

# ADAPTATION OF SMALLHOLDER MAIZE FARMERS TO AGRICULTURAL INFORMATION IN KALIWE AREA OF NYIMBA DISTRICT, EASTERN ZAMBIA.

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The current paper has explored how smallholder maize farmers in Kaliwe area of Nyimba District in Zambia have adapted to agricultural information. It is a thesis of a Master of Science in Geography dissertation. Although there is increased awareness on the importance of agricultural information on climate adaptation, there is very little empirical evidence on how such information is specifically applied by smallholder farmers in remote districts of Eastern Zambia particularly in making their decisions. The primary goal was to understand how smallholder maize farmers use agriculture information in their decision-making procedures in Kaliwe area. The qualitative approach was used, which was founded on the descriptive research design. The purposive and expert purposive sampling methods were employed to get a sample of 46 respondents; including 36 smallholder maize farmers and 10 key informants. The analysis was guided by the Innovations Diffusion Theory especially its aspects of innovation, communication media, and time to gain insight into the spread and adoption of agricultural information to smallholder farmers.

The results on usefulness of agricultural information showed that most of the farmers testified that agricultural information that was available was useful. Majority of the small hold farmers were relying on such information to plant drought tolerant crops, early maturing crops and also to tune their farming calendar with respect to onset or end of rainfall. The results showed that agricultural information reached out to smallholder maize farmers to inform them on how to use fertilizers, nutrient retention practices, how to use pesticides and right farming practices. One of these methods of farming is mixed farming where cereals including maize are planted with legumes including cowpeas or groundnuts, as legumes are known to enhance the soil fertility level. In addition, the farmers have been planting better kinds of maize seeds that have a tendency of growing in a short duration. The farmers have indicated that they used this information to modify their farming activities.

The paper suggests that the small-scale farmers must be trained on the growing of various drought resistant crops; conservation agriculture like crop rotation, cover crops and zero tillage should be realized effectively among the small holder maize farmers. Lastly, the paper suggests that the Government of Zambia and its partners ought to introduce new technologies like SMS alerts and mobile applications that can greatly enlarge and offer the right information on the weather conditions, market prices and pests' outbreaks that can accelerate the rates of adaptation.

**Keywords:** Adaptation, Agricultural information, Diffusion of Innovations, Crop diversification, Information Dissemination, Resilience, Nyimba District, Smallholder farmers.

## 1.2 Introduction

Owing to the fact that climate change will most probably escalate the severity of the environmental challenges, there are high risks facing agricultural systems in every part of the world, which will be altered weather conditions, altered crop productivity, water deficiency, and weed and illness urgency. All these are posing a threat to food security, rural livelihood, and agricultural productivity, particularly in the most susceptible areas, like sub-Saharan Africa. The study was carried out to determine how maize smallholder farmers in Kaliwe region of Nyimba District in Zambia have adapted to agricultural information. The primary aim was to investigate the way smallholder maize farmers integrate agricultural information in their decision-making process in Kaliwe area. This is a snippet, and it is a part of the Master of Science in Geography (MSc) course that is undertaken at Kwame Nkrumah University (KNU).

## 1.2 Background

The effects of climate change are still being felt in most sectors of the economies of the world. The increase of the temperature and fluctuation in the rainfall patterns have been extremely challenging to the crop production. The effects of

global warming, the shift in precipitation, and extreme weather events are predicted to have a negative effect on the production of agricultural products around the world, because this sector directly and heavily relies on land, water, and other natural resources that are changed due to climate change (Walsh et al., 2020; Gowda et al., 2018). As was found in research conducted by Economic Research Service of the USDA in 2011/19, agricultural output growth across the globe has fallen since 2000s when it stood at 1.96 to 2010s when it has reached 1.31. In addition to this, the agricultural output went down to an average annual growth of 2.08 in 2011-2019 (2.68 in 2001-2010). This deceleration has been witnessed in the developing countries with the Asian countries being the most prominent ones (Fuglie et al., 2021). The African continent has not been left out in the effects of climate variability and change. Julie et al., (2023) estimated that African food production and output would reduce and by 2050, the continent would be capable of covering 13% of its requirements.

Zambia has not been an exception of the effects of climate change and its variation especially in the agricultural sector that is affecting other developing countries. Agriculture supply is 80 percent of the domestic food in Zambia, and it is estimated to contribute 20 percent of the Gross Domestic Product and up to 12 percent of the export earnings (Aaron O'Neill, 2025). Therefore, the economic stability of the country is bound to tremble because of the changes in climate that have led to long dry seasons, rainfalls that are unpredictable, uncertain about growing certain crops, more weeds, pests and diseases (Paavola, 2016). The reason is that the agricultural sector of Zambia consists of most farmers, the majority of them being small, relying on rain-fed farming that is very susceptible to climatic change. The country has been savaged with a decline in rainfall of an average rate of 1.9 mm/month (2.3) per decade since 1960, which has resulted in shorter and less predictable rainy seasons and less frequent but more intense rainfall occurrences (AfDB, 2019). Climate change remains a major challenge to the Zambia fight against poverty, food insecurity and sustainable management of natural resources.

This further increases the threat of hunger and poverty especially in the country in the event that climate resilient crops are not widely promoted. El Nino in 2004 to 2005 and 2015 to 2016 resulted in droughts, which cut the yield of maize by about 20% and income by 37 percent (Filho, 2020). In addition, the El Nino caused dry weather trends in the 2023/24 agricultural year led to extended dry seasons, which led to droughts in 84 out of the 154 districts in the country (Chisalu, 2024). This resulted in the reduction of rice, cassava, soya beans, sweet potatoes, millet and sorghum production. The most impacted one was maize, the staple food in the country with about 1 million hectares out of the estimated 2.2 million hectares planted being affected and hence impacting more than one million farming families (Chisalu, 2024). Production also continued to reduce to 1.5 metric tonnes, compared with the forecasted 3.2 metric tonnes, giving an imbalance of 1.7 metric tonnes (Chulu, 2024), which is especially alarming to Kaliwe area.

Even with access to information, there are several challenges that affect smallholder farmers, including reduced access to resources, lack of proper infrastructure, and low literacy rates, that may reduce their capacity to act on agricultural advice positively (Malekela & Yanda, 2021). Furthermore, local conditions tend to alter the relevance of the information given and it is important to customize information to the local context in the Nyimba District. Increased interplay in the changing climatic conditions, agricultural practices, and socio-economic challenges have made adaptation of small holder maize farmers to agricultural information in Nyimba District to be more critical. Maize yields and harvest patterns have been very diverse over the last 10 years, which can be explained by underlying problems connected with information distribution, the implementation of innovative farming technologies, and limitation of the resources.

The maize harvests of the Nyimba District have been fluctuating tremendously beyond 2013 and 2024. In 2013, the average maize in the district was approximately 1,200 metric tonnes which marginally increased to approximately 1,350 tonnes in 2014 (Nyimba District Farmers Association Report, 2015). There was however, a steep decline in the yields in 2015 up to about 950 tonnes because of the drought and incomplete information on weather forecasting. Some progress was recorded in 2012, as the harvests of about 1,500 tonnes were achieved in 2016 due to a better farming system and access to agricultural extension services (Zambia National Farmers Union, 2016). Harvests in 2017 and 2018 have hit levels of approximately 1400-1600 tonnes, although erratic weather conditions and lack of information flow caused the trend to reverse again in 2019, returning to the levels of about 1200 tonnes (Nyimba District Agricultural Report, 2023).

These issues continued to intensify in 2020 with the COVID-19 pandemic reducing them to approximately 1,100 tonnes as the farmers experienced disruption in market access and extension services. In 2021 and 2022, harvests have become more active, approximately 1,500 tonnes, with the help of systematic information activities and state actions. However, the harvests will fluctuate between 1,300 and 1,400 tonnes in 2023 and will presumably be in 2024, therefore, making the harvests susceptible and creating a need to develop an effective approach to inform people. The estimated yield of the 220 tons of maize production that would take place at the proposed Kaliwe area in Nyimba District in 2023/2024 was down to 9.24 tons (DACO, 2024).

Zambian government has come up with the following national policies to address the impact of the changing climate over the years, which encompass national Adaptation Plan of Action (NAPA, 2007), the National Climate Change Response Strategy (2010) and the National Policy on Climate Change (2016) (Irish Aid, 2017). These policies will counter the impact of the climate change and its variability. Moreover, they incorporated the environmental sustainability and climate change mitigation in the Eight National Development Plan (8NDP) 2022- 2026 (Santosh, 2023).

8NDP also aligns with the vision 2030 which strives to achieve the long-run goal of making Zambia a prosperous middle-income country (MFNP, 2022). It is also reflected in the framework with Sustainable Development Goals (SDGs) 1, 2, and 13 that are to be achieved through eliminating hunger and providing food security, improving nutrition, promoting sustainable food production, and focusing on climate change and its implications respectively with burning urgency. Besides, the government and other stakeholders have been promoting the use of climate variability resilient crops to be one of the measures that can be embraced.

Climate resilient varieties are those who have better resistance to biotic and abiotic stresses, such that, they still produce

or even produce higher yields in unfavorable situations (Zohry & Ouda, 2022; Dhankher and Foyer, 2018). The approach will focus on establishing agricultural systems of resiliency that will enable farmers to effectively deal with the climate change (Acevedo et al., 2020). Thus, the agricultural information must be made easy to the farmers such that it can be understood and applied easily.

### 1.3 Theoretical Framework

In adapting the smallholder maize farmers to the agricultural information context of Kaliwe area of the Nyimba District, the Diffusion of Innovations theory was suitable to the context of the research since it was interested in the response of the smallholder farmers to the agricultural information. This theory was formulated in 1983 and amended by Everett Rogers in 2003. It presupposes that there is no possibility of introducing a new idea into a society and making its members accept it with relative easiness. Most of the members of the community will usually view new ideas with suspicion until they are convinced in some way or the other that they will reap some benefits. The theory consists of three significant factors that should be grasped accordingly Innovation, Communication channel and the Time elements.

The aspect of Innovation in the case of the small holder farmers in an area of Nyimba, Kaliwe, in the Nyimba district relates to the new farming methods, technologies, or knowledge that can boost the production and sustainability of maize. Adoption of such innovations is successful depending on their relevancy, availability and perceived benefits they hold to the farmers. In the case of drought-resistant maize hybrids or better methods of farming, this is an innovation and may greatly affect productivity. The interpretation of innovation in this context is the ability to comprehend the local practices, as well as the translation of new information in respect to the needs, preferences, and socio-economic realities of farmers. The innovation element plays a key role in effective dissemination as the diffusion of innovations theory stresses that perceived relative advantage, compatibility with established values, and complexity are the factors that affect the pace of adopting new practices by farmers.

Communication Channel is critical in the process of receiving agricultural information by the smallholder farmers. There are effective channels like local radio, extension services, community gatherings or peer-peer networks through which knowledge can be transferred about innovations. The credibility and adoption of new farming practices in the Kaliwe area that might have poor literacy and limited access to formal communication infrastructure could be positively influenced by using channels of trust and cultural relevance. The character of such channels greatly influences the process of diffusion; personal communication is often more convincing than mass media which is impersonal and particularly in the rural area. Therefore, it is essential to know the most accessible and trusted channels by farmers to allow information concerning innovations to reach the target population, thus speeding up their adoption.

The element of Time is the rate by which small holder farmers in Kaliwe adopt new agricultural practices and the way by which diffusion process occurs over time. The periods of awareness to trial and eventual adoption or not depend on time. The past experiences and social networks of farmers and their perceptions or beliefs on the positive implications innovations have influence the rate at which farmers go through these stages. In that regard, a temporal consideration will be crucial in developing interventions that carry post-implementation support, training and evaluation systems to maintain the implementation. Also, the concept that diffusion is a step-by-step approach enables development practitioners to have sensible expectations and design the strategies that will benefit farmers in the short-run so that the innovations integrate into the farming lifestyles in the long-run.

Everett Rogers came up with five attributes of any group of individuals or society that receive and react to an innovation. These include; the Innovators, the Early adopters, the Early majority, the Late majority and the Laggards. Thus, within this paper, the role of Innovators: they are the first to experiment with new methods or new forms of inputs, Early Adopters: they adopt innovations after innovators and can affect others, Early Majority: larger groups adopt after experimentation and Late Majority: these farmers are the last to adopt and may not adopt because of resistance or lack of resources. Their resistance plays a great role in the low yields of maize.

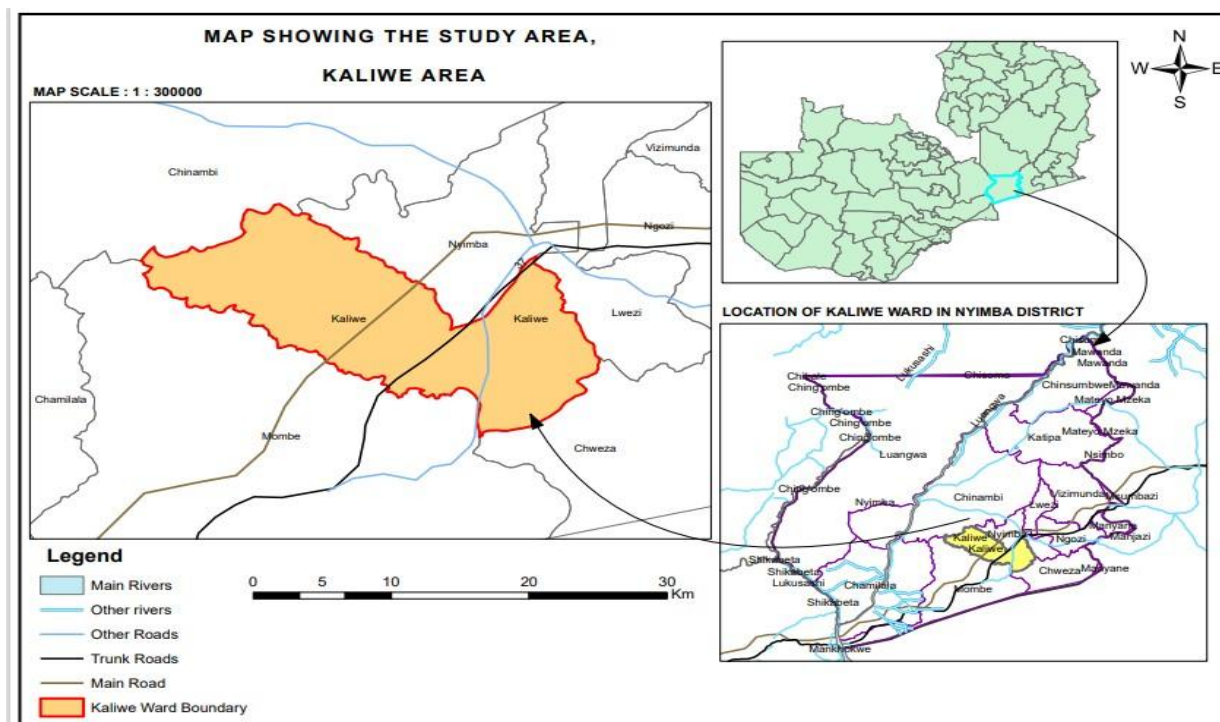
## 2. Methods

### 2.1 Location of the study area

The district of Nyimba is in the south of the Eastern province and is between the 30 degrees and 31 degrees East and the 13 degrees and 15 degrees South (Nyimba Town Council, 2023). The district occupies a suitable space that is 125,000 square kilometers. It borders on six districts and one country. It borders Serenje to the North, Petauke to the East, Mozambique to the South, Luangwa district to the south West, chongwe to the west and Mkushi to the north West. It is further partitioned into four chiefdoms as such, senior chief Luembe, chief Ndake, chief Nyalugwe and chieftainess Mwape. Kaliwe has geographical latitudes of 14deg20'46.6/

S and 30deg35'49.4/ E (latitude -14.3462800deg and Longitude90deg35'49.4deg). Nyimba District is located in the Eastern Province of Zambia (Central Statistical Office Zambia, 2022).

Kaliwe area of Nyimba district was a good choice as a study site to test how the smallholder maize farmers adapted to agricultural information because in the recent past, there has been a trend with decreasing maize harvests than the past, and the need was high to determine the underlying factors which had influenced the productivity. Kaliwe area has a historical agricultural production potential, as it used to be one of the food basket of the district and the present production of low maize production is an ideal site on how the agricultural information will affect the practice of the farmers.



Source: Google maps

Figure 1: Location of Kaliwe area in Nyimba District

## 2.2 Research Design

A research design is the broad approach that you decide to incorporate the various facets of the research in a consistent and rational manner, which will in turn, guarantee you will approach the research problem successfully, it is the road map to the gathering, quantification, and examination of data (Gimblett and Barbra, 2018). Nevertheless, a Case study was selected due to the richness of qualitative information and understanding of a specific context to assume how individual farmers or groups of farmers understand and react to agricultural information.

The research design also enabled the researcher to describe, explain and validate the findings of the research at the end of the research, analyze facts and enabled the researcher to develop a comprehensive concept of the research problem. The design also helped the researcher to observe the behaviors of the individuals in a natural context, and the researcher could also apply the qualitative research method in facts collection, presentation and analysis.

## 2.3 Sample size and sampling strategy.

The research used the methods of expert purposive and purposive sampling. Expert purposive sampling was used to choose key informants since they had experience in specialized knowledge giving a closer insight into climate variability adaptation. Maize farming households were also sampled with small households under sampled with a lot of time spent in the location and also under consideration that they have been practicing maize farming. The study involved forty six (46) participants, which were 10 key informants and 36 heads of smallholder maize farming households. The research was mainly qualitative and was done in accordance with the principle of saturation. According to Guest et al., (2006) a minimum of 15 to 30 participants and a realistic maximum of 30 to 60 participants are good enough to attain saturation and arrive at the required outcomes.

## 2.4 Data collection

The research used a semi-structured interview guide, which provided the researcher with the opportunity to probe the key informants to gain a deeper understanding of the subject matter of adaptation and extract in depth information. The type of interviews (Semi-structured interviews) was the most suitable to the current study, as the interviews are open-ended and enable the researcher to require the participants to clarify, elaborate or rephrase their responses whenever necessary, and openness to follow-up questions. The key informant interviews were to gather the information of the sources of as many people as possible, such as the community leaders such as headmen, officers of agriculture camps, NGOs, DMMU officers and farmers being the first people to have direct understanding of the community. The community specialists with their specific knowledge and understanding should also be able to give an insight into the nature of the issues and offer solutions (USAID, 2020). The authors also used the field observation study, where the researcher took a walk through the study site and the maize agriculture fields to have an overview of how the small holder farmers will adapt and adjust the agricultural information.

The best fit data collection technique in this study was, in fact observation technique, as it does not entail researchers having technical skills as far as the collection of data is concerned since they do not need to face the difficulties of making people share their subjects based on the fact that some may not be comfortable with sharing. Moreover, observation method is simple to arrange and may bring out better data compared with others.

## 2.5 Data Analysis and Processing.

The data were collected and cleaned down and thematically coded according to emerging themes. Coding that follows the data collection process is an essential part of the qualitative analysis since it implies defining what matters and what trends can be identified. The information was coded in order to get it arranged into simple descriptive data and summarised in frequency tables (Saldana, 2015). The data that was obtained was analysed through inductive thematic analysis. An approach used is inductive thematic analysis, which implies deriving meaning and constructing themes of the data, with no prior opinions. This method was applied during the subjective data qualitative analysis whereby related reactions were sorted together to produce a single similar theme and thereafter given descriptively. The analysis was employed due to its flexibility as it can result in the development of new themes. It is also clear because it is not based on preset themes therefore capable of investigating subjective experiences and assist in discovering something new through the information. 3. To guarantee reliability and validity of the findings, triangulation was adopted with the aid of several sources of data. As it was a qualitative study, to test reliability and validity; three key elements of trustworthiness that is; credibility, dependability as well as Confirmability were put to the test. This was by doing member checking and confirmability where in both cases, the researcher had to ensure by asking participants whether what they recorded was what they said. This was coupled with audit trail. Triangulation was also confirmed as the different instruments which had been employed in data collection have certain questions common or similar to each other. Such usage was useful in authenticating the data gathered. Sometimes same questions were used in different occasions in order to understand whether the researchers would yield similar or same answers.

## 3.0 Findings and Discussions

**Table 1: Response of smallholder maize farmers to Agricultural Information**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Seed Selection	30	17.2	17.2	17.2
	Fertilizer Application	2	1.1	1.1	18.4
	Pest and disease management	29	16.7	16.7	35.1
	Weed Control	18	10.3	10.3	45.4
	Irrigation	2	1.1	1.1	46.6
	Planting Methods	11	6.3	6.3	52.9
	Market Prices	26	14.9	14.9	67.8
	Post-Harvest Handling and Storage	22	12.6	12.6	80.5
	Climate Information	34	19.5	19.5	100.0
	Total	174	100.0	100.0	

Source: Field Data, 2025

The table above encapsulates the data on agriculture which is obtained through various sources by the smallholder maize farmers. The results found out that information on agriculture had been availed to maize smallholder farmers. This information included better drought-tolerant and early-maturing seed/ crop varieties 17.2%, in an area, Kaliwe, of Nyimba district, farmers reported that they mainly rely on information given to them by the extension officers as well as other farmers in their decision on the type of seeds to use. When these are brought to their mind, they are likely to buy better varieties of seeds which will lead to increased yields and also resistant to pests. The last few authors have stressed that farmers will start improving their seed varieties due to the availability of sufficient information about the quality of their seeds, as well as the reaction to the local environment (Johnson & Kunda, 2021). One of the interviewees felt like saying the following:

*"In our village, for a long period of time, we have been receiving different types of agricultural information such as changing the farming calendar in relation to onset and cessation of rainfall. This has enabled us to schedule our agricultural activities properly, to cope with climate change. Moreover, we normally receive information about cultivation of drought tolerant crops such as millet and cassava because they have high adaptive capacity and can withstand drought conditions. This has been a very important agricultural information strategy because it has reduced the problem of household food insecurity for the majority of households in our village ( Nyankama village, 01)".*

**Photograph 1: A smallholder farmer in Kaliwe area, Nyimba District, demonstrating the use of improved drought-tolerant maize seed varieties as an adaptation strategy in response to agricultural information received from extension officer**



Source: Field Data, 2025

In the part of fertilizer application 11%, the respondents revealed that their application practices are mostly affected when they obtain the extension messages and peer opinions. They also admitted that better crop performance is as a result of good timing and dosage as conveyed through the agricultural information channels. This corresponds to the current development of the recommendations, which indicate that the application of fertilizers by farmers is considerably enhanced when they get specific recommendations and instructions (Lungu et al., 2023)

In pest and disease management 16.7, the research indicated that farmers are interested in and access information about pest and disease management modes. According to them, immediate warnings and trainings can help them put in place proper control measures that lead to minimal losses of crops. This reaction is in line with the recent literature that informs about the positive improvement in the ability of farmers to manage pests by their access to the information about integrated pest management (Mwale & Banda, 2022).

The reaction of farmers to the methods of weeds management showed dependence on the information offered by the service of extension about the usage of herbicides and manual methods of weeds. They explained that when tools of sound weed management are known, its control becomes more efficient and this can be supported by the fact that the latest research shows the dissemination of information enhances the management of weeds among smallholder (Chanda et al., 2021).

Farmers at Kaliwe region of Nyimba complained that they adjust their ways of planting based on the information they receive on the most appropriate planting depths and spacing. They observed that when properly relayed such knowledge leads to high crop emergence and outputs. This is reinforced by the fact that recent studies show that planting methods have a specific message that promotes the use of the better approaches of planting protocols (Kaunda & Zulu, 2022).

According to the respondents, awareness of market prices that is informed by the mobile alerts and extension officers will enable them to want to sell their maize when and where. Lack of access to adequate markets of agricultural products deter most smallholder farmers to embrace climate resistant crop varieties. The results of this study are thus in line with Kassie et al., (2015) which claimed that inaccessibility to markets is what causes farmers not to invest in new crop varieties because they fear to lose their market. Moreover, the smallholder farmers find it challenging to use the resilient crops to climate variability due to limited market information, ineffective credit facilities, and other related risk factors (Gbegbelegbe et al., 2017). Moreover, farmers experienced information on post-harvest handling and storage practices that are obtained through the extension services facilitate minimization of postharvest losses. These reactions can be aligned with the recent research findings, which have demonstrated that market and post-harvest information helps farmers improve their

bargaining power and minimize losses (Tembo et al., 2023).

The experiment revealed that any type of climate information 19.5, including weather forecasts, has been significantly helpful in making decisions on what has been planted and in what time has been harvested. Farmers were reported to change their practices depending on weather forecasts in order to reduce the climate variations risks. This is consistent with the recent academic literature that highlights the significance of climate information services in supporting smallholder farmers to be more climate resilient (Chirwa & Mumba, 2022).

**Table 2: Farming Experience of smallholder maize farmers**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2 years	1	2.8	2.8	2.8
	3-4 years	1	2.8	2.8	5.6
	5 years and above	34	94.4	94.4	100.0
	Total	36	100.0	100.0	

Source: Field Data, 2025

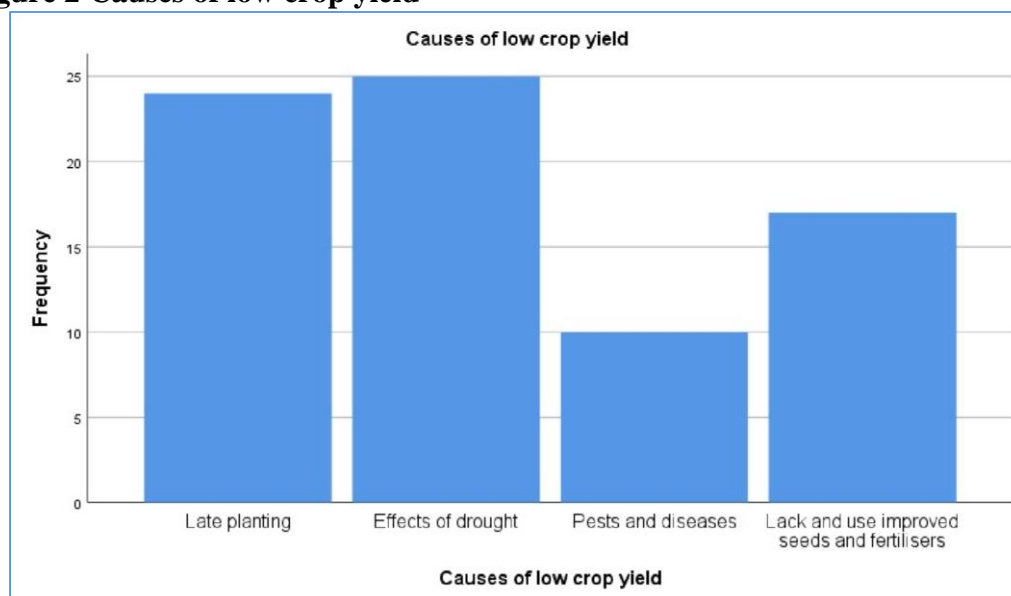
Table 2 results reveal that most 34 (94.4) had over 5 years of farming experience whereas the minority 1 (2.8) had less 5 years of farming experience. In general, these results indicate that nearly all respondents possessed sufficient experience in the field of farming, which could have predisposed them to desire the necessity to be able to find out and utilize the information about agriculture. Such implication is that personal experiences of extreme weather conditions, e.g., floods and droughts, make one more aware and concerned about the variability of the climate. Also, the geographic location and years of experience which has been acquired through repeated exposure to climatic related events support personal knowledge and ideas of climate variability. Such exposure has the ultimate consequence on climate variations resistant crops that small scale farmers decide to grow.

### 3.1 Causes of low maize yield among smallholder farmers (Table 3)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Late planting	24	31.6	31.6	31.6
Effects of drought	25	32.9	32.9	64.5
Pests and diseases	10	13.2	13.2	77.6
Lack and use of improved seeds and fertilizers	17	22.4	22.4	100.0
Total	76		100.0	100.0

Source: Field data, 2025

The results of Table 3 reveal that drought (32.9) was the biggest contributor to poor yield of maize with the minor (13.2) suggesting pest and diseases. In Zambia, it was found that amid the 2022/23 farming season, the maize was produced at 16250 metric tonnes compared to the anticipated 65 000 metric tonnes that could be regarded as a mere quarter of the output. In the 2023/24 season, the projected 14,000 metric tonnes dropped down to 586 metric tonnes i.e. at 4.2 production rate (Kilubi, 2024).

**Figure 2 Causes of low crop yield**

Source: Field Data, 2025

The study established that low crop yield was due to the prolonged dry spell. The results are consistent with the works of Matchaya, Tadesse & Kuteya (2022) that low crop yield was due to dry spells, floods and water logging. The findings also align with those of the USDA, which indicated that drought caused a 25% reduction in maize yields in Zambia (USDA, 2022).

Similarly, the IPCC (2019) reported reductions in global wheat and maize production of 6-12% and 7-15%, respectively. Another key informant added that:

*“Pests were affecting plant growth and production in the area. Armyworms fed on crops, especially maize, leading to poor plant growth. When maize is attacked at the tasselling stage, production is usually affected, resulting in low yields (K-1)”*.

The findings clearly indicated that biophysical factors such as poor rainfall, high temperatures, and the frequent occurrence of crop diseases negatively affected the maize production in Kaliwe area. One of the participants had this to say:

*“There is no positive expectation from the rains these days, as it is usually not enough, the rainy season is now difficult to predict. Sometimes, the rains start on time in October or November, but end abruptly (P-2)”*.

The authors found that the Kaliwe area had been registering lower levels of rainfall since the year 2016, the reduced level had harmed agricultural production. This meant that pace of adoption to agricultural information was slow and this added to the high poverty levels in the region. The least influential factors showed technological influences such as low usage of the telephones and the televisions. Majority of the smallholder farmers in Kaliwe area were not able to access modern technological tools and therefore had less agricultural information.

It is astonishing that climate and temperature, plant and water management, and soil nutrient management factors affect crop yield. The best heredity, and the power to manipulate and optimize the plant environment usually led to the ultimate yields. Both climate and temperature conditions are essential in ensuring high yields are obtained by crops. Thus, climate variability has a role in low yields, changes in growing seasons, and more crops failures, especially in regions with high vulnerabilities to it like Sub-Saharan Africa, which is highly likely to suffer food insecurity (IPCC, 2019).

### 3.2 Determinants of Access and Use of Ag Information.

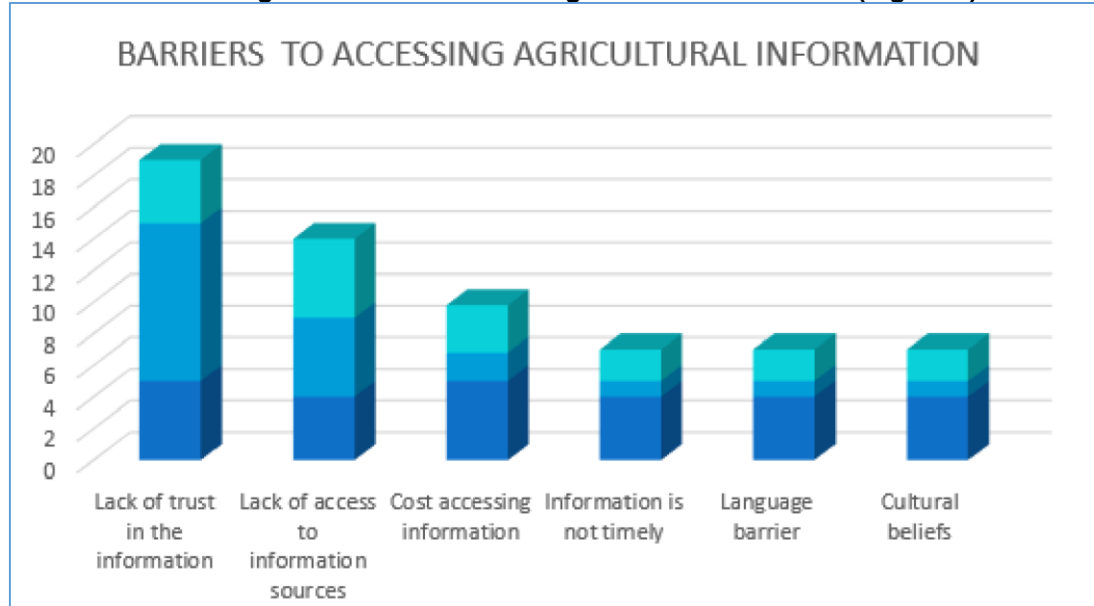
The research has found the broadcasting time, language barriers (5.5%), absence of information sources (22.2%), not timely information (5.5%), cost of accessing information (8.3%), lack of trust in the information (52.7%) and cultural beliefs (5.5) to be the key limitations that lack the majority of smallholder farmers to have effective access to and utilization of agricultural information. Mass media programmes were termed as being too brief and unpopulately time of the day. Radio programmes were found to be allocated during the day time when farmers were engaged in their farms hence not able to listen. Key informants also echoed this at the in-depth interviews as follows:

*“We have been facing different challenges in the access to agricultural information from the mass media because most of the important programmes are scheduled during the afternoon when most farmers are in their farms or other places. Therefore, we don't know what to do in order to be able to access and use agriculture information so that we can at least increase our crop production and overcome food insecurity (Village Headman, 03)”*.

4. Results to show that 52.7 percent of smallholder maize farmers in the Kaliwe section of the Nyimba district do not exhibit trust in the information they receive on agriculture are also reflective of a huge disparity mismatch between the channel of information delivery channels and the perception of the receiver farmers. Such mistrust can hinder the

implementation of the suggested productive agricultural methods, which will consequently drag back the efforts to promote the productivity and resilience of the smallholder farmers. As a researcher, these findings make it clear that the delivery channels and the sources of agricultural information are to be carefully assessed, and the socio-cultural aspects that affect the perceptions of the farmers are to be comprehended. It recommends that extension services or information providers should focus on establishing trust based more participatory activities and make sure that the information is contextual and true and conveyed by the trusted channels. This lack of trust is important to deal with in order to enhance effective interaction, increase efficacy of agricultural interventions and thus, increasing maize output in the area.

### 3.3 Factors Affecting access to and use of agricultural information (Figure 2)



Source: Field Data, 2025

The findings have revealed that extension officers were not disseminating agricultural information to smallholder farmers effectively because of financial challenges caused by insufficient funds received from the government. This hinders farmers' agricultural information access and use as confirmed by one interviewee as follows:

*"Farmers claim that they don't receive agricultural information on time; but to be honest, this is due to the insufficient budget that is allocated by the government for agricultural related activities which makes it difficult for us to visit smallholder farmers on a daily basis due to high operational costs. That's why sometimes we normally use village meetings to provide agricultural information such as proper planting time, types of crops to be cultivated and fertilizers to be used (Area Agricultural officer, 04)".*

It was revealed that exposure to and application of agricultural information was influenced by some aspects like broadcasting time, language barrier, and feedback. As an example, the radio programmes could be aired during the day when the farmers were occupied with their farm work hence, they could not hear. This is consistent with Agwu et al., (2018) that demonstrated that unfavourable timing of radio programmes, use of language in its presentation, failure of farmers to ask pertinent questions of radio presenters and poor response of radio presenters influenced access and use of agricultural information by farmers to attain climate change adaptation. Considering that majority of the farmers in rural settings use the radio to raise awareness and get access to agricultural information to adapt to climate change, radio programmes that are poorly designed and feedback which is inadequate deprives the farmers a chance to access and utilize information to help boost their knowledge (Kalokola, 2016).

In addition, the results have indicated that the extension officers were failing to deliver agricultural information to the smallholder farmers effectively due to financial limitations occasioned by lack of money brought to them by the government. This observation agrees with Agwu et al., (2018) statement that the performance of the agricultural sector of developing countries remains poor because a high level of poverty that impacts daily agricultural activities still exists. To ensure that farmers who are the targets get access to and employment of the agricultural information well, Maddison (2017) suggested that agriculture extension officers should be prioritized in terms of investment since most farmers primarily trust and depend on information dispensed by these officers.

### 3.4 The best ways that can be adopted to drive exposure of the smallholders to maize farming information.

The gap can be addressed in Kaliwe area of Nyimba by conducting frequent field days and practical workshops to enable peer learning among farmers which has proved to increase the rate of adoption in the same setting as it has been demonstrated in Zambia. Also, adoption of new information and communication technology (ICTs) including mobile handsets and electronic platforms is a new method of facilitating access to information. Mwansa et al., (2024) also discovered that agricultural advisory services based on mobile features had a significant positive impact on the availability

of farmers to weather forecasts, market prices, and pest management information. These technologies make it easy to provide information on time and in customized ways, particularly when it comes to distant community such as Kaliwe area of Nyimba whereby the traditional forms of extension might be lacking. Such extension activities are based on the idea that the promotion of mobile apps and SMS alerts can be used to supplement the already set extension activities so that farmers can make informed decisions as quickly and effectively as possible.

Improving the agricultural knowledge dissemination channels is the other good step. Manda et al., (2022) assert that the mobilisation of the mobile technology and use of information services by using SMS to pass information to the farmers remarkably contributes to the farmers accessing information services that are timely and relevant in enhancing agriculture practices. Through the use of mobile phones, farmers are able to get updated on the weather forecasts, pest outbreaks, and best farming practices and this directly improves their levels of decisionmaking and strategies of adapting.

In theory, the results of this study are justified on the basis of the Innovation Diffusion Model created by Rogers (2003). As it has been noted, the smallholder farmers are only able to adjust to a new agricultural practice after they have been exposed to it with the help of agricultural information dissemination. This has been echoed in this paper because majority of the farmers acknowledged that they had employed various climate change adaptation techniques including conservation farming, planting to drought resistant seed varieties, and early maturing seed varieties. These groups of farmers are referred to as adopters according to the Innovation Diffusion Model. It was however seen that not all smallholder farmers have reported having adapted the advanced innovations; some of them are laggards since they have no intention of adapting any advanced technology irrespective of its accessibility. These individuals can only adopt an innovation once it has been disseminated and main streamed.

### 3.5 Synthesis and Broader Implications

This paper has demonstrated that the adoption of smallholder maize farmers to agricultural information in Kaliwe area is a complicated complex relationship that exists between; access to information; information dissemination processes; socio-economic factors and environmental factors. The outcomes are a synopsis of valuable data relating to how agricultural news can serve as an initiator of climate adaptation by the vulnerable rural communities.

Arguing on the basis of the combination of the Diffusion of Innovations Theory and the empirical data, one will find that the predictable trends have the control over the integration of the agricultural information in the lives of farmers, which, nevertheless, are categorically dependent on the situational factors of the Nyimba District. The fact that most of the farmers (94.4) had an experience in farming exceeding five years means that the experience that they have acquired in regards to farming, coupled with the formal information on agriculture offers a superior point on which farmers adapt. This synthesis suggests that the information intercession should build on the past understanding of the farmers rather than attempting to wipe out all the activities of the farmers.

The general implication of this study to other communities of smallholders in sub-Saharan Africa that have issues of climate variability is broader than in the Kaliwe area only. It is seen in the analysis that information alone would not be enough to subject the process of adaptation; these should be complemented by other factors that will prompt adaptation like timely delivery of the information, the right channel through which the information can be delivered, enough extensions services and the provision of economic facilities to make the implementation of the adaptation possible. The fact that 52.7 percent of the farmers interviewed cited lack of trust in information as one of the major constraints is a critical weakness between information delivery and trust of the farmers and, therefore, demonstration and participation should be employed to build credibility.

In policymaking terms, the results indicate that there is the need of concerted endeavors that would transform the traditional extension systems into the emerging IT platforms. It is a fact that there has been success of seed varieties and conservation practices among the early adopters, this indicates that there is potentiality of scaled impacts when the information is contextualized and being presented via channels that they place trust. However, the fact that laggards are impossible to be eliminated in the society reflects those general approaches are not appropriate, strategies targeted towards different classes of farmers must be created.

What is of interest, in particular, is the implication to climate resilience. As weather becomes increasingly unpredictable in Zambia and the region in general because of rising climatic change levels, the timely, precise and practical agricultural information is made significant. In this paper, the researcher will posit that the governmental allocation of money into information systems in agriculture, capacities of extension officers, and agriculture farmer training are also some of the cost-effective interventions of enhancing food security and rural livelihoods. That the crop of maize decreased to 9.24 tons in Kaliwe area, instead of 220 tons, is evidence of the predisposing effects of lack of good adaptation, and the need to introduce systematic information interventions can hardly be overestimated.

In addition, the study also contains the interrelatedness of the agricultural information with the general development aspirations, which include poverty reduction, food security and ecologically friendly management of the natural resources. It is observed that farmers who receive and make use of agricultural information have superior farming practices and decisionmaking capacities which points to the fact that the access of information is a multiplier effect which has augmented the proficiency of other agricultural investments.

Other important development practise implications of the research to policy makers are also realised. One, it is important that the information systems applied in agriculture puts into consideration the local environment including the language, literacy levels, cultural beliefs and information network that currently exists. Second, the information delivery timing and form is equally important as the itself since at the farming hours people could not listen to radio programs. Third, distrust and distorted attitudes towards new practices should be overthrown by building trust and credibility based on regular and

right information and confirmed results.

The synthesis of the findings in one of the views indicates the need to have adaptive management techniques in the agricultural extension that is characterized with the constant improvement of information systems based on the feedback of the farmers based on the changing ecological considerations. There is a good footprint in incorporating climatic information services with agricultural advisory systems such that farmers are able to make proactive decisions rather than the reactive ones. The other considerations include the possibilities of the mobile technology and the Internet to overcome the geographical and timerelated barriers to reach the information, which allows one to suppose that with a proper design and application, technological innovation can accelerate the process of the adaptation to an impressive extent.

And, finally, the research contributes to the growing body of research to demonstrate that not only is climate adaptation in the smallholder agricultural system a technical problem, but also a social and institutional one. The facilitating factors to the effective adaptation endeavors include the availability of information, resources, faith in the advisory services and systems to assist farmers in eliminating the risks of adoption of the new practices. The outcome in Kaliwe area is thus applicable in other developing agricultural development programs that are more positive, fair, and sustainable in the climate prone regions worldwide.

#### **4.0 Conclusion and Recommendations**

The evaluation revealed that there exists an average degree of integration of agricultural information in the decision-making process by the smallholder maize farmers in Kaliwe area of Nyimba District. Although there are farmers who proactively use available information to change their practice, generally, the integration is not consistent, but can be improved. Hence, the existing decision-making adaptation of these farmers is rather efficient but needs specific measures to enhance the systematic use of agricultural information to achieve better adaptation results. The paper concludes that there was a favorable attitude of smallholder farmers towards adaptation to agricultural information.

##### **4.1 Policy Recommendations:**

Since various factors influenced the adaptation of the smallholder farmers to the agricultural information, the Ministry of Agriculture, the district Agriculture Coordinating Officer, the local agricultural extension officer, the seed breeding companies, and the non-governmental organizations should use a holistic approach to provide the small holders with the skills and information to adapt and mitigate climatic change.

The ministry of Agriculture should implement and integrate in the agricultural practices of the small-scale farmers the identification of appropriate strategies to be applied to the adaptation process of the varieties that are climate resistant, which will enhance agricultural production and the entire process of adaptation.

##### **4.2 Academic Recommendations:**

It is advisable that the Ministry of Agriculture should educate the small-scale farmers to plant a multiplicity of drought resilient crops that have varying maturity so as to widely distribute climate related risks as well as increase resilience, given that climate resilient varieties are able to endure drought. It is in this study that the staff of the ministry of Agriculture (MOA) should encourage the application of CSA practices, prove its usefulness and display the ill effects of conventional practices including poor crop productivity, soil degradation, and high soil erosion only to mention a few. New technologies should be set by the Zambian Government and the partners SMS alerts and mobile apps which can broadly grow and avail timely information on weather forecast and prices in the market and pest outbreaks.

##### **4.3 Ethical Considerations**

All the participants in this study were given the freedom to participate voluntarily and high levels of confidentiality were assured since no identity was given to the participants. The participants had their rights that were upheld.

##### **4.4 Acknowledgements**

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##### **4.5 Contributions to the Paper**

Anthony Khwabe planned the whole research and the methodology took place, formal analysis done, data collection process done, and field work done by him with him writing the first draft. It was supervised by Dr. Kalapula Shepande who took part in data analysis, checked the manuscript and made some critical comments and suggestions regarding the paper. Madam Getrude Siachiyako was the person who oversaw and administered it, edited and revised the draft, and made her input to the theoretical framework.

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