**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

**Faculty of Tropical AgriSciences**


# The Effects of Cooperatives on Farmers' Access to Agriculture Extension Services: A case of the Southern Province of Zambia.

MASTER'S THESIS

Prague 2022

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# Declaration

I hereby declare that I have done this thesis entitled ‘The Effects of Cooperatives on Farmers’ Access to Agriculture Extension Services: A case of the Southern Province of Zambia’ independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 14th May, 2022

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Samuel Mwanza

# Acknowledgements

I would like to render my unfeigned appreciation to my thesis supervisor Ing. Jiří Hejkrlík, PhD, of the Faculty of Tropical AgriSciences at Czech University of Life Sciences Prague. Whose guidance, support, and dedication during the work is priceless. This work carries with it the footprints of his constructive criticism.

I wish to thank the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, for the combined effort from the members of staff and their dedicated input into my studies. This study was made easier by the faculty's financial support towards my data collection.

To the Staff under the Department of Agriculture of the Ministry of Agriculture in Zambia, the Zambia College of Agriculture- Monze, and the farmers in the Southern Province of Zambia, I render my appreciation for their cooperation during my data collection exercise.

I would like to thank Ing et. Ing. William Nkomoki, Ph.D., Enock Siankwilimba Vincent Malata MSc, MSc, Ing. Ebenezer Donkor, Austine Nakanga MSc, Patricia Chileshe MSc, Precious Nanja BSc. For their immense support counsel during data collection.

My acknowledgements to my classmates for their valuable company and tireless help through out the academic journey.

To my mum Mrs Bethrine Mwanza, family, and friends for providing me with the encouragements through out the course of my studies.

Finally, thanks and praise be to God

## Abstract

Sustainable development demands targeting the rural populations which are at the heart of poverty. Majority rural populations thrive on small scale agriculture while operating under worst dynamic conditions which require quality and reliable information for sound decision making. Cooperatives have been cited to improve farmers' access to quality information through agricultural extension services. Although Zambia has for a decade now promoted cooperatives as a channel for extension service delivery, the effects thereof have not been examined. Using descriptive statistics, deductive content analysis, and ordered probit regression on data from 410 maize farmers comprising of 208 members and 202 non-cooperative members, the effects of cooperatives on smallholders' access to agricultural extension services in the Southern province of Zambia were analysed. Results showed that provision of extension services in Zambia was dominated by the public extension providers, followed by the NGOs extension providers and finally the private extension providers. Cooperative members also had significantly higher extension contacts and more confidence in extension agents than non-members. Prominent information pathways included public extension agents, radio, and cooperatives. Focus group discussions revealed cooperatives having deliberate initiatives for aiding members' access to extension services. Further, cooperative membership had significant positive effect on easier access to agricultural trainings, quality of trainings and quality of agricultural information. Other keys factors for improved access to trainings, and quality information included number of extension contacts, proximity to the extension office, gender of extension agent and increased social capital.

**Key words**: Information, Farmer groups, Ordered Probit Regression, Advisory services.

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## List of the abbreviations used in the thesis

| | |
|---|---|
| CAC | Camp Agricultural Committee |
| EO | Extension Officer |
| EAS | Extension and Advisory Service |
| FG | Farmer Groups |
| MAL | Ministry of Agriculture and Livestock |
| MoA | Ministry of Agriculture |
| PEA | Participatory Extension Approach |
| PSP | Private Service Provider |
| iDE | International Development Enterprise |
| TPB | Theory of Planned Behaviour |
| CFU | Conservation Farming Unit |
| DAPP | Development Aid from People to People |

# 1. Introduction

Poverty reduction is one of the most important global issues in contemporary discussions. The road map to sustainable development demands targeting the rural populations who are at the heart of poverty. About 58 per cent of the rural populations depend on agriculture for their livelihoods (FAO 2018). Rural farmers operate in worst working conditions than any other global sector because their production activities depend on diverse environmental factors (Atsan et al. 2019). In Africa, agricultural economic activities absorbed about 53 per cent of the populations in the year 2016. While agriculture remains the engine of economic growth in Africa, the sector is very stagnant (Bernard et al. 2008; FAO 2017). In addition, Sub-Saharan African populations are the worst hit in terms of food insecurities as compared to all other regions of the globe (FAO 2020). This situation is attributed to farmers' high transaction costs and reduced access to services such as extension services (Kilelu et al. 2017).

High transaction costs, farmers' low economies of scale, and institutional distortions, limit farmers' participation in output markets and consequential hampering of sustainable develpment (Markelova et al. 2009; Poulton et al. 2010). The reduced access to extension services has been identified as one of the major factors hindering agricultural growth among rural farmers (Asfaw et al. 2012; Danso-Abbeam et al. 2018). Traditionally, agricultural extension has involved the process of providing agricultural information and development of skills of farmers critical for increased productivity. But recently this has also extended to assisting farmers' group formation to meet their various market imperfections (Babu et al. 2015). The provision of agricultural information through extension services is therefore critical in averting various risks faced by farmers (Abdulai & Huffman 2014; Bavorová et al. 2020). Hence, agricultural extension service forms the foundation of any significant development in agricultural sector (Kassa 2016).

In Zambia, where agriculture absorbes about 53.6 percent of the population (ILOstat 2021), efficient delivery of Agricultural Extension Services (AESs) to smallholders become very critical. Agricultural extension services in Zambia have centred around sustainable improvement of agricultural production, productivity, and food security among smallholders (NAIP 2013). To meet complex needs of smallholders, the Ministry of Agriculture implements AESs through the pluralistic model since 2013

(MAL 2013). Most pluralistic extension approaches employed in Zambia and also in other African countries (e.g Ghana, Malawi and Uganda), operate through farmer groups such as study circles, farmer field schools and cooperatives (Nkonya et al. 2007; Oladele & Adesope 2011).

The typical limitations faced by smallholder farmers in accessing AESs can be addressed by collective action of farmers found in farmer groups such as cooperatives (Swanson & Riikka 2010; Wanyama et al. 2016; Shrine et al. 2019). Literature cites cooperatives having influence on smallholders' access to various agricultural services including AESs (Ortmann & King 2007; Markelova et al. 2009; Shrine et al. 2019; Awuor et al. 2021). There is also increasing literature suggesting that cooperatives have a positive effect on the adoption of agricultural technologies (Abebaw & Haile 2013; Ma & Abdulai 2016: Feleke et al. 2017; Manda et al. 2020).

## 1.1. Problem Statement

For almost a decade now, the Zambian AES delivery has mainly employed the channel of cooperatives in accordance with Zambian National Agriculture Investment Plan and the Sixth National Agricultural Policy (NAIP 2013; Keluarga 2016). However, to the best of our knowledge, very few studies, if any, have been conducted to exhaustively unearth the effects of cooperative membership on the farmers' access to agricultural extension services in Zambia. Some assessments were carried out on the pluralistic extension approach in Zambia for example by Tucker et al. (2015) and Burrows et al. (2017). The recent one by Somanje et al. (2021) compared effectiveness of AESs between Ghana and Zambia. However, these studies did not investigate how cooperatives affect extension service delivery among the farmers in Zambia. The current gap was also noted by Manda et al. (2020). Birner et al. (2009) and Agbarevo (2013) also recommended further studies on the performance of extension service delivery. The above mentioned studies warrant related studies on the Zambian cooperatives aimed at assessing the effects of farmer groups on AES as a whole.

## 1.2. Significance of the Study

The main research question therefore is to understand better; how cooperatives as self-governed institutions contribute to delivery of AES among smallholder farmers in general. The critical aspect is also to ascertain how effective are cooperatives as a channel in AES delivery and what can be done to enhance their performance. This research contributes to the bridging of this lack of empirical evidence on the cooperatives and seeks to unveil key elements for enhanced AES delivery among smallholder farmers in developing countries bearing similar contexts. This information could help the governments in developing countries and other stakeholders in reshaping the policies and programmes which aim at improving rural livelihood.

For the sake of uniformity in this study, we use Agriculture Extension Services (AES) to imply both extension and advisory services. The term 'access to extension services' is also broadly used to mean seeking, barriers, opportunity and or motivation towards extension services. This is because the term access may have different connotations to diverse categories of farmers, for example, when access is applied in the context of gender, it may refere to opportunities related to gender differences while the same may imply motivation when employed in the context of age of farmers.

The rest of the study is organised as follows: Chapter 2 introduces the review of literature on the characteristics of AESs in Zambia by first highlighting the extension processes and the factors that influence farmers' access to AESs which form the basis for the econometric analysis. This chapter is crowned by the conceptual framework. Chapter 3 describes the aim and the three (3) main objectives upon which the study is based. Chapter 4 proceeds with the operationalisation of the study and the respective quantitative and qualitative tools employed during data collection. This chapter further details the study area and the statistical basis for the sample size. Chapter 5 presents the results in quantitave and qualitative terms from our econometric and content analyses respectively. Chapters 6 and 7 adds the context to our results, and proceeds with recommendations and conclusion.

# 2. Literature review

## 2.1. Agriculture Extension Services in Zambia

Agriculture extension is sometimes used interchangeably with 'advisory services' which may imply agriculture education with all its attempts to bridge the gap between farmers and various information sources and service providers (Wanyama et al. 2016; Kassem et al. 2021). The critical role of agricultural extension lies in the development and sharing of information on modern agricultural technologies, (Bonye et al. 2012; Shah et al. 2016), and aiding farmers to adopt and adapt to efficient farming methods (Parkinson 2008). Access to trainings, information and knowledge on a wide range of modern agricultural issues can lead to a rise in the efficiency of rural agriculture (Buadi et al. 2013). AESs may also involve linking smallholders to financial lending institutions, creation and support of community savings groups, facilitating smallholders access to inputs and market linkages (Burrows et al. 2017). These extended facets of agricultural extension services have not received good space in this study.

According to FAO, the main objectives of good AES provision includes; a) transfer of technology, b) improvement of farm incomes, c) building social capital, and d) education of farmers in good natural resource management (Swanson 2008). According to Hounkonnou et al. (2012), main efforts to ensure farmers' increased productivity has often ignored interlinked services such as extension services, marketing, credit facilities, agricultural inputs, instead, more forcus is given to technology transfer. However, effective agricultural research and extension service delivery still remains one of the critical policy measures against poverty reduction and for agricultural development (Asfaw et al. 2012; Hailemichael & Haug 2020; UN 2021).

The Zambian AESs takes the form of the Participatory Extension Approach (PEA) (Tucker et al. 2015; Burrows et al. 2017). This approach, as opposed to the Top-Down approach, mainstreams smallholders into extension activities and research (Agbarevo 2013; Mwada et al. 2019). Zambia like other African countries, employ a pluralistic model which embraces the participation of various NGOs and Private firms in provision of AESs to smallholders (Mofya-Mukuka & Kabisa 2016). The pluralistic model helps to meet diverse AES needs which demand complementarity of mixed and harmonised

approaches and methodologies from various stakeholders who may also provide credit support, information, social, production, nutritional and market needs of smallholders (Burrows et al. 2017). However, non-public AES providers i.e., Rural Development NGOs and private AES providers are usually limited in coverage and targeting of beneficiaries. Therefore, the main responsibility of reaching farmers especially in inaccessible areas falls upon the already overwhelmed public AES provider (Tucker et al. 2015; Ugochukwu & Chinyelu 2020). Due to its long term presence among the farmers, the public AES provider becomes very important.

The Zambian extension program is designed and advanced by the Department of Agriculture under the Ministry of Agriculture which also undertakes its mandate in the direction of improving production and productivity of the rural smallholder farmers (MAL 2013). The public extension service ensures that there is harmony among other providers and their respective messages directed to the farmers. The public extension operates through a vast team of field-based extension officers whose official mission is 'to undertake the provision of extension services in order to facilitate dissemination of information and technologies for improved agriculture at camp level' (Tucker et al. 2015). Other extension services may include linkage of farmers to credit providers, agricultural inputs, and access to markets, but these aspects are out of the scope of our analyses due to space.

Various NGOs also provide AESs in Zambia, funded either bilaterally and or international development partners. Other organisations such as the Zambia National Farmers Union (ZNFU) employ their own field extension agents, while others collaborate and capacitate the already existing public extension system. The strategy on National Agricultural Extension and Advisory Services by MAL (2016) also recognises the private sector as a notable extension and advisory service provider in Zambia. Usually, this sector is comprised of seed companies involved in the crops i.e sugar, cotton, maize, and tobacco and they offer services to their respective clients.

### 2.1.1. Advisory Methods and Processes

The Zambian public extension approaches have undergone evolution since the mid-1970s when the world bank championed the Training and Visit (T&V) method. The T&V did not fulfil the purpose in Zambia due to its unsustainability experienced even in

other states that adopted it (Tucker et al. 2015). The Farming Systems Research (FSR) then followed which aimed at involving the smallholders in the research and technology development. In the 2000s, Participatory Extension Approach (PEA) was promoted as the desired method for revitalisation of the AES following the recommendation from the world bank (MAL 2016). Under PEA, AESs facillitate farmers' adoption of new technologies and this is done through field demonstrations, field days, agricultural shows, extension presentations and relevant materials (MAL 2016).

### 2.1.2. Agricultural Trainings

Recently, Farmer Field Schools (FFS), and on-farm demonstrations organised by group-based learning Farmer to Farmer, and Lead Farmers are the prevalent methods and approaches endorsed by the ministry of agriculture, NGOs, and other Extension service providers (Baloch & Thapa 2019). Using PEA and FFSs approaches, trainings have been offered to farmers as the main process through which knowledge and information is diffused to farmers. In the Southern province of Zambia, AESs are also dominated by trainings- which broadly include the process of transferring agricultural information and skills to farmers mainly through agricultural trainings (Alex et al. 2002; Babu et al. 2015; Siankwilimba et al. 2021). Agricultural trainings encompasses all activities related to capacity building of farmers and improving their production and management skills to achieve improved production and productivity.

Trainings can be done through farmer to farmer training sessions, organising of visits to successfull farmers' fields, Farmer training groups, field demonstrations, and farmer clubs (Crop Life International 2013). In farmer training groups, the extension agent meets with a group of about 20 to 30 farmers in their villages to provide training in a classroom style setting. Under field demonstration, the extension agent offers practical and hands-on demonstrations to farmers. In farmer to farmer training, farmers are encouraged to relay their experiences and lessons to other farmers in the locality either verbally or through print media. Finally, under farmer clubs, after special training of farmers, they are encouraged to form official clubs/groups for knowledge and information sharing and they benefit from special farming services.

### 2.1.3. Training Levels of Extension Agents

According to studies by Shah et al. (2013) and Benge et al. (2020), extension officers and agents, apart from having proficient skills in communication skills, building of community relationships, they also need to posess skills in all other agricultural desciplines for their effective delivery. According to Agbarevo (2013), some extension agents lack the capabilities in training activities. In a study by Moyo & Salawu (2018) most of the interviewed Extension Officers in his study only held agricultural college certificates which implied limitation in the quality of knowledge to relay to farmers. Investing in the education capacities of the extension agents is very critical for functional agricultural extension service (Hu et al. 2012).

### 2.1.4. Number of Clients

The extension agent to farmer ratio is cardinal in the efficient dissemination of AESs and can vary widely from one country to another. The Zambian agent-to-farmer ratio was about 1 : 1200 in 2016 (MAL 2016). As compared to Zambia, other countries such as in Cross River State of Nigeria, and the Democratic republic of Congo have a lower extension agent to farmer ratio of about 1 : 160 and 1: 540 respectively (Agbarevo 2013; Ragasa et al. 2016). On the other, Ghana, and Tanzania, have higher ratios of about 1 : 1300 and 1: 2500 respectively as compared to Zambia (Ragasa et al. 2016; Anang et al. 2020). In extension approaches that are characterised by visiting farmers at their homesteads, the ratio of extension agents to farmers can critically affect the success of the AESs.

### 2.1.5. Specificity of Content

AESs can be provided using various methods which may encompass technological approaches such as soft technologies such as internet, mobile phones, radio, television, and other various platforms. According to Faure et al. (2012), the main aspects included here relate to: a) provision of advise based on demand from the farmers while ensuring that solutions are arrived at using the participation of targeted farmers, b) the incorporation of local knowledge in generating solutions c) the participation of farmers in production of advises as dependant on the form of advice, and finally, d) issue of rightly placing information technologies.

## 2.2. Quality and Factors Influencing Performance of AESs

### 2.2.1. Quality of Extension Services

While the measuring of extension services is best conducted at impact level, such as adoption of technologies, improved incomes and yields (Mofya-Mukuka & Kabisa 2016; Buehren et al. 2018), Birner et al. (2009b) insists that quality and performance of AESs is complex to evaluate at impact levels because the extension agents administer their services on a broad spectrum of the clientele, wideness, diversity of the subjects and fields focused upon. For example, AESs may cover aspects relating to crop production, gardening, livestock production, water and environmental conservation, human nutrition, community resilience, youth development to name but a few. In addition, agriculture is affected by many random factors in a conflicting and complex ways which makes it difficult to trace the impacts of the extension inputs at farm level (Anderson & Feder 2007; Buehren et al. 2018). Hence the impact levels of extension intervention as may be reflected in the adoption of technologies at farm level does not form the focus of this study and can therefore be documented here only in faint cast.

According to the International Standardisation Organisation, quality is defined as the ability of a product or service to meet requirements with its set of inherent characteristics. According to Birner et al. (2009) and Sylla et al. (2019), the quality of extension service can be scrutinised based on their relevance, timeliness, availabitlity, cost, targeting, effectiveness, content, feedback, efficiency. Therefore, in our study we focus on some characteristics of the process of extension service delivery on one side and the content on the other side. We first examine farmers' understanding on how easy they access extension services. Further, we examine farmers' perception on the quality of the process of the extension services as reflected by quality of agricultural trainings. On the next level, we examine the content as reflected in the perceived quality of agricultural information.

*Quality of Agricultural Trainings*

Quality of a product or service can be understood in relation to two facets i.e expected quality and perceived quality (Castillo Canalejo & Jimber del Río 2018). Quality of agricultural trainings in this study referes to the farmers' subjective evaluation

and judgement of the perceived set of technical support activities aimed at technological and skill transfer to improve farmers' productivity (Sylla et al. 2019).

*Quality of Agricultural Information*

Quality information should be verifiable and reliable (Granovetter 2018). According to Mokotjo & Kalusopa (2010), quality information also involves timeliness, sufficiency, relevancy and accuracy. Majid et al. (2001) adds that lack of these elements in the provision of agricultural can jeopardise agricultural development. For quality of agriculture information to prevail, the above highlighted elements should be characteristic of the agricultural information posters, booklets, newsletters, farm radio broadcasts, photographs, magazines, and agricultural news articles for broadcast.

Closely related to quality of information is the ability of given information to satisfy the clientele. Although the two are related, they are not indistinguishable (Castillo Canalejo & Jimber del Río 2018). Quality relates to how a client evaluates the expected, and the actual attributes of a product or service (Castillo Canalejo & Jimber del Río 2018; Tong & Jia 2018) while satisfaction is measured by a set of four variables which include the expected quality, the actual quality, the perceived value and the customer loyalty (ACSI 2022).

### 2.2.2. Factors Influencing perceived quality of AESs

Motivation to seek for AESs can also be blocked by poor designing of the AESs. This implies that the content, targeting, and timing is not well aligned with farmer needs (Agbarevo 2013). Added to this is the aspect of relevance of the extension messages to the farmers. Poorly designed AES programmes and messages can be unfit for the target groups and their utilisation becomes difficult because their design does not correspond to their needs (Anderson et al. 2006; Anang et al. 2020). This hinders smallholders from seeking AESs (Agbarevo 2013).

To ascertain the effect of cooperatives on the farmers' seeking of AESs, and the degree to which cooperatives contribute to farmers' motivation to seek for AESs, it is first critical to establish what characteristics of farmers facilitate better seeking of AESs. Delivery and reception of AESs are said to be influenced by household and farm factors, social capital and networking, locational factors (Buadi et al. 2013; Baiyegunhi et al. 2019). These factors may include, but not limited to, the age of household head, gender,

level of education, farming experience, income levels, membership to farmer groups, distance to the extension office, number of extension contacts, social capital elements like trust. It is also imperative to understand the available claims regarding the differences in performance between co-operators and similar non-co-operators.

#### 2.2.2.1. Household and Farm Factors

*Age of Household Head*

The age is perceived to be a factor in decision making processes of farmers. Older farmers are more likely to have better motivation to seek extension services than younger ones (Wossen et al. 2017). Older farmers are assumed to have experienced from past modern technologies, hence more interested in extension services and easily try out new technologies (Kidanemariam 2015; Grabowski et al. 2016). Adeoti (2008) on the other hand found no significant differences in the age of household head as regards seeking of irrigation technologies. Some studies (Atsan et al. 2009; Neill & Lee 2001; Davis & Mekonnen 2012) also suggest that young farmers are generally less conservative, more apt to change and likely to accept new technologies than older farmers, therefore, participate more in extension services than the older farmers. Alongside age of farmers is the farming experience. Gido et al. (2015) found that farmers with lower years of farming experience sought more AESs than farmers with more years of farming experience. This is linked to farmers with less farming experience trying to catch up for their low agricultural knowledge. On the contrary, study by Danso-Abbeam et al. (2018) showed that farmers with more years of farming experiences sought more extension services and were more willing to seek information, suggesting their attempt to optimise their agricultural businesses and incomes.

*Gender*

Differences between males and females are perceived to raise inequalities related to opportunities and access to productive resources. Inequalities in resource use contribute to an average yield gap of about 20 - 30 per cent between men and women (FAO (2011). Similar studies suggest that female farmers have seek less to extension services, credit facilities, technologies, modern agricultural inputs, (Nambiro et al. 2006; Owolabi et al. 2011; Manfre et al. 2013; Birch 2018). Quisumbing et al. (2010) suggests that female famers' low seeking of EASs, stem from their limited education, risks in

mobility and marketing, human capital constraints, multiple domestic tasks, limited access to collateral  to cite but a few. In addition, extension programmes and approaches are often designed and disseminated by men who overlook the role of women from that of being stakeholders to mere welfare beneficiaries and supporters to husbands (Galiè et al. 2013; Achandi et al. 2018). In cases where women are incorporated in the AESs, the male-chauvinistic attributes of modern technologies disadvantage the female farmers (FAO 2011). Literature also suggest that female farmers prefer female extension agents because they can discuss and understand their productive and reproductive roles and preferences (Manfre et al. 2013).

*Household size*,

Household size is also deemed as a significant factor in motivating farmers to seek extension (Oyetunde-Usman et al. 2021). Larger households are likely to adopt labour intensive practices more that smaller housholds due to labour availability (Ndiritu et al. 2014). In studies by Birru Goshu (2019) and Tesfay (2020), household size positively influenced seeking of AESs and adoption of fertilizer application respectively.

*Education levels*

The ability to take up relevant information on agriculture highly depends on the conceptual capabilities of the recipient farmers (Nazari & Hassan 2011). Education helps people to correctly value extension services (Atsan et al. 2009; Wossen et al. 2017; Atsan et al. 2019). Illiteracy on the other hand delays and often hinders smallholders in developing countries from coping with the ever-changing agricultural technological and educational demands (Khan & Khan 2015). Several studies suggest that educated farmers have better affinity to farming knowledge through AESs than their counterparts (Nambiro et al. 2006; Adeoti 2008; Gido et al. 2015). However, studies by Davis & Mekonnen (2012) and Kaliyeva et al. (2020) hypothesise that some extension approaches such as Farmer Field Schools are more sought by less educated and that the educated tend to preserve their prestige among the educated.

*Land size/distribution*

According to Khan & Khan (2015), farm size plays a vital role in the rate of dissemination and diffusion of AESs, among the smallholders. Large farm sizes therefore are more associated with better access to AESs (Baiyegunhi et al. 2019). Certain

technologies have a minimum requirement in farm size for efficient operations to be achieved and farmers with smaller farm size may have less interest in extension activities that rely on extending the area under cultivation (Neill & Lee 2001). Contra findings by Wossen et al. (2017) suggest that smaller farm sizes increase chances of being targeted by extension agents thereby increasing the probability of accessing AESs. In a study by Ntshangase et al. (2018) larger plot sizes were negatively related to conservation tillage practices.

*Household Income*

Alongside the off-farm income levels are household incomes. Low levels in household income among smallholders can hinder access of AESs and can even lead to non-adoption of technologies (Owolabi et al. 2011). Increased off-farm farm income on the other hand (non-agribusinesses, pension, social grants/and remittances) can lead to decreased participation in AESs activities due to more time dedicated to off-farm activities (Gido et al. 2015; Baiyegunhi et al. 2019). In the review by Mwangi & Kariuki (2015) on the economic factors influencing farmers motivation to information and skill acquisition, off-farm income is portrayed as a double-edged sword, which can either encourage or hinder farmers to reach out for extension services while pursuing more off-farm incomes at the expense of AESs.

#### 2.2.2.2. Gender of Extension Agent

The differences in the effects of gender of extension agent on the access of AESs by the farmer is very critical more especially towards the female farmers who form a significant share in rural agricultural development. Lahai et al. (1999) in their study on the effect of gender of extension agent on farmers' access to extension services revealed that female farmers who were supervised by female agents had more participation in extension activities than female farmers who worked with male agents. Further, their study suggested that female farmers having female agents were more satisfied with the quality of AESs offered by the female agent, they had more technical knowledge in recommended modern agricultural technologies. Remedying the gender differential effects that may exist can greatly contribute to agriculture and economic development among rural farmers (Achandi et al. 2018).

#### 2.2.2.3. Locational Factors

The distance to the extension agent reflects the cost for accessing AESs. The longer the distance to the extension service provider the higher the cost of transport and consequently lower access to AESs (Gido et al. 2015). According to Nambiro et al. (2006), the distance between the location of smallholders and centre or source of extension services influences the probability of accessing AESs and agricultural information. Study results by Asfaw et al. (2012), showed that the proximity to the extension agent contributed to the enhanced acquisition of technical skills required in production of pigeon pea.

#### 2.2.2.4. Contacts with extension agents

The effectiveness of the extension agent and that of AESs can be assessed by among other things, the level of awareness by the farmers, number of visits by agents, frequency of meetings held with agent, number of field days, phone calls with the agent (Agbarevo 2013). Contacts between the extension agent and the farmer are very critical more especially for farmers requiring special and farm-specific information. The general understanding is that more extension contacts raise the likelihood of farmers accessing the package of extension services. The study by Adeoti (2008) in Ghana revealed significantly higher uptake of technologies among households with higher extension visits per year (4.31 visits) than households with fewer visits (2.07 visits). However, Ndiritu et al. (2014) and Kotu et al. (2017) suggest that farmers who receive advice from model farmers easily adopt some agricultural technologies than those who receive from extension agents.

#### 2.2.2.5. Social Capital and Networking

The role of social capital in the access to agricultural technologies has been investigated by other researchers and is known to have an influence on the rate of access of AESs of technologies (Kolade & Harpham 2014). Social networks influences the sharing of quality of information (Deroiain 2002; Granovetter 2018). Information seekers are generally people who have higher social participation, higher interconnectedness in the social system and they travel widely being engaged in matters even outside their boundaries (Rogers et al. 1995). The participation of household members in farmer groups has been understood to signalise the higher level of social capital which in turn

contributes to information sharing and interconnectedness among members (Quisumbing et al. 2010). The number of traders a household knows and trusts outside the village is also construed to contribute to increased social capital attributes which influences access to extension (Kassie et al. 2013)

### 2.2.3. Cooperatives as Channel of AES

The cooperative is vital for its role as a broker or a hub in the agri-services offered to farmers. This may include horizontal synergies which includes farmers' and output market actors and vertical synergies involving aspects among farmers. Access to AESs by farmers can often be influenced by how easily the services can reach them, hence farmer groups constitute one of the easier ways of channelling extension services to farmers (Anang et al. 2020). Since belonging to a farmer group enhances farmer to farmer extension services with consequential sharing of views and knowledge and ideas on farm business, group members are then more likely to get more sensitisation to join extension programmes for more sensitisation on their farming activities (Danso-Abbeam et al. 2018). The research by Wossen et al. (2017) in the rural part of Nigeria found a positive effect of access to extension services on the use of modern farmer technologies. Similarly, Asfaw & Neka (2017) found the practice of soil water conservation practices among smallholders in Ethiopia being positively linked to access to agriculture extension services.

***Horizontal Coordination***

Smallholder farmers face insurmountable challenges in their farming operations ranging from production through to the access of the market for their produce. Major benefits of collective action is the ability of cooperative members to create economies of scale through bulking (Wossen et al. 2017; Grashuis & Ye 2019), and minimisation of transaction costs incurred by individual smallholder (Chagwiza et al. 2016). High transaction costs in seeking and disseminating information (Moyo 2010), accessing high-quality agricultural services and agricultural technologies (Stockbridge et al. 2003), can be minimised by acting collectively through membership in farmer organisations (Gyau et al. 2014).

Although various factors exist that influence horizontal dispersion of information in the group (e.g type of information, group structure and composition, group member

characteristics) (Wittenbaum et al. 2004), the cooperative is generally perceived to be a better channel for horizontal information flow. Cooperatives increases probability of information dissemination among farmers which creates a ripple-effect on transfer of agricultural technology (Cook et al. 2021). Cooperatives may act as pathways to access of AESs and agricultural technologies by relaxing constraints in financial, input, and output markets and information (Wossen et al. 2017). Through spill-over effects, cooperatives can also speed up farmers reach to agricultural technologies (Chagwiza et al. 2016; Manda et al. 2020).

*Vertical Coordination in the Cooperative*

There are two ways through which smallholder farmers can access various and these may involve contract farming (buyer oriented relationship) and cooperatives (producer oriented relationship). Contract farming offers a platform to avoid challenges related to smallholders' linking to high value markets while embracing the farmers with least productive capacity (Ton et al. 2017; Mwambi et al. 2020). Contract farming is essential for smallholders because it can improve flow of information along the supply chain thereby reducing the marketing risks. Further, contract farming can improve access to financial capital, avail modern technologies to farmers, linking farmers to markets, and ensuring quality controls among the producer group members (Ton et al. 2017; Gramzow et al. 2018). Cooperatives act like a hub, by enhancing trust among actors, minimising risk, and promoting desirable quality standards of produce among member farmers (Ton et al. 2017). Also cooperatives ensure coordination of between farmers, input and innovation support such as extension services (Kilelu et al. 2017). Membership in farmer organisations can also facilitate easier access to technologies (Shiferaw et al. 2011), improved seed varieties, production inputs (Real et al. 2013; FAO 2016), easier access to agricultural training and better markets (Bernard et al. 2008; Chagwiza et al. 2016; Gyau et al. 2016). Cooperative membership is also necessary to increase bargaining power (Bernard et al. 2008). Access to the above services results in the increased agricultural diversification among members, improved yields, and use of sustainable agricultural practices (Gramzow et al. 2018).

*Zambian Cooperatives and AESs.*

The first registered cooperative activities in Zambia begun in 1914, being introduced by the European settlers who targeted to supply agricultural produce to the

mines in the Copperbelt Province. In 1947, Africans also adopted cooperatives as a recognised standard unit of business. Similar to many other African countries, cooperatives in Zambia have undergone phases from state-led control (from 1964-1990) to market liberalisation (1991-2000) and finally to the partial liberalisation paradigm since the early 2000s (Siame 2016). Cooperatives have been a vital instrument of each and every Zambian political regime where they have often been regarded as machines of rural development particularly through agricultural activities (Manda et al. 2020). Most of the cooperatives since the year 1964 onwards were agricultural cooperatives usually oriented towards crop production and rarely promoted the economic goals of the members and cooperative at large.

Recently, the importance of cooperatives has been re-emphasised although the activeness of the majority cooperatives in Zambia has been exhibited mainly through distribution of the agricultural inputs from the Farmer Input Support Programme (FISP). FISP was established by the government to assist farmers, to access subsidised inputs (MAL 2013). The beneficiaries of the program are cooperative members who are registered with the Ministry of Agriculture (Mason et al. 2018). The government aimed at strengthening cooperatives also by engaging them in crop marketing through Food Reserve Agency (FRA) depots and other collection points (MAL 2013). The group approach of AES delivery is known to have advantages not only in the horizontal technology transfer but also in capturing many farmers at one time thereby mitigating the challenge of low agent to famer ratio (MAL 2016).

### 2.2.4. Farmers' Decision-Making Processes

Social-Psychological constructs influencing seeking of AESs are often neglected in many related studies (Hyland et al. 2018). Although several theories exist that explain causal links between hearing something-intention-motivation and actual effect of behavioural change of individuals, the Theory of Planned Behaviour (TPB) as illustrated by Ajzen (1991) is herein employed to highlight some of the psychological factors influencing the process of seeking for information. According to the theory of planned behaviour, human behaviour can be predicted and explained in relation to the intention to behave in a certain way (Hyland et al. 2018). Intention is formed by individual attitudes and beliefs which can be divided into personal, normative and control. Some researchers

(Bhuyan 2007; Hyland et al. 2018; Mutyasira et al. 2018; Hyland et al. 2018) also employed the theory of planned behaviour in their various works. According to Dakurah et al. (2005) and Hyland et al. (2018), personal beliefs are concerned with results of someone's intention, normative belief relates to the social influence to perform something, and control beliefs are constructed by how easy or difficult a particular behaviour is.

The study by Kaliyeva et al. (2020) who analysed the factors influencing the rural household's participation in governmental agricultural programmes found that psychological factors such as having positive attitudes, and perceived social norms on cooperatives had great importance. More importantly, the increased beliefs on the benefits of production as influenced by the cooperative and the support from social referents have the potential to raise the acceptance of desired government interventions by the rural people (Kaliyeva et al. 2020).

*Extrinsic Factors*

Extrinsic factors influencing seeking of information include characteristics of the farmers, their respective decision-making environment, as well as characteristics of the innovation. According to literature (Meijer et al. 2015; Faruque-As-Sunny et al. 2018; Tesfay 2020) farmer attributes that are vital in the skill-exchange processes can be grouped into the following categories: 1) individual farmer attributes (gender, age, marital status etc,), 2) social-economic parameters (level of education, income and assets), 3) characteristics hinging on the personality of the farmer (independence, self-reliance/self-confidence), 4) position in a social structure and network (connectedness, level of interactions and extent of social networks), 5) the attributes of the status of the farmer with respect to control over resources, and 6) the familiarity of the farmer to promoted innovation.

According to Rogers et al. (1995) and Meijer et al. (2015), decision making environment can be influenced by the society and the culture of the individual (norms, values, beliefs, tribe, language, ideologies), political conditions (land tenure, bureaucracies, the political situation) and the geographical settings (climate, weather pattern, distance to the market, roads etc). Rogers et al. (1995) further characterises the attributes of innovations as encompassing five main elements which include relative advantage, compatibility, complexity, trialability, and observability.

### *Intrinsic Factors*

While intrinsic factors influencing positive change in farmers may include internal decision-making involving psychological and motivational aspects (Meijer et al. 2015), intrinsic factors may also include knowledge, attitudes and perception of the farmers as regards the new skills. Farmers positive attitude can positively influence access to extension service (Vanclay & Lawrence 1994; Bhuyan 2007; Ntshangase et al. 2018). Meijer et al. (2015) postulates that there is an interaction between economic factors and attitudes of farmers in shaping the decision for reaching out for agricultural extension services.

# 3. Aims of the Thesis

GENERAL OBJECTIVE

The overall objective of this research is to ascertain the effects of cooperatives on smallholders' access to agricultural extension services in the Southern province of Zambia.

## 3.1. Specific Objectives

1) To describe the available channels of AES available to farmers and the channel favourable to the smallholder farmers in the Southern province of Zambia.
2) To describe how the cooperatives facilitate smallholders' access to agricultural extension services.
3) To determine the influence of cooperative membership and group participation among the factors that influence smallholders' access to AESs.

## 3.2. Hypotheses

**$H_1$:** The study hypothesises that cooperative membership has a positive effect on the access to agriculture extension services.

**$H_2$:** The study hypothesises that social capital, expressed as trust among the farmers influences access to agricultural extension services.

## 3.3. Conceptual Framework

Agricultural extension has been widely studied but with varying frameworks with most of them not applicable in the modern transformed agricultural extension approaches and methods. Major changes that have taken place in the extension systems include the turn from merely introducing modern technologies to farmers to taking the role of facilitation for farmers to make decisions that best depicts their farming needs (Ragasa et al. 2016). These transformations in the national and global contexts in the organisation, orientation and approaches render various assessments of the effects and extension services challenging (Faure et al. 2012). The other element rendering the work of assessing the effects of extension provision is the presence of modern pluralistic approaches in the provision of extension services. This is further complicated by the fact that each participant among the multiple providers in the pluralistic approach may have different methods and models which require different frameworks in assessments of AESs.

### 3.3.1. Causal-Effect Measurement

We employ in our study of the effect of cooperatives on access to AESs the framework adapted from Birner et al. (2009) which more comprehensively portrays the relationship between effective extension services and the impacts. The framework is uniquely blending insights from diverse disciplines which otherwise are approached separately by different authors. The framework developed by Birner et al. (2009) was also employed and recommended by Faure et al. (2012) and Ragasa et al. (2016) during their studies relating to extension services. Since the extension service provision in Zambia has a prioritised component of cooperatives through which AESs are channelled, we adapt the framework to depict the structure of AESs structure in the study area.

The framework broadly begins by describing the external and institutional environment, the participants of AESs as a pluralistic approach and the agricultural system as factors giving the local context for determining the appropriate AESs. Further, these interact with the AES characteristics which constitutes of policy environment, capacity, management, and methods of AES delivery. The next phase is the channel (farmer groups) through which AESs are delivered to farmers.

When the assumptions in (**A), (B)** and (**C)** (see Figure 1 below) are fulfilled, and are channelled through the cooperatives (**D)** with a positive attitude towards the AESs in accordance with the theory of planned behaviour, the immediate impact is seen in the attributes of the farmers (**E)**. The emphasis of the framework hinges on the assumption that when AESs are channeled through the cooperative (**D**), which has attributes of high level of Social capital, better economies of scale, reduced transaction costs and high reciprocity, the effects on farmers' perception of AESs will be stronger and positive. The positive perception on quality of trainings and information leads to positive changes in farmers' practices, and capacities resulting in transformation of the targeted households. This inturn positively influences livelihoods in the long-term with increased productivity, higher household incomes, gender specific impacts as well as environmental aspects. However, as mentioned earlier on, the potential impacts are not captured in our framework because they are beyond the scope of this study.

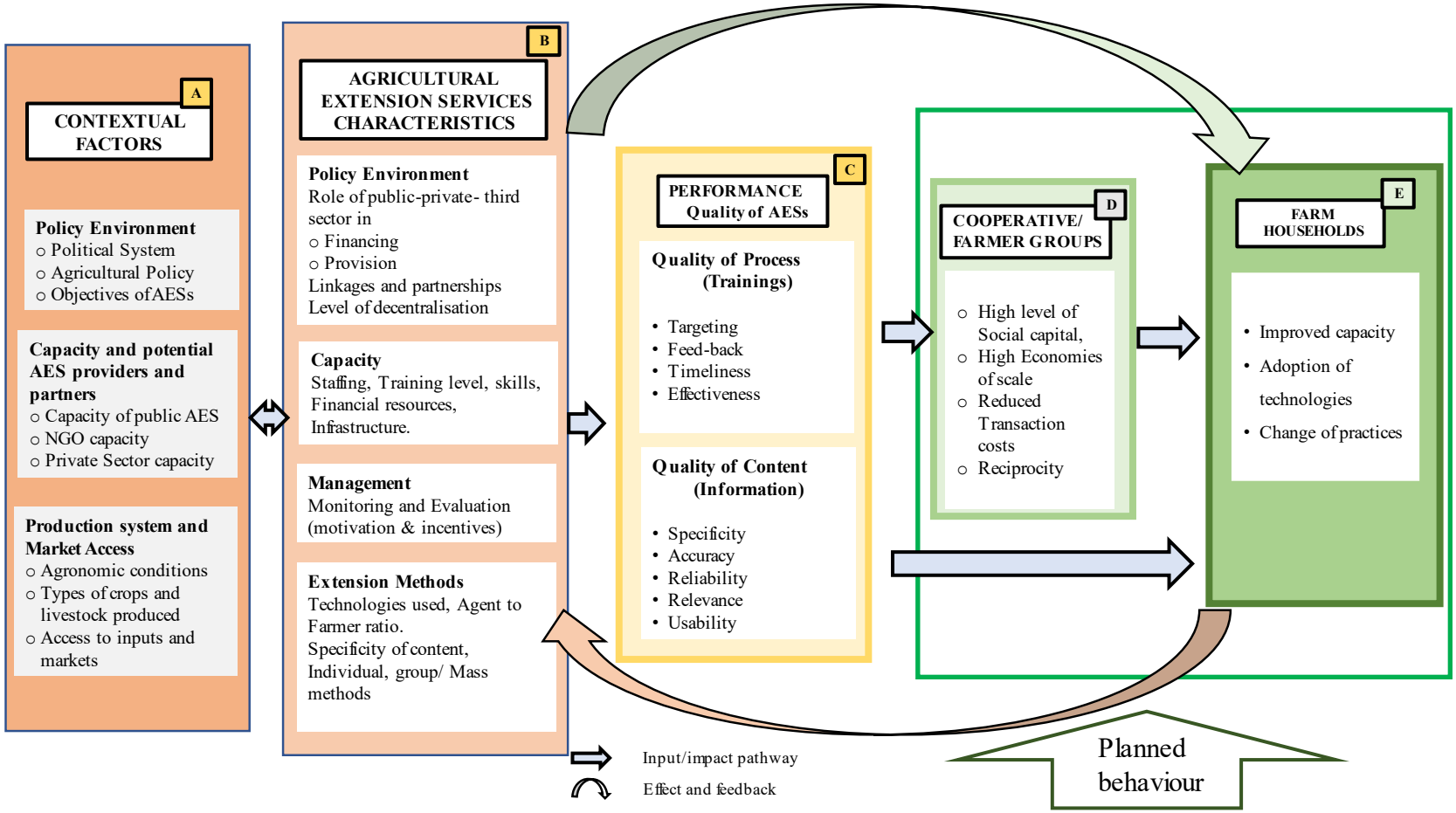


Figure 1: Conceptual Framework.

Conceptual framework adapted from Birner et al. (2009)

# 4. Methodology

The study employed a quasi-experimental research design to study the effects of cooperatives on farmers' access to AESs. According to Antonakis et al. (2010), the quasi-experimental design can be applied when an experimental design, which is considered as the ideal design, is not pragmatic, as is the case in our study. In a quasi-experimental design, the experiment consists of treatments, outcome measures and experimental units, with the possibility of randomisation without manipulation (Morgan & Winship 2007).

Due to lack of baseline data, cross-section data was employed which was obtained by observing the treatment and control groups at one given point of time. While we appreciate other researchers such as Birkhaeuser et al. (1991) and Davis et al. (2010) who, among others, appropriately employed longitudinal impact evaluation by use of the ex-post facto design, our context, however does not permit such a design due to lack of baseline data which is a requisite when applying such a design.

## 4.1. Study Area

The study was conducted in four districts of the Southern province of Zambia. Southern province is located atleast 128 Kilometres south of Lusaka and receives annual precipitation of less than 800mm (Kanno et al. 2015; Somanje et al. 2021). The province has had 43 agricultural blocks and 220 camps (MoA 2021). The Southern province was selected because of its historical prominence in agricultural extension activities in Zambia, having been once a food basket of Zambia (Nkomoki et al. 2018). It is characterised by one agricultural season per year with extreme weather varriations comprising of hottest and driest areas in comparison to the rest of the country (Somanje et al. 2021). The province is shared between the agro-ecological regions I and IIa of Zambia. Southern province is dominated by smallholder farmers practicing mixed farming mainly involving crop production and livestock production. Maize is the most cultivated crop in Southern province. Other crops include soyabeans, groundnuts, sunflower, cotton, sorghum, millet, cow peas, and Irish potatoes. The Figure 2 below shows the map of the southern province with districts under the study.

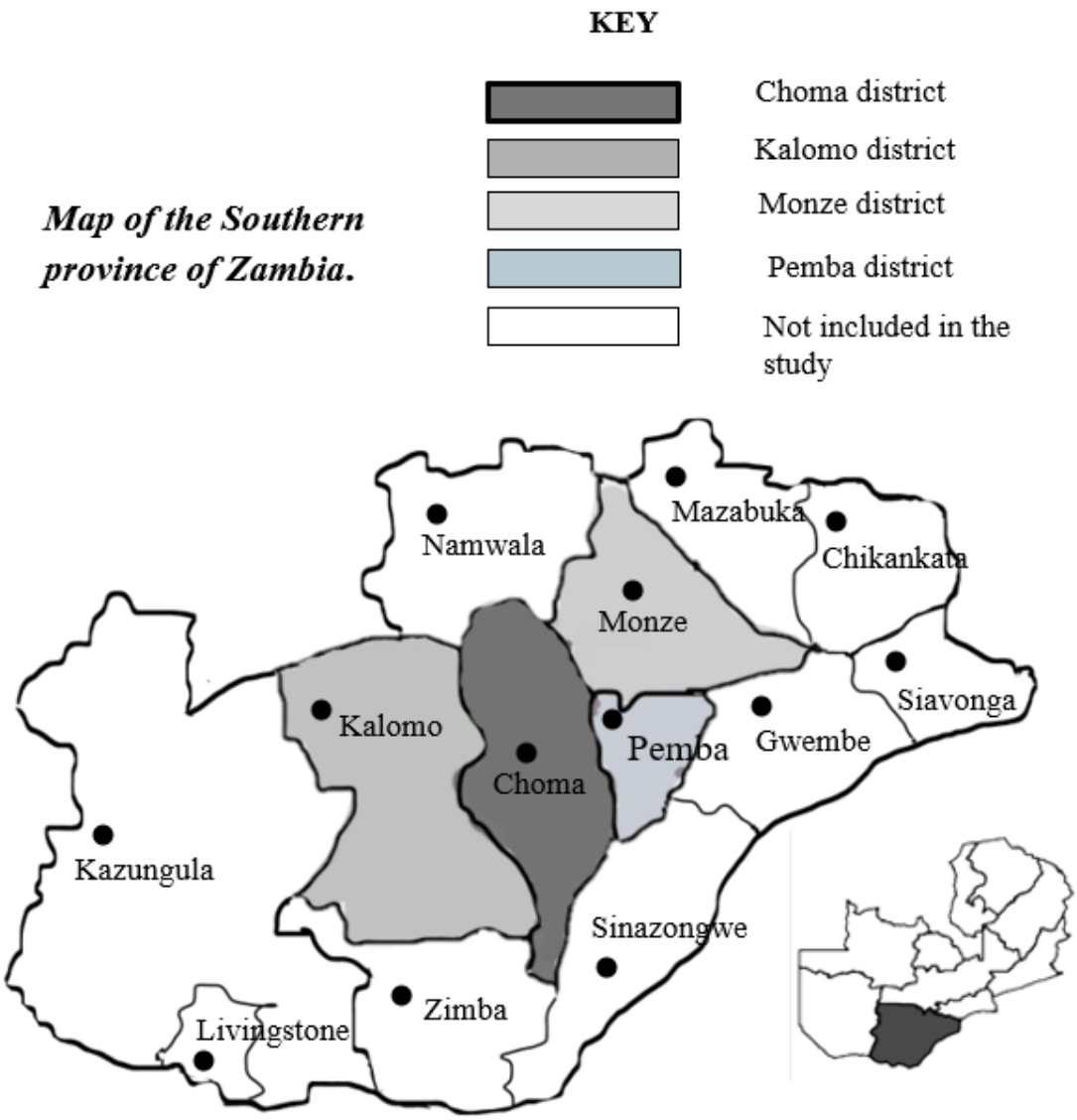


Figure 2 Map of the Southern Province of Zambia

Source: Author 2022

## 4.2. Operationalisation of the Research

Given the complexity in attributing farm level effects to extension inputs, extension indicators are often adopted as 'performance' criteria because they are undemanding to establish (Anderson & Feder 2007). The performance criteria therefore include number of extension contacts, number of clients per extension agent, number of demonstrations, and so on. Although these are sometimes used to judge wether the extension services are effective or not, they are not outrightly indicative of the quality and relevance of the shared knowledge (Anderson & Feder 2007). Hence, our study draws

more attention on some of the perceived quality features of the processes and the content of the Agricultural Extension Service as opposed to farm level adoption of technologies. In this study, the process, and content is represented by the trainings and information respectively.

*Trainings- The Process of AES*

Extension as perceived in modern times mainly involves a whollistic process forming the conduit for information provision and awareness to the farmers (Alex et al. 2002; Joshi 2017). The trainings are the main method employed by many extension stakeholders to undertake the process of creating awareness and delivering information to the farmers (Schöll et al. 2016). Before focussing on the quality of the process (agricultural trainings), it is essential to understand the perception of the farmers as regards how easy it is to access the agricultural trainings. This is because the process of extension service delivery, herein construed as agricultural trainings, may depend on the beliefs and attitudes expressed as control belief which according to Dakurah et al. (2005) and Hyland et al. (2018), is mimicked by perceived difficultiness or simplicity of accessing trainings on the part of farmers. Therefore, the first dependant variable, which forms the first model, is based on how farmers perceive how difficult or easy they access the trainings, as ranked on the five-point likert scale. At the next level we employ agricultural trainings as another criteria of our examining the quality of the process of offering extension services to farmers. The process of deseminating information and skill development to farmers has also gone beyond trainings to include assisting farmers to act collectively, sending messages, addressing market issues (Birner et al. 2009). But this study does not offer much space to these aspects.

*Information- The Content in the Process of AES*

Agriculture Information is considered as a critical input not only to extension activities but also in agricultural education, research and development (Kizilaslan 2006). While different users have different information needs, potential users of agricultural information include government decision makers, researchers, students, field workers, project managers, farmers, etc. Information needs can be broadly grouped into extension education, input information, agricultural technologies, agricultural credit and marketing (Vidanapathirana 2012). The flow of agricultural information can be through commercial information services, societies and organisations, extension information, media, TV,

magazines, Newspapers, websites, journals and books, commercial agricultural suppliers and consultants (Vidanapathirana 2012).

Some of the organisations engaged in AESs provision in the Southern province of Zambia include; (a) the public AESs provider which is administered by the Ministry of Agriculture. (b) Non-profit making organisations such such as Catholic Relief Services (CRS), Self-Help Africa (SHA), Care International, Conservation Farming Unit (CFU), World Vision, We Effect, Musika-Zambia, Heifer International, International Development Enterprise (iDE), (c) private companies such as Good Nature Agro, ACD, Famarama,

## 4.3. Target Group and Sample Size

Primary data from a household survey was employed on maize farmers. The population estimates of the Southern province had a total of about 1.9 million in 2010, making a total of 292,000 households, of which 175,754 are farm households (CSO 2010). The sample size employed was calculated based on a simplified formular by Yamane (1967) as cited by Israel (2003) and Adam (2020). To arrive at the estimated required sample size for the study, a 95% confidence level and 5% level of significance (= 0.5) were considered. Given that 'n' is the sample size, 'N' being the population size (farm households), and 'e' is the level of precision, the estimated required sample size for the study was given by;

Equation 1

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

Sample size = 175, 754/ [1+ 175,754$(0.05)^2$] =399 households

A total of 410 respondents comprising of 208 members (treatment) and 202 non-members (control) were interviewed using structured questionnaires with the help of NestForms mobile Application. The data was collected by the author in collaboration with the field staff (Enumerators) from the Ministry of Agriculture in the selected districts in the year 2021. A survey questionnaire was used to obtain household-level information from both members and non-members of cooperatives. The questionnaire comprised of closed-ended questions, and were pre-tested in the field during orientation of the enumerators (field officers).

The respondents were selected using a multi-stage sampling technique coupled with stratified sampling. Multi-stage stratified sampling is helpful in heterogenous populations like ours (non-members and cooperative members), ensures appropriate sample and reliability of data from same sample size of the stratified population (Ahmed & Mesfin 2017). The sampling was done firstly by selecting the districts in the province. Four (4) districts were selected purposively based on their level of maize crop production at provincial level. Secondly, camps from each district were selected using the list from the district offices of the Ministry of Agriculture.

Three (3) camps were randomly selected per district totalling twelve (12) agricultural camps. At the camp level, at least four (4) cooperatives were selected using the list from the camp office. The selected cooperatives had the history of participation in trainings of good agricultural practices in order to verify aspects of quality of trainings and information from respective members. Both cooperative members and non-members were purposively selected using non-probability sampling, applying the snowball sampling technique. This was aimed at capturing maize farmers and also to capture non-members (control) who were located atleast 2 kilometres from counterpart cooperative members. The two (2) kilometres was a reasonable distance for minimal exposure to potential spill-over effects from the contact with cooperatives located in their proximity.

The data collected from the survey was supplemented by data from focus group discussions with cooperative leaders using a semi-structured questionnaire. A total of seven (7) focus group discussions were conducted from the four districts. The focus group discussions helped to get the data on whether the cooperatives have deliberate initiatives on accessing AESs, how cooperatives facilitated members' access to AESs, and the accompanied perceived challenges and benefits.

## 4.4. Data Analysis

### 4.4.1. Objective One - Descriptive Statistics

To respond to the first (1) objective, descriptive statistics was employed by use of means, standard deviation, percentages, figures and charts to describe the available and favourable channels of extension service delivery to both cooperative and non cooperative members. Data with normal or abnormal distribution were subjected to

parametric and non parametric tests respectively using SPSS version 25.1. Five-point Likert scale were used to capture the perception of both cooperative and non-cooperative members on the pre-screened potential extension channels, how they prioritised possible AES channels, the frequency of their access to advice, and the level of their satisfaction with available AESs. In addition, data on whether both members and non-cooperative members accessed AESs directly or passively were also captured. Respondent characteristics are summarised in Table 1 below.

### 4.4.2. Objective Two- Qualitative Analysis

To tackle objective three (2), qualitative analysis was employed using deductive content analysis as a way to understand members' conditions, behaviors, and group experiences more deeply (Neuendorf & Kumar 2015; Bengtsson 2016). In deductive content analysis, the interviews were guided by an appropriately formulated questionnaire, and verbal group discussions were recorded using a voice recorder. Audio records were transcribed into text. Transcribed texts were further manually coded. According to Saldaña (2016), a code in content analysis is a word or short phrase serving as a unit of condensed meaning. Codes dealing with same issue were further sorted into categories (Bengtsson 2016). Categories were further grouped into themes. Themes are a portrayal of the magnitude of some responses (Erlingsson & Brysiewicz 2017). Themes helped to arrive at the conclusion.

### 4.4.3. Objective Three -Ordered Probit Regression Model

Objective two (2) intended to address the factors that influence the access of AESs. According to Bonye et al. (2012) and Danso-Abbeam et al. (2018) the provision of AESs hinges on provision of agricultural information and trainings to farmers. Farmers' access to information resulting from their informal systems (farmer to farmer) and formal linkages (extension agents) is cardinal in explaining access to AESs (Kotu et al. 2017). The value of accessing AESs by smallholders hinges on various quality features embodied in the AES package (Buadi et al. 2013). Since our questionnaire intended to capture the responses of respondents on three perceptional aspects that can be best captured by ordinal scoring (Alho 2015), the Ordered probit regression model was therefore used to answer to objective three (3).

The Ordered probit regression is also a suitable model for statistical analysis of ordinal responses which take the form of five-point likert scale (McKelvey & Zavoina 1975; Greene 2002). The ordered probit regression model was successfully employed by Alho (2015) in the study related to farmers' perception on cooperative membership, and Wollni et al. (2010); Pilarova et al. (2018); Teklewold et al. (2019) and Oyetunde-Usman et al. (2021), also employed it in their studies related to adoption of conservation and sustainable agricultural practices. With inspiration from Anaman & Lellyett (1996); Buadi et al. (2013); Moyo & Salawu (2018) and Kassem et al. (2021), we proxy the access of Agriculture Extension Services as a dependant variable by asking respondents' perception on two composite questions; a) quality of trainings from AESs, b) quality of information from AESs. In each case, the perception of the quality was ranked on a five-point likert scale as: 1-very poor, 2- poor, 3-fair, 4-good, and 5-excellent.

According to Greene (2002), Alho (2015), and Mutyasira et al. (2018), the ordered outcomes are modelled sequentially on a latent variable $y^*$, where y* is an underlying unobservable measure of the respondents' score of the access to AESs in numbers as illustrated below: The latent index yi* is taken to depend linearly on the vector of observed characteristics $xi$ which explains a respondent's attitude and unobserved factors $\varepsilon_i$.

$$y_{i*} = xi\beta + \varepsilon_i \qquad (2)$$

the observations take the form of

$$y_i = 0 \text{ if } y_i^* \leq 0 \qquad (3)$$

$$y_i = 1 \text{ if } 0 \leq y_i^* \leq \mu_1 \qquad (4)$$

$$y_i = 2 \text{ if } \mu_1 \leq y_i^* \leq \mu_2 \qquad (5)$$

$$y_i = 3 \text{ if } \mu_2 \leq y_i^* \leq \mu_3 \qquad (6)$$

$$y_i = 4 \text{ if } \mu_3 \leq y_i^* \leq \mu_4 \qquad (7)$$

where $\mu$s are unknown parameters to be estimated with $\beta$.

$$yi^* = CMi\beta 1 + ECi\beta 2 + PEi\beta 3 + GA\ i\beta 4 + AA\ i\beta 5 + ML\ i\beta 6 + AEi\beta 7 + Agi\beta 8 + GFi\beta 9 + Ed\ i\beta 10 + FSi\beta 11 + LIi\beta 12 + LA\ i\beta 13 + \varepsilon i \quad (8)$$

where:

***CM**- Cooperative Membership, **EC**-Extension Contacts, **PE**- Proximity to Extension office, **GA**-Gender of Agent, **AA**- Active Seeking of AESs, **ML**-HH Members in Leadership, **AE**-Trust, **Ag**- Age, **GF**- Gender of Farmer, **Ed**- Education, **FS**-Farm Size, **LI**- log of HH Income, **LA**- log of HH Assets*

Using Stata 15.0 software package, three (3) ordered probit regression models were estimated using same set of independant variables against each dependent variable. The dependent variables employed in the model include perception on (a) how easy farmers accessed agricultural trainings, (b) quality of agricultural trainings, and (c) quality of agricultural information received by farmers. It is widely accepted that perception of quality of a given service can be affected by social-economic factors (Anaman & Lellyett 1996; Buadi et al. 2013; Kassem et al. 2021). Therefore, attributes of farmers and their farms, social capital, agent characteristics, behavioural factors (psychological), were considered as independent variables. The literature also describes some psychological factors herein described as personal beliefs, normative beliefs and control beliefs (ref chapter 2.2.8). However, under psychological factors, only the control belief variable was included in the model. Other variables were dropped due to their non-fit in models and these also include non-psychological factors.

The variables were also tested for potential multicollinearity. The variance inflation factors (VIF) were analysed and calculated based on a separate estimation using regression. The VIF results (see appendix 2) computed for all the variables employed in the analysis showed the maximum VIF value of 1.382, with the mean VIF being 1.26. These values are within the acceptable range (Gujarati 1972). Further, the correlation analysis (see appendix 1 on Correlation Matrix) also did not reveal strong relations among the variables that were considered in the analysis. Therefore, the analyses are not threatened by multicollinearity.

Table 1 below shows statistical description of all important variables that were employed in all the three ordered probit regression models. The model contains three

main domains of variables which include; farmer specific variables, related variables, and extension service related variables. The statistical differences between the treatment (cooperative members) and control (non member) were tested using Independent Sample Test and Mann Whitney U Test. All the dependent variables were statistically different (at 1% confidence level) in the respective means for perception of how easy they accessed agricultural trainings, quality of agricultural trainings, and quality of information. For more details, see Table 1 on description of employed variables.

Table 1 Statistical description of variables employed in the analysis

| Variable | Description | Co-op members (n=208) Mean (S.D) | Non-members (n=202) Mean (S.D) | Mean Diff. |
|---|---|---|---|---|
| ***Dependent variables*** | | | | |
| Access to agricultural trainings | (1-Very difficult, 5-Very Easy) | 3.70 (.97) | 3.07 (1.05) | 0.63*** |
| Quality of trainings from AESs | (1-Very poor, 5-Excellent) | 4.05 (0.53) | 3.63 (0.87) | 0.42*** |
| Quality of information from AESs | (1-Very poor, 5-Excellent) | 3.98 (0.74) | 3.61 (0.96) | 0.37*** |
| ***Independent variables*** | | | | |
| **AES and Agent Characteristics** | | | | |
| Extension contacts | Number of contacts per year | 9.04 (8.303) | 6.41 (6.3) | 2.637*** |
| Proximity to extension office | Kilometres | 4.26 (3.09) | 6.11 (5.12) | -1.84*** |
| Gender of extension agent | (1-Male, 0- Female) | 0.76 (0.428) | 0.74 (0.438) | 0.017 |
| Active seeking of AESs | If farmer actively seeks AESs (1-Active, 0-Passive) | 0.34 (0.474) | 0.36 (0.482) | -0.025 |
| **Social capital** | | | | |
| Household members in leadership | If in leadership position (1-Yes, 0-No) | 0.67 (0.47) | 0.41 (0.493) | 0.26*** |
| Trust among community members | (1-Strongly disagree, 5-Strongly agree) | 4.71 (0.602) | 4.05 (0.936) | 0.652*** |
| **Control variables** | | | | |
| Age of the farmer | Years | 46.88 (11.46) | 43.58 (13.20) | 3.30** |
| Gender of farmer | (1-Male,0- Female) | 0.70 (0.45) | 0.65 (0.47) | 0.05 |
| Education of farmer | Number of years | 8.51 (2.76) | 8.26 (2.51) | 0.25 |
| Farm size | Total No. of Hectares | 8.77 (7.81) | 7.30 (6.86) | 1.47** |
| Annual h/h income | Zambian Kwacha | 14666 (11964) | 12118 (9680) | 2547** |
| Farm Asset value | Zambian Kwacha | 17015 (22897) | 16607 (23258) | 408 |

Note-Parametric test (Independent Sample Test) and non-parametric test (Mann Whitney U Test) showing; *Denote significance level of 10%,

** Denote significance level of 5%, *** Denote significance level of 1%

# 5. Results

This section presents both quantitave findings as well as results from focus group discussions.

## 5.1. Objective One- Results from descriptive statistics

### 5.1.1. Extension Service Providers in Southern Province

Results on the AES providers in Southern province and the respective extension contacts received from extension agents are shown in the Table 2 below. Further, the confidence of respondents in the agents is also portrayed. Results on the extension contacts reveal significant differences among the three AESs providers, with public extension agents showing highest contacts with an average of 5.45 and 4.17 contacts for cooperative members and non members respectively. On the other hand, the private extension agents being the least shows mean extension contacts of 1.53 and 1.23 for members and non members respectively. In each case, cooperative members show significantly higher number of extension contacts. A similar trend transcends through the results on respondents' perception on confidence in extension agents.

Table 2 Extension contacts and farmers' confidence in extension agents.

| | **Cooperative Members (n=208)** | **Non-members (n=202)** | |
|---|---|---|---|
| | **Mean (S.D)** | **Mean (S.D)** | **Mean diff.** |
| ***Number of extension Contacts*** | | | |
| Public extension agent (s) | 5.447 (3.938) | 4.173 (3.548) | 1.274*** |
| NGO agent(s) | 2.783 (3.263) | 1.618 (1.855) | 1.165*** |
| Private Extension agent | 1.533 (1.673) | 1.232 (1.455) | 0.301*** |
| ***Confidence in extension agents*** | | | |
| Public extension agent(s) | 4.105 (0.693) | 3.618 (1.040) | 0.487*** |
| NGO agent (s) | 3.592 (1.108) | 3.115 (1.318) | 0.651*** |
| Private Extension agent | 3.115 (1.177) | 2.712 (1.362) | 0.403*** |

Notes *** Denote significance level of 1%, Confidence in extension agents rated as: 1-Very poor, …, Excellent-5

The services provided by various extension providers under the maize sector include trainings in production techniques, maize-post harvest trainings, farmer to farmer exchange visits, field days, organising of training events with other farmers areas for experience sharing. Some NGOs providing AESs include:

a) Conservation Farming Unit (CFU) which promotes climate smart agriculture through CFU field officers who provide technical trainings to smallholders. b) DAPP which is involved in promotion of village banking and group savings. c) CARE International-promotion of savings among smallholders. d) World Vision which facilitates and promote credit savings, and e) Child Fund, also engaged in provision of credit facility.

Private extension providers present in southern province include: a) Seed companies such as Seedco, Syngenta, Pannar and pioneer, Delkab, Zambseed, and Kamano. These collaborate with public extension agents to sell hybrid varieties to smallholders. b) Export Trading Group (ETG)-supplying of agro inputs such as fertilizer, seed and agrochemicals. c) Farmarama- Suppliers of fertilizers.

### 5.1.2. Information Pathways Available to Farmers in Southern Province

Figure 3 below shows main agricultural information channels available in the Southern province.

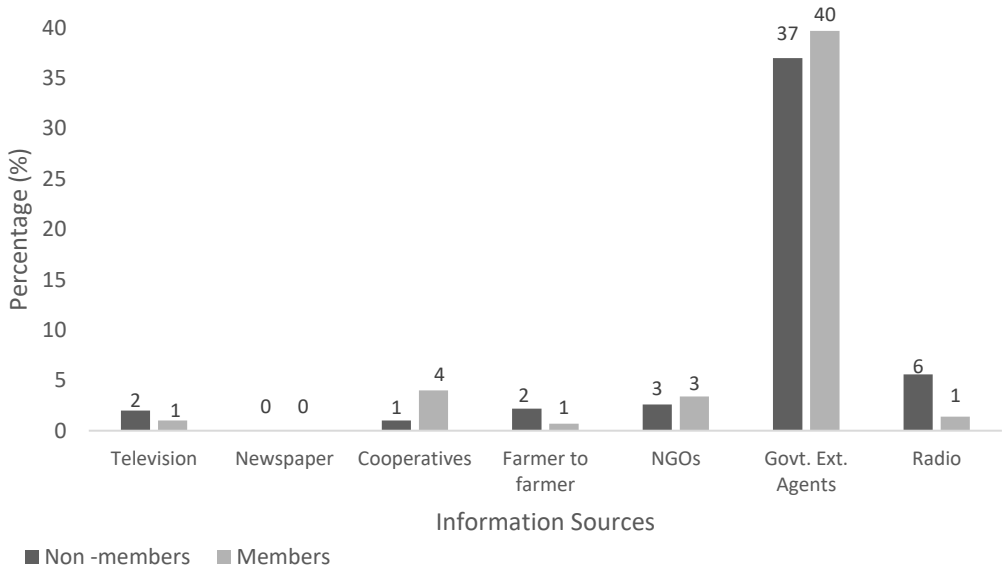


Figure 3: Sources of agricultural information

From the results in Figure 3 above, Television accounted for only a total of 3%, no respondent received information from News papers. However, group discussions revealed that posters and brochures containing generalised messages are also distributed in local languages. Print media hardly meets smallholders' needs because of low literacy levels and content generalisation.

Despite the vital roles played by cooperatives among farmers, only 5% of respondents in total obtained information directly from cooperatives. Interestingly, non members generally show higher percentages regarding the use of television, farmer to farmer, and radio. Results further show public extension agents ranking the highest in providing information with a total of 77% for both members and non members. This high ranking of public extension service was also noted from focus group discussions in Southern province. Radio is also prevalent among smallholders and the public extension service providers collaborate with local radio stations to provide tailored agricultural messages to local smallholders. For example, the following Table 3 highlights some radio programmes from four selected districts.

Table 3 Main agricultural radio programmes broadcasted by some radio stations

| **District** | **Radio station** | **Specific topics** | **Frequency of programmes** | **Responsible people** |
|---|---|---|---|---|
| Monze | Sky FM, Chikuni station | Farm management, conservation farming etc | Depends on sponsors | Farm Management Unit in conjunction with Extension Methodologist (Department of agriculture) |
| Pemba | Byta FM | Conservation agriculture, herbicide use etc. | Depends on sponsors | National Agriculture Information Services (NAIS) |
| Choma | Byta FM, Choma mano | Phone-in programmes on various topics e.g land preparation, weed and pest control. etc | weekly | Sponsored by SIFAZ project, facilitated by NAIS |
| Kalomo | Radio Namianga | Value addition, Conservation Agriculture (orange maize, legume, cassava) | Twice per week (an hour per session) | Sponsored by ADRA Topics hosted by alternating extension officers. |

## 5.2. Ojective Two- Initiatives by the cooperatives on accessing AESs

Results from Focus Group Discussions (FGs) reveal that cooperatives play a vital role in initiating, facillitating trainings and dissemination of agricultural information. Cooperatives receive extension services either by demanding for services from extension agents or the extension agent may propose such services to the cooperative. The role of the cooperatives in facilitating desemination of agricultural information in Zambian context first starts from their involvement in the Camp Agricultural committees (CAC) through cooperative representatives. The CAC is mostly composed of democratically elected cooperative representatives, each representing a particular zone of the agricultural camp. The CAC is also composed of the public extension agent who undertakes the roles of the executive secretary. The role of the CAC is to share agricultural information via zonal cooperative meetings and relay trainings to fellow farmers in their respective zonal areas where the extension agent may hardly reach. The following excerpt from focus group discussion is a response to wether cooperatives have initiatives to facilitate access to AESs:

'*Yes we have various services through zone meetings organised by our zone leaders (CAC representatives), we are not very consistent but periodically. The system uses us as cooperatives to train other members. Sometimes within the zones we invite extension officers to come and teach us within our respective zones.'*

When asked about forms of AESs which are easily accessible via cooperatives, respondents cite trainings, because it only involves learning and sacrificing time and no other contributions from the farmer. Although it is perceived that the government has a duty to fund all the public extension programes, active cooperatives accelerate the implementation of trainings (the extension process) and influences information (the content) dissemination through annual contributions remitted to the CAC committees. The contributions cover-up minor costs incured by the extension officer to undertake urgent movements within the camp to cooperators. In certain cases, cooperatives contract specialised extension personel to provide specific information needed by the group.

Subsidised farm inputs (FISP) and credit support are easily accessed when one is in a cooperative than those who are not in cooperatives. Hence, some NGOs such as Care International, World Vision, and DAPP promote savings groups in order to improve liquidity among the farmers who either belong to groups or by forming new savings

groups. This helps farmers to provide credit support among themselves (group members). On the other hand, a group member ( from cooperatives, women's and youth clubs) stands a better chance to access individual loans when in a group because the group acts as collateral. However, the implications of defaulting by individual members is that the loans from such members rests upon the entire group. Hence the cooperative enhances cooperation, entrepreneurship, reciprocity, and inclusion of smallholders in decision making.

Due to demanding documentation required during loan accession, members who can't read and write obtain assistance from those who can. The following excerpt from the respondent highlights the challenge of low literacy levels among cooperators:

*'When accessing certain services like loans which demands a lot of documentation and records and forms, we find a lot of challenges to fill in forms on our own especially if we have to do it from our homes because then we don't know what exactly to do with them or what to write on the forms and other required documents. Sometimes as cooperative leaders we receive some literature with University English (advanced) and they tell you that you have to read and relay the information to others therefor that becomes challenging for us.'*

The Figure 4 below summarises the responses from the focus group discussions regarding how cooperatives through their initiatives, accelerate the extension processes and the sharing of agricultural information among the farmers.

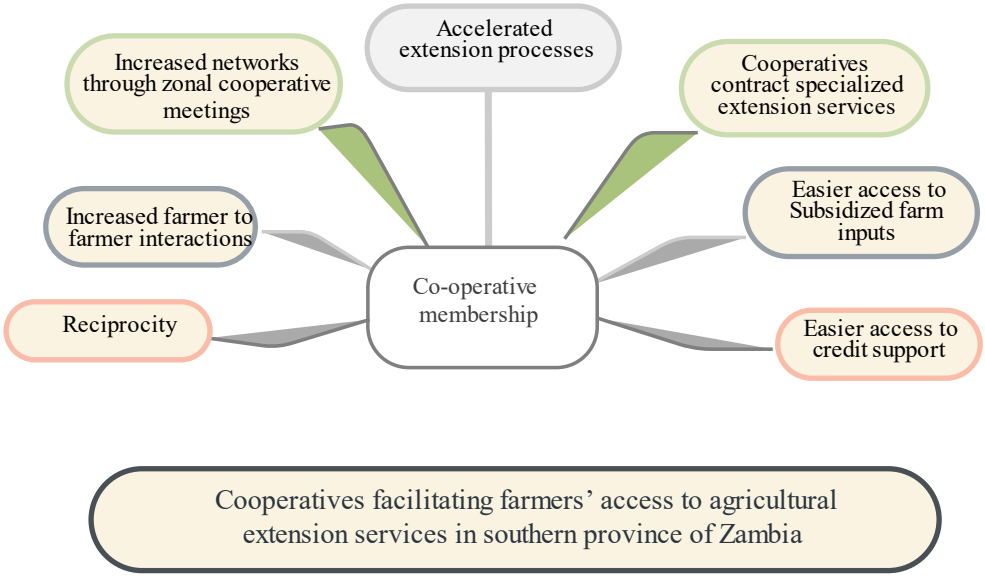


Figure 4 Summary of how cooperatives facilitate farmers' access to agricultural extension services.

## 5.3. Objective Three-Results from Ordered Probit Regression

In the Table 4, Table 5, and Table 6 below, the Ordered Probit regression results with respective marginal effects for the dependent variables are portrayed. Table 4 below shows ordered probit regression and marginal effects results on the perception of farmers regarding how easily they access agricultural trainings. The chi-square statistics from the ordered probit model is significant ($p < 0.001$).

From the ordered probit results in Table 4 below, cooperative membership has a significant and positive effect (0.405) on the the perception of farmers on how easily they access agricultural trainings. Respective marginal effects are denoted by positive values on the access of trainings being easier or better. Marginal effects further show that for every cooperative member, there is 10% chance of perceiving access of agricultural trainings as easy which further validates the findings that cooperative members access trainings easier than non-members. Results further show that higher number of extension contacts (0.031 at 1% ), proximity to the extension office (0.036 at 1%), and the social capital attribute of trust among community members (0.508 at 1%), have significant and positive effects on the farmers' easier access to agricultural trainings. The ordered probit regression results on gender of the extension agent shows a significant negative coefficient (-0.564 at 1%), suggesting that female extension agents facilitate easier access of agricultural trainings to smallholder farmers than their male counterparts. The marginal effects show that having a female extension agents increased the chance to easily access trainings by 12.7%.

Further results show that age of farmer, gender of the farmer, farmer education , and value of farm assets, have positive and significant effects on the farmers' easier access to agricultural trainings. On the other hand, annual household incomes are denoted by negative coeficients (-0.401 at 1%), suggesting that farmers with higher household income levels ranked the access to trainings as difficult.

Table 5 below shows the ordered probit regression and marginal effects' results on the factors influencing the quality to trainings among the smallholders in the Southern province of Zambia. The chi-square statistics from the probit model is significant ($p < 0.001$).

The probit regression results on cooperative membership reveals a positive coefficient (0.454, at 1%) which implies that the perception of quality of agricultural trainings among cooperative members is satisfactory. Marginal effects for cooperative membership reveal positive and significant coeficients for quality of trainings being good or better. Further, membership increased the probability of farmers perceiving quality of trainings being good by 15.1%. This implies that cooperative members have better quality of agricultural trainings. The positive coefficient (0.042, at 1%) for results on extension contacts also show that the number of extension contacts received by the farmers has a positive effect on the quality of agricultural trainings by the farmers. The results further reveal that proximity of the farmers to the extension office has a positive bearing on the quality of agricultural trainings (coefficient of 0.045 at 1%). Active seeking of agricultural extension services is denoted by a significant and negative coefficient (-0.583 at 1%) which implies that farmers who actively seek extension services perceive agricultural trainings as of unsatisfactory. Active seeking increases the probability to perceive the quality of trainings as poor by 11.3%. Perceived trust of the farmer in the community is denoted by a positive and significant coefficient (0.225 at 1%), an increase in trust increases the chance to perceive quality of trainings as being good by 7.6%. These results imply the positive effect of social capital on the quality of perceived agricultural trainings.

The results from the ordered probit regression in Table 5 also shows that the larger the hectarage, the higher the perceived quality on agricultural trainings (0.058 at 1% ). Further, the higher the income levels the less the perceived quality of agricultural trainings (-0.308 at 1%). In other words, a unit decrease in income increases the probability of perceiving quality of trainings as good by 10.3%. These results imply that farmers with higher annual income levels perceive the trainings as of poor quality. No significant differences were observed regarding the effects of gender of agent, household members in leadership, value of farm assets, education of farmer, and gender of farmer on farmers' perception on quality of agricultural trainings.

In the Table 6 below, the results of the ordered probit regression and the respective marginal effects on the factors influencing quality of agricultural information are presented. The chi-square statistics from the ordered probit model is seen to be significant ($p < 0.001$).

From the ordered probit regression results below, Cooperative membership is seen to positively and significantly (0.315 at 5%) influence the quality of agricultural information received by the farmers. The marginal effects for cooperative membership denote negative coeficients on quality of information being poor while showing positive coeficients on good quality of information. Cooperative membership raises the probability to perceive quality of agriculture information as excellent by 6.0%. This shows the positive effect of cooperative membership on better quality of agricultural information. As expected, the higher the number of extension contacts a farmer receives, the better the quality of agricultural information (0.022 at 1%). The follow-up marginal effects analysis reveals positive coeficients on perception of quality of information being good or better.

Although results show proximity of the farmer to the extension office having a positive coefficient (0.019), the influence it has on perceived quality of agricultural information is statistically insignificant. The probit regression coefficient on active seekers of AESs is negative (-0.492, at 1%), with respective marginal analysis having positive coefficients on poor quality while negative coeficient on good quality of agricultural information. This therefore implies that farmers who actively sought for extension services perceived the quality of the received agricultural information as poor and or worse and therefore not satisfied. Marginal effects show that passive seeking increased the probability of perceiving the quality of trainings as excellent is 8.6%. Of interest also is the social capital element of trust which seems to drive farmers to acquisition of quality agricultural information and this is significant (0.292, at 1%). Marginal effects depict the increase in trust as increasing the chance of farmers to consider the agricultural information as excellent quality by 5.5%.

Further, age is denoted by a negative regression coefficient (-0.014 at 1%) meaning that younger farmers have a statistically significant and good perception on quality of information. Farm size (0.015 at 1%) and farm assets (0.230 at 1%) also positively influence the quality of received information acquisition of better quality of agricultural information. Interestingly, education and annual household income seem not to influence the quality of agricultural information received by the farmers.

Table 4 Ordered Probit Regression and marginal effects on farmers' access to trainings

| **Original model** | | | **Marginal effects** *(dy/dx)* | | | | |
|---|---|---|---|---|---|---|---|
| Access to agricultural trainings | | Coef. (S.E) | **Very difficult** Prob. (Y=1 \| X) | **Difficult** Prob. (Y=2 \| X) | **Fair** Prob. (Y=3 \| X) | **Easy** Prob. (Y=4 \| X) | **Very Easy** Prob. (Y=5 \| X) |
| ***Predictor variables*** | | | | | | | |
| Cooperative membership | | **0.405** (0.126)*** | -0.024** | -0.069* | -0.067*** | 0.108*** | 0.052*** |
| Extension contacts per year | | **0.031** (0.008)*** | -0.002*** | -0.005*** | -0.005*** | 0.008*** | 0.004*** |
| Proximity to the extension office | | **0.036** (0.014)*** | -0.002** | -0.006** | -0.006** | 0.010*** | 0.005** |
| Gender of extension agent | | **-0.564** (0.146)*** | 0.026*** | 0.085*** | 0.106*** | -0.127*** | -0.089*** |
| Active seeking of AESs | | -0.201 (0.126) | 0.013 | 0.035 | 0.032 | -0.056 | -0.024 |
| ***Social capital attributes*** | | | | | | | |
| HH members in leadersship | | 0.086 (0.122) | -0.005 | -0.015 | -0.014 | 0.023 | 0.011 |
| Farmer trusted by community | | **0.508** (0.076)*** | -0.030*** | -0.087*** | -0.085*** | 0.138*** | 0.064*** |
| ***Control variables*** | | | | | | | |
| Age of farmer | | **0.008** (0.005)* | -0.000 | -0.001 | -0.001 | 0.002 | 0.001 |
| Gender of farmer | | **0.333** (0.124)*** | -0.023** | -0.059** | -0.051*** | 0.094** | 0.038*** |
| Education of farmer | | 0.041 (0.023)* | -0.002* | -0.007* | -0.007* | 0.011* | 0.005* |
| Farm Size | | -0.009 (0.008) | 0.001 | 0.002 | 0.002 | -0.002 | -0.001 |
| Annual H/H Income | | **-0.401** (0.074)*** | 0.024*** | 0.069*** | 0.067*** | -0.109*** | -0.051*** |
| Farm Asset Value | | **0.204** (0.046)*** | -0.012*** | -0.035*** | -0.034*** | 0.055*** | 0.026*** |
| Mean dependent var | 3.382 | SD dependent var | | | 1.071 | | |
| Pseudo r-squared | 0.152 | Number of obs | | | 401 | | |
| Chi-square | 171.927 | Prob > chi2 | | | 0.000 | | |
| Akaike crit. (AIC) | 993.684 | Bayesian crit. (BIC) | | | 1061.581 | | |

**** p<.01, ** p<.05, * p<.1*

Table 5 Ordered probit regression with marginal effects of factors influencing quality of trainings

| **Original model** | | | **Marginal effects** | | | | |
|---|---|---|---|---|---|---|---|
| Quality of agricultural trainings | | Coef. (S.E) | **Very poor** Prob. (Y=1 \| X) | **Poor** Prob. (Y=2 \| X) | **Fair** Prob. (Y=3 \| X) | **Good** Prob. (Y=4 \| X) | **Excellent** Prob. (Y=5 \| X) |
| ***Predictor variables*** | | | | | | | |
| Cooperative membership | | **0.454** (0.131)*** | -0.008** | -0.081*** | -0.088*** | 0.151*** | 0.027*** |
| Extension contacts per year | | **0.042** (0.009)*** | -0.001** | -0.007*** | -0.008*** | 0.014*** | 0.002*** |
| Proximity to the extension office | | **0.045** (0.014)*** | -0.001** | -0.008*** | -0.009*** | 0.015*** | 0.003*** |
| Gender of extension agent | | 0.087 (0.147) | -0.002 | -0.016 | -0.017 | 0.030 | 0.005 |
| Active seeking of AESs | | **-0.583** (0.131)*** | 0.013** | 0.113*** | 0.103*** | -0.199*** | -0.030*** |
| ***Social capital attributes*** | | | | | | | |
| HH members in leadersship | | 0.057 (0.126) | -0.001 | -0.010 | -0.011 | 0.019 | 0.003 |
| Farmer trusted by community | | **0.225** (0.075)*** | -0.004** | -0.040*** | -0.045*** | 0.076*** | 0.013*** |
| ***Control variables*** | | | | | | | |
| Age of farmer | | -0.002 (0.005) | 0.000 | 0.000 | 0.000 | -0.001 | -0.000 |
| Gender of farmer | | 0.126 (0.127) | -0.002 | -0.023 | -0.024 | 0.043 | 0.007 |
| Education of farmer | | 0.005 (0.023) | -0.000 | -0.001 | -0.001 | 0.002 | 0.000 |
| Farm Size | | **0.058** (0.009)*** | -0.001** | -0.010*** | -0.012*** | 0.020*** | 0.003*** |
| Log of Annual H/H Income | | **-0.308** (0.076)*** | 0.005** | 0.055*** | 0.061*** | -0.103*** | -0.018*** |
| Log of Assets value | | 0.036 (0.046) | -0.001 | -0.006 | -0.007 | 0.012 | 0.002 |
| Mean dependent var | 3.414 | SD dependent var | | | 1.071 | | |
| Pseudo r-squared | 0.218 | Number of obs | | | 401 | | |
| Chi-square | 156.254 | Prob > chi2 | | | 0.000 | | |
| Akaike crit. (AIC) | 869.183 | Bayesian crit. (BIC) | | | 1061.581 | | |

**** p<.01, ** p<.05, * p<.1*

Table 6 Ordered probit regression with marginal effects of factors influencing quality of agricultural information

| **Original model** | | | **Marginal effects** | | | | |
|---|---|---|---|---|---|---|---|
| Quality of agricultural Information | | | **Very poor** | **Poor** | **Fair** | **Good** | **Excellent** |
| | | Coef. (S.E) | Prob. (Y=1 \| X) | Prob. (Y=2 \| X) | Prob. (Y=3 \| X) | Prob. (Y=4 \| X) | Prob. (Y=5 \| X) |
| ***Predictor variables*** | | | | | | | |
| Cooperative membership | | **0.315** (0.134)** | -0.011* | -0.025** | -0.049** | 0.025* | 0.060** |
| Extension contacts per year | | **0.022** (0.009)*** | -0.001** | -0.002** | -0.003** | 0.002* | 0.004** |
| Proximity to the extension office | | 0.016 (0.014) | -0.001 | -0.001 | -0.002 | 0.001 | 0.003 |
| Gender of extension agent | | -0.229 (0.153) | 0.007 | 0.017 | 0.035 | -0.012 | -0.047 |
| Active seeking of AESs | | **-0.492** (0.134)*** | 0.021** | 0.042*** | 0.078*** | -0.055** | -0.086*** |
| ***Social Capital Attributes*** | | | | | | | |
| HH members in leadersship | | 0.111 (0.129) | -0.004 | -0.009 | -0.018 | 0.009 | 0.021 |
| Farmer trusted by community | | **0.292** (0.079)*** | -0.010** | -0.023*** | -0.046*** | 0.024** | 0.055*** |
| ***Control Variables*** | | | | | | | |
| Age of farmer | | **-0.014** (0.005)*** | 0.000** | 0.001** | 0.002** | -0.001** | -0.003*** |
| Gender of farmer | | -0.199 (0.131) | 0.006 | 0.015 | 0.031 | -0.013 | -0.040 |
| Education of farmer | | -0.008 (0.024) | 0.000 | 0.001 | 0.001 | -0.001 | -0.002 |
| Farm Size | | **0.015** (0.009)* | -0.001 | -0.001 | -0.002 | 0.001 | 0.003* |
| Log of Annual H/H Income | | 0.016 (0.076) | -0.001 | -0.001 | -0.003 | 0.001 | 0.003 |
| Log of Assets value | | **0.230** (0.048)*** | -0.008*** | -0.018*** | -0.036*** | 0.019** | 0.044*** |
| Mean dependent var | 3.800 | SD dependent var | | | 0.883 | | |
| Pseudo r-squared | 0.235 | Number of obs | | | 401 | | |
| Chi-square | 102.292 | Prob > chi2 | | | 0.000 | | |
| Akaike crit. (AIC) | 818.565 | Bayesian crit. (BIC) | | | 886.462 | | |

**** p<.01, ** p<.05, * p<.1*

# 6. Discussion

## 6.1. Objective one

Higher number of extension contacts among the public agents as reported in Table 2 can be attributed to the support given to the public agents from other extension providers (NGOs and agricultural companies) who operate through public agents and have less or no direct contacts with farmers. In addition public agents are usually closer to farmsteads than other extension agents. Higher extension contacts from public agents were also noted by Mofya-Mukuka & Kabisa (2016). Even when private agents have direct access to farmers, only farmers with interest in a related commodity and have a certain level of capacity avail themselves. Hence the lower number of contacts among the NGOs, and private agents as compared to public agents.

Since cooperators can mostly demand for meetings and trainings with and or through public agents, this always raises the number of contacts with public agents than with other extension providers. Likewise, this would contribute to the margin between cooperators' and non cooperators' number of extension contacts (average of 5.45 and 4.17 contacts for coop members and non members respectively) since non members are mostly not involved in the trainings initiated by the cooperative.

Results in Figure 3 reporting only 5% of smallholders receiving information from Television may be due to poor coverage of television signal and poor or lack of electrical supply in many rural areas. This view is also supported by Aldosari et al. (2019). A study by Yiridoe et al. (2010) which examined the determinants of farmers' participation in Nova Scotia's Environmental Farm Plan program, revealed farmers using more print media (agricultural magazines and newsletters) than the electronic media and computer channels. The majority farmers in Nova scotia had obtained tertiary education. Further, study results from predominantly urban (Choma central A and B) and rural (Pemba District) where the average education of respondents was about 10.2 years showed that 40% of the respondents felt print media was effective while 60% had the view that print media was ineffective (Somanje et al. 2021). Therefore, the low usage of print media (newspapers, broschures, posters) in our results may be attributed to high illiteracy level

(average of 8.26 - 8.51 years of schooling) as compared to the above mentioned study by Somanje et al. (2021). The use of English language in all newspapers in Zambia may also disadvantage farmers who only read local languages. However, Focus Group Discussions revealed that some posters and brochures, translated in local languages were useful despite containing generalised contents.

In Figure 3, It can be noted that 1% of non members received AES through cooperatives which suggests minimal spill over effects of cooperative benefits in Southern province. The 4% of cooperatives members accessing information from cooperatives still appear to be low but this is because cooperatives in Southen province mostly act as conduits through which agricultural information is passed on to members. This however does not undermine the role of these cooperatives in facilitating farmers' access to information. Similar to the results from Kenya by Nyaga (2012) public extension agents in Zambia appear to be highly profound than all other forms of information pathways. We acknowledge the potential inclination of farmers to give responses based on their fairness towards their public extension agents. However, these results can be better understood by the fact that the public extension system is perceived as the main link to farmers through which all stake holders, cooperatives inclusive, have to relay authentic agricultural information for smallholders. For example, a cooperative can provide information to its members by inviting the public extension agent during cooperative meetings to directly speak to its own members on a given subject. Likewise, some local radio stations host programes where some public extension agents discuss some topics weekly. From the results, it seems non-cooperative members favour information pathways that can be accessed individually with less collective action and these include television, radio, farmer to farmer. Although Figure 3 is a portrayal of the major information pathways for the farmers, focus group discussions revealed complimentarity among different information pathways. For example some farmers reported having received information via WhatsApp from fellow farmers who acquired the same information through the Television.

## 6.2. Objective Two

Although the cooperatives in Zambia may appear not to be a prominent source of agricultural information, it can be seen from Focus Group Discussions that cooperatives form the hub between extension agents and farmers. The existing extension structures composed of camp agriculture committee members working hand in hand with extension agents is similar to the 'contact farmers' present in other countries like Kenya as noted by Nyaga (2012).

## 6.3. Objective Three

### 6.3.1. The Access to Agricultural Trainings

The positive influence of cooperative membership on the access to trainings is not surprising since most of the agricultural developmental projects and activities use cooperatives and other farmer groups as the channel to reach the farmers (Schöll et al. 2016). Cooperatives also form the platform for social networking which can positively influence farmers' perception thereby easily accessing the trainings. This view is also supported by Mutyasira et al. (2018). Our results on the extension variable are in line with Gido et al. (2015) who found that the higher the number of extension contacts a farmer had, the more the accessed trainings. This was attributed to the fact that during the farmer agent acquaintance, there is exchange of information which may include future trainings sessions and the farmers can easily plan to participate in such trainings. Similar to the current findings, Gido et al. (2015) found that proximity to agriculture extension office contributed to accessing extension services.

Interesting results relate to the variable of gender of extension agent in which female extension agents appear to make trainings easily accessible to farmers as compared to their counterpart male extension agents. Notwithstanding the fact that our results portray male farmers as having easier access to trainings than female farmers, female extension agents are revealed to be outstanding in facilitating easier access to trainings. Our results are not strange. Lahai et al. (1999) compared the different genders of extension agents among female farmers in Nigeria and their findings suggested that female agents were prominent in facilitating farmers access to extension services. While

in their studies the prominence of female agents may be contended since the higher extension services were found on female agent to female farmers, a case which might be possible among the male-agent and male farmers, our results anyway reinforce the idea of women being very influential in this regard. Moreover, female agents may be perceived to be more receptive, accomodative and less agressive as compared to their male counterparts. Present results on education are in line with Davis & Mekonnen (2012) who found that extension services are easier accessed among farmers with high-level education.

Since there is significantly higher number of older farmers in cooperatives than younger farmers (as shown in Table 1), this is probably the reason why older farmers easily access trainings than their younger counterparts. Also older farmers generally have capacity to invest in assets and technologies that expose them to trainings (Grabowski et al. 2016). More access to trainings by male farmers than their female counterparts may be attributed to the prevalent male chauvinistic culture which prioritises male participation in trainings although the males usually fail to accurately relay the acquired information to their female partners. Also when residential trainings, or trainings with long duration are conducted, parenting female farmers often succumb to child care and home duties. Similar findings have been reported by other authors (Lahai et al. 1999; Diaz & Najjar 2019; Atsbeha & Gebre 2021). Diaz & Najjar (2019) has insisted that extension services have long and continue to side-line female farmers in their approach and that inequalities will persist until female farmers are integrated sufficiently in the extension systems.

The increase in income among farmers often results in them enganging in alternative livelihood activities as opposed to routine farming activities. This can dis-engage farmers from their long established social networks thereby lessening the awareness on future planned trainings.

### 6.3.2. Quality of Trainings

There are constraints to farmers perceptions on trainings, and these may include distance to the training centre, education level of the trainee, and time allotted for training (Kazeem et al. 2017). The perception of poor quality of trainings among non cooperative members may be linked to their relatively longer distances from farms to the training

centres (Camp extension office) than their fellow counterparts as can be seen in Table 1 above. Longer duration of trainings can negatively influence the perception of farmers who cover longer distances to reach their homes. Results from research by Somanje et al. (2021) portrayed Zambian farmers having a general better perception where 72% respondents rated trainings as highly effective as compared to Ghanian farmers where 62% rated trainings as highly effective.

According to Bekele & Pillai (2011), increased awareness lessens the need for trainings. The negative influence of age on perception of trainings is probably due to the relatively higher awareness levels among the older farmers than the younger farmers. In addition, since the younger the person the more rapid they respond to information and trainings, hence more appreciation of the trainings among the younger farmers (Ayesha & Muhammad 2012). Younger farmers may also appreciate the quality of trainings because they are in the active labour group as compared to the older group. Similarly, the above explanation may be valid for results (see Table 6) on the perception of quality of information by the older farmers.

Gender and education of farmers positively influence farmers' perception on quality of trainings but has negative influence on perception of quality of information. In each case, the influence is not significant. However it can be observed that males perceive trainings as of good quality as compared to females, this can explained by the fact that females are usually engaged in extra tasks of preparing meals for the participants even during the course of the trainings, hence, they have less appreciation of the content. Probably due to the fact that the avearge years of education is too low to fully appreciate quality elements in the trainings and information received. This shows that the process of extension services (trainings) are considered differently from the contents (quality of information).

Our findings on negative influence of income on perception of quality of trainings are consistent with Bekele & Pillai (2011), which maybe be due to the fact that as smallholders' income increases, they tend to seek for better and context-based trainings (e.g in highvalue crops) from other providers. In addition, they may switch to other income ventures and loose interest in the ordinary trainings from the extension agents, a behaviour which is also noted by Babu et al. (2015). A positive effect of farm assets on the other hand may be due to the fact that as smallholders acquire new farm implements

or equipments e.g knapsack sprayers, they tend to seek for expertise in the utilization of newly acquired asset. Presence of farm assets may kindle interest in related trainings thereby raising the perception on quality of trainings. Similar explanation can be given to results relating to quality of information (see Table 6). Education is widely considered as a factor in the quality of trainings, although present results show a positive coefficient, the influence is not significant. This is similar to findings by Kazeem et al. (2017), whose results showed positive but with an insignificant influence on the perception of farmers on trainings from extension agents.

### 6.3.3. Quality of Agricultural Information

Since Cooperative membership in farmer groups forms a powerful social network for exchange of information (Abdulai & Huffman 2014), it is therefore not surprising that cooperative membership positively influences farmers' perception on the quality of received information. Some studies (Liang et al. 2015; Granovetter 2018) have explained how different forms of trust among farmers can improve the sharing of quality information. It can be noted (see Table 1 ) that cooperative members in our sample have significantly more trust than non members, hence the higher perception of quality of information among cooperative members as depicted in the results (see Table 6) above. In addition, our results in Table 6 further consolidates the idea that higher levels of trust have a positive effect on the perception on quality of information. Since contact with extension agents is one of the most reliable ways of acquiring information by farmers (Abdulai & Huffman 2014), our results are in line by showing that more extension contacts positively influence the farmers' perception on quality of agricultural information. Our results on gender of extension agents are different from results in Kenya by Tata & McNamara (2018) where information from female extension agents was preferred especially among female farmers. Our result could be due to a poor representation of the In their study, this was attributed to female extension agents preferring face to face extension services (FAO 2011; Manfre et al. 2013).

Our results on active seekers' dissatisfaction to information is understanderstood on the basis that farmers who actively seek information in most cases have contextual needs which can hardly be met by the current extension system which is dominated by the public extension providers. Such farmers can be satisfied by the private extension

providers who have specialised information as contrasted to generalised information from public providers. This view is also supported by Babu et al. (2015) who shows that private extension providers become more prominent as the agricultural sector evolves towards commercialization.

Our results on age and quality of information are in contrast with study results by Feleke et al. (2017) where older farmers seemed to access better information. Younger people are generally less risk averse, more explorative thereby finding better alternatives to sources of information. This may explain the better perception on quality of information among the younger farmers. Our results on effect of farm assets are in line with findings by Feleke et al. (2017) where farm assets increase the quality of received agricultural information. Refer to discussion on quality of trainings above.

# 7. Conclusion and Recommendations

The aim of this study was to ascertain the effects of cooperatives on farmers' access to agricultural extension services in the Southern province of Zambia. The first objective was to describe the channels of agricultural extension services available to farmers and the channel favourable to the smallholder farmers in the Southern province of Zambia using descriptive statistics. The study showed that the public extension service provider superseded in providing extension services over all other stakeholders in the Zambian pluralistic extension system. The farmers' confidence in extension services ranked highest on the public providers and lowest among the private extension service providers, with further significant differences between cooperative members and non members.

The second objective was to describe how the cooperatives facilitate smallholders' access to agricultural extension services using qualitative data collected through focus group discussions. The study showed that cooperatives had structures working and cooperating with agricultural service providers beginning from the agricultural extension agents reaching down to the cooperatives in the communities. These structure comprising of fellow farmers were very instrumental in aiding the farmers to receive various agricultural services from all agricultural stakeholders.

The third objective was to determine the influence of cooperative membership and group participation among the factors that influence smallholders' access to agricultural extension services using the ordered probit regression model. Using access to agricultural trainings, quality of the received agricultural trainings, and perceived quality of the agricultural information as dependant variables. We found that cooperative membership was very critical in farmers' easier access to agricultural trainings, perceived quality on agricultural trainings, and perceived quality of the agricultural information from the extension services. Other factors that were influential include but not limited to higher number of extension contacts, proximity to the extension office, gender of extension agent and trust among community members. While we understand the potential neglect on some factors for example qualifications of extension agents, which is mainly due to broad nature of the field of agriculture extension, there is good evidence to conclude that

cooperative membership, and increased social capital expressed as trust, have positive effect on smallholders' access to agricultural extension services.

In order to improve the performance of the agricultural extension systems in Zambia, and in other countries with similar status quo, there is need to reconsider the processes and the contents of extension provision to farmers. There is need to consider a more demand driven participatory system and give much attention to quality provision of extension services which reflects the demands and needs of the different farmer categories.

Since the majority of farmers in southern province of Zambia are small holders, currently they can hardly access private extension services due to their limited capacities. The current agricultural extension situation in Zambia and other developing countries also presents the need for promotion and appropriately supporting cooperatives, and other farmer groups, to equip them with necessary skills to seek appropriate services from private firms through collective action.

There is need for the public extension service provider to reduce the farmer to extension agent ratio by increasing the number of public extension agents, giving special attention to the numbers of female extension agents. Further, to reduce the proximity of farmers to agricultural extension offices by strategically establishing more extension offices. There is a urgent need to establish or improve rural communication infrastructure to help in facilitating desemination of localised agricultural information through modern electronic and digital media.

The current dominant share of public agriculture extension in the present set of Zambian pluralistic extension system does not reflect sustainable levels of quality extension service provision. For agricultural growth to take effect, there is need for increased participation of the private extension providers which corresponds to the level of agricultural development and desired quality levels. The proportion of public extension provision in the pluralistic extension system should reflect mainly the needs of farming population which is more or less passive seekers of extension services. This can encourage the development and stabilization of the private extension providers whose good performance dictates the sustainability and development of agriculture. More studies should be undertaken revolving around the potential of demand driven agricultural extension services in Sub Saharan Africa.

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# 9. Appendices

**List of the Appendices:**



# Appendix 1: Survey Questionnaire

This questionnaire has been designed to execute research purposely for academic work. The principal objective is to ascertain the effects of cooperatives on smallholders' access to agricultural extension services in the Southern province of Zambia. All information provided will solely and exclusively used for academic purpose and all respondents will remain anonymous to the public domain. Information provided would be used to make sound empirical analysis and suggest policy recommendations that would help improve the delivery of agriculture extension services in the region. The entire interview will take 30 minutes of your time and you are kindly requested to provide honest and genuine answers within your possible best.

**SECTION A: HOUSEHOLD CHARACTERISTICS**

1) What is the age of the household head? (years)

2) Gender of household head? (1- Male, 0- Female)

3) Gender of extension agent (1-Male, 0-Female)

4) Marital status? (1-Single, 2-Married, 3-Divorced, 4-Widowed)

5) Size of household (total members of the family)?

6) Total years of education of household head? (yrs.)

7) Total years of farming experience? (yrs.)

8) Are you a paid-up member of the cooperative? (1-Yes, 0-No)

**SECTION B: FARM ATTRIBUTES**

9) What is your total land holding area (in hectares)?

10) Size of total cultivated land (in hectares)?

11) What is the distance from your farm stead to the nearest extension office (kilometres)?

12) What is the distance from your farm to the market (Km)

**SECTION C: ECONOMIC ATTRIBUTES**

13) What is your annual household income (Zambian kwacha)?

14) What is the value of your major farm assets (Zambian Kwacha)?

**SECTION D: SOCIAL CAPITAL**

15) Is there any of your household members in leadership position? (1-Yes, 0-No)

16) Do you agree that most people in your community, farmer association or cooperative can be trusted (1-Strongly disagree, 2-Partly disagree, 3-Neither agree nor disagree, 4-Partly Agree, 5- Strongly agree)

17) Do you agree that most people in your community, farmer association or cooperative have trust in you? (1-Strongly disagree, 2-Partly disagree, 3-Neither agree nor disagree, 4-Partly Agree, 5- Strongly agree)

**SECTION E: EXTENSION CONTACTS**

18) When do you access extension services/advice? (1-Upon demand, 0- Without demanding)

19) How many extension contacts did you have from Government, NGOs, and Companies in the past year?

20a) How many extension contacts did you have from GOVERNMENT extension agents only?

20b) How many extension contacts did you have from NGO extension agent(s) only?

20c) How many extension contacts did you have from PRIVATE extension agent (from companies) only?

21a) Rate your confidence in the skills of the GOVERNMENT extension agents (Very poor -1, Poor-2, Fair-3, Good-4, Excellent-5)

21b) Rate your confidence in the skills of the NGOs extension agents (Very poor -1, Poor-2, Fair-3, Good-4, Excellent-5)

21c) Rate your confidence in the skills of the PRIVATE extension agents (Very poor -1, Poor-2, Fair-3, Good-4, Excellent-5)

**SECTION F: ACCESS TO EXTENSION SERVICES**

21d) Please with help of rank below, rate how easily you can access trainings (1-very difficult, 2- Difficult, 3-Fair, 4-Easily, 5- Very easy)

22) Which one has been your main source of agricultural trainings? (1-Government extension agents, 2-NGO extension agents, 3-Private extension agents)

23) Rate the quality of agricultural trainings you received from AESs (1-Very poor, 2- Poor, 3-Fair, 4-Good, 5-Excellent)

**SECTION G: INFORMATION SOURCES**

24) What is your main source of agricultural information? (1-Television, 2-Newspaper, 3-Farmer groups/coop, 4-Internet, 5-Farmer colleagues, 6-NGOs, 7-Govt. Ext. Agents, 8-Radio)

25) Rate the quality of agricultural information received through Agricultural Extension Services (Very poor -1, Poor-2, Fair-3, Good-4, Excellent-5)

**SECTION H: PSYCHOLOGICAL FACTORS**

26) Is it easy for you to access agricultural information? (1-Yes, 0-No)

27) Would members of your village recommend you seek agricultural information? (1-Yes, 0-No)

**THANK YOU FOR YOU COOPERATION**

# Appendix 2: Variance Inflation Factors

| | VIF | 1/VIF |
|---|---|---|
| Farm Asset Value | 1.382 | .724 |
| Annual H/H Income | 1.365 | .733 |
| Cooperative membership | 1.341 | .746 |
| Farmer trusted by community | 1.337 | .748 |
| Farm Size | 1.321 | .757 |
| Gender of extension agent | 1.263 | .792 |
| H/H members in leadership | 1.256 | .796 |
| Active seeking of AESs | 1.249 | .801 |
| Extension contacts | 1.228 | .814 |
| Age of farmer | 1.202 | .832 |
| Gender of farmer | 1.176 | .851 |
| Proximity to extension office | 1.147 | .872 |
| Gender of farmer | 1.108 | .903 |
| **Mean VIF** | **1.26** | **.** |

# Appendix 3: Correlation Matrix

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Cooperative membership | 1.000 | | | | | | | | | | | | | | | |
| (2) Extension contacts | 0.176 | 1.000 | | | | | | | | | | | | | | |
| (3) Proximity to extension office | -0.214 | -0.025 | 1.000 | | | | | | | | | | | | | |
| (4) Gender of extension agent | 0.020 | 0.112 | 0.106 | 1.000 | | | | | | | | | | | | |
| (5) Active seeking of AESs | -0.026 | -0.204 | 0.112 | 0.291 | 1.000 | | | | | | | | | | | |
| (6) H/H members in leadership | 0.258 | 0.211 | 0.028 | -0.088 | -0.087 | 1.000 | | | | | | | | | | |
| (7) Farmer trusted by community | 0.384 | 0.110 | -0.064 | -0.025 | -0.157 | 0.205 | 1.000 | | | | | | | | | |
| (8) Age of farmer | 0.133 | 0.165 | 0.023 | -0.006 | -0.076 | 0.187 | 0.269 | 1.000 | | | | | | | | |
| (9) Gender of farmer | 0.052 | 0.118 | 0.073 | -0.131 | -0.065 | 0.131 | 0.067 | -0.055 | 1.000 | | | | | | | |
| (10) Education of farmer | 0.047 | 0.198 | 0.009 | 0.008 | 0.015 | 0.186 | 0.008 | -0.106 | 0.202 | 1.000 | | | | | | |
| (11) Farm Size | 0.100 | 0.100 | 0.233 | 0.118 | 0.117 | 0.157 | 0.004 | 0.174 | 0.072 | 0.110 | 1.000 | | | | | |
| (12) Annual H/H Income | 0.116 | 0.136 | 0.070 | -0.131 | -0.101 | 0.267 | 0.196 | 0.195 | 0.167 | 0.031 | 0.334 | 1.000 | | | | |
| (13) Farm Asset Value | 0.009 | -0.115 | 0.099 | 0.203 | 0.274 | 0.035 | 0.078 | 0.107 | 0.037 | -0.092 | 0.301 | 0.317 | 1.000 | | | |
| (14) Access to trainings | 0.296 | 0.235 | 0.044 | -0.159 | -0.179 | 0.174 | 0.436 | 0.180 | 0.206 | 0.086 | -0.017 | 0.032 | 0.073 | 1.000 | | |
| (15) Quality of trainings | 0.263 | 0.332 | 0.145 | 0.038 | -0.228 | 0.167 | 0.234 | 0.110 | 0.136 | 0.099 | 0.311 | 0.076 | -0.004 | 0.358 | 1.000 | |
| (16) Quality of information | 0.209 | 0.204 | 0.067 | -0.067 | -0.224 | 0.158 | 0.320 | 0.062 | 0.075 | -0.018 | 0.150 | 0.201 | 0.148 | 0.247 | 0.359 | 1.000 |