kalembo1	3	3
Total		**89**	**100**

The survey showed that Balaka is one of the poorest districts in Malawi. Both CABMACC and non-members had mean farm size of 0.5 ha, with the largest farm size of 1.6ha, which they cultivate using a traditional hoe for subsistence (Table 2). In all sections, the average household size was 6 people with some households comprising of 11 people (Table 2). The average age for the area under study was 37 and oldest was 81. The farmers also reported that they do not usually hire labour to help with farming activities. Most households get help from family members.

In addition, the majority of the participants in the CABMACC project were women. This study comprised of 61 women and 28 men. This is because the project was implemented in the southern region of Malawi, which is dominated by matrilineal societies (Chilongo, Ngwira and Kabambe, 2017). In matrilineal societies, men move to women's villages when they get married in a practice locally called *Chikamwini*. In these societies, women own the land and have a higher decision-making power than in patrilineal societies. The other reason for the project being dominated by women was that women were more willing to take risks to improve their households (Ellis, 2000). In terms of ethnicity, the dominant tribal group in Ulongwe EPA is Yao, which are mostly Muslims. Other tribes include the Lomwe and Ngoni tribes.

Household assets in this study showed that 53% of the households had bicycles and mobile phones, 29% radios, 9% solar panels and 4% TV sets as shown in Table 2. Assets assisted in determining

appropriate communication tools to use for dissemination of agricultural information. During interviews, respondents mentioned that radios are usually not used due to the short lifetime of batteries. Since 53% of the households had mobile phones, this provided a good opportunity for the project to distribute information through mobile phones. Only 4 households indicated owning a TV, which they never used because of lack of electricity. Some households stated that they owned solar panels but they had low capacity and did not cover the electricity demands in the households.

Table 2. Mean characteristics of the household

Variables	**Min**	**Mean**	**S.D**	**S.E**	**Max**
Age	20	37.4	19.8	2.1	81
Farm size (ha)	0.08	0.5	0.8	0.1	1.6
Household size	1	6.4	2.5	0.3	11
Years farming(yrs.)	1	13	15.1	1.6	101
Family members farming	0	3	1.9	0.2	9

Gender distribution (%)

Gender	**Number**	**Percentage**
Male	28	32%
Female	61	68%

Household assets

Asset	**No. of farmers**	**Percentage**
Bicycle	48	53
Mobile phones	48	53
Radio	26	29
Solar	8	9
Television	4	4

Education level assists in identifying appropriate communication tools to facilitate the diffusion of the ISFM practice. Education level helped in understanding farmers preferred modes of communication and the implementation of the practice from the information available to them. The majority of the households had primary education (62%), 21% had no education and 12% secondary education (Fig 5). Those with higher education levels were selected as lead farmers.

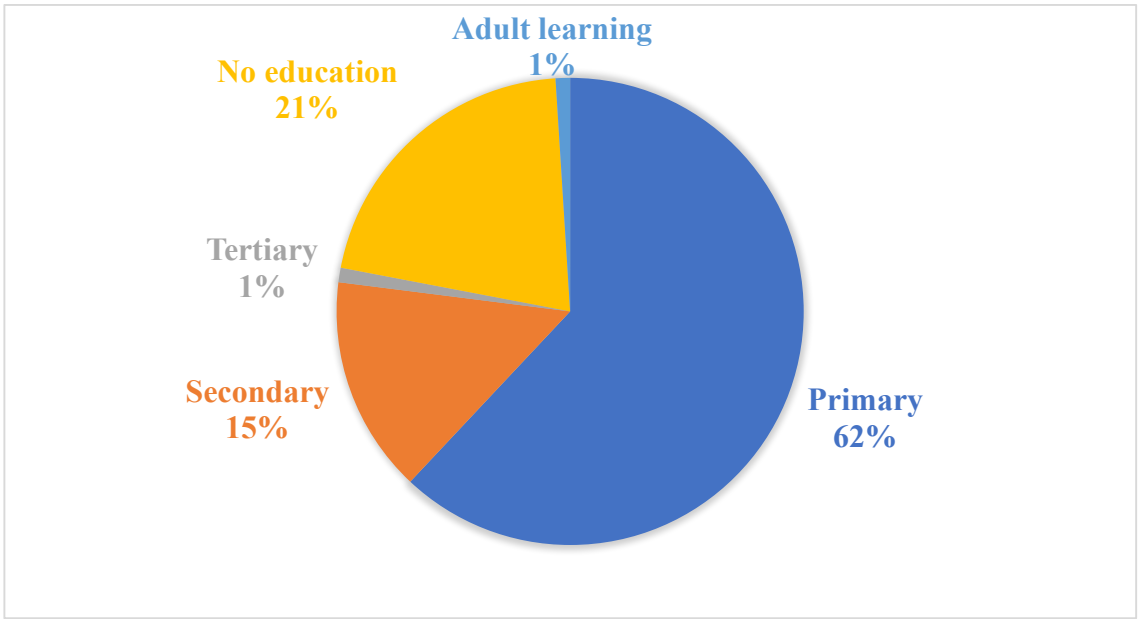

Figure 5. Education level of farmers

Farmers pointed out that they have multiple sources of income to support their households. Most farmer's income was derived from maize production. Maize is a staple food in Malawi. Maize is used for subsistence and only a small surplus is sold to supplement household needs. The second common source of income in the area was local trade (Table 3). Most farmers sold products such as home-made mats and vegetables that they grow in their home gardens. The cash crop in this area was cotton, which is commonly grown due to the favourable climate for its production. However, the majority of farmers in this area were subsistence oriented and focused on producing maize. Only 20% of the farmers grew cotton.

Casual labour and remittance were also mentioned as a source of income. Some young men migrated to cities or moved to South Africa for work and business to assist their families (Anglewicz, *et al*., 2017). This is a common practice, especially for the villages that were located close to the main road. This was due to easy access to information and transportation. Moreover, villages that were located closer to the main road had multiple sources of income and easy access to the market for the crops compared to villages that were located further away from the main road.

Table 3. Farmers' main source of income (N=89)

Source of income	Number of Farmers	Percentage
Field crops	33	37
Local trade	21	23.5
Remittance	11	12.4
Cash crops	11	12.4
Casual labour	6	6.7
Garden crops	3	3.4
Livestock	2	2.3
Village bank	2	2.3
Total	**89**	**100**

6.2 Farming Characteristics

Farmers' characteristics helped to explain farmers willingness to adopt agricultural innovation in their fields (Padel, 2001). Farmers in this area had small farm sizes and lacked inputs to improve their crop productivity. The findings indicated large differences in the crop yield between farmers. This was shown by the large standard deviations in Table 4 below. For instance, the average maize yield for the last crop season was 707 kg/ha with the standard deviation of 593. These large differences occurred because some farmers reported zero harvests while other farmers harvested 3800 kg/ha of maize in the last cropping season. This show how widely dispersed the yields were among farmers in the area. This was the same with cotton, some farmers harvested up to 1130 kg. Farmers pointed out that lower maize yields were also a result of drought and pests in the last cropping season and were optimistic about this year's yields due to better rainfall patterns.

Maize was grown by 97% of the farmers, 70% pigeon peas, 49% grew cowpea and groundnuts, 20% cotton and 10% beans. Other crops grown included soya, sorghum, and millet. Farmers in this area grew legumes to improve their diets. The common agricultural practices in the study area were monocropping and maize-legume intercropping. This indicated that farmers were willing to implement ISFM practices to improve soil fertility. In addition, legumes were already popular in the communities and part of the farmer's diets, which increased the chance of adopting ISFM package. According to Chinangwa (2006), agricultural innovations that need small modifications in their farming practices stand a better chance of being adopted than new and complex innovations.

In terms of crops sold, farmers pointed out that the common crops sold were cotton, maize, and groundnuts with the mean of 37.4 kg, 38.6 kg and 19.4 kg sold respectively (Table 4). Only an average of 9.4 and 7.9 kg of pigeon peas and cowpeas were sold respectively by farmers. The low amount of pigeonpeas and cowpeas sold was explained by farmers during focus group discussions. Pests and diseases attacked these crops during the last growing season leading to lower yields. Farmers reported that they sold their crops in the local trading centres. The main trading centres in the area were Mwima and Ulongwe located along the Liwonde-Mangochi main road. Other farmers mentioned selling their crops to ADMARC (government owned corporation) in Ulongwe trading centre. Some of the sections were closer to the trading centres such as Hindahinda and Chitseko than others such as Chibwanansamala and Mulambe.

This area was characterized by a low number of livestock. Farmers mainly owned poultry (chickens and ducks) and goats. Only 2% of households reported owning pigs, which is not surprising due to this being predominately a Muslims area. Muslims do not rear pigs because of religious believes. As farmers did not have livestock, they cannot rely on the sale of livestock as a means to generate income in times of stress. Stress periods in Malawi occur during the planting season from November until March. Harvesting begins in April (Chilongo, Ngwira and Kabambe, 2017). In addition, the ISFM practising farmers lacked manure to incorporate into the soil to improve soil fertility. CABMACC farmers reported that they were encouraged to use human manure as an alternative source but it was difficult in terms of handling. During field observations, the researcher was able to visit a field in Namunde that incorporated human manure to improve soil quality.

Input usage in the area indicated that both CABMACC and non-member farmers used commercial seeds (Table 4). Only a few farmers reported purchasing fertilizers for their fields. Farmers mentioned that the government provides fertilizer through the fertilizer subsidy program (FISP). Manure and lime/ash were used by farmers. Farmers reported that they use ashes to kill pests in their fields. Herbicides and pesticides were not commonly used by the farmers. Farmers reported that most inputs were expensive to purchase and they used traditional methods to complement purchased inputs. Access to inputs was also pointed out by farmers as the reason they joined CABMACC project because the members received seeds, fertilizers, and pesticides.

Table 4. **Mean Farming characteristics**

Mean crop harvest for last season (kg)

Crop	Mean	S.D	Min	Max	% of farmers
Maize	707	593	0	3800	97
Cotton	73.2	221.7	0	1130	20
Groundnuts	52.3	117.8	0	600	49
Pigeon peas	31.4	72.5	0	500	70
Cow Peas	21.1	64.7	0	500	49
Beans	8.7	55.4	0	500	10
Soya	2.8	17.5	0	150	8

Mean crops sold (kg)

Crop	Mean	S.D	Min	Max
Maize	38.6	137	0	1100
Cotton	37.4	147.4	0	1130
Groundnuts	19.4	50.2	0	200
Pigeon Peas	9.4	29.4	0	200
Cow Peas	7.9	31.1	0	250
Sorghum	0.5	5.3	0	50

Mean number of livestock

Livestock	Mean	Min	Max
Poultry	2.8	0	21
Goats	1.5	0	16
Sheep	0.1	0	4
Pig	0.0	0	2
Cattle	0.0	0	0
Rabbits	0.1	0	7

Mean application of farming inputs (kg/ha)

Inputs	Mean	S.D	Min	Max
Manure	88.3	151.3	0	1100
Fertilizer	42.5	54.3	0	250
Lime/Ash	11.7	32.5	0	200
Commercial seeds	9.2	12.7	0	50
Herbicides	1.3	10.6	0	55
Pesticides	0.3	1.2	0	10

Hired labour by households in the last farming season

Activities	No of HH	Percentage
Weeding	25	28
Tillage	22	25
Harvesting	8	9
Planting	7	8
Banding	7	8

Hired labour was used during tillage and weeding by 25% and 28% of the farmers respectively. Only 8% for planting was reported and 9% for harvesting (Table 4). However, the majority of the farmers

indicated that they depend on family members to cultivate their fields. Only the elderly farmers and the ones that have large farm size stated that they used external labour to cultivate their fields. Other activities that required labour were banding and processing of the harvested crops.

Farmers in Malawi face many challenges that affect their potential to improve crop yields and to take risks by adopting new agricultural practices (Lwesya and Vedeld, 2008). In this area, the most common constraint mentioned by farmers was lack of income to buy farm inputs. This was the main challenge facing farmers in Ulongwe EPA. Figure 6 shows that 69% of the farmers reported lack of income as the main challenge, followed by drought, which was reported by 12% of the farmers. The others stated lack of labour (8%), poor health (6%), pest and diseases (2%) and drought and diseases (3%) as problems experienced by the farmers.

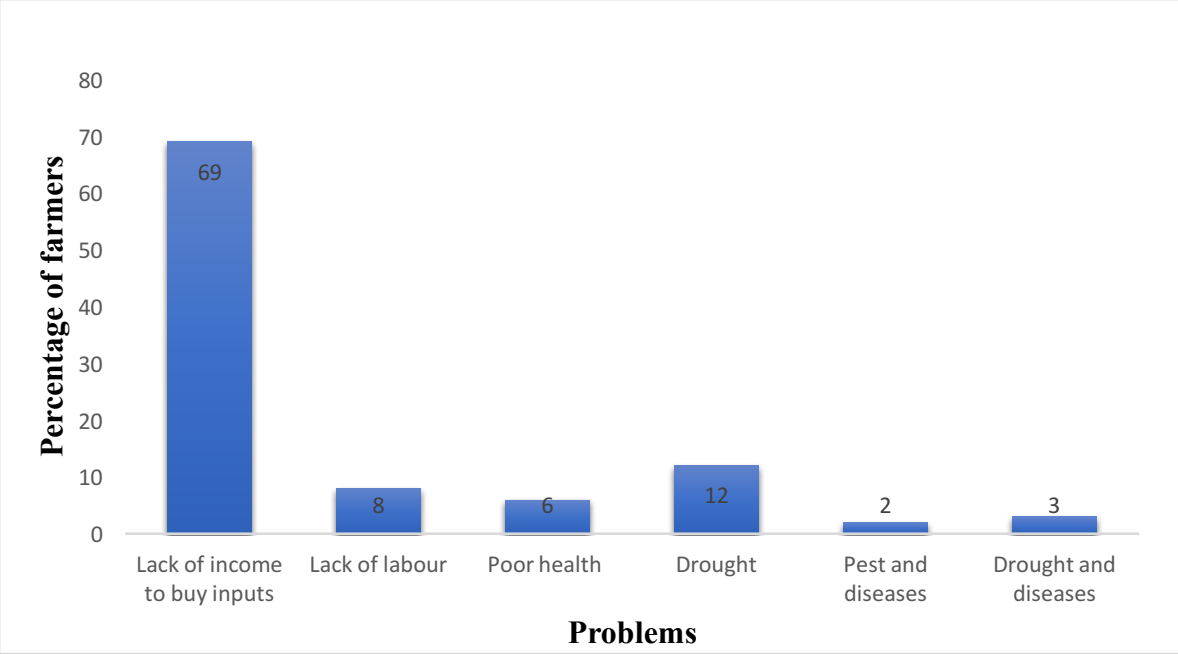

Figure 6. Main constraints facing farmers to improve crop production

6.3 Impact of different sources of information in the dissemination of ISFM practices

Multiple sources of information contribute to the adoption and dissemination of ISFM in Ulongwe EPA. This section analyses farmers' perceptions and interaction with the different sources of information. The source of knowledge on ISFM differs among farmers. About 90% of the farmers were aware of the ISFM practices and only 10% lacked the knowledge of ISFM (Table 5). Farmers

reported that they gained knowledge about the practice from different sources including training from the CABMACC project. Approximately 69% of the farmers stated that they have been trained about the ISFM practice by the government extension officers or NGOs and 31% stated that they have never been trained but heard about the practice from fellow farmers (Table 5). Generally, most farmers are aware of the ISFM practice but the question is; did awareness lead to adoption? This depends on the level of understanding of the ISFM practice, benefits and willingness of the farmers to take risks. Level of understanding can be alleviated with relevant information from trusted sources.

Table 5. Farmers' knowledge about ISFM (N=89)

Variable	No. of farmers	Percentage
ISFM awareness	Yes: 80	90
	No: 9	10
Training in ISFM	Yes:61	69
	No:28	31

Trusted source of information contributes to farmers adoption of new agricultural innovations (Fisher, Holden and Katengeza, 2017). Farmers ranked government extension as the most trusted source of information with 50%, followed by farmer to farmer (traditional knowledge, lead farmers) with 41% and 33% NGOs. Research scientists were ranked as the least trusted (Table 6). This was supported by both key informant interviews and focus group discussions held in the region. Farmers stated that they trusted extension officers because they regularly visited and interacted with the farmers through training on appropriate farming practices. They also trusted information from NGOs because many NGOs were implementing projects on improved farming practices in the region that provided farmers with the necessary inputs.

In terms of traditional knowledge, farmers trust was divided because most of the traditional knowledge was made irrelevant by the government's previous interventions such as mono-cropping. However, those that obtained agricultural knowledge from their parents still used and trusted traditional knowledge despite being against the government's previous agricultural agenda. Currently, traditional knowledge has become an integral part of the improved farming practices that the government is promoting. For instance, using ashes as pesticides, intercropping legumes as well as using tree leaves to improve soil fertility. However, it is important to understand that in most rural areas in Malawi, the government extension agents are still the most trusted and preferred source of

information (Ndilowe, 2013). For projects to be successful, there is need to incorporate the government extension service throughout the process.

Table 6. Ranking of the most trusted source of information (percentage of farmers)

Source	Rank 1	Rank 2	Rank 3	Rank 4
Government extension	50	16	11	0
Farmer to farmer	23	41	24	4
NGOs	14	25	33	13
Research scientists	13	18	32	83
Total	**100**	**100**	**100**	**100**

Farmers received information from the government, traditional knowledge, radios, scientist, and NGOs. The diverse sources of information had the potential to encourage farmers to implement the ISFM practice. However, the different sources of information have the danger of confusing farmers on the choice of the innovation to implement, especially when the extension message differs among different organisations. It is crucial that the information promoted to farmers is harmonised among the organisations to improve farmers' livelihoods. Although most of these organisations have their own objectives, it is best to involve the government before implementation to make sure that the information provided to farmers is similar to avoid confusion during implementation.

Despite the ISFM practices being new in this region, there has been a number of organisations that have introduced similar principles such as conservation agriculture as programs or interventions. Farmers reported that the organisations promoting similar information to CABMACC about ISFM practices are Catholic Development Commission Malawi (CADECOM), Project Concern International (PCI), Oxfam International, Self Help Africa (SHA), Total Land Care (TLC), African Institute of Corporate Citizenship (AICC) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Farmers mentioned the main organisations that disseminate information related to CABMACC are CADECOM, ICRISAT, PCI and SHA in the areas. When asked whether the information was different or overlapping with CABMACC, most farmers reported similarity. Farmers indicated that having access to different information sources increased their confidence in ISFM practice because they were assured of the advantages of adopting ISFM on their farms.

Farmers mentioned the existence of women supports groups in the village to improve their livelihoods. The groups were not agricultural organisations but provided women with agriculture information to improve their households. Many of these organisations were faith-based groups such as reflective circle and Muslim Women Association (MWA). Farmers also indicated that the Village Banking group provides access to income, which assists them to buy inputs to improve crop production. During the Village Bank meetings, farmers reported that they discuss farming practices and markets to sell their produce. Most of the farmers taking part in Village Banking were women that sell garden crops in the markets such as leafy vegetables, fruits, onions and tomatoes. Other organisations in the sections were community organisations such as Community Based Organisations (CBOs), Village Development Committee (VDC) and Area Development Committee (ADC). Matuschke and Qaim (2009) found that farmers adoption of agricultural innovations was influenced by the adoption of other farmers in their social network. This is supported by Rogers (2003) diffusion of innovation theory that the most influential sources of information are fellow farmers through interaction that improves their knowledge. Constructivism theory of learning also states that learning is a social activity that is influenced by the community. Therefore, farmers that belong to social groups or organisation in the villages are most likely to adopt ISFM packages in their farms.

6.4 Evaluating communication tools in the dissemination of ISFM practices

Farmers ranked the most effective communication tools used by the ISFM project in Balaka (Table 7). The learning centre and radios had the same rank and mobile phones (text messages) were least preferred. Use of mobile phones was limited because of the costs of calling and text messaging. Only 37% of the farmers reported using mobile phones for agricultural purposes (Table 8). Text message from mobile phones was a challenge in the region because some of the farmers were illiterate and the majority of farmers had only primary education. Furthermore, the use of brochures and leaflets implemented by the project was limited due to illiteracy levels of some farmers. Some farmers preferred the leaflets and brochures. Generally, print media could be used to complement radios and mobile phones in disseminating ISFM principles.

Table 7. **Ranking of most effective communication tool used by CABMACC (% of farmers)**

Communication tool	Rank 1	Rank 2	Rank3
Extension officers	26	10	6
Lead farmers	22	13	10
Farmer to farmer	17	29	9
Learning centre	13	17	22
Radio	13	16	23
Mobile phones	9	15	30
Total	**100**	**100**	**100**

Farmers in the study area reported that on average, they contacted the lead farmers twice a month (Table 8). Contact with extension officers and lead farmers was important for reinforcing the information that increased farmers knowledge on ISFM. This contributed to proper implementation and adoption of ISFM. According to constructivism theory, repetition of ideas and regular exposure to the idea strengthens the knowledge. Farmers stated that the role of lead farmers in the implementation of the CABMACC project was very effective for the adoption of the practice. This was supported by farmers during focus group discussions, where farmers reported that lead farmers were readily available in the community and when they needed information they could easily ask the lead farmer. In addition, lead farmers motivated them by providing guidance in their individual fields on how best to implement the ISFM practice. Farmers also reported that they were aware that lead farmers needed to attend to their own needs before attending to them. For this reason, it might be best to incorporate other communication tools in addition to lead farmers and extension officers such as radios, mobile phones and learning centres. Farmers reported that learning centres and radios were effective communication in transferring information. Farmers suggested that these communication tools have the potential to facilitate the adoption of ISFM practice in the region.

Table 8. **Characteristics of communication**

Variable	Mean	S.D	Min	Max
Times of training	2.3	2.9	0	10
Contact with lead farmers	2.1	1.4	0	4
Contact with AEDO	2.5	1.5	0	6
Mobile phone usage%				
Use of mobile phones	Yes:33		37	
	No:56		63	

Knowledge sharing by CABMACC farmers with non-member was one of the goals of the CABMACC project. The goal was to build the capacity of farmers to transfer the knowledge to other non-participating farmers for wider dissemination of the ISFM practice in the region. The CABMACC project was aware that it cannot reach all farmers in the region and focused on training few farmers to eventually teach others. The benefits associated with implementing ISFM practice were supposed to encourage non-members to apply the practice. Farmers reported that knowledge sharing with other farmers was effective in the CABMACC project. Furthermore, learning centres were identified as very effective in knowledge sharing because farmers learn from each other and improve the way the practice is implemented.

Farmers reported that they were trained by the AEDO (extension officers) of the sections on average twice a month (Table 8). The CABMACC farmers stated frequent contact with the CABMACC extension officer in the region, who provides information and guidance on the best management of ISFM practice in the region. Contact with extension officers helped in understanding the quality of knowledge farmers had on the practice, which determined dissemination of the ISFM practice. It was observed that the more contact farmers had with extension officers, the more the farmers were willing to implement the recommended practice. According to Rogers (2003), interpersonal communication tools are most effective in changing people's strong attitudes. This is supported by Vatn (2005) that peoples' preferences change with information and that learning about a new innovation has the potential to shift farmers perspective once they become aware of the benefits incurred in adopting such innovation. Ban and Hawking (1988) argued that farmers who adopt new technologies have characteristics such as frequent contact with extension workers and positive attitudes to change.

6.5 Farmer's perception towards the communication tools used in the CABMACC project

Various communication tools have the capacity to influence farmers adoption of new agriculture innovations. The effectiveness of the communication tools depends on the sources of the information and farmers perception of them (Padel, 2001). Communication tools accessible to the farmers in this region were extension officers, farmer to farmer, learning centre, radio, mobile phones and participatory videos. Farmers ranked the extension officers (51%), lead farmers and learning centres higher while modern communication tools such as mobile phones, radios, and videos had lower rankings (Fig. 7).

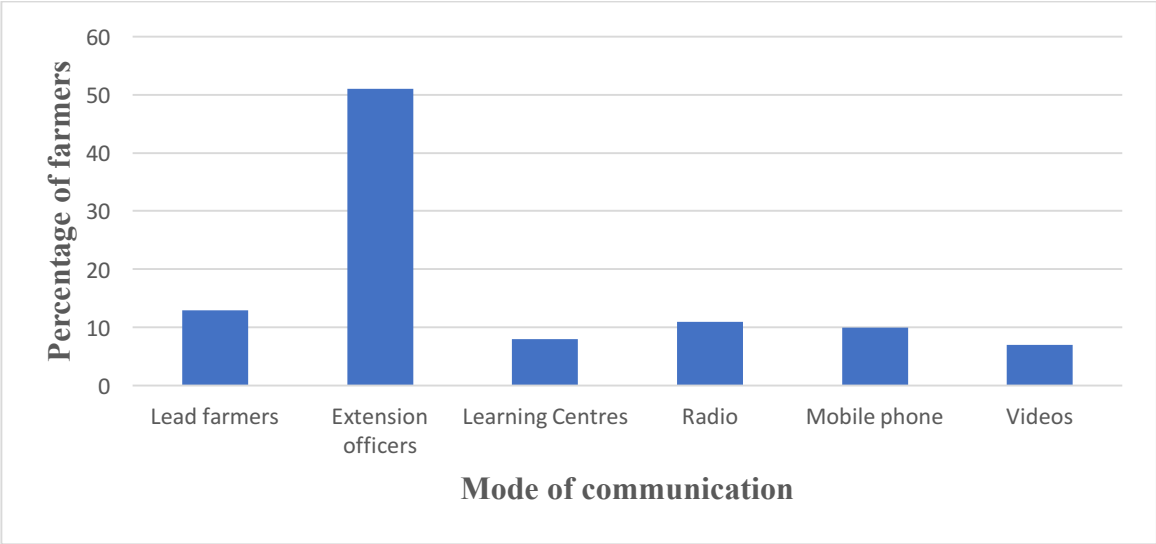

Figure 7. Preferred mode of communication by farmers

Furthermore, education levels determine the type of communication tools to use in the dissemination of agricultural information to smallholder farmers. The cross-tabulation (Table 9) indicated that 58% of the primary educated and 42% with no education farmers preferred using the extension agents as the mode of communication for diffusion of the ISFM. Secondary educated farmers also preferred the extension agents and lead farmers. Tertiary education and adult learning were not used for comparison because of few observations. The lead farmers and mobile phones were also used by farmers with no education. The radio was mostly preferred by the primary educated farmers, which made the majority of the farmers in Ulongwe EPA. The correlation between education and preferred mode of communication was significant with X-squared = 32.35, d.f = 20, P = 0.03968. Therefore, the cross tabulation showed that the best communication channels to use for farmers that are illiterate were the extension officers, lead farmers and mobile phones (calling). These can be supported by the radio and learning centres to increase their knowledge on ISFM practice. The literate farmers had more access to information through different means than illiterate farmers. Primary and secondary educated farmers were able to obtain information from all the communication tools but continued to prefer using the extension officers as the main communication tool to use in delivering information about the ISFM practice.

Table 9. Percentage of education by preferred mode of communication

	Education					
Communication Tools	Primary	Secondary	Tertiary	No education	Adult learning	Total (%)
Extension agent	58 (32)	39(5)	0(0)	42(8)	(0)	51(45)
Radio	15(8)	8(1)	0(0)	5(1)	(0)	11(10)
Lead farmers	7(4)	30(4)	0(0)	21(4)	(0)	13(12)
Mobile phone	7(4)	8(1)	100(1)	16(3)	(0)	10(9)
Learning centre	6(3)	15(2)	0(0)	5(1)	100(1)	8(7)
None	7(4)	0(0)	0(0)	11(2)	(0)	7(6)
Total	**100(55)**	**100(13)**	**100(1)**	**100(19)**	**100(1)**	**100(89)**

The government extension service was preferred because of feedback, familiarity and accessibility to farmers. In this way, farmers were able to ask questions on the practices and feel recognised by the government. Farmers stated that feedback with extension officers was more important for better implementation. Therefore, the section below will discuss the most effective communication channels used by the CABMACC project according to farmers' perspective.

6.5.1 The role of extension officers in the dissemination of ISFM practices

Agricultural extension officers transfer information from researchers to farmers. The role of the extension officers was to advise farmers to make sure appropriate farming practices are implemented to achieve best results. Activities of the extension officers included training, sensitizing and supervising farmers on farming practices (Vanclay, 2004). Extension officers had the opportunity to improve crop productivity through transferring of knowledge at the right time. According to Lweya and Vedeld (2008), extension services contributes to increased adoption of agricultural innovation. Farmers pointed out that the best communication tool in the sections was the extension officers both from the CABMACC project and the government. This is in line with Rogers (2003) theory that face to face communication has the potential to persuade farmers to adopt new agricultural technologies. Following the household survey, interviews and focus group discussions, it was clear that extension workers were highly respected by the farmers and were usually the primary source of information.

In the initial phase of the CABMACC project, the Agriculture Extension Development Coordinator (AEDC) and the Agriculture Extension Development Officers (AEDOs) of the region were intensively trained about the ISFM principles by the CABMACC project to ensure that relevant

information was delivered to the farmers. This was done to increase the capabilities of the extension officers who were responsible for training lead farmers. Faulty training of extension officers implied that the whole information chain will be fallible. Some of the information that the extension officers delivered to farmers include manure and crop residue management, soil and water conservation, proper spacing and application of agricultural inputs, early planting and pest and disease control. Farmers reported that the extension agents were effective in training them on proper farming practices through demonstration trials. Demonstration trials improved farmers knowledge through observing and experimenting with ISFM practice that led to proper implementation in their fields.

The CABMACC ISFM project had their own extension officer in Ulongwe who made regular visits with the farmers. The local officer distributes inputs to CABMACC farmers, monitored the progress of the field trials that have been implemented and provides advise on proper adoption of ISFM. The CABMACC extension officer reports the findings to the ISFM project coordinator in Lilongwe University of Agriculture and Natural Resources (LUANAR). Generally, extension officers contributed to the smooth flow of information in the area because of their familiarity with the region, which increased farmers' willingness to adopt the ISFM practice on their farms.

The extension agents have been effective in delivering information in Ulongwe EPA. Non CABMACC farmers during focus group discussions reported that they had started implementing ISFM practice, especially intercropping of legumes such as pigeon peas and cowpeas with maize, manure and crop residue application in their fields to improve soil fertility. AEDOs and the CABMACC local officer also reported that they had observed non-CABMACC members adopting the practice. And they were sometimes called to provide advice on non-member's farms on how best to implement the ISFM principles. However, these farmers lacked access to knowledge and inputs that CABMACC farmers had such as proper land preparation, handling of crop residues and pest management. The AEDO mentioned that they provided ISFM information to as many farmers as they could during village meetings. AEDO stated that they had limited resources to teach individual farmers in their fields about the ISFM practice.

Farmers reported that interaction with the extension officers gives them a sense of recognition by the government. This was reported during an interview with the village headman of Milambe, who stated that: '*For a long time his village has not been selected to promote new innovations that could improve*

the livelihoods of the people. When the AEDC approached him about the CABMACC ISFM project, he felt honoured that his village can become a model for other villages on using ISFM'. He further mentioned that he felt recognized by the government, which motivated farmers to actively participate in the CABMACC project. This was also reported by Lweya and Vedeld (2008) in the adoption of treadle pumps in Kasungu, Malawi that increased contact between extension officers and farmers enhanced the farmers confidence and trust.

The challenge faced by the extension workers as stated by the AEDOs was lack of financial resources to conduct regular follow-ups on the CABMACC practices. This hindered the ability of extension officers to visit and train villages on a regular basis to improve the implementation of ISFM principles. In addition, there are few extension officers in Malawi and one extension officer is usually responsible for more than 1,000 farmers (Fisher, Holden and Katengeza, 2017). Extension officers were supposed to cover 15-25 villages but in reality, the extension agents did not have the capacity to follow-up all the villages (Fisher, Holden and Katengeza, 2017). For this reason, villages that are close to main roads receive regular visits from the extension officers than those located farther from the main road. The extension coordinator of the EPA stated that '*although the extension officers (AEDO) movement was limited, they visited the villages as frequently as possible'*. The AEDC of Ulongwe EPA mentioned that each AEDO developed monthly plans for their sections to visit and follow up on improved farming practices promoted to farmers as part of the government agenda. The practices include conservation agriculture, ISFM, agroforestry and improved land management practices in Malawi.

The other problem that was stated by the farmers was that some of the farms were located far from the villages and it was extremely difficult for the extension officers to visit the individual farms to teach them on how to implement the practice. Because of this weakness, farmers sometimes misunderstood the information they were receiving through group training about the ISFM practice. Farmers were sometimes embarrassed to inquire about the ISFM practice when they were in groups, which led to misunderstanding of the practice. This was observed when farmers were asked to describe the ISFM practice and how they were implementing it on their farms in regard to intercropping and crop rotation. In addition, CABMACC local officer stated that he has observed some farmers that had poorly implemented the practice after being trained. Poor understanding of the practice leads to poor crop productivity that contributes to poor adoption. Therefore, farmers need to

be adequately and frequently trained on the ISFM practice to ensure understanding of the general principles for efficient implementation. According to the constructivism theory, active learning increases knowledge through practical experience that strengthens the knowledge of the learners. Lack of adequate training reduced the ability to transfer information to fellow farmers. Farmer to farmer extension approach assists extension officers in delivering extension services to farmers (Khaila, *et al*., 2015). Farmers indicated that the lead farmer approach was the best supplementary communication channel to extension officers.

6.5.2 Lead farmers approach

Lead farmer approach, also known as farmer to farmer extension, involves the use of farmers to disseminate agricultural information to fellow farmers (Khaila, *et al.,* 2015). Lead farmer approach was mentioned by farmers as one of the most efficient and cost-effective modes of communication in Ulongwe EPA. Lead farmers supported the work of extension officers by training and supervising farmers on their individual plots to ensure proper implementation of ISFM practice. Currently, there are over 12,000 lead farmers in Malawi working with agricultural extension service in the promotion of agricultural technologies (Fisher, Holden and Katengeza, 2017). Lead farmers, also known as early adopters according to Rogers (2003), were farmers willing to try the innovation, take risks and have leadership qualities. Lead farmers reported that the main motivation for being a lead farmer is to learn more about ISFM as well as to help other farmers.

In the CABMACC project, lead farmers trained follower farmers by demonstrating the practice on their farms. Lead farmers received inputs such as improved seeds of pigeon peas, cowpeas and groundnuts, pesticides, sprayers, and gumboots. Lead farmers were classified as groundnut lead farmer, pigeon peas lead farmer and cowpea lead farmer. Lead farmers and follower farmers received 1.8 kg of cowpeas, 10kg of groundnuts and 1.6kg of pigeon peas to establish the seeds on a quarter acre (Kabambe, 2015). A study by Fisher, Holden and Katengeza (2017) pointed out that lead farmers recommend innovations that they have implemented in their fields and have observed the benefits through own adoption. Farmers in Ulongwe observed benefits that the lead farmer obtained from adopting the ISFM practice that motivated them to implement the practice. Lead farmers were selected by the farmers and on a volunteer basis, which is cost-effective in delivering information to farmers. The lead farmers selected were motivated, hardworking, skilled, honest, accessible and willing to share information with other farmers. In Ulongwe EPA, lead farmers had better education

level and better access to information through interaction with the extension officers. According to Feder and Savastano (2006), farmers learn better from their fellow farmers, especially those with a higher social status.

Farmers reported that lead farmers organised meetings with them twice a month and visited their farms when they needed help with the implementation of the ISFM practice. Lead farmers used on-farm demonstration plot for the follower farmers to observe how the ISFM practice was done. According to Rogers (2003), trialability and observability of an innovation are some of the factors influencing the diffusion of an innovation. Farmers are most likely to adopt an innovation that produces tangible benefits, which reduces their uncertainty on the innovation. Furthermore, lead farmers knowledge improved with training and through own experience. The constructivism theory states that practical experience or active learning enhances knowledge of an idea. Farmers familiarize with the innovation through physical interactions and experiments that contributes to proper adoption of the innovation.

Lead farmers train follower farmers on proper spacing, crop residue management, ridge realignment and proper application of pesticides. Pesticides used were dimethoate and cypermethrin to deal with aphids, pod borers and thrips. This was reported as most effective because farmers were able to ask questions and share experience about the ISFM approach. Therefore, the lead farmer approach was one of the best communication tools as it could increase adoption of agricultural practices. Beside disseminating ISFM practice, lead farmers conducted other activities in the area such as organising farmers for meetings, reporting field data to extension officers, identifying problems such as pest outbreak and connecting farmers to extension officers. The extension officers contacted lead farmers first to organise meetings with the farmers. It is important for the lead farmers to be readily accessible with mobile phones or their homes should be easy to reach. Therefore, the lead farmer approach is crucial for the dissemination of ISFM. It is important to recognise that lead farmers' role is to supplement extension officers and not to replace them.

However, the lead farmer approach experienced some constraints in Ulongwe EPA. The main constraints facing lead farmers were lack of transport, motivation and financial assistance to organise activities. In addition, the success of the lead farmer depended on the motivation of the farmer. In the study area, farmers highlighted that some lead farmers were more concerned about their farms and

lacked the motivation to proactively promote the ISFM practice. Lack of motivation of the lead farmer caused conflicts in some parts between the lead farmer and their follower farmers. The constructivism theory states that motivation of farmers is important because lack of it leads to farmers not applying the knowledge obtained through training and not sharing the information with fellow farmers. Davis, Franzel and Spielman (2016) also state that increased dissemination of agricultural innovation depends on the motivation of the lead farmers.

Some lead farmers did not have mobile phones, which made contact with extension officers difficult. This reduced the effectiveness of information transfer because mobile phones ensure fast and easy message transfer. During the interviews, farmers reported that some farms are isolated and some lead farmers do not have bicycles to help them move around, this creates difficulty for the lead farmer to reach each farm for training. Therefore, it was either better to select lead farmers that have bicycles and mobile phones for easy information transfer. Or the government should make bicycles available to the lead farmers to improve their mobility. Additionally, follower farmers were supposed to share their seeds with non CABMACC members to ensure wider adoption of the practice. Follower farmers did not share seeds because of low yields in the last planting season as well as unwillingness to share with others. Responsibilities of the lead farmers and follower farmers should be clarified to make sure that information and seeds are being shared.

Another challenge of the lead farmer approach was that there were many organisations in the area that involved the same lead farmers. Some CABMACC lead farmers were also involved with other organisations as lead farmers because the most active farmers in the area were the same. This confused the lead farmers on what practice to teach the follower farmers since the practices were similar, especially conservation agriculture and ISFM, which delays the progress of the ISFM project. Lead farmers concentrated on the projects they received most benefits, which affected the adoption of the other practices. According to the CABMACC extension officer, some CABMACC farmers received inputs to implement the ISFM practice but never did, instead they had joined other organisations to receive more inputs.

In order to increase lead farmers motivation, incentives need to be improved. It is important to recognise that incentives should be moderate because strong incentives may produce undesirable consequences. Consequences include changed lead farmers behaviour as well as changed attitudes of

follower farmers towards the lead farmer. It is important to note that lead farmers motivations are different. The extension officers and CABMACC officials should identify what motivates the lead farmers in the area to provide proper incentives. Incentives include the provision of inputs, training, visits from researchers, increased contact with extension and participation in decision making about the project. Other incentives for lead farmers are recognition by the ISFM project, which may include the provision of certificates or public recognition (Kundhlande, *et al.,* 2014). In the sections, some lead farmers reported that their motivation in the project could increase through field visits to other regions to share the experience with other lead farmers on the project or travel to Bunda campus to be trained on the practice.

6.5.3 Radio programs

Listening to agricultural information through the radio provided a great opportunity for the dissemination of the ISFM practice to a wider population. Farmers indicated that radios motivated them to adopt the practice because they listened to what other farmers from different parts of Malawi were doing and the similarities in their implementation. They also pointed out that listening to themselves speak on the radio made them feel part of the project, which encouraged them to distribute the information to friends and family. Farmers stated that after listening to the radio in their radio listening clubs established by the CABMACC project, they were supposed to discuss, implement and share the newly obtained information.

Some of the common radio programs that farmers listened to in the area were *ulimi wa lero* on Radio 1, *Tipindule ndi ntedza* on the Zodiak radio, *mlimi wozitsata ndi wamakono* on the Zodiak*, ulimi ndi nyengo, mlerathaka, phindu mu ulimi* and *ulimi ndi business* on the zodiac. Farmers reported that the message they obtained from the radio programs were conservation agriculture (*ulimi wa mtayakhasu*), legumes management, Sasakawa, plant spacing, horticulture, agribusiness, pests' information and crop residue management. The main radio stations available to farmers in this area were MBC Radio1, Zodiak, Radio Islam, Ufulu radio and YONECO Radio station. YONECO Radio station was a community radio station and the others were national broadcasting stations.

Farmers under the CABMACC project were encouraged to take notes of the information to facilitate discussions as well as to ask the extension officers to clarify on parts they did not understand. Radios complemented extension workers, especially in isolated areas where extension officers rarely visited.

Radios provided opportunities for the illiterate farmers because it did not require them to write or read. Furthermore, radios were cost-effective in broadcasting information because the information reached more people than the extension and lead farmers. Rogers (2003) supports the use of mass media as the most effective channel for the diffusion of an innovation. The benefits of using the radio were higher than the cost of investing in developing radio programs. Radios proved to be effective in delivering information to the farmer. Farmers (non CABMACC members) during interviews stated that they adopted the ISFM practice after hearing about the benefits of ISFM on the radio and from observing CABMACC farmer's fields. Farmers reported that they had started incorporating crop residues in the fields after harvesting.

However, some CABMACC farmers reported that they had not started listening to the radio in their radio listening clubs because of low levels of income to purchase batteries for the radios. Farmers pointed out that they will actively start listening to the radio after the rainy season because they were occupied with their farming activities. Only two radio listening clubs had been able to discuss the information from the radio. The farmers suggested that the best radios in the area were solar radios.

Furthermore, farmers indicated that out that lack of feedback (one-way communication) was the main challenge with radios. When farmers have questions about the ISFM practice they wait for the extension officer next visit to the village. Farmers also reported that the radio programs were on specific dates and times and once missed on those days then they did not have access to the information.

The CABMACC extension officer indicated that the radios in some parts of the region were increasing tensions between the lead farmer and the follower farmer and sometimes even with the village headman. The conflicts rose because of lack of clarity when providing the radios to the lead farmer. It is best to clearly state the purpose of the radios to the community that it is not personal but for enhancing their knowledge about the ISFM practice. In some instances, the lead farmer did not gather radio listening clubs, which frustrated the follower farmers and the CABMACC extension agent had to intervene to resolve the conflicts. The CABMACC local officer also mentioned that some of the conflicts in the area were caused by cultural problems. Some male lead farmers experienced tensions from the follower farmers because of the matrilineal aspects of the area.

6.5.4 Communication through mobile phones

Mobile phones were reported by farmers as good communication channels because of the fast delivery of information. Mobile phones reduced the cost of transportation for extension officers as information could be delivered through text messaging or calling the farmers. This ensured quick information transfer and increased farmers contact with extension officers. Mobile phones were flexible because farmers were able to change plans on time with extension officers in cases of unplanned activities in the villages such as funerals and social events. Mobile phones strengthened the capability of small-scale farmers by obtaining relevant information on time to improve the ISFM practice. Farmers can use mobile phones to gain access to information about the weather forecast, pest outbreak, the market for the crop products and guidance from extension officers on improved farming practices (Aker, 2011). However, the use of mobile phones in the area was limited because of lack of mobile phones and those that had, did not use them for agricultural purposes. Moreover, this area did not have access to electricity, which created battery charging problems during emergencies as the nearest charging stations were in towns.

Generally, the main challenge with mobile phones was affordability and lack of local content. The AEDO and CABMACC project only used mobile phones to contact farmers when they wanted farmers to organise. In this regard, there was no feedback between farmers and extension workers because farmers could not afford to send text messages. So far, the project had not made the initiative to use mobile phones to transfer agricultural information. In Kenya and Zimbabwe, voice-based audio files have been uploaded to the mobile phones to make agricultural information readily available to farmers (Aker, 2011). The project is missing out on an opportunity to use mobile phones to enhance the diffusion of the ISFM practice. This could be improved through collaborating with phone service providers to make agricultural information transfer cheaper, include local content and orient farmers on how they can utilize their phones to transfer information on markets and ISFM practices to each other. During data collection, mobile phones proved useful, especially when organising meetings with lead farmers in the region. Farmers in the area should be encouraged to use mobile phones to exchange agriculture information with fellow farmers and relative. This has the opportunity to increase the diffusion of ISFM principles to many people from different parts of Malawi.

6.5.5 Learning centre approach

Learning centres also known as integrated farms were established to demonstrate the implementation of ISFM practice to farmers. Learning centres were used by lead farmers and extension officers to train follower farmers on proper implementation of the ISFM package. The objective of the learning centres was to demonstrate through practical experience how to obtain good yields with pigeonpeas, cow peas and groundnuts and to achieve best crop rotation. The main information learnt from learning centres was the use of good source of seeds of improved varieties, planting timing, ridge spacing for efficient use of land, rotations with legumes and management of legume crop as an alternative cash crop. The learning centres were established on a half-acre of land (0.1ha) in Chitseko, Mulambe, Chibwana and Hindahinda section.

According to Rogers (2003), demonstration trials have the potential to increase adoption because farmers observe the performance of the innovation in the trial fields that encourage them to replicate in their farms. In learning centres, farmers observed what others have benefited from the ISFM practice to improve their farming strategies. Learning centres increased farmers confidence and encouraged information sharing with other farmers. Farmers reported that the learning centres had the potential to increase the adoption of the ISFM practice. The public extension officers suggested that the project should also consider introducing Farmer Field Schools (FFS), which is a very effective way of disseminating agricultural innovations. The capacity of extension officers in areas where CABMACC was operating was limited and FFS plays a crucial role in exchanging knowledge.

FFS is a group based learning process that encourages interaction of the extension and farmers to improve farm productivity (Chepkoech, 2015). FFS encourages farmers to experiment and innovate to increase their understanding of agricultural practices that encourages them to introduce the practices in their farms (Hiller, *et al.,* 2009). In FFS, extension officers are mainly facilitators and farmers are the main actors in the learning process. This promotes information sharing among farmers, which empowers them to adopt the practice, learn new agricultural technologies and discover opportunities available to them as farmers in the region. According to the AEDO, FFS are beneficial for the adoption and dissemination of the ISFM practice because farmers knowledge on soil fertility improvement technologies improves.

6.5.6 Print media

Print media was one of the supporting communication tools promoted by the CABMACC project. The CABMACC project distributed brochures and leaflets to farmers to increase their access to information about ISFM practice. Leaflets contained information on ISFM principles and guidelines on how to implement the practice. Leaflets included information on the benefits of legumes, importance of crop residues and pictures of ISFM. The leaflets were in Chichewa, which allowed farmers to read and understand the information. Farmers reported that leaflets and posters were good for disseminating the practice because they supported the radio. Farmers were able to establish the ISFM practice by imitating as demonstrated in the leaflets.

However, farmers reported that print media was only good for farmers that could read and was least preferred by most farmers. This was supported by Ariyo, *et al.*, 2013, in a study of extension tools in rural Nigeria found that print media was least effective in disseminating agricultural information due to low literacy levels. Ndilowe (2013) found similar results in Lilongwe, Malawi, where print media was least preferred by farmers as a means for distributing conservation agricultural information because of low literacy levels and costs of making leaflets and brochures. Therefore, print media in Ulongwe EPA can be used to support other communication tools.

6.5.7 Video/digital storytelling

Participatory videos comprise the participation of communities in making a film that is accessible to them. PVs organises farmers to implement innovations by communicating their experiences through the videos (Colom, 2010). Farmers reported that videos were very important for the adoption of the ISFM practice. Videos contained demonstration features that made it more attractive to farmers, and when joined with other extension services had the opportunity to effectively disseminate ISFM packages to farmers. A study by Chepkoech (2015) on participatory videos in Kenya indicated that videos were most effective in isolated areas that had minimal contact with extension officers. Farmers reported that a film was shown once in the area and it motivated them to try out the ISFM practice. The video encouraged the farmers to adopt the practice and increased their sense of recognition as being part of the CABMACC project. The videos were also helpful since farmers saw what other farmers were doing in the district. This encouraged farmers to implement and learn new things about how the ISFM practice was being implemented in other areas. This was beneficial for CABMACC farmers because they had never gone on field trips to observe how other farmers were adopting ISFM.

The videos were a sustainable communication tool if they were shown frequently to the farmers. However, it was expensive for the project to show videos regularly to the farmers because the area had no electricity.

Digital storytelling was supposed to be implemented as part of the communication tools but had not been introduced in the area. Digital storytelling has the potential to show the ISFM process, which is helpful for farmers to grasp information faster. Digital storytelling increases understanding of ISFM practice because digital stories are short and clear. This study did not examine the effectiveness of digital storytelling in the dissemination of ISFM because it has not yet been implemented.

To sum up, the communication tools used in the CABMACC project were very relevant for the adoption and dissemination of the ISFM practices. The communication channels complemented each other to ensure wider dissemination. It is important for the government to promote the use of diverse communication tools to ensure sustainability. Some communication tools were more applicable than others. In the CABMACC ISFM project, the most effective communication tools were lead farmers, extension officers, learning centres and radios. These communication tools allowed non CABMACC farmers to receive information on ISFM principles. Non CABMACC farmers reported implementing the ISFM practice, especially crop rotation of pigeon peas and cow peas with maize. Farmers reported adopting the practice due to observed benefits that CABMACC members incurred in the area in the last growing season. Balaka district experienced drought in 2015/2016 cropping season and most crops dried up. Despite the drought, CABMACC farmers managed to harvest crops on the small trial fields. This motivated both CABMACC members and non-members to implement the ISFM practice on a wider piece of land in the second year of the project. This was an indication that ISFM information was reaching more farmers in the area contributing to adoption by the wider population.

In terms of cost-effectiveness, lead farmers, radios, learning centres and mobile phones were more affordable. Lead farmer volunteered to work in the CABMACC ISFM project, which reduced the cost of transportation for the extension officers. Lead farmers supported the work of the extension officers by training follower farmers on their individual fields. Radios broadcasted ISFM information to a wider population thereby reaching more people than the extension agents. Mobile phones enabled the extension officers to deliver information to farmers quickly and on time. The cost of sending a text message to farmers was lower than the cost of the extension officers to travel to the villages to

deliver the agricultural message. Therefore, lead farmers, radios and mobile phones need to be promoted to reach more farmers in the region. The most expensive communication tools were extension agents and print media. Although the extension agents were expensive to manage, they were the most effective and preferred in disseminating ISFM information. Print media could be used to support other communication tools.

The communication tools had opportunities and constraints in Balaka. Constraints of the communication tools included problems with lead farmers and radios. Regarding radios, farmers need to be orientated on how to use the information they obtain from the radios. Lead farmers and follower farmers need to be clearly informed of the purpose of the radio to avoid future conflicts. Furthermore, lead farmers need to be regularly trained and go on field visits to other parts where CABMACC project has been implemented as an incentive.

In addition, selection of lead farmers needs to be reformulated because some lead farmers were passive, which discouraged follower farmers. In other cases, lead farmers had multiple organisations, which meant limited time for the project. Lead farmers were encouraged to delegate to follower farmers some responsibilities but none of that has happened. Because of this, it is best that the lead farmers responsibility should be circulating among follower farmers. Farmers should select new lead farmer after a year. In other words, lead farmers activities should be evaluated by the farmers and allow them to choose a proactive lead farmer that engages them. This will encourage lead farmers to do a good job to ensure that the follower farmers are satisfied with his/her activities as a lead farmer.

6.6 Farmer's reasons for adopting ISFM practice

Motivations of adopting ISFM influence the wider adoption of the ISFM practice in Balaka and the sustainability of the project. In this study, 60% of the farmers reported that the main reasons for adopting ISFM practice were observed benefits from other farmers that had implemented the practice. About 12% reported that they adopted to receive inputs such as commercial seeds, fertilizers and pesticides that assisted in improving crop productivity. Farmers also stated that early harvest (9%), weather changes (6%) and access to the extension officer (7%) were the reasons they joined the ISFM project (Table 10). The reasons mentioned in Table 10 made the use of various communication tools relevant to the dissemination of ISFM practice. Observed benefits were the determinant factor for

farmers to adopt new innovations. Communication tools that highlighted ISFM benefits should be encouraged such as learning centres, videos, lead farmers and field demonstrations.

Table 10. **Farmer's main reasons for adopting ISFM (N=89)**

Reasons	**No. of farmers**	**Percentage**
Observed benefits	54	60
Receive inputs	12	13
Get early harvest	8	9
Access to extension service	6	7
Weather changes	5	6
Gain knowledge	2	2
None	2	2

With regard to farmers reasons for not joining CABMACC, 49% reported lack of awareness about the arrival and benefits of the project in their villages. The information about CABMACC was not well distributed in the villages and most of the farmers missed out on the opportunity to join the group. Table 11 shows that 24% of the farmers reported that the project only required few people to join. The CABMACC project needed about 33 farmers from each village in the four sections that were willing to spare a small proportion of land to implement the ISFM practice. Only 15% reported that they were not willing to take the risk of implementing ISFM on their farms because of the small farm size used for subsistence needs. However, through observed benefits, farmers had started to implement the practice on their own and were interested in joining the group. Only 10% of the farmers reported that they still preferred conventional farming because of stability. CABMACC members joined the project to learn more about ISFM (55%). About 36% reported joining to gain access to inputs and 9% joined because of curiosity about the CABMACC project (Table 11).

Table 11. Farmers reasons for not joining CABMACC

Reasons	No. of farmers	Percentage
Lack of awareness	44	49
Few people required	21	24
Health problems	1	1
Risk and uncertainty	13	15
Used to old farming practices	9	10
Joined other groups	1	1
Reasons for joining CABMACC project		
Reasons	No. of farmers	Percentage
To learn about ISFM	49	55
Access to inputs	32	36
Curiosity	8	9

6.7 Use of communication tools by gender in the adoption of ISFM

Majority of CABMACC farmers that adopted ISFM practices were female farmers. About 67% of the female farmers had adopted the practice through communication tools such as radios, lead farmer, and extension officers (Table 12). This was because of cultural reasons and women's willingness to improve their households through diversifying their source of livelihoods with new agricultural technologies (Ellis, 2000). Most men became interested in joining such projects through observed benefits such as improved crop performance and access to inputs. Generally, motivation determined the sustainability of the practice. If the reason for joining the CABMACC project was to receive inputs, the probability of farmers returning to the conventional farming practices once the project ends was high. It is important for farmers to be properly trained because, with information, farmer's motivation changes when they become aware of the benefits of ISFM. In addition, ISFM projects need to properly target the communication tools that address women's needs to ensure the adoption and dissemination of ISFM practice such as lead farmers, extension officers and mobile phones.

Table 12. **Adoption of ISFM practice using communication tools by gender**

	Adopted ISFM practice		
Gender	Yes (%)	No (%)	**Total (%)**
Female	67 (37)	71 (24)	**69 (61)**
Male	33 (18)	29 (10)	**31 (28)**
Total	**100 (55)**	**100 (34)**	**100(89)**

6.8 Diffusion of ISFM practices in Ulongwe

The information about ISFM was readily available in Ulongwe EPA. Adoption and dissemination of ISFM depended on the information and knowledge of farmers. The ISFM project used different methods of demonstrating the practice to farmers to ensure that farmers were aware of the benefits. This was done through trial plots (learning centres) where farmers observed the benefits and experimented to increase their knowledge on the ISFM practice. In addition, ISFM principles were easy to manage by farmers and compatible with local needs. For instance, intercropping maize with legumes had been practised by farmers before the project was established in this area. ISFM offered benefits such as better crop yields because of improved soil fertility and diversified farmers livelihoods through selling legumes. These characteristics assisted farmers in deciding to adopt the

ISFM practice. Generally, ISFM provided relative advantage, compatible with local needs, simple to establish and observable benefits, which contributed to the diffusion of ISFM approach. This was in line with Rogers (2003) diffusion of an innovation theory that attributes of an innovation such as relative advantage, compatibility, complexity, trialability and observability contribute to diffusion of an innovation. These factors reduce the uncertainty of farmers in deciding to adopt an innovation.

The ISFM project used different types of communication channels for wider dissemination of the ISFM information. The decision on the appropriate communication tools depended on the socioeconomic characteristics of the farmers. For example, education level allowed the researcher to assess the best communication tool to use for transmitting information. The use of interpersonal and electronic channels improved access to ISFM information and encouraged farmers to adopt and distribute the ISFM practice. Rogers (2003) supports this by stating that appropriate communication channels are most important in influencing people's perceptions and plays a role in increasing farmers knowledge that assist in making decisions about adopting an innovation. In addition, farmers adopted innovations at different times. Rogers identified farmers as early adopters to laggards. Late adopters require more information about the practice before adopting.

However, the diffusion of innovation theory has limitations. The limitations include focusing on few farmers, early adopters, with the assumption that the innovation will trickle down to the late adopters leading to the adoption of the innovation by all farmers. This was noticed in the ISFM project with lead farmers being the main focus of distributing information besides the extension agents. Although the lead farmer approach was effective in transferring knowledge, some lead farmers were not productive. These lead farmers continued as lead farmers because they had better contact with the extension officers and were influential in the community. In this way, some farmers were left out from the project.

In the ISFM project, farmers interacted with the lead farmers and extension agents in the integrated farms (learning centres) developed by the project. Learning centres encouraged farmers to learn, share their own experience and observe the practice. This enhanced farmers knowledge on ISFM that led to proper adoption of ISFM principles. The constructivism theory supports participatory approaches to build knowledge through experience. The ISFM project recognised the benefits of using diverse sources of information. Farmers reduced uncertainty when they received ISFM information from

different sources such as from the radio, NGOs and the CABMACC project. This strengthens their decision to adopt ISFM. Constructivism theory supports this by encouraging the use of many sources of information to improve knowledge that allows learners to construct their own interpretation. Therefore, constructivism theory assisted in assessing the behaviour of farmers and the quality of knowledge obtained through learning.

The findings of the study pointed out that farmers that belonged to social groups were most likely to adopt ISFM. This was because farmer influenced each other into adopting the practice with tangible benefits. Farmers through peer pressure persuaded others to implement ISFM in their fields. This is supported by both constructivism theory and the diffusion of innovation theory that social systems and time are some of the determinants of diffusion of an innovation. Constructivism theory states that learning requires adequate time for farmers to be exposed to the new idea and revisit the idea to acquaint themselves with the topic through the process of learning. This reinforces knowledge of the topic. The constructivism theory also suggests that learning is a social process, where interactions with the communities improve knowledge.

Farmers that were more interested in learning about ISFM had a potential to disseminate the practice. Motivation assisted in determining the sustainability of the ISFM project. Farmers that joined ISFM project for the inputs are most likely to abandon the practice once the project is finished. Furthermore, the farmers that joined the ISFM project to improve their livelihoods benefit a lot from implementing ISFM, which contributes to the sustainability of the project. Lead farmers were able to motivate follower farmers to implement the practice through observed benefits incurred by the lead farmers. According to the constructivism theory, motivation to learn something new influences the dissemination and adoption of new ideas.

Therefore, the findings of the study were in line with the diffusion of innovation and constructivism learning theory. The theories predicted farmers behaviour and helped to understand farmers interpretation of the obtained information. Constructivism theory allowed the researcher to assess farmers knowledge and perceptions that determined the sustainability of the ISFM project.

6.9 Summary of communication in the CABMACC project

Access to agricultural information is crucial for small-holder farmers to improve their agricultural output. Communication tools play a big role in the dissemination of relevant information to farmers. Farmers highlighted the effective communication tools in the dissemination and adoption of ISFM in Ulongwe EPA such as extension officers, lead farmers, mobile phones and learning centres. Print media and digital storytelling were least used by the farmers. Videos and radios were identified as one of the best communication tools, however, these channels had not been properly implemented. There is a need to develop these communication channels to effectively disseminate the information to farmers. Additionally, use of multiple sources of information increased farmer's knowledge and confidence in the ISFM practice. Farmers implemented agricultural technologies when the information came from different sources using different communication tools. Some farmers understood concepts through observing while others learnt through practice. Therefore, using different approaches to provide information to farmers is crucial for wider dissemination and adoption of ISFM practices in Balaka. Figure 8 shows how the information flows in the ISFM project in Balaka.

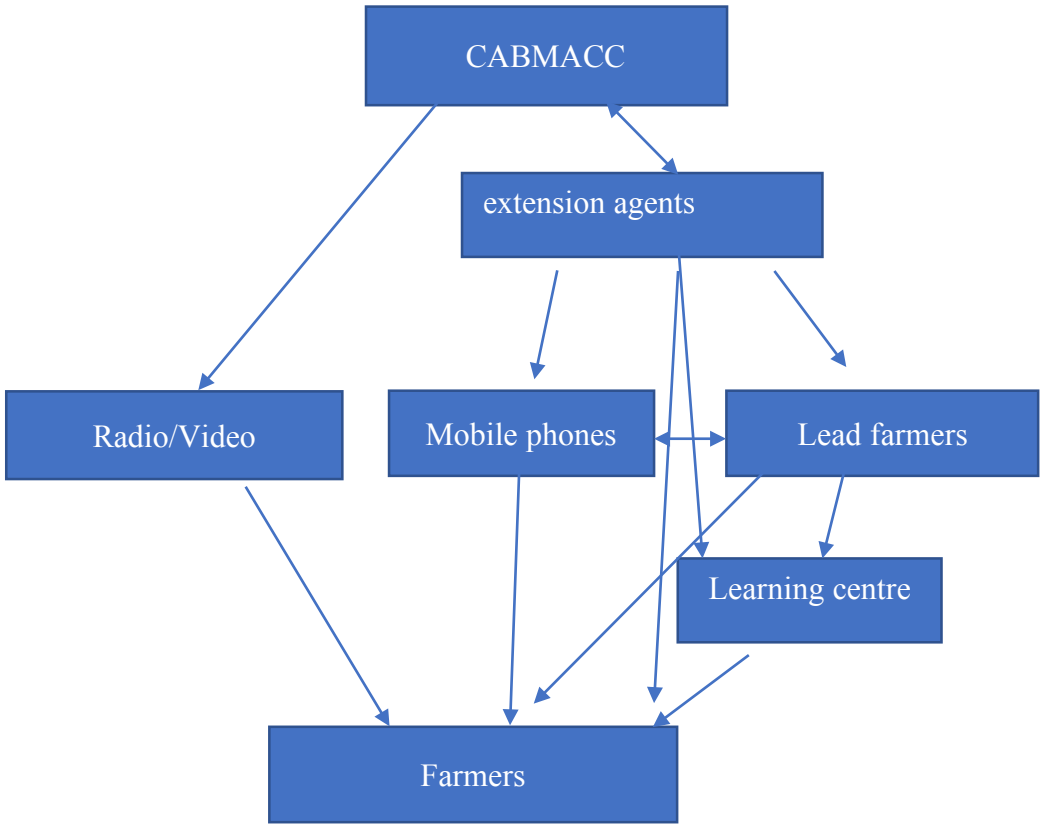

Figure 8. Information flow in the ISFM project in Ulongwe EPA

According to Pannell *et al*., (2006), multiple communication tools, repetition of information, multiple sources of information and peer pressure are most effective for wider dissemination of agricultural information. Relying on single extension approach, for instance, group extension or print media has limited impact on the diffusion of ISFM than more diverse approaches. Furthermore, different farmers required different learning approaches and preferred using different communication channels to meet their specific information needs. Therefore, farmers need to be frequently trained for the ISFM principles to be internalised for effective implementation of the ISFM practice.

To ensure effective communication in the region, the CABMACC project should work together with other organisations promoting ISFM in the region to harmonise the information that farmers receive. According to Chilongo, Ngwira and Kabambe (2017), farmers that belong to agricultural groups are more open to change and willing to implement new innovations. Therefore, having many organisations providing similar information is an advantage for faster dissemination of ISFM information. Table 13 summaries the opportunities and constraints of the communication tools used by the CABMACC project in Ulongwe EPA, Balaka district.

Table 13. Summing up the communication tools in the CABMACC project

Communication tools	Opportunities	Constraints
Extension officers	• Transfer agricultural knowledge to farmers • Trusted by farmers • Connects farmers to researchers • Monitor farmers practices • Provides advise on proper implementation • Distribute inputs to farmers • Feedback	• Lack of financial resources • Poor transport • Shortage of extension staff • Inadequate interaction with researchers • Inadequate interaction with farmers
Lead farmers	• On farm training • Accessible • Reached more farmers • Cost effective • Increase adoption	• Low literacy rate • Lack of transportation • Lack of incentives • Increased number of organisations

Radio	• Information is accessible to wider population • Encourages farmers • Available to illiterate farmers • Does not require intellectual exertion	• Specific dates and times • Cost of battery • Increased tensions • Difficult to find the appropriate station • One-way communication
Mobile phones	• Faster and timely information delivery • Various information accessible to farmers • Flexible (Voice and text)	• Low income levels and high cost • Low literacy • Lack of electricity • Lack of support infrastructure
Learning centres	• Benefits easily observed • Farmers learn through practice • Encourages sharing of experiences • Two-way communication	• Not properly promoted • Low participation of follower farmers
Participatory videos	• Watch other farmers ISFM implementation • Strengthens farmers belief in the practice • Imitate the practice in their fields • Increases adoption rate	• Lack of electricity • Expensive to operate • Lack of feedback
Print media (leaflets and brochures)	• Easy to understand • Easy to distribute • Reaches more people	• Low literacy rate • Expensive • Lack of knowledge on how to use the information • Lack of feedback

CHAPTER SEVEN

7.0 CONCLUSION

The study assessed the impact of communication tools in the dissemination of ISFM in Ulongwe EPA, Balaka district. The study analysed the effectiveness of the communication tools and the role of using different sources of information in the adoption of ISFM practices. Farming and household characteristics assisted in evaluating the best-fit communication tools to properly disseminate ISFM information. Characteristics such as education level, access to mobile phones, radios and literacy rate. The study also identified some traits that assisted dissemination of ISFM in this area such as contact with the extension officers and lead farmers, training and background knowledge (NGOs or traditional knowledge). Farmers stated that communication tools used by the ISFM project provided relevant information for proper implementation of the practice. However, some communication tools were more effective in disseminating information than others in the area.

Farmers identified the most effective communication channels for disseminating ISFM information. Government and ISFM project extension officers and lead farmers were reported as the most effective communication tools to use. Radios, learning centres, mobile phones and videos as supplementary tools to extension agents and lead farmers. Print media were least preferred by the farmers. Interpersonal communication tools were most preferred because of the feedback mechanisms, which allowed the extension officers to understand farmer's needs. In terms of lead farmer approach, it was observed that farmers learn best from fellow farmers and the lead farmers motivated the other farmers to implement the practice. In addition, lead farmers and mobile phones were effective for transferring information to farmers located far from the extension offices. This reduced the cost for the extension since extension officers lacked transportation to regularly visit and train farmers in their fields.

Extension officers, lead farmers, radios, learning centres, mobile phones and videos were effective for the illiterate farmers. This reduced communication barrier that illiterate farmers experienced with extension. Radio listening groups proved useful in other areas and the information reached beyond the intended target. Learning centres (demonstration plot) encouraged farmers to implement ISFM practices because farmers observed and discussed the ISFM practice, which increased their knowledge. Mobile phones were also effective in terms of quick transfer of information to farmers and easy contact with extension. However, radios and videos had not been properly promoted by the project. The illiterate farmers had not benefitted from these communication tools. It is important for

the ISFM project to recognise that different communication tools were applicable to different farmers and that farmers learn differently. Some farmers learnt through visual modes and others through audio. Some farmers were fast learners and others required repetition of information to grasp the ISFM concepts. Training of farmers in ISFM should be frequent by using diverse communication tools that enhance farmers knowledge and increases their confidence in the practice. This contributes to the adoption and diffusion of the ISFM packages.

Different sources of information proved relevant for the adoption of ISFM in Ulongwe EPA. Farmers stated that they receive information about improved agricultural practices from NGOs, traditional knowledge (fellow farmers), radios, extension and the ISFM project. Interaction of farmers with different sources of agricultural information strengthened their knowledge and trust in the ISFM practice. This plays a crucial role in the adoption and dissemination of the ISFM innovation. Therefore, the ISFM project should collaborate with other organisations and the government in the area to ensure that farmers receive the same information. Harmonising the message improves the quality of knowledge of farmers that assist farmers in making informed decision on adopting agricultural technology.

Furthermore, the extension officers and farmers need to take an active role in the project. The extension officers in the ISFM project were trained on the ISFM principles. Extension officers need to be frequently trained on the technical aspects of the practice and communication skills to ensure appropriate adoption of ISFM for farmers to reap the benefits. Furthermore, the goal of the ISFM project was to improve the capacity of the extension services and so the public extension should participate in the decision making to ensure sustainability of the ISFM practices. Extension officers' credibility was high in this area as farmers respected and trusted the information they delivered. This provides a great opportunity for the ISFM project to ensure wider dissemination.

Women participation was encouraged in the ISFM project. The project had more female members than men. Women were also selected as lead farmers. These lead farmers had a better chance of motivating and empowering other women in disseminating and adopting the practice. In Ulongwe EPA, women and men made joint decisions about their households, which contributed to increased dissemination of the ISFM practice. Most women joined village organisations to improve their livelihoods, which could be used as a platform to diffuse ISFM practices.

Generally, diverse communication tools and sources of information, frequent training and farmers involvement increased dissemination of ISFM practices. However, challenges such as poor infrastructure to support mobile phones, lead farmers lack of motivation and poor transportation, needs to be addressed for effective information transfer to farmers. Furthermore, the communication components of most organisations and the government need to be properly promoted and funded to improve farmers livelihoods. It is also important to understand farmers characteristics and information needs to determine the best communication tools to use for effective dissemination of ISFM principles in Ulongwe EPA.

CHAPTER EIGHT

8.0 Further research

This study mainly focused on exploring the communication tools used in the CABMACC ISFM project. The other aspects of communication that could be studied further were:

The effectiveness of videos in the dissemination of agricultural information. During interviews, farmers pointed out the importance of videos. It will be interesting to assess the capacity of videos in increasing farmers' knowledge of ISFM principles. To examine what kind of information can be transferred using videos.

Another topic to study is to analyse the role of social institutions in the adoption of ISFM in Balaka district. The findings can contribute to the proper establishment of similar projects in the district by understanding power dynamics in the villages.

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Appendices

Appendix 1: Household survey questionnaire

Survey questionnaires

Dear Sir/Madam
My name is Cecilia Munthali. I am a M.Sc student at the Norwegian University of Life Sciences (NMBU). I am writing my thesis on the opportunities and constraints of communication tools in the dissemination of ISFM in Balaka and I am interviewing farmers to answer my research. I am interested in the assessing the role of various communication tools in disseminating ISFM and its contribution to adoption of the practice.

You have been randomly selected by me using the ISFM project list and the list given to me by extension officer in this area. Participation in this interview is voluntary and you can choose not to participate. However, it would be helpful if you agree to answer the questions. You are also allowed not to answer questions that are making you feel uncomfortable. The answers are confidential and anonymous and will only be used for my studies.
If you have questions, please do not hesitate to ask

Interview Number		**Village**		**Time started**		**Date**	
Interviewer code		District		Time finished			

Section A: Household Information

1. Name:……..
2. Gender: (A) Male (B) Female
3. Age/ Year of Birth:
4. Education level: (A) Tertiary (B) Secondary (C) Primary (D) Other (Specify) …….
5. State household size:

Household size	**Males**	**Females**	**Below 15**	**15 and above**

6. How many household member take part in farming? ……..
7. Please state if you have any of the items mentioned below and number of each

Radio	Mobile phones	Television	Bicycle	Solar

Section B: Farm Assets

8. What is the total farm size……..

9. How long have you been farming on this land?……..Years.

10. What are the cultivation methods used, types of crops grown and yields for last season?

Tillage	Oxen ploughing	conventional hoe	other (specify)
Area			
Crop			
Yields			

11. Do you have livestocks? If yes, specify the number and type of animals

Bee keeping		Goats		Poultry	
Cattle		Pigs		Sheeps	
Other:					

12. What type of agricultural inputs do you use?

Type of inputs	commercial seeds	Manure	Fertilizers	Lime/Ash	Pesticides	Herbicides
Quantity						

13. Do you use labourer to help with farming activities and how much do you pay them?

Tillage	Planting	weeding	Harvesting	other

14. Did you sell any of the harvest from last growing season? state the crop and quantity.

Crop				
Quantity sold (Kg)				

15. What is your main source of income?

(A) Garden crops (B) Field crops (C) Cash crops (D) Livestock (E) Remittance (F) Charcoal

(G) Local trade (H) Other……

16. What are your main problems as a farmer?

(A) Lack of income to buy inputs (B) Lack of labour to cultivate (C) Poor health (D) Other……

Section C: Improved farming practices knowledge systems

17. Have you heard about improved farming practices? (A) Yes (B) No

18. From who do you get agricultural information about the improved farming practices?

(A) Traditional (Farmers) (B) Extension service (C) Scientific knowledge (D) NGOs (E) Other…….

19. Using a scale from 0= Not important to 5= Very important, please rank the sources of agricultural information you trust?

Sources of Information	0= Not important	1	2	3	4	5= Very Important	No opinion
Farmer to farmer							
Extension service							
Research							
NGOs							
Others							

20.Have you received information from other organisations on improved farming practices? If yes, please state the organisation……..

21. If yes, was the information you received different from the improved farming practices project?…….

22. Did the different sources of information help you to adopt improved farming practices on your farm?

(A) Yes (B) No

23. How often do you contact the extension service about the improved farming practices?……..

24. Does the information from different sources overlap?

(A) Yes (B) No Why?……

25. How effective is the knowledge sharing through Farmer Field School?

(A) Very Effective (B) Effective (C) Indifferent (D) Less Effective (E) Not effective

26. How often do you contact the lead farmers about the improved farming practices information?

……

27. What do you think is the reason most farmers adopt improved farming practices practices?

(A) Access to extension services (B) Observed benefits (C) Get early harvest (D) Receive inputs (E) Other…….

28. What is the reason for not adopting?

……

Section D: Communication tools

29. Have you been trained by the improved farming practices project? Yes……

30. How many times have you been trained by the improved farming practices project?……..times.

31. Why did you join improved farming practices project? (A) access to inputs (B) Curiosity (C)To learn about improved farming practices (D) Other……..

32. What kind of communication tools do you have access to exchange improved agricultural practices information? please rank the relevance of the communication tools. Using a scale from 0= Not important to 5= Very important

	0	1	2	3	4	5	Don't have
Radio							
Mobile phones							
Television							
Farmer Field Schools (FFS)							
Extension service							
Farmer to Farmer							

33. Which of the communication tools mentioned above do you prefer?……

34. How do you share improved farming practices information using the modern communication tools? …….

35. Have you changed practices from using the modern communication tools such as radios, mobile phones and FFS?

(A) Yes (B) No

If yes, which communication tool and why did they changed?……

……

……

36. What kind of practices have they not changed when adopting improved farming practices?

…….

37. What do you do after receiving information about improved agricultural practices?

…….

38. Which radio program do you listen to obtain information about improved farming practices?

…….

39. Do women have radio programs that encourages them to exchange improved farming practices practices? If yes, what is the name of the program?……..

40. What does it take for you to change practices to improved farming practices practices?

(A) Access to extension services (B) Observed benefits from other farms (C) Get early harvest (D) Receive inputs (E) Other……

41. Do you agree with the statement: Lead farmers' improved farming practices information transfer to local farmers contributes to the adoption of the practice?

(A) Strongly agree (B) Agree (C) Undecided (D) Disagree (E) Strongly disagree

42. Do you use mobile phones to receive improved farming practices information from extension officers?

(A) Yes (B) No

How?……..

43. What do you think about the use of different communication tools to disseminate improved farming

practices?……

44. How many times do you have contact with the extension officer about improved farming practices?…….

45. Do you have informal clubs to exchange agricultural information among farmers?

If yes, describe it……

46. What kind of improved farming practices knowledge does Farmer Field Schools disseminate?……

…….

47. Could you rank the most effective communication tools used in improved farming practices project for extension purposes? Using a scale from 0= Not effective to 5= Very effective

Communication tools	0= not effective	1	2	3	4	5= Very effective	No Opinion
Radio							
Mobile phones							
Extension service							
Farmer Field Schools							
Farmer to Farmer							
Lead Farmer extension							

Appendix 2: Focus group discussion checklist

Improved farming practices participating farmers

How did you learn about improved farming practices?

What motivated you to adopt improved farming practices on your farm?

What do you think about the agriculture information you are receiving?

Knowledge systems

What do you think about the different sources of knowledge used to disseminate improved farming practices?

(a) Traditional Knowledge (Farmers) (b) Scientific information (c) NGOs

(d) Extension service

Which of the knowledge sources do you trust or prefer?

Has the information assisted in decision making about adoption of improved farming practices?

Any overlaps or conflicting information from the different knowledge sources?

How do you deal with conflicting messages you receive from different sources? How do you decide on the best information from the different sources?

Efficiency of the communication tools

What communication tool do you prefer to exchange agricultural information?

Are the different communication tools assisting in adopting improved farming practices?

Have you changed practices after receiving the information?

Do you have informal organisations to exchange agricultural information?

How effective are the farmer field schools?

Do you incorporate your own knowledge about agricultural practices?

How can communication tools improve in distributing improved agricultural practices information?

What are the advantages and disadvantages of the different communication tools?

Non participating farmers

Have you heard about improved farming practices practices?

How do you receive agricultural information?

Why have you not adopted improved farming practices?

How do you evaluate the best practice?

What do you think about the improved farming practices project?

Have you implemented any component of improved farming practices on your farms?

Are farmers field schools accessible to everyone?

Appendix 3: Guidelines for interviews with key informants

1. What are advantages of using different knowledge sources in the dissemination of improved farming practices?
2. Have you noticed any overlaps with other improved farming practices or conservation farming organisations in the area? thus conflicting messages with the project.
3. Are the different knowledge sources contributing to the implementation of improved farming practices on their farms?
4. Are the number of farmers involved in the project increasing or decreasing? and why do you think there are changes?
5. Do you think the modern communication tools used in the project contribute to the wide dissemination of improved farming practices? Have farmers adopted the practice through communication tools?
6. What is the best communication tool used in the improved farming practices project?
7. What are the cost of setting up the communication tools?
8. What are the cost of radio programs and how many farmers are reached with radio programs?
9. Have you developed any radio programs specific for women needs in agricultural extension?
10. How are women needs incorporated in the project? in terms of communication needs