ANALYSIS OF GENDER DIFFERENCES IN SMALLHOLDER FARMERS' USE OF INFORMATION SOURCES TO COPE WITH DROUGHT IN MASINDI DISTRICT, UGANDA

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DECLARATION

I hereby declare that this thesis titled **"*Analysis of Gender differences in Smallholder Farmers' Use of Information Sources to cope with Drought in Masindi District, Uganda*"** is my original work and that to the best of my knowledge; it has never been presented in any University for a degree or other academic award.

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This thesis has been submitted with our approval as the University Supervisors

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DEDICATION

To my gracious and glorious Lord God Almighty in Jesus' name who lives eternally and has seen me through this period of research

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LIST OF ACRONYMS

DA	District Administrator
DAO	District Agricultural Officer
DAP	Di-Ammonium Phosphate
DC	District Council
DLG	District Local Government
DSO	District Sanitation Officer
FF	Fellow Farmer
FGD	Focus Group Discussion
FM	Frequency Modulation
HH	Household
ICTs	Information and Communication Technology
IEC	Information Education Communication
ITU	International Telecommunications Union
L.C	Local Counselor
LG	Local Government
MADFA	Masindi District Farmer's Association
MoH	Ministry of Health
NAADS	National Agricultural Advisory Services
NGO	Non-Government organization
UBOS	Uganda Bureau of Statistics
VHT	Village Health Trainer

ABSTRACT

While socio-economic and institutional determinants of use of information sources have been widely studied in various contexts, the gender dimension of information use, and in relation to coping with the adverse effects of climate change has not been dealt with satisfactorily. A study was therefore conducted to: - (i) determine the sources of information used among smallholder farmers to cope with drought; (ii) characterize these sources of information and (iii) identify the socio-economic and institutional factors influencing farmers' use of information sources to cope with drought. Using mixed methods combining a cross sectional survey and focus group discussions, data was collected from 313 smallholder farmers (167 men and 146 women). Results show that, fellow farmers mainly men were an important source of information for both men and women farmers to cope with drought. Farmers' organizations were an important source of information among the women, while government extension services were an important source for the men for information to cope with drought. Overall, both men and women farmers perceived fellow farmers who were sources of information to be very good at communicating, convincing others, willing to share information, having appropriate information for both men and women, and bringing information from various sources. Women however had a significantly higher positive disposition compared to men. In regards to fellow farmers' farming experience, while both men and women perceived them as highly experienced and exemplary, men had a small but significantly higher regard of this compared to the women. Both men and women farmers characterized fellow farmers as providers of information that was useful, timely, affordable, accurate, relevant and problem solving. A significant difference existed around women farmers' perception of fellow farmers' information as affordable and relevant more compared to the men. With regard to information obtained from extension agencies, both men and women perceived it as useful, timely, affordable, accurate, relevant and problem solving. However, women's perceptions of the relevance of this information were significantly and positively higher compared to men. In determining why farmers' used fellow farmers as sources of information to cope with drought, the significant explanatory factors included; not being a member of a farmers' group ($\beta = -2.57$, $p < 0.01$), farmers perceiving a fellow farmer as a good communicator ($\beta = 3.049$, $p < 0.01$), as having access to many extension agencies ($\beta = .9912$, $p < 0.009$), as a user of agro-technologies ($\beta = -1.54$, $p < 0.01$); as not so educated ($\beta = -0.861$, $p < 0.01$) and contacting a farmer of the opposite sex ($\beta = -1.176$, $p < 0.01$). The factors that explained farmers' use of extension workers for information to cope with drought included having access to radio ($\beta = 1.214$, $p < 0.01$), to transport ($\beta = 2.668$, $p < 0.01$), membership to a farmer group ($\beta = 2.54$, $p < 0.01$) 989 and having access to mobile phones ($\beta = .665$, $p < 0.1$). In conclusion, both fellow farmers and extension agencies were important sources of information to cope with drought to both men and women farmers. More women need support in maximizing these sources compared to the men. There is need to build the capacity of fellow farmers to guarantee easy access to relevant information especially for women. Extension services need to continually retool their staff to reach men and women farmers more objectively and equitably. Enhancing women's access to extension services such as owning a radio, a mobile phone and being mobile is key for climate smart farming.

1.0 CHAPTER ONE: INTRODUCTION

1.1 Effect of Drought on smallholder farmers

Agriculture remains the most important livelihood source among the majority of Sub-Saharan Africa (Ebewore & Emuh, 2013; Komba & Muchapondwa, 2015). However, it is being threatened by climate variability in form of droughts, floods, unreliable rainfall, increase in temperature and hailstorms compromising the food, income, social and environmental security of entire populations and economies (Mubiru *et al.,* 2015; Singh & Grover, 2013; Mishra & Singh, 2010; Ozor *et al.,* 2010; Apata *et al*., 2009). In some areas, prolonged droughts remain the most devastating on agriculture among all climate events (IFAS, 1998). Drought is a natural phenomenon of abnormally low precipitation where the temperature is higher than normal for a sustained period of time causing more water to be drawn off by evaporation (AMCEN, 2011; IFAS, 1998). Drought can lead to water stress, affects soil moisture, crop resilience to diseases and pests, rainfall predictability, seasonal patterns, crop and livestock yields, as well as the management of harvests (Hepworth *et al*., 2008; Ozor & Nnaji, 2011).

As the probability and severity of droughts are expected to increase in many parts of the world, concerns over increased production costs and food prices have emerged (van Duinen *et al*., 2015). In Uganda's context, droughts are more frequent compared to other weather-related events leaving most of the rural poor farmers, food insecure and their livelihoods threatened (Okonya *et al.*, 2013). Apparently, there has been a 30% reduction in agricultural yields equivalent to 800,000 hectares of crops being destroyed annually by droughts and floods (CCU, 2012). Zake (2012) noted that the droughts in Uganda which used to last for a shorter period such as 3 months have currently been stretched to about 4-6 months. A study by Nakiganda *et al.*, (2012) on the effects of climate

change on men and women farmers of Kyengeza and Gosola villages in Lwanda Sub county, Rakai district; found that dry seasons were lasting between 2 to 6 months.

Universally, socio-cultural and economic differences exist among farmers (Ongoro & Ogara, 2012), and as such, climate change effects will be experienced differently by various socio-economic groups (IFAD, 2014). The subject of gender as a socio-cultural concept, points to the fact that differences exist among men and women in terms of their roles, rights and responsibilities in any livelihood endeavor including how they respond to drought as farmers. Globally, women in most societies and cultures face inequalities compared to the men when it comes to access to agricultural production resources and services, as well as control over resources and benefits (Carvajal *et al.,* 2008). This inequality condition is due to the patriarchal norms that give the men more power and rights over the control of resources including keeping women in a subordinate position (Solar, 2010). This gender inequality makes women become more vulnerable to climatic variabilities such as, drought and its effects due to limited access to resources and services thus easily compromising their ability to respond appropriately as compared to men (Abeka *et al.,* 2012; Pettengell, 2010; UNDP, 2009; Röhr, 2006; BRIDGE, 2008). Women, children, the elderly and the poor remain the most vulnerable to the disastrous impacts of drought and other climate events (Cherotich *et al.,* 2012). Climate-related shocks have often led to greater negative impacts on women than men (Chaudhury *et al.,* 2012; Ongoro & Ogara, 2012; Solar, 2010). While farmers have introduced indigenous practices to respond to drought (ESAFF, 2010), these responses are likely to differ between men and women (Tunde, 2011). The responses also known as adaptation measures to climate variability are many (Akinnagbe & Irohibe, 2014) and include adjustments in the farmers' routine farming practices involving switching to other practices, crop diversification, changing planting and harvesting dates to correspond to the changing pattern of precipitation,

planting tree crops, establishing water and soil conservation techniques, planting drought resistant crops, planting early maturing crop varieties, use of irrigation and switching to non-farm income activities (Adger *et al.,* 2007; Boko *et al.,* 2007; Ngigi, 2009; Tarnoczi & Berkes, 2010; Uddin *et al*., 2014; Komba & Muchapondwa, 2015).

1.2 Information and information source use for farmers' response to drought

Accessing the technologies and practices that help in responding to drought requires a source of reliable information (Manoranjan *et al.,* 2012; Osberghaus *et al.,* 2010). While some farmers are fully aware of changes in climate and prefer certain adaptation practices, the majority still lack detailed information concerning such changes, its causes and impacts (Sarkar *et al.,* 2010). Mittal & Mehar (2015) asserted that given the uncertainty brought by climate change and climate variability, it is important that first, farmers are empowered with access to credible information on weather updates, new technologies, government schemes and market prices to enable them make better choices and decisions. Given the importance of information for adaptation, farmers need multiple sources of information which are also considered good and effective (Adegboye *et al*., 2012; ITU, 2012; Manoranjan *et al.,* 2012; Tarnoczi & Berkes, 2010). Access to climate information influences farmers' use of better technologies to adapt (Osberghaus *et al.,* 2010) and minimizes loss from climate catastrophe (Manoranjan *et al.,* 2012). Information can enhance farmers' knowledge about new technologies, inputs and markets resulting into improved decision-making related to agricultural activities (Mittal & Mehar, 2015). So, farmers' exposure to information on climate change is likely to significantly influence their adaptation to a range of climate events including drought.

Given that the vulnerability of women and men to drought is not even (IFAD., 2014), gender differentiated information sources to befit farmers' enterprises have been used (Naab & Koranteng,

2012; Chaudhury *et al.,* 2012). Men and women's use of information and information sources seem to differ in situations partly due to differences in farming roles and challenges faced (Nosheen *et al.,* 2010).

1.3 Problem statement

Small holder farmers need to acquire agricultural information and knowledge if they are to make meaningful decisions with regard to improved farming activities (Sarker & Itohara, 2009). While Zhang, *et al.,* (2016); Alam *et al,* (2015); Mittal & Mehar, (2015) and Lambrou &Nelson, (2010) reveal a range of agricultural information sources in drought response, characterizing those sources and farmers' perceptions of the effectiveness of the different information sources remains unclear. Gender has been found to influence use of communication resources and information (Chaudhury *et al*., 2012; Kyazze *et al.,* 2012), but it is still less often looked at in the choice of the explanatory factors specific to information on coping with drought (Lambrou & Nelson, 2010). Thus, the call for the determination of how gender influences use of information sources when coping with drought (McOmber *et al.,* 2013; Chaudhury *et al*., 2012; Kyazze *et al.,* 2012), including determining the gendered constraints in the use of information sources. Gendered inequalities are known to feature during challenging climate change events (McOmber *et al.,* 2013). For Masindi district that had faced frequent droughts, this study questioned; - Which information sources were most important to men and women? What information and technologies did men and women farmers get from these information sources? What unique characteristics did sources of information have? What was the perceived effectiveness of these sources? What factors influenced access to information sources in times of drought from a gender perspective? These would be useful in formulating gender responsive information dissemination strategies for drought response.

1.4 Main objective

The main objective of the study was to determine the gender differences in Smallholder farmers' use of information sources to cope with drought in Masindi district, Uganda.

1.4.1 Specific objectives

i. To determine the sources of information used among smallholder farmers of Masindi District to cope with drought.

ii. To characterize the sources of information used to cope with drought among smallholder farmers.

iii. To identify social, economic and institutional factors influencing farmers' use of information sources to cope with drought.

1.5 Hypothesis

The following null hypotheses were tested; -

i. $H_{01:}$ The sources of information used to cope with drought will not differ among men and women smallholder farmers of Masindi District, Uganda.

ii. $H_{02:}$ Perceptions of the characteristics of key farmers (fellow farmers) and extension agents will not differ between men and women farmers.

iii. $H_{03:}$ Farmers' use of information sources is likely to be influenced by social, economic and institutional factors. Social characteristics of fellow farmers included: - fellow farmers' being social, level of experimentation on farming practices, quality of communication skills, level of use of agricultural technologies and level of education. The social characteristics of the farmer respondents included; Gender, marital status, education level, age and years spent in farming. The economic characteristics of farmer respondents included: Access to transport, mobile

phone and radio; ownership of land and cattle. Lastly, institutional characteristics included: - fellow farmers' attachment to extension and the respondents' membership with farmer groups

1.6 Significance for the study

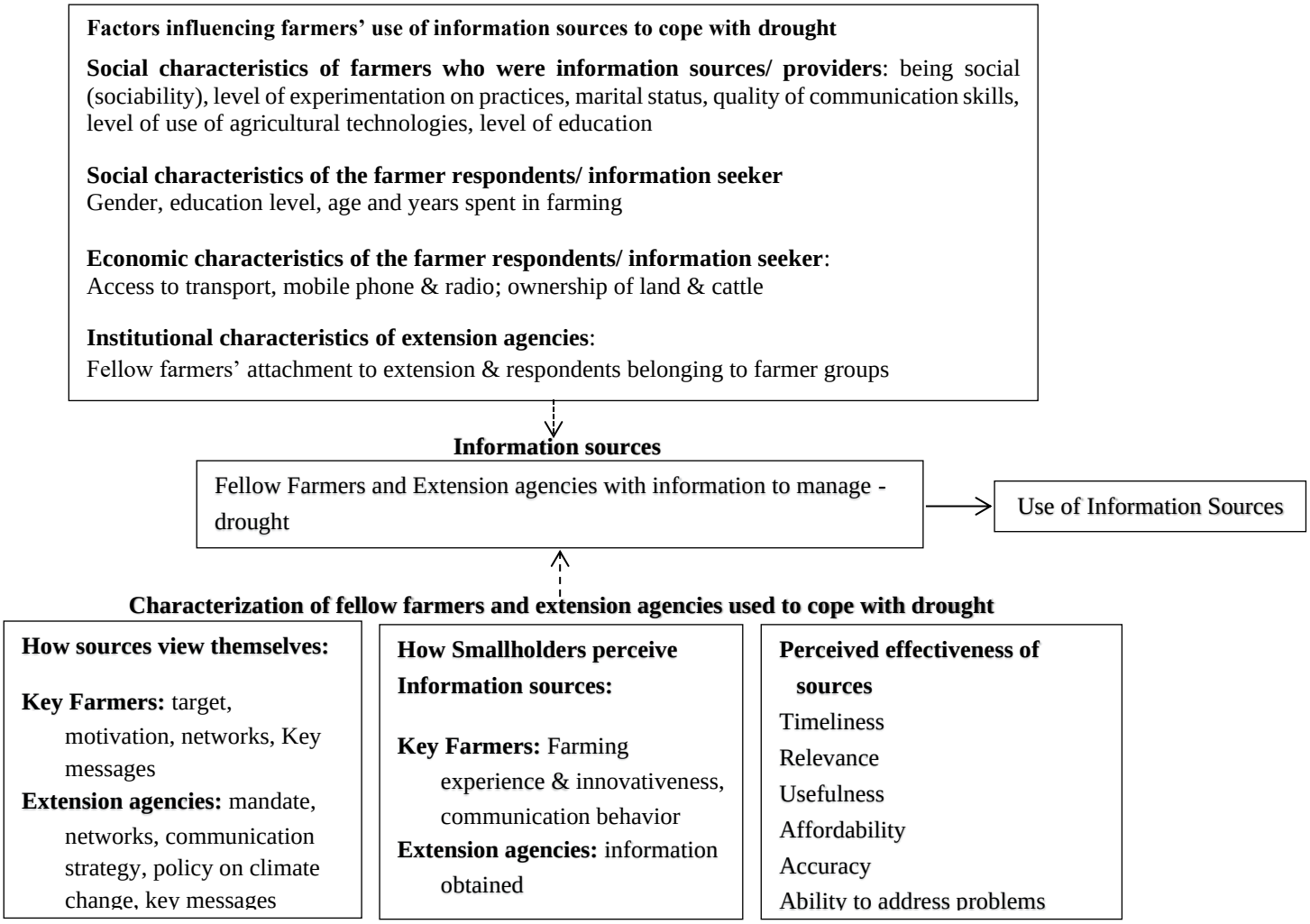
Usually, disaster fatality rates appear much higher for women than for men due, in part, to insufficient access to information and early warnings from effective information sources (IFAD, 2014). However, what farmers perceive as effective sources needs to be investigated to create a clear understanding of the most appropriate sources that could be helpful to farmers to cope with drought including understanding the factors which influence men or women farmers' use of such information sources. This study described the characteristics of the sources used as well as the various aspects which account for the effectiveness of the information obtained from information sources that men and women farmers used. Understanding the characteristics and the perceived attributes of the sources helps come up with useful information sources that can be used to disseminate information and technologies for drought adaptation even to the less advantaged farmers. The findings can guide extension agencies to come up with gender responsive strategies helpful for both men and women farmers in receiving technical information. The study results can guide government agencies to formulate agricultural policies and programs that will give more attention to the information and technology needs of women and men farmers to manage drought.

1.7 Conceptual framework of the study

The conceptual framework builds on the premise that men and women obtain information from a range of information sources to respond to drought (Mittal & Mehar 2015). Even where many information sources exist, farmers have their most important information source(s) from which they obtain information to cope with climate catastrophes including drought (Khan & Akram, 2012; Kyazze *et al.,* 2012; McOmber *et al.,* 2013). The most important documented information

sources in developing countries include fellow farmers and extension organizations. Furthermore, women still lag behind men in the utilization of information sources (Zakaria *et al*., 2007). Gender responsiveness in identification of information sources for drought response is important in respect to their differing information needs. The difference in use of information sources among men and women can be associated with the social structure including their needs, interests, preferences, resource access, norms, social statuses, hierarchy and level of knowledge of the information users (Chi & Yamada, 2002). Additionally, farmers have a way they perceive information sources they use to manage drought. Farmers' perception of information sources is usually "effectiveness" driven (Egbe & Eze, 2014). There are many factors behind men and women farmers' choice to use sources perceived to be effective in providing information (Egbe & Eze, 2014). Some of the factors shaping farmers' use of information sources perceived to be effective have been categorized into socio-economic and institutional factors. Social characteristics include; fellow farmer being social, gender, fellow farmer experimenting on practices, marital status, communicating well, use of technologies and education. Economic characteristics include access to transport, mobile phone and radio, ownership of land and cattle, while institutional characteristics include the fellow farmer being attached to extension agencies and the respondent belonging to farmer groups. A combination of these factors can be key determinants of farmers' use of information sources when responding to drought.

Figure 1: Conceptual Framework



1.8 Organization of the Thesis

This thesis is organized into six chapters. Chapter one introduces the background and problem under the study area, the research objectives and the conceptual framework of the study. Chapter two focuses on the review of the literature. In chapter three is the research methodology which covers the description of the study area, the research design, sample size and method of sampling, data types and sources, methods of data collection, and data analysis. The research findings are presented in chapter four and discussed in chapter five. Finally, chapter six presents the summary, conclusions and recommendations of the study.

2.0 CHAPTER TWO: LITERATURE REVIEW

This chapter presents the literature that was relevant to the study. The first section focuses on the major sources of information as used by men and women. The second section focuses on the characteristics of key farmers and extension agencies. Lastly, the third section is on the factors that influence farmers' decisions to use the information sources.

2.1 Information sources used by men and women farmers

According to Benard *et al.,* (2014), farmers seek information to meet specific needs and knowledge gaps that they have. Information needs of farmers differ from one location to another depending on the agricultural enterprise, socio-economic factors and the severity of the climate change event they face. Information needs differ among women and men when they face adverse climate events. For example, the vulnerability of women and men to drought is not the same (Abeka *et al.,* 2012). Access to information tends to differ between men and women. Farmers have relied on gender differentiated information sources (Chaudhury *et al.,* 2012). For example, Nosheen *et al.,* (2010) revealed that the most effective and frequently used sources of information on home and farm practices for women farmers in Potohar region in Pakistan in order of reducing use included television, friends, relatives, radio and local farmers. Men on the other hand relied on local farmers, relatives, friends, television and radio. Gender-based differences exist in how men and women farmers use information sources (Nosheen *et al.,* 2010).

There are many information sources farmers use to access agricultural information including during times of climate adversity. Two of these sources include (i) Fellow farmers and (ii) Extension service organizations. Fellow farmers can be neighbours, relatives, local leaders, trained farmers, and model farmers (Kumar *et al.,* 2011; Lwoga *et al*, 2011, Akanda & Roknuzzaman, 2012; Kyazze *et al.,* 2012; McOmber *et al.,* 2013). Extension service organizations can be Local

Government Extension Organizations, Non-governmental Organizations (‘*not for profit*’ organizations), Farmers Organizations and private sector companies (‘*for profit*’) (Mittal & Mehar, 2015; Korsching & Hoban, 2008). In this study there is a focus on these two main sources of information used for coping with drought as an adverse climate event by contrasting how men and women differ in their use.

2.2 Characterization of information sources used among men and women farmers

Information sources are used based on how they are perceived. The source based on its characteristics is perceived by the user, leading to the user deciding to use it or not. In this study, information sources used to obtain information for coping with drought were characterized based on the way the user perceived them. This included their perceived effectiveness. Women and men’s perceptions of the information sources were sought.

Characteristics of Extension Agencies

In order for farmers to effectively adapt to the vagaries of weather events, Agricultural extension organizations (both public and private) support farmers to solve problems they face. In addition, the extension organizations link farmers to markets and to other players in the agricultural value chain. These linkages help farmers obtain information, skills, and technologies on how to cope with the challenges they face (Kristin, 2009). Extension organizations can be a source of useful agricultural techniques and technologies that can assist farmers to cope with adverse climate events such as drought. Some of the technologies can help farmers deal with the unpredictable and rampant demands brought about by climate change events (Mohammad, *et al.,* 2015).

Technology policy of the Extension Organization on Climate Change

Extension plays a significant role in providing information and new technologies including new ways of managing crops and farms (Kristin, 2009). The rising climate related agricultural

challenges call on Agricultural extension services to provide solutions to these challenges. Solutions can be generated to respond to such events, which in turn helps develop enterprises that promote productivity and generate income in present changing climate (Baig *et al*., 2009). However, extension organization need to have a clear policy on climate change which can focus on adaptation to climate change and or promoting of technologies that address climate change events. Some extension organizations tend to focus majorly on agricultural development and their traditional roles while remain blind to aspects of climate and yet agriculture is mostly rain fed, and climate sensitive (Iwuchukwu *et al*., 2014).

Networking with other extension service organizations

Networks have different and specific needs and are characterized by; shared purpose; flexibility for members to participate in (Llewellyn, 2011). Networking and information sharing among different extension services is pertinent for the development of most rural farming areas especially in the context of adaptation to climate change and its complexities (Boateng, 2012). Extension organizations can through their networks link to agencies who focus on climate change and how to mitigate it in agriculture. Such networks can influence the extension organization to focus on climate change issues.

Key messages disseminated by the extension organization and the channels that they use

Extension services can focus on certain messages as they address climate change issues. Some focus on climate adaptation, while other focus on climate mitigation. Messages can focus on weather patterns, weather forecasting, improved technologies, business-oriented aspects and credit resource. Some can focus on inputs including seeds, feeds, fertilizers, and pesticides from well-trained input suppliers so as to improve productivity. Various information channels can also be

used by the extension agency to disseminate this climate related information including radio, social media, short messages, print media, face to face meetings among others (Bethe, 2015).

Characterizing Fellow farmers as sources of information

McOmber *et al.,* (2013) contends that within communities, there are certain people and groups who have legitimacy and trust of others to transmit/share information into and across a community. Fellow farmers can have characteristics which attract other farmers to rely on them for agricultural information and technologies that can be useful when faced with a climate change event. Farmers perceive other farmers differently. Perception is the process by which information or stimuli are received from the environment and are transformed into psychological awareness (Chi & Yamada, 2002). Perceptions emanate from cultural and societal norms and values, preferences, perceived self-efficacy, knowledge, experience, and habitual behavior that partly influence individual and societal actions (Kisauzi *et al.,* 2012). Grothmann & Patt (2005) argue that cognition of individuals always depends on their socio-physical context, and the social discourse; for example; people's perceptions of risk or adaptive capacity with regard to climate change are influenced and shaped by what they hear about climate change in the media, from friends, colleagues, neighbours, or public agencies. Kisauzi *et al.,* (2012) mentioned that perceptions played a key role in shaping individual and collective response to changes in climate. Since perception acts as a filter through which new observations are interpreted (Chi & Yamada, 2002), Juana *et al.,* (2013) asserted that awareness and perceptions of changes in climatic conditions shaped action or inaction on the problem of climate change. Persuasion of individuals contributing to alteration in behaviour by changing the beliefs underlying attitudes is linked to attributes of the source (source characteristics) and message (message characteristics), together with motivation and ability to process information (recipient characteristics), which combine to determine whether attitude

change is induced (Blackstock *et al*., 2009). However, given that significant differences exist between men and women in their perception of farming as a profession (Siriwardana & Jayawardena, 2014), it is likely that perceptions' influence on farming and information seeking behavior among men and women farmers will also differ.

Communication behavior of fellow farmers

Communication is a very important aspect of information and technology exchange among the source and the end users. Communication increases socially negotiated learning through interaction among information sources and the farmers. Socially negotiated learning illustrates how knowledge exchange is mediated through social relationships and local group learning (Blackstock *et al*., 2009). Despite fellow farmers having differing abilities, effort and credibility to transmit information and technologies to other farmers (Ben-Yishay & Mobarak, 2012), successful communication requires fellow farmers (communicators) to possess personal communication qualities. These qualities can include the ability to communicate well with farmers, ability to get on with people, enthusiasm for the job, common sense and initiative to essentially deliver information and technologies to other farmers (Anaeto *et al*., 2012). Suvedi & Ghimire, (2015) argue that it is important that any farmer communicating information to other farmers to know the various types and styles of communication and be able to use them. They should be able to engage in adaptation of new technologies, demonstrate good speaking skills, demonstrate and effective listening skills. So, fellow farmers with good communication behaviour are likely to persuade or convince other people to take on new innovations and this will have an impact on their perceptions. Information from personal experience and information from external description can yield drastically different choice behavior under conditions of risk or uncertainty (Hansen *et al.*, 2004).

Innovativeness of fellow farmers

Innovations are ideas, practices, or objects that are perceived as new by individuals or other units of adoption (Tabor, 2011). Innovative farmers are always coming up with new solutions to the challenges they go through as a result of drought. So, people can pay a visit to these farmers who in turn will change their attitude. Additionally, as the farmers observe the innovations experimented in the fellow farmers' field, the farmers will improve his/her conscience to rely on fellow farmer. Likely, farmers who often innovate are likely to be relied on most for drought response. Innovatively, knowledge transfer approaches promote through dissemination of information and technical solutions, the adoption of predetermined practices (Blackstock *et al*., 2009).

Information that farmers obtained from information sources such as fellow farmers

Sources of information provide a range of information to farmers when responding to climate events (Cherotich *et al.,* 2012). In Kyengeza, Uganda; while men farmers relied on agricultural radio programs to access information on planting seasons, onset of rains, women relied on information from community meetings for advice as to when they should plant and use better farming methods (Chaudhury *et al.*, 2012). Cherotich *et al.,* (2012) asserted that the elderly in the semi-arid areas of Kenya, men farmers accessed climate change information from indigenous forecasters while the women farmers accessed climate related information from radios in their local dialects. Some farmers accessed adaptation information through asking and copying from other farmers, neighbours, mobile phones and radio to receive formal weather-related information and forecasts (Chaudhury *et al.,* 2012). Some of the climate change management information farmers have accessed from their fellow farmers includes identifying the onset of rain season, copying better farming methods, post-harvest handling, pest control, soil and water conservation and many others (Chaudhury *et al.,* 2012; Kyazze *et al.,* 2012; Naab & Koranteng, 2012).

Effectiveness of information sources used by men and women farmers

Effectiveness of information sources is often measured in terms of source usefulness, accessibility, availability, credibility accuracy, reliability, and affordability (Mwambi *et al.,* 2015; Mtambanengwe *et al.,* 2012). Asogwa *et al.,* (2012), mentions that the quality of information rests on three pillars including accuracy, timeliness and relevance. Accuracy implies that information is free from bias; timeliness means that recipients can get information when they need it, while relevance implies whether the piece of information specifically answers the users' question of what, why, when, who and how (Asogwa *et al*., 2012). Another example that assessed the appropriateness of the channels for disseminating climate change information among the vulnerable groups of the semi-arid areas in Kenya, found the majority of women (88.5%) preferred radio in local language while indigenous knowledge was preferred by a large majority of the elderly (Cherotich *et al.,* 2012). Adding that the elderly consistently rated radio lower than women for attributes related to information reliability, detail and language used, which indicated that different channels were necessary to reach women, the elderly and other vulnerable groups.

2.3 Determinants of farmers' use of information sources perceived to be effective

There is a strong gender dimension in the way in which climate variability is experienced and expressed by farmers in their coping strategies, choice of information and information sources when responding to drought (Lambrou &Nelson, 2010). There are factors known to influence men and women's choice of access and use of information sources. The choice of factors considers dimensions that bring out how men and women access and control opportunities and resources (Bernier *et al.,* 2015). Access to and control over resources among farmers influence the way men and women make their choices in the use of information sources when responding to drought (Magnan *et al.*2013). According to Lambrou &Nelson, (2010), gender differences in access to

information sources reflect differences in men's and women's education levels and literacy, as well as their culturally defined roles in decision making and division of labour. Men and women perceive and experience the vagaries of climate change differently (Kisauzi *et al.,* 2012) given the different roles they have in farming (IFAD, 2014), their needs in terms of access and use of resources, information and information sources they use to cope with weather and climate conditions (Lambrou & Nelson, 2010). There is a growing body of literature on gender differentiated factors affecting farmers' access and use of information sources and their influence on farmers' response to climate change. This stems from an understanding of differences in men and women farmers' preferences and use of information sources when carrying out their farming programs (Lamontagne-Godwin *et al*., 2018). Differences in men and women's choice of information sources have been linked to demographic, social, cultural, and economic factors (Mtega *et al*., 2016; Mtega & Benard, 2013; Mtega, 2012; Rehman *et al.*, 2013). Mtega *et al*., (2016), Jayawardena, (2014), Velandia *et al.*, (2011), Tarnoczi & Berkes, (2010), Buyinza *et al.*, (2008) and Chi & Yamada, (2002) point out some of the factors influential in determining farmers' access to and use of information sources to cope with climate variability across different geographical locations. A gap exists between men and women farmers when it comes to access and use of information sources to cope with climate variability. This is brought about by socio-cultural settings, beliefs and norms, which create distinctions among farmers. For instance, women's interactions with outside male extension agents in India has always been limited, which makes them miss out on very technical information and institutional support, that could be useful in building resilience to long-term climate change (Lambrou & Nelson, 2010). In Pakistan a gender study revealed that women informally accessed much less variety of information from their female neighbours/friends who they met in informal places, conducive to informal discussions such as

spiritual locations, fields or marketplaces more often than men who valued use of official services like extension services (Lamontagne-Godwin *et al.,* 2018).

Education does influence a farmer's decision to bear the risks associated with new technologies and modern information sources (Mittal & Mehar, 2012). Farmers with better education are more likely to be earlier adopters of modern technologies, diversify their information base and use multiple sources of information (Mittal & Mehar, 2012). Literacy levels of information seekers limit the usage of information especially when sought from formal or ICT based information sources (Mtega, 2012). Women often have lower levels of education than men limiting their use of new communication technologies and formal information sources (McOmber *et al.,* 2013). Agricultural knowledge and information sharing among men and women farmers in Kilombero-Tanzania was also found to increase with the level of education, where farmers with informal education rarely shared acquired agricultural knowledge and information as compared to those who had primary level of education and higher (Mtega *et al.,* 2016). When it comes to receiving information from face-to-face interactions with fellow farmers and friends, literacy levels may not affect men and women's confidence to access and use informal services as compared to when they are accessing and using formal services like extension services due to socio-cultural norms evident in patriarchal societies (Lamontagne-Godwin *et al.,* 2018). Gender differences in literacy levels among farmers demonstrate complexities in equal access to technical formal information sources such as extension agents, which require technical understanding of the key agricultural information disseminated (Ragasa *et al*., 2012). Highly educated men were able to observe demonstration plots while women relied on agricultural extension agents for agricultural information (Mtega *et al.,* 2016). The same trend applies to men and women farmers' preference of ICT based information sources and channels. The distinction between men and women's demand for ICT based

information resources including radio sets, TV, mobile phones and print resources can be linked to their level of education. McOmber *et al.,* (2013) contend that as women are overwhelmingly less educated than men in developing countries, women tend to have less knowledge of emerging technologies and thus less likely to incorporate them into their adaptive livelihood strategies in the context of climate change. While illiterate or less educated women may be able to physically access ICT resources such as a mobile phone, it may be difficult for them to understand text messages sent to them regarding climate information in case they are unable to read technical languages, which limits the usefulness of audio-visual information services (Mtega, 2012). Women and female youth more than men and male youth failed to understand hypothetical seasonal forecasts and its implication on agricultural activities and did not seem to know how to read it or use it to plan for their agricultural activities given their reportedly lower education (Kyazze *et al.,* 2012).

Mobility of farmers to different information sources is critical in building adaptation capacity of men and women farmers. Being mobile has a gender dimension to it. Men usually move with in and around to different areas for drought response information than women. A study in Ghana revealed that men occasionally crossed by canoes on the river to neighboring country (Burkina Faso), used lorries to distant places within and bicycles and foot to nearby villages while it was easy for women who had money to board vehicles to travel further unlike those who had neither a bicycle nor money to board a vehicle (Naab & Koranteng, 2012). However, women had limitations in the use of certain modes of transport such as bicycles, in and out of their communities due to cultural norms that forbid women from riding bicycles.

Wealthier farmers tend to have greater accessibility to diverse information sources as compared to smallholder or subsistence farmers (Mittal & Mehar, 2015). Also, social network connections have been found to influence men and women's access and use of technical or formal information

sources. In India, poorer women informally received agricultural information from fellow poor women within their larger social networks while the poor men in their small networks were connected to wealthier and more progressive farmers. This had implications on their decisions to access and use new agricultural information from fellow farmers or extension services within their reach when coping with drought (Magnan *et al.*2013).

3.0 CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Research design

The study used the mixed methods approach with quantitative and qualitative methodologies to address the objectives. Specifically, it used a cross sectional survey, focus group discussions and key informant interviews as presented in the table below.

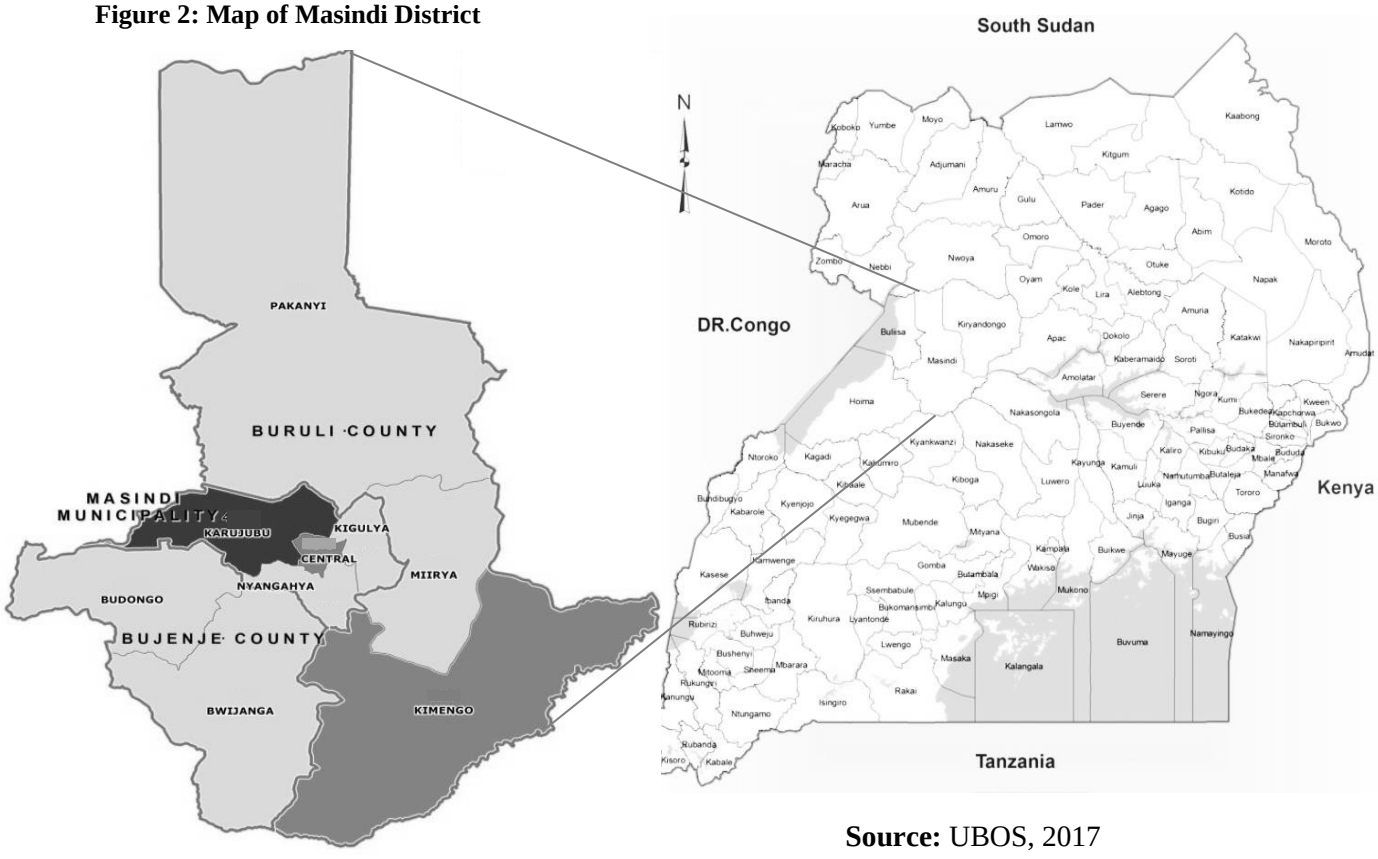
Table 1: Presentation of the study research design

No.	Objective	Data collected	Data Source	Data collection method	Method of analysis
1	Determine the sources of information used among smallholder farmers of Masindi District to cope with drought.	- Climate change scenarios & impacts on agriculture - Key Information sources used.	- Men and women farmers - Extension agents - Key farmers	- Cross section survey	Descriptive statistics: - - Percentages - Frequencies Inferential statistics: - - Chi-square
		- Relationship between sex of farmer and sex of fellow farmers contacted for information	- Men and women farmers - Key farmers	- Cross section survey	Descriptive statistics: - - Percentages - Frequencies Inferential statistics: - - Chi-square
		- Number of fellow farmers that men and women contacted for information to respond to drought	- Men and women farmers - Key farmers	- Cross section survey	Descriptive statistics: - - Percentages - Frequencies Inferential statistics: - - Chi-square
		- Types of extension agencies used	- Men and women farmers - Extension agents	- Cross section survey	Descriptive statistics: - - Percentages - Frequencies Inferential statistics: - Chi-square
		- Relationship between sex of farmer and extension agencies contacted	- Men and women farmers - Extension agents	- Cross section survey	Descriptive statistics: - - Percentages - Frequencies Inferential statistics: - Chi-square
2	Characterize the sources of information used to cope with drought among men and women smallholder farmers to cope with drought.	- Characteristics of fellow farmers contacted	- Key farmers (2 women & 2 men from 2 sub-county)	- FGDs of 10-12 farmers - Key informant interviews	Thematic analysis
		- Perceived characteristics of fellow farmers	- Men and women farmers	- Cross section survey	Inferential statistics: - - Mann-Whitney U test
		- Characteristics of Extension agencies	- Extension agents	- FGDs of 10-12 farmers - Key informant interviews	Thematic analysis
		- Perceived characteristics of extension agencies	- Men and women farmers	- Cross section survey	Inferential statistics: - - Mann-Whitney U test
		- Important information obtained	- Men and women farmers - Extension agents	- Cross section survey - Key informant interviews	Descriptive statistics: - - Percentages - Frequencies
		- Perceived effectiveness of information sources	- Men and women - Extension agents	- Cross section survey - Key informant interviews	Inferential statistics: - - Mann-Whitney U test
3	Identify factors influencing use of sources	- Channels used to access sources - Factors use of sources	- Men and women - Extension agents	- Cross section survey - Key informants	Descriptive statistics: - - Means, SD - Binary Logistic Regression

3.2 Description of study area

The study was conducted in Masindi district given its location in a climate change prone area. Masindi district is located in the mid-west part of Uganda, 130 miles (216 Km) from Kampala the capital city of Uganda. Masindi's geographical coordinates are 1˚ 40' 28" North, 31˚ 42' 54" East, bordering Buliisa district in the north, Nakasongola district in the east, Hoima and Kiboga districts in the south and the south-east, and the Democratic Republic of Congo in the west. The total population has been approximately 291,113 representing 148,121 (50.1%) men and 142,992 **(**49.9%) women (UBOS, 2014). Of the total population in Masindi District, 85% are engaged in smallholder agriculture while approximately 6% of land is under large scale farming activities (Kugonza *et al*., 2009).

Figure 2: Map of Masindi District



Source: UBOS, 2017

A total of 15,184 (71%), 9,644 (45%) and 16,147 (75%) of the households are engaged in crop growing, livestock farming and both crop growing and livestock production respectively (UBOS, 2017). The climate of Masindi District is modified by a number of water bodies and swamps (permanent and seasonal), forests, savanna grassland and savanna woodland which significantly modify the temperature and rainfall patterns in the district. Temperature varies between 17.8^0 C in wet season and 30^0 C in the dry season while rainfall varies between 800mm and 1042mm (Masindi District Council, 2007). Based on rainfall patterns, the District can be divided into three major zones including; - High rainfall zones, Medium rainfall zones and Low rainfall zones (UBOS, 2014). Masindi District was chosen for this study because of its frequent drought scenarios and variability in rainfall across the region (Wamatsembe *et al.,* 2017).

Table 2: Descriptions of farming and rainfall zones in Masindi District

Rainfall Zone	Description	Sub-County and Parishes	Main livelihood activity
High rainfall zones	• Receive 1000 - 1200mm of rainfall per annum. • Experiences floods and hail storm. • Most parts are fertile for farming	**1. Pakanyi** • Kyatiri • Kihaguzi • Kyakamese • Kiruri • Labong	• Maize production • Cassava production • Tobacco growing • Banana growing.
Medium rainfall zone	• Receive a range between 800 mm – 1,000 mm per annum of rainfall. • Poor and rural agricultural population	**2. Miirya** • Kigulya • Bigando • Isimba	• Maize production • Cassava production • Banana growing.
Lower rainfall zone	• Receive less than 800mm of rainfall per annum and is comparatively dry. • Severe water shortages in dry season	**3. Kimengo** • Kijunjubwa • Kimengo	The major activities are: - • Pastoralism • Fishing

Source: (Masindi District Local Government, 2009)

3.3 Sampling procedure and techniques

The study employed multi-stage simple random sampling procedure to select respondents. Consideration was made of the three rainfall zones in Masindi District (***Table 2.0***), the high rainfall zone, moderate rainfall zone and the low rainfall zone represented Kimengo sub-county, Miirya Sub-county and Pakanyi Sub counties respectively. This was done with the help of documents from population office, District Agricultural Officer (DAO) and the Village Health Teams (VHTs).

Smallholder farmers in the three agro-ecological zones of the Masindi District constituted the population (N) for this study. One parish in each case was randomly selected from Kimengo and Miirya Sub-counties while two parishes were selected from Pakanyi Sub County (***Table 4.0***). Two parishes were purposively selected from Pakanyi Sub-county because of its large size and population of 29,194 men and 29,208 females compared to Miirya of 10,679 males and 9,567 females and Kimengo having 7,671 males and 6,337 females (UBOS, 2014). This represented a ratio of 2:1:1. So, the selection of parishes from each sub-county was followed by the determination of the sample of respondents for the entire district. To calculate a sample, reference was made to the population sizes per sub-county as in ***Table 3.0*** below.

Table 3: Households and Population by County, Sub county and Gender

County	Sub county	House holds	Men	Women	Total
Buruuli	Kimengo	2924	7671	6337	14008
Buruuli	Miirya	4555	10679	9567	20246
Buruuli	Pakanyi	12654	29194	29208	58402
Total		**20133**	**47544**	**45112**	**92656**

Source: UBOS, (2014)

The sample was obtained using equation *1* (Baanni *et al.,* 2018; Cherotich *et al.,* 2012).

$$n = \frac{N}{1+Ne^2} \qquad \text{.....} \quad (1)$$

Where *n* is the sample size, *e* is the margin of error (which is 0.05 with confidence level of 95%). N is the population of smallholder farmers which was 92,656 for this study ***(Table 3.0)***. By substitution, the actual sample size (*n*) was computed to 398 respondents (***Table 4.0***).

Selection of villages from parishes: In Kimengo sub-county, Kimengo parish with five villages was selected. In Miirya sub-county, Isimba parish with five villages was selected. In Pakanyi Sub-county, *Kihaguzi* and *Kyakamese* parishes with 10 and 19 villages respectively were selected (***See appendix 5***.0, for a list of all villages per parish). This provided a ratio of villages per parish in each sub-county as 1:1:2:4. Using this ratio, villages were randomly selected, where one village

was selected from the parishes in Kimengo and Miirya sub counties. Also, 2 villages were selected from Kihaguzi parish and 4 from Kyakamese parish both parishes being of Pakanyi sub-county.

Sample selection at village level: Lists of names of farmer household heads for each of the selected villages was obtained from the District sanitation officer (DSO) who had recently conducted the health census under the Ministry of Health (MoH).

Random selection of Household per village: To obtain the number of respondents per village, a ratio factor was used with the smallest village size taking on the ratio of 1. For each of the eight villages, the ratios were derived depending on the number of households per village which was *1:1:1:1.5:1.5:2:2.5:2.5*[1]. The resultant number of households that were selected per village is shown in ***Table 4.0***. Proportionate sampling was used to determine the total number of the households taking into consideration the total sample needed and size of the village. With the number of the respondents needed per village in place, it was decided that half of that would be women headed households and the other half would be for the male headed households.

Table 4: Derived samples of Households on the village

Sub county	Parish	Total Number of vilages	No. of sampled villages	Village Sampled	HHH population	Ratio[2] Used	HHH Sample Derived
Kimengo	Kimengo	5	1	Karwara-Kididima	90	1.5	50
Miirya	Isimba	5	1	Kyabaswa-Kyikyope	50	1	50
Pakanyi	Kihanguzi	10	2	Kidwera I	148	2.5	70
				Kigaragara	43	1	43
	Kyakamese	19	4	Kasomoro	100	2	47
				Kisindizi II	131	2.5	62
				Kyarumbeiha	89	1.5	42
				Katumba	70	1	34
Total		39	8		**721**	**14**	**398**

Source: Data

[1]These are ratios that were used to derive the sample used in this study

[2]The ratios of the samples used in this study were computed per sub county depending on their respective villages and population

3.4 Instrumentation

Interview schedules were developed to collect data from the separate FGDs of men and women farmers in Pakanyi, Miirya and Pakanyi Sub-counties. Separate Focus Group Discussions (FGDs) of eight men and five women in *Kinuuma* village, Bigando parish in Miirya Sub-county and eight men and six women in *Nyakaronge* village, *Kiruri* Parish in Pakanyi Sub-county were used in the identification of four key farmers (one male and one female from each of the villages) to be interviewed. This was aimed at characterizing the information sources used by farmers in the different rainfall zones (Miirya - medium rainfall zone and Pakanyi - high rainfall zone) of Masindi District to cope with drought. Masindi District officials and FGDs of men and women farmers helped in the identification of the most contacted categories of extension agencies. The structured interview schedule collected information on information sources used among men and women farmers, characteristics of information sources and the socio-economic and institutional variables of the respondents. Also, qualitative data helped in the construction of a survey questionnaire which was used to collect quantitative data. The validity of the content in the interview schedule and survey questionnaire was determined by a group of knowledgeable personnel ***(Appendix 1)*** to ensure that data collected addressed the objectives of the study. The tools were pre-tested in a neighboring parish excluded from the main study to measure their reliability and validity.

3.5 Data collection

3.5.1 Qualitative Data collection

Qualitative information on the climate events and sources of information was collected using Focus group discussions (FGDs) among 10 to 12 separate men and women farmer groups. FGDs were held in Kibaale Kitonde, Bigando and Kinuuma in Miirya Subcounty; Nyakaronge in Pakanyi Subcounty and Kimengo in Kimengo Subcounty representing the rainfall zones. Other qualitative

data were collected through field visits and individual interviews with key informants who included Village leaders, District Administrators (DAs), District Agriculture officer (DAO), Non-Government Organizations (NGO) workers and extension officials such as National Agricultural Advisory Services (NAADS).

Quantitative Data collection

Quantitative data was collected using a structured interviews schedule. After pretesting it for suitability, trained enumerators fluent in the local dialect were used to collect information from the sampled respondents.

3.6 Data Analysis

After data cleaning, data from only 313 households were used in the analysis as 85 questionnaires were dropped on account of incomplete and/or inconsistent data. These constituted 167 male and 146 female-headed households as indicated in the table below.

Table 5: Final samples of used for the study

Sub county	Parish	Total Number of vilages	No. of sampled villages	Village Sampled	Men HHH Used	Women HHH Used	Overall Sample Used	Samples Dropped
Kimengo	Kimengo	5	1	Karwara-Kididima	20	16	36	14
Miirya	Isimba	5	1	Kyabaswa-Kyikyope	22	15	37	13
Pakanyi	Kihanguzi	10	2	Kidwera I	20	20	40	30
				Kigaragara	20	19	39	4
	Kyakamese	19	4	Kasomoro	20	18	38	9
				Kisindizi II	32	27	59	3
				Kyarumbeiha	20	18	38	4
				Katumba	13	13	26	8
Total		39	8		**167**	**146**	**313**	**85**

Source: Data

Additionally, statistical analysis was carried out by using the statistical package IBM SPSS Statistics version 20. Data was analyzed using descriptive statistics, involving means, standard deviations, percentages and frequencies; and inferential statistics involving Mann Whitney *U*-test

statistic, Chi-square test of independence and the Binary Logistic Regression analysis as summarized in ***Table 6***. For internal consistency of the variables ranked on the ordinal likert scale, reliability test was done using a Cronbach's alpha reliability analysis.

Table 6: Summary of analyses by study objective

Objective	Specific analyses
1: Determine the information sources to cope with drought	Descriptive statistics such as percentages and frequencies and inferential statistics (Chi-square) were used to determine the key sources of information used, relationship between gender of farmer and sex of fellow farmers used, number of fellow farmers that men and women contacted, types of extension agencies used and the number of extension agencies that men and women farmers used.
2: Characterize information sources used among men and women farmers	**Characteristics of fellow farmers and extension agencies** • Characteristics of extension services and fellow farmers were analyzed using thematic analysis. **Perceived Characteristics of information sources used by men and women farmers** • The differences in characteristics of fellow farmers used by men and women farmers to obtain drought management information were analyzed using mean ranks, frequencies and Mann Whitney *U* test. Responses to characteristics included; the scores ranged from 1- 5: 1= Strongly Disagree 2=Disagree 3 =Not sure, 4=Agree, 5= strongly agree. **Most obtained information from information sources to cope with drought** • The differences and associations between the gender of farmers and the use of the most important information obtained from information sources to cope with drought was analyzed using frequencies, percentages and chi-square tests **Perceived effectiveness of information sources used to cope with drought** • Ranking of effectiveness of fellow farmers and extension services was done using percentages, frequencies, mean ranks and analyzed using Mann Whitney *U* test. Responses to perceptions included; the scores ranged from 1- 5: 1= Strongly Disagree 2=Disagree 3 =Not sure, 4=Agree, 5= strongly agree.
3: Determinant of use of information sources	• First, the factors were first tested using the Chi-square to determine how different factors are associated with men and women farmers' use of information sources. • The determinants of farmers' decisions to use sources perceived to be effective were also analyzed using the Binary logistic regression model and was specified as Y_i=f ($\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3$……...$\beta_n+X_n+\delta_i$).

3.7 Model specifications

A logistic regression model was used to identify factors which influence men and women farmers' use of one or two information source (s) for coping with drought. Logistic regression is categorized under Limited Dependent variable model and is extensively used in social research when the dependent variable is dichotomous (Kega *et al.,* 2015). The use of the dichotomous choice data model was the best method to investigate the influence of socio-economic and demographic factors on men and women's decisions to use fellow farmers and extension agencies or otherwise. Given that the dependent variable was dichotomous, it assumed the influence of a

set of explanatory variables (that are either continuous or dummy) on a dichotomous outcome by estimating the probability of the event's occurrence (Muriithi *et al.,* 2020; Gujarati, 2004). Farmers' use of information source (s) or otherwise was expressed as binary choice models which assumed that individual respondents had a choice between two alternatives, which involved taking a decision to use the information source (s) or not. A value of 1 was given to farmers who used any of the information sources and value 0 otherwise. The probability function of this binary decision variable can be described as P=P [Y_i=1] and, 1- P = [Y_i = 0] respectively where Y_i=0, 1. To determine the parameter estimates of the factors that influence farmers' use of information source (s) to cope with drought, the theoretical model to be estimated by using the binary choice model has been formulated as follows;

$$Y_i^{*}=\beta_{0+}\sum_{i=1}^{k}\beta j X_{ij}+\delta_i \qquad (2)$$

Where, the farmer's decision-making parameters are often un-observed and can be measured by a latent variable Y_i^{*} that might be due to socio-economic and institutional variables and the observed is the dummy variable Y_i such as; -

$$Y_i=\begin{matrix}1\\0\end{matrix}\begin{cases}\text{If } Y_i^{*}>0\\ \text{Otherwise}\end{cases} \qquad (3)$$

(X_{ij}) is a set of explanatory variables, β_{ij} are coefficients to be estimated and δ_i is the random error term assumed to follow a logistic distribution. After the determination of farmer's choice of information source, dummy variables can be used to express the observed pattern of farmers' use of information source (Y_i) while the observed values of Y_i are related to latent variable Y_i^{*}; that is otherwise. Thus, the probability of farmers using information sources can be given as: -

$$P[Y_i=1] =P(e_i>-X_i\beta) = 1-F(X_i\beta) =F(X_{ij}\beta) \qquad (4)$$

Where β is the parameters used in the maximum likelihood procedure and F is the Logistic Cumulative Distribution Function (LCDF).

$$F(X_i) = \frac{e^{(X_i\beta)}}{1+e^{(X_i\beta)}} \quad (5)$$

To specify factors contributing to the probability of a farmer using an information source or otherwise, the logit model can be used and expressed as:

$$P_i = P[Y_i=1] = \frac{e^{(X_i\beta)}}{1+e^{(X_i\beta)}} \quad (6)$$

Since logistic regression calculates the probability of success (P_i) over the probability of failure ($1-P_i$), the results of the analysis are in the form of an odds ratio also presented as;

$$\text{Odds} = \frac{P_i}{1-P_i} \quad (7)$$

Empirically, the logistic model is represented as

$$\text{Log}\left\{\frac{P_i}{1-P_i}\right\} = \beta_0+\sum_{i=1}^{k}\beta ij X_{ij} \quad \text{or as} \quad \text{Log}\left\{\frac{P_i}{1-P_i}\right\} = e^{\beta_0+\sum_{i=1}^{k}\beta ij X_{ij}} \quad (8)$$

Where, P_i = prob (y_i=1) and the left hand corresponds to the logit or the log of the odds ratio. In the second expression in the ***Equation 8***, the left-hand side is an odds ratio and the right-hand side gives the marginal effects of X_{ij} on the odds (Hailpern & Visintainer, 2003). The estimated parameters of the model are comparatively easy to analyze in terms of their marginal effects which measures the change in one independent variable keeping all other variables constant. The marginal effects are the partial derivatives of the probability of an event. But, in case of categorical variables, the marginal effects are represented by the difference in the predicted probability of each of the category. Given the specific factors, the probability of farmers' use of information sources can be predicted. For any change in the farmers' choice, the change in probability (ΔP) was

estimated. If other factors being constant (*ceteris peribus*), the marginal effect on the probability that the farmer chooses to use particular information source (s) can be computed as:

$$\left.\frac{\Delta P_i}{\Delta X_i}\right| = \frac{\partial P_i}{\partial X_i} \quad \text{(all other X constant)} \qquad (9)$$

In the context of this study, farmers' use of information sources as a dependent variable is on the left-hand side and it is measured as a dichotomous variable which takes the value of 1 for farmers' use of information source (s) and, 0 otherwise. The explanatory variables represent the attributes which influence a farmers' alternative choice between use of only fellow farmers or extension agencies. The predictor variables in logistic regression can take any form since logistic regression makes no assumption about the distribution of the independent variables. That's to say, they do not have to be normally distributed, linearly related or of equal variance within each group (Reddy *et al.,* 2015; Mbukwa, 2013; Sarkar & Midi, 2010; Gujarat, 2004). The relationship between the predictor and response variables is not a linear function in logistic regression; instead, the logistic regression function is used, which is the logit transformation of P.

$$\text{Log}it[p(x)] = \text{Log}\left\{\frac{P_i}{1-P_i}\right\} = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots...\beta_n+X_n+\delta_i \qquad (10)$$

The logistic transformation being nonlinear in nature uses the maximum likelihood estimate (MLE) method to find the most likely estimates for the coefficients and the likelihood of an event occurring. The best fit logit model is based upon the statistics namely likelihood ratio, denoted as -2 log likelihood (-2LL). The minimum value of -2 log likelihood is 0, which corresponds to a perfect fit, hence; the lower its value, the better the model. The description of the names of the variables used to estimate the models are represented in ***Table 7***. To determine the factors contributing to the probability of a farmer using particular information source (s) over the other source (s), the logit model can be used and expressed as:

$$\text{Log}\left\{\frac{P_i}{1-P_i}\right\} = Y_i=\beta_0+\beta_1(SOC)+\beta_2(GND)+\beta_3(EXP)+\beta_4(MAR)+\beta_5(EDR)+\beta_6(EDF)+\beta_7(COM)+\beta_8(TEC)+\beta_9(YSP)+\beta_{10}(AGE)+\beta_{11}(TRP)+\beta_{12}(MPH)+\beta_{13}(RAD)+\beta_{14}(LND)+\beta_{15}(CTL)+\beta_{16}(ATE)+\beta_{17}(FGP)+\delta_i \quad (11)$$

Basing on the econometrics of Gujarati, (2004), the logistic distribution for farmers' use of information source(s) has been specified as follows: -

$$Y_i=\beta_0+\beta_1(SOC)+\beta_2(GND)+\beta_3(EXP)+\beta_4(MAR)+\beta_5(EDR)+\beta_6(EDF)+\beta_7(COM)+\beta_8(TEC)+\beta_9(YSP)+\beta_{10}(AGE)+\beta_{11}(TRP)+\beta_{12}(MPH)+\beta_{13}(RAD)+\beta_{14}(LND)+\beta_{15}(CTL)+\beta_{16}(ATE)+\beta_{17}(FGP)+\delta_i \quad (12)$$

Y_i was the dependent variable, (Farmers' use), β_0 was the intercept term, β_1- β_n, was the logistic regression coefficients and δ_i was the Error term.

3.7.1 Description of Variables used in the Binary Logistic Regression Model

The table below summarizes the description of the set of independent variables and their expected influence on the farmers' use of information sources as the dependent variable.

Table 7: Summary description of variables used in Binary logistic Model

No.	Variable Name	Variable label	Variable type and code	Expected sign
A	**DEPENDENT VARIABLE**		Dummy (Use Information source = 1,	
	Use of information sources		Otherwise = 0)	
B	**EXPLANATORY VARIABLES**			
	Social characteristics			
1	Sociability of fellow farmer (SOC)	X_1	Dummy (Social= 1, otherwise= 0)	-/+
2	Gender of Respondent (GND)	X_2	Dummy (Male=1, Female = 0)	-/+
3	Experiment practices for other farmers (EXP)	X_3	Dummy (Experiments = 1, otherwise= 0)	+
4	Marital status of respondent (MAR)	X_4	Dummy (Married =1, Otherwise =0)	-/+
5	Education level of respondent (EDR)	X_5	Continuous	-/+
6	Education for Fellow farmer (EDF)	X_6	Dummy (Educated =1, Otherwise = 0)	+
7	Communication ability for FF (COM)	X_7	Dummy (Yes = 1, otherwise)	+
8	Technology use for FF (TEC)	X_8	Dummy (Yes = 1, otherwise)	+
9	Years spent in Farming (YSP)	X_9	Continuous	+
10	Age of respondent (AGE)	X_{10}	Continuous	-/+
	Economic characteristics			
11	Access to Transport for respondents (TRP)	X_{11}	Dummy (Yes = 1, Otherwise = 0)	+
12	Access to Mobile phone for respondents (MPH)	X_{12}	Dummy (Yes = 1, Otherwise = 0)	+
13	Access to radio for respondents (RAD)	X_{13}	Dummy (Yes = 1, Otherwise = 0)	+
14	Land ownership for respondent (LND)	X_{14}	Continuous	+
15	Cattle ownership for respondent (CTL)	X_{15}	Continuous	+
	Institutional Characteristics			
16	Attachment to extension agencies for FF (ATE)	X_{16}	Dummy (Yes = 1, Otherwise = 0)	+
17	Belonging to farmer groups for respondents (FGP)	X_{17}	Dummy (Yes = 1, Otherwise = 0)	+

4.0 CHAPTER FOUR: PRESENTATION OF RESULTS

This section presents the findings, interpretation and discussions of results objective by objective.

4.1 The socio-economic and demographic characteristics of respondents

4.1.1 Demographic characteristics of respondents

A total 54% of respondents were in the age range of 18-40 years, followed by 36% in the age range of 41-60 years. In terms of farming experience, 60%, 38%, and 3% of farmers had a farming experience of 1-20, 21-40 and 41-60 years respectively. Also, 74% of the 313 respondents interviewed were obtained from Pakanyi Sub-county followed by Kimengo, 14% and Miirya, 12% respectively.

Table 8: Demographic characteristics of respondents *(n=313)*

Socio-demographic variable	Description	Gender of the respondent		
		Men (*n=167*) %	Women (*n=146*) %	Overall (n=313) %
Age				
	18-40	55	53	54
	41-60	34	38	35
	61-80	10	9	10
	81-90	1	0	1
Years spent in independent Farming	1-20	65	54	60
	21-40	34	42	38
	41-60	2	4	2

4.1.2 Socio-economic characteristics of respondents

Table 9 shows that while 93% of the respondents indicated growing crops to be most important enterprise, only 7% of the respondents indicated to livestock rearing to be the most important livestock. In the order of presentation, respondents practiced intercropping (72%); mixed farming (70%); annual crop growing (56%); perennial crop growing (50%) and mono cropping (31%).

Table 9: Key agricultural activities of the respondents (n=313)

Key agricultural activity	Men (*n=167*) %	Women (*n=146*) %	Overall (*n*=313) %[3]
Mainly crop growing	93	94	94
Mainly livestock rearing	7	6	6
Mixed farming	71	69	70
Mono cropping	35	27	31
Intercropping	73	70	72
Annual crop production	59	53	56
Perennial crop production	55	45	50

[3] The totals exceeded 100% in most categories because of multiple responses for both men and women farmers

4.2 Information sources used by men and women farmers to cope with drought

A scoping study revealed that in Masindi district the two sources of information most commonly used by farmers in managing drought were fellow farmers and extension agencies. Overall, ***Table 10*** indicates that the majority of the farmers (43%) used only fellow farmers while 37% of the farmers indicated to have used both fellow farmers and extension services. On the other hand, a small portion of farmers (20%) indicated to have used only extension agencies to obtain information to cope with drought. Specifically, 36% of men and 51% of the women respectively used only fellow farmers, while 41% of men and 34% of women respectively used both fellow farmers and extension agencies. Still, a small portion of men, 23% and women, 16% respectively used extension agencies only. Generally, women farmers mainly used fellow farmers than they used only extension services or both sources of information. On the contrary, to cope with drought, men mostly used both fellow farmers and extension agencies than they used fellow farmers alone or extension agencies alone. A chi-square test was used to determine the association between sex of farmers and type of information source used (fellow farmers only, extension agencies only or both fellow farmers and extension agencies) to cope with drought. Results show that men and women differ significantly in their use of sources for drought information ($\chi^2 = 8.117$, $p = 0.017$). These results demonstrate the significance of gender in farmers' use of either one information source or both sources of information.

Table 10: Sources of information used to cope with drought

Source of information	Men *(n=167)*		Women *(n=146)*		Overall (*n=313*)		Chi-square test[4]
	f	(%)	*f*	(%)	*f*[5]	(%)	X^2
Both FF and Ext.	68	41	49	34	117	37	8.117**
Only F. Farmers	60	36	75	51	135	43	
Only Extension	39	23	22	16	61	20	

[4] **Significant at .01

[5] *f* means frequency

Relationship between sex of farmer and sex of most contacted fellow farmer

In order to determine whether men and women farmers' information use was associated with the sex of fellow farmers contacted, the sex of fellow farmers contacted for information to cope with drought was asked for. Overall, 51% men and 49% women farmers (totaling to 252 farmers) reported to have contacted a fellow farmer to seek information on drought copying strategies. Eighty nine percent (89%) of the men had contact with male farmers while 11% of the men contacted women farmers for information to cope with drought. On the other hand, 66% of the women farmers contacted male fellow farmers on how to cope with drought, while 34% obtained information from fellow women farmers (***Table 11***). Both men and women farmers mainly obtained information to cope with drought rom male fellow farmers.

Table 11: Relationship between sex of farmer and sex of the most contacted fellow farmer for information (*n* = 252)

Men's contact with a fellow farmer by sex (n=128)	***n***	***(%)***	X^2	***p*-value**
Men that contacted fellow men farmers	114	89	14.360**	0.001
Men that contacted women fellow farmers	14	11		
Women's contact with a fellow farmer by sex (n=124)	***n***	***(%)***	X^2	***p*-value**
Women that contacted men fellow farmers	82	66	52.026**	0.001
Women that contacted fellow women farmers	42	34		

The association between the sex of farmers and the sex of fellow farmers contacted was tested using a chi-square statistic revealing a significant relationship for men's (χ^2 =14.360, p= 0.001) and women's (χ^2 = 52.026, p= 0.001) contact with fellow farmers (***Table 11***).

Sex category of fellow farmers that men and women contacted for information

To further reveal whether men and women contacted at least one or multiple fellow farmers, the study assessed the sex categories of fellow farmers (only male, only female or both male and female fellow farmers) from which men and women obtained information to manage drought (***Table 12***). Overall, 58% of the farmers obtained information from only male fellow farmers followed by 30% of the farmers who obtained information from both male and female farmers. Only 12% of the farmers contacted only female farmers for information to cope with drought. The

results also indicate that 70% of the men respondents, contacted only fellow male farmers, while 46% of the women contacted only male fellow farmers. Thirty three percent (33%) of the women respondents contact both male and female fellow farmers compared to 27% of the men. Twenty one percent (21%) of the women contacted only fellow female farmers compared to 3% of the men. The relationship between sex category of the most contacted fellow farmers and the sex of farmers was tested. Findings confirmed that men mostly contacted only fellow male farmers (χ^2 = 15.358, p = .000) more significantly than women did. Also, more women happened to contact only fellow female farmers (χ^2 = 19.120, p = .000) more significantly that men contacted them for information to cope with drought.

Table 12: Sex category of fellow farmers most contacted for information to cope with drought by men and women farmers (n = 252)

Sex category of fellow farmer	Men (n=128)		Women (n= 124)		Overall (n=252)		X^2[6]	p-value
	f	*(%)*	*f*	*(%)*	*f*	*(%)*		
Only males	90	70	57	46	147	58	15.358	.000
Only females	4	3	26	21	30	12	19.120	.000
Both males and females	34	27	41	33	75	30	1.274	.259

Number of fellow farmers that men and women farmers contacted for information

Results revealed that some men and women farmers contacted only one fellow farmer for information to cope with drought, while others contacted more than one fellow farmer. ***Table 13*** reveals that overall, 66% of men and women farmers contacted more than one fellow farmer as compared 34% of men and women farmers that contacted only one fellow farmer. The results further reveal that women tended to consult only one fellow farmer, while the majority of the men contacted between 2 to 5 fellow farmers for information to cope with drought. The relationship between sex of the respondent farmers and the number of fellow farmers contacted was tested. Findings confirmed that men contacted between 2-5 fellow farmers significantly more than women did during the times of drought (χ^2 =4.168, p = .041).

[6] **Significant at 1%

Table 13: Number of fellow farmers that men and women farmers contacted to respond to drought

No. of fellow farmers contacted	Men's contact with fellow farmers (*n*=128)		Women contact with fellow farmers (*n*=124)		Overall (*n*=252)		Chi-square test[7]	*p*-value
	f	%	*f*	%	*f*	%	X^2	
Only 1 farmer	36	28	50	40	86	34	4.168*	0.041
Between 2 to 5	92	72	74	60	166	66		

Extension agencies that farmers contacted most for information to cope with drought

Farmers were asked to indicate the extension agencies they contacted for information to cope with drought. Overall, 58% of the farmers got information on managing drought from farmers' organizations such as Masindi District Farmers' Association, followed by 55% who obtained information from the Government's National Agricultural Advisory Services (NAADS) extension program. Twenty four percent (24%) sourced information to cope with drought from the Non-Government Organizations (NGOs) while 21% got it from Private sector companies like Mukwano (***Table 14***). The findings confirmed that there was a difference in the level of men's and women's use of farmers' organizations as sources of information to cope with drought (χ^2 = 24.343, *df* = 1; p= 0.000); Local Government Extension agencies (χ^2 = 54.950, *df* = 1; p= 0.000); Non-Governmental Organizations (χ^2 = 10.711, *df* = 1; p= 0.001) and Private Sector Companies (χ^2 = 17.371, *df* = 1; p= 0.000). In three of the extension sources (Local Government, NGO, and private sector) men had greater use, while women had greater use of farmers' organizations than men.

Table 14: Extension agencies' user status among men and women farmers to cope with drought

Extension service agencies	Men (n=107)				Women (n=71)				Overall (*n*=178)				χ^2	*df*	*P* ≤ 0.05
	Users		Non-Users		Users		Non-Users		Users		Non-users				
	f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%			
Farmer Orgs	46	43	61	57	57	80	14	20	103	58	75	42	24.343	1	.000**
Local Govt ext.	83	78	24	22	15	21	56	79	98	55	80	45	54.950	1	.000**
Non-Govt Orgs	35	33	72	67	8	11	63	89	43	24	135	76	10.711	1	.001**
Private sector	34	32	73	68	4	6	67	94	38	21	140	79	17.371	1	.000**

[7] *Significant at .05

Number of extension agencies that farmers contacted for information to cope with drought

Table 15 indicates that some of the men and women farmers contacted only one extension service agency. Fifty-two (52%) percent of the farmers contacted only one extension agency for information to cope with drought while 48% of the farmers contacted more than one extension agency. Eighty two percent (82%) of the women farmers contacted one extension agency for information to cope with drought compared to 32% of the men. A total of 68% of the men contacted more than one extension agency for information to cope with drought compared to 13% of the women. The findings indicate that men were contacting more than one extension agency while most women were able to contact only one extension agency. A significant relationship was also found between sex of farmer and the number of extension agencies contacted revealing the stack difference between the number of extension agencies contacted by men for information to cope with drought from those contacted by women ($\chi^2 = 44.314$, $df = 3$, $p = 0.000$).

Table 15: Number of extension agencies that men and women contacted for information to cope with drought

No. Extension agencies used	Men (*n*=107)		Women (*n*=71)		Overall (*n*=178)		Chi-square test		
	f	%	*f*	%	*f*	%	X^2	*df*	$P \leq 0.05$
1	34	32	58	82	92	52	44.314	3	.000
2	58	54	13	18	71	40			
3	10	9	0	-	10	5			
4	5	5	0	-	5	3			

4.3 Characterizing the Information sources used to cope with drought

The agencies used included; the Local Government Extension, BUILD Africa an NGO, MADFA a farmers' organization and Mukwano Industries a Private Sector company. The extension agencies were characterized based on the following aspects: their target farmers, mandate, networks, socio-economic and demographic characteristics, communication strategies used and the key messages they disseminated ***(Table 16)***. Extension agents gave information on their mandate, policy on climate change, collaborative networks, key messages disseminated and communication strategies (***Table 24).*** In addition, men and women farmers' perception of the

communication behaviour, experience and innovativeness of fellow farmers contacted were assessed. The most sourced information was identified, including how men and women perceived the information's effectiveness in helping them cope with drought.

4.3.1 Characteristics of fellow farmers contacted for information to cope with drought

Characterizing of fellow farmers was an attempt to describe whether they are using certain parameters. Selected fellow farmers who had been contacted for information to cope with drought were asked to describe themselves using a number of characteristics as shown in ***Table 16***. The farmers who provided information to other farmers on how to cope with drought indicated to having a desire to reach out to both men and women farmers. While these fellow farmers were willing to be contacted by either men and women farmers, some had specific gender groups contacting them more. For instance, in Pakanyi, the male farmer indicated to have been contacted mainly by male farmers. Another male farmer from Miirya indicated to have been contacted mainly by women farmers for information to cope with drought. Female fellow farmers from Pakanyi and Miirya indicated to have been contacted more by women farmers for information to cope with drought.

The farmers who were contacted for information to cope with drought indicated that they were motivated to promote agronomic practices on particular crops, food security, crop diversification, and high yielding crop varieties among fellow farmers. A male fellow farmer from Pakanyi focused on offering specific information on climate events, specifically drought and its adaptation. Some women farmers promoted post-harvest agro-technologies such as, food preservation. Promotion of food preservation innovations such as drying of sauce like beans, *Amaranthus spp*, cowpeas, *Nakati* etc. and foods such as cassava and potatoes for future use. Such information was often exclusively shared with fellow female farmers.

Across all men and women fellow farmers, individuals had varying networks they belonged to. For instance, the male farmer from Pakanyi had connections with only the district production officer while the male farmer from Miirya was an agent for several organizations. He was connected to the Government extension service NAADS, an information technology organization that promoted the use of mobile phones as a source of agricultural information called Grameen foundation. He was also connected to district political leaders. The two female farmers were connected to the District Political leaders and were agents of extension agencies including the Northern Uganda Social Action Fund (NUSAF), BOMIDO, CLUSA; BUILD AFRICA an NGO, the NAADS program and Masindi District Farmers Association (MADFA). One of the female informers had connections with a Private sector company.

In terms of the fellow farmers' socio-economic and demographic characteristics, all had sufficient acreage (between 20 – 80 acres) of land for agriculture enterprises except for the female fellow farmer from Miirya who owned only two acres; they were between 30-60 years of age with agriculture as the main source of livelihood. Two male fellow farmers were married. One was a former District Agricultural Officer (DAO) who had a diploma in education and a Bachelor of Science degree in Agriculture. One male farmer from Miirya had secondary school education level, a community leader who also regularly participated in agricultural trainings. The women fellow farmers similarly were regular participants in agricultural training, had leadership roles in the community and in religious circles. The female farmer from Pakanyi had a secondary school level education and was married, while the other female farmer from Miirya had never gone to school and was unmarried.

The fellow farmers communicated with men and women farmers through: demonstration of farming skills and technologies to farmers, meeting farmers in their farmer groups, using radio and

face to face meetings with individual farmers. One male farmer from Miirya disseminated weather updates and market information from his smart mobile phone to women farmers who contacted him.

The fellow farmers mainly shared information on new agro-technologies, enterprise mixing, use of drought resistant crop varieties and commercial agriculture. Other information was on planting trees to curb climate change and market prices. The male farmer from Pakanyi advocated for collective marketing among farmers for better prices, promoted the use of artificial fertilizers and disseminated information on weather. The male farmer from Miirya mainly shared information with women on how to control crop diseases and best choices of drugs for livestock treatment. Both female farmers shared information with other farmers on the choice of drugs for livestock treatment, and on climate change and how to address it. In Pakanyi, the female farmer shared on collective marketing for better prices, how to control of crop diseases, tree planting trees to curb climate change, good soil fertility management, use of fertilizers and market price information. In Miirya, the female farmers shared on food and sauce preservation as important in keeping women that approached her to remain food secure. Through demonstration, the women farmers observed and learnt the processes through which this farmer preserved food (cassava, potatoes etc.) and sauce (*pea leaves, Nakati, beans etc.*) which were either sundried or stored (in the case of food and some sauce such as beans) or sundried, ground and stored (in the case of sauce) in anticipation of drought as indicated in ***Figure 2.***

Figure 3: Dried *Amaranthus 'Dodo'* (left); Ground cow pea leaves (center) and half-cooked beans (right); an innovation from Ms. Nyangoma Joyce in Miirya

Source: Field Data, 2014

Table 16: Self-characterization of fellow farmers used to cope with drought

Characteristics of fellow farmer examined	Pakanyi		Miirya	
	MFF*[8]	FFF**[9]	MFF	FFF
Target of the Farmer				
Wanted to equally reach out to men and women	√	√	√	√
I reached out equally to men and women	×	×	×	×
Men contacted me most	√	×	×	×
Women Contacted me most	×	√	√	√
Scope or mandate of the sources				
Offer information on climate change and adaptation	√	×	×	×
Promote agronomic practices on particular crops	√	√	√	√
Help others to access market information	√	√	√	×
Promote practices that curb climate change. E.g., planting trees	√	√	√	×
Promote particular post-harvest agro-technologies e.g., food preservation	×	√	×	√
Promoted crop varieties that could increase production	√	√	√	√
Promote crop diversification	√	√	√	√
Promote food security	√	√	√	√
Increase household income	√	√	√	×
Networks they belong to				
District Political leaders	×	√	√	√
Government extension service like NAADS	×	√	√	√
Community Based Organizations like NUSAF, BOMIDO, CLUSA	×	√	×	√
Non-government organizations like BUILD AFRICA	×	√	×	√
Private sector companies like Mukwano	×	√	×	×
Farmer organization like MADFA	×	√	×	√
Private-Public organizations like Grameen foundation	×	×	√	√
District production officer	√	×	×	×
Agent of extension agencies or organizations within the community	×	√	√	√
Socio-economic and demographic characteristics				
Specialized in Agriculture as the main source of livelihood	√	√	√	√
Primary level of education	×	×	×	√
Secondary level of education	×	√	√	×
Tertiary level of education	√	×	×	×
I am between 30-60 years of age	√	√	√	√
Regular participation in agricultural training	√	√	√	√
Am married with a family	√	√	√	×
Have sufficient acreage of land for agriculture enterprises e.g., ≥02	√	√	√	√
Affiliated to or leader in a religious group or faith	×	√	×	√
I have leadership roles in the community	×	√	√	√
Communication means with farmers				
Meet face to face with individual farmers	√	√	√	√
Meet farmers in their farmer groups	√	√	√	√
Use mobile phones to communicate with farmers on farming issues	×	×	√	×
Pass on agricultural information from radio to farmers	√	√	√	√
Demonstrate farming skills and technologies to farmers	√	√	√	√
Key messages disseminated				
I always discuss with members on issues of climate information	√	×	√	×
I always teach farmers about new agro-technologies	√	√	√	√
I promote commercial agriculture	√	√	√	√
I always inform farmers of market prices	√	√	√	×
I always help to disseminate information on climate	√	×	×	×
I teach farmers concerning use of drought resistant crop varieties	√	√	√	√
Teach farmers about drugs for livestock treatment	×	×	√	×
Taught people how to control crop diseases	×	√	√	×
Plant trees to curb climate change	√	√	√	×
Encourage enterprise mixing	√	√	√	√
Encourage soil fertility management such as use of fertility management	√	√	×	×
Encouraged collective marketing among farmers for better prices	√	√	×	×

[8]* MFF- Male Fellow Farmer
[9]** FFF- Female Fellow Farmer

How do men and women farmers perceive fellow farmers contacted for information?

An assessment was done to determine how men and women farmers perceived fellow farmers' communication behaviour, farming experiences and innovativeness, and effectiveness of information obtained from them.

Men and women's perceptions of fellow farmers' communication behaviour

Overall, fellow farmers who were sources of information to cope with drought were perceived to be good communicators (91%), sharing information willingly (90%), providing information which can be easily used by either men or women (88%), and regularly shared information they had obtained from other sources (82%) (***Table 17***).

Table 17: Assessment of men and women's perceptions of communication behavior of fellow farmers contacted

Aspects describing perceived Communication behaviour of the key farmers	Men (%) (n=128)			Women (%) (n=124)			Overall (%) (n=252)		
	A	NS	DA	A	NS	DA[10]	A	NS	DA
Communicates well & easily convinces someone	95	1	4	86	2	12	91	1	8
Willingly share information	96	0	4	84	5	11	90	2	8
Information usable by men	94	4	2	83	4	13	89	4	7
Information usable by women	91	3	6	83	5	12	87	4	9
Regularly shares information from other various sources	88	6	6	75	5	20	82	5	13

To determine whether there were differences between men and women's perception of the communication behaviour of fellow farmers as sources of information, the Mann Whitney *U* test was used. The Mann-Whitney compared mean ranks of two different sample groups from a population because of its high level of tolerance to outliers, location and shape shifts (Hoffman, 2019; Mengistu *et al.*, 2019; Divine *et al.*, 2018; Gauthier & Hawley, 2015; Traweger, 2010; Nachar, 2008 & Hart, 2001). Significant differences in men and women perceptions of fellow farmers were observed. These differences included the way they perceived farmers' ability to communicate well and convince others, willingly share information, provide information that

[10] A =agree, DA =disagree. Following data analysis, strongly agree and agree were collapsed into the 'agree' (A) column, while strongly disagree and disagree were collapsed into the 'disagree' (DA) column. However, 'Not Sure' (NS) was not collapsed in the analysis on the basis that respondents being unsure could not be represented in either the Agree or Disagree column. They were coded as; 1= Agree, 2=Not Sure and 3=Disagree.

could be used by men and regularly share information from various sources of information. Specifically, women perceived fellow farmers significantly more favorably than men in terms of being good communicators (*U*=7283.500, *p*=.027); sharing information willingly (*U*=6951.000, *p*=.001), having information that is usable by men (*U*=7120.500, *p*=.011), and regularly sharing information from various sources (6961.000, *p*=.012) (***Table 18***).

Table 18: Test of differences in men and women's perceptions of communication behavior of fellow farmers contacted

Aspects describing perceived Communication behaviour of the key farmers	Men		Women		U^{11}	Z	P ≤ .05
	Mean Rank	Rank sums	Mean Rank	Rank sums			
Communicates well & easily convinces someone	121.40	15539.50	131.76	16338.50	7283.500*	-2.217	.027
Willingly share information	118.80	15207.00	134.44	16671.00	6951.000**	-3.285	.001
Information usable by men	120.13	15376.50	133.08	16501.50	7120.500*	-2.546	.011
Information usable by women	121.40	15539.00	131.77	16339.00	7283.000	-1.954	.051
Regularly shares information from other various sources	118.88	15217.00	134.36	16661.00	6961.000*	-2.508	.012

Farmers' perceptions of fellow farmers' farming experiences and innovativeness

Men and women farmers were asked to describe the farming experiences and related innovativeness of the farmers from whom they obtained information to cope with drought (***Table 19***). Farmers experiences and innovativeness of the fellow farmers from whom they obtained information to cope with drought was assessed based on the fellow farmer being 'knowledgeable about farming', 'provided solutions to farming problems', 'experimented on farming practices', 'had exemplary fields', 'regularly used improved agricultural practices', 'quickly took on new agricultural technologies' and being 'a model farmer of improved agricultural practices. Over 80% of all men respondents indicated that they agreed that the fellow farmers possessed these attributes except in the aspect of fellow farmer quickly taking on new agricultural technologies (72%) and being a model farmer of NAADS and NGOs (53%).

[11] *, **Significant at α =0.05 and α =0.01 probability levels respectively

Table 19: Assessment of men and women's perceptions of farming experience and innovativeness of key farmers

Aspects describing perceived farming experience and innovativeness of the key farmers	Men (%) (n=128)			Women (%) (n=124)			Overall (%) (n=252)		
	A	NS	DA	A	NS	DA	A	NS	DA
Knowledgeable about farming	89	1	10	82	1	17	86	1	13
Makes solutions for farming problems	90	4	6	79	7	14	85	5	10
Experiments on farming practices	88	3	9	77	8	15	83	5	12
Fields are exemplary	88	2	10	73	7	20	81	4	15
Regular user of improved agric. Pracs.	81	4	15	70	8	22	76	6	18
Quickly takes on new agric. Techs	72	6	22	53	8	39	63	7	30
Model farmer of NAADs / NGO	53	6	41	42	7	51	48	6	46

Eighty-two percent (82%) of the women farmers agreed with the fact that the fellow farmers who were a source of information to cope with drought were knowledgeable about farming. Fifty three percent (53%) of the women farmers agreed with the fact that fellow farmer quickly took up new agricultural practices, while 42% agreed that these farmers who provided information were also model farmers of NAADs or NGOs (***Table 19***).

The Mann Whitney *U* test was conducted to determine if there was a difference in the way men and women farmers perceived the characterization of the fellow farmers in aspects of farming experience and innovativeness. Results show that women perceived fellow farmers significantly favorably and differently compared to men in aspects of: - coming up with solutions to farming problems (*U*=7084.500, *p*=.019), experimenting with farming practices (6993.000, *p*=.014), having exemplary fields (*U*=6777.000, *p*=.004), being regular users of agricultural practices (*U*=7085.500, *p*=.050) and in quickly taking up new agriculture techniques (*U*=6479.000, *p*=.003) as compared to men **(*Table 20*)**.

Table 20: *U* test of Mean rank difference in farmer's perceptions on Farming experiences and innovativeness of farmers (n=252)

Aspects describing perceived farming experience and innovativeness of the key farmers	Men		Women		U^{12}	*Z*	$P \leq .05$
	Mean Rank	Rank sums	Mean Rank	Rank sums			
Knowledgeable about farming	121.82	15592.50	131.33	16285.50	7336.500	-1.689	.091
Makes solutions for farming problems	119.85	15340.50	133.37	16537.50	7084.500*	-2.342	.019
Experiments on farming practices	119.13	15249.00	134.10	16629.00	6993.000*	-2.469	.014
Fields are exemplary	117.45	15033.00	135.85	16845.00	6777.000**	-2.911	.004
Regular user of improved agric. Pracs.	119.86	15341.50	133.36	16536.50	7085.500*	-1.956	.050
Quickly takes on new agric. Techs	115.12	14735.00	138.25	17143.00	6479.000**	-2.959	.003
Model farmer of NAADs/ NGO	119.70	15228.00	133.58	16650.00	6972.000	-1.864	.062

[12] *, **Significant at α =0.05 and α =0.01 probability levels respectively

Information obtained from fellow farmers

The most obtained information from fellow farmers that is by over 50% of the men and of the women respondent farmers included: - early or timely planting, early land preparation, growing short term crops like beans, growing of drought resistant crops such as cassava, crop diversification, spraying with pesticides, plant vegetables near streams, grow cash crops like coffee and bananas, marketing food to meet family needs and use of inorganic manure ***(Table 21)***. The number of pieces of information obtained by more than 50% of the men was more compared to those obtained by over 50% of the women. This indicates that men in this case are getting more specific and varied pieces of information from fellow farmers while women are getting fewer or a lesser variety of information to cope with drought.

Table 21: Information obtained from fellow farmers so as to manage drought (*n*=252)

Information from the Fellow Farmers	Men (*n*=128)		Women (*n*=124) *[13]		Overall (*n*=252)	
	f	*%*	*f*	*%*	*f*	*%*
Early/or timely planting	101	79*	104	84*	205	81
Early land preparation	93	73*	86	69*	179	71
Growing short term crops	82	64*	74	60*	156	62
Drought resistant crops	77	60*	73	59*	150	60
Crop diversification	70	55*	67	54*	137	54
Spraying with pesticides	73	57*	60	48	133	53
Planting vegetables near streams	74	58*	59	48	133	53
Growing cash crops	73	57*	54	44	127	50
Market food in drought	69	54*	53	43	122	48
Inorganic fertilizer use	74	58*	47	38	121	48
Stocking food stuffs in cribs	63	49	50	40	113	45
Herbicides/ superglo use	57	46	50	40	107	43
Irrigate crops in drought	52	41	42	34	94	37
Mulching gardens	50	39	33	27	83	33
Tree planting	42	33	29	23	71	28
Feed stuff preservation	30	23	11	9	41	16
Provide weather forecasts	22	17	19	15	41	16

Farmers' Perceptions of effectiveness of information obtained from fellow farmers

Farmers' perceptions of the effectiveness of information obtained from fellow farmers were assessed for the most contacted farmer. This was done in terms of usefulness of information, timeliness of information, affordability of information, accuracy of information, relevance of

[13]* Shows the most obtained pieces of information by over 50% of either men or women

information and ability of the information obtained to address the problem being faced. Both men and women perceived fellow farmers to be highly effective in all the above aspects. Over 80% of both men and women agreed that fellow farmers were effective in all the above aspects, the only exception was their ability to solve problems, where about 70% of the men and the same proportion among the women indicated to have agreed with this attribute of the information obtained from fellow farmers as indicated in ***Table 22***.

Table 22: Farmers' perceived effectiveness of information obtained from fellow farmers

Aspects of effectiveness	Men (%) (n=128)			Women (%) (n=124)			Overall (%) (n=252)		
	A	NS	DA	A	NS	DA[14]	A	NS	DA
Usefulness	98	-	2	94	1	5	96	1	3
Timeliness	94	-	6	95	1	4	95	1	4
Affordability	97	2	1	90	1	9	94	2	4
Accuracy	95	1	4	90	1	9	93	1	6
Relevancy	98	-	2	84	3	13	91	2	7
Addresses problems	69	1	30	67	3	30	68	2	30

The Mann Whitney *U* test revealed that women perceived the information obtained from the most contacted fellow farmer to be significantly more affordable compared to the men (U=7367.500, p=.024). A focus on the mean ranks between men and women in ***Table 23*** show that women perceived the information obtained from the most contacted fellow farmers to be significantly more relevant as compared to the men (U=6764.000, p=.001).

Table 23: *U* test of Men and women's perceptions of effectiveness of information obtained from fellow farmers (n=252)

Aspects of effectiveness	Men		Women		U[15]	Z	$P \leq .05$
	Mean Rank	Rank sums	Mean Rank	Rank sums			
Usefulness	123.96	15867.00	129.12	16011.00	7611.000	-1.748	.081
Timeliness	127.31	16296.00	125.66	15582.00	7832.000	-.453	.651
Affordability	122.06	15623.50	131.08	16254.50	7367.500*	-2.261	.024
Accuracy	122.91	15732.50	130.21	16145.50	7476.500	-1.736	.083
Relevancy	117.34	15020.00	135.95	16858.00	6764.000**	-4.140	.000
Addresses problems	124.44	15928.50	128.62	15949.50	7672.500	-.563	.574

[14] A =agree, DA =disagree, NS = Not sure. Following data analysis, strongly agree and agree were collapsed into the 'agree' (A) column, while strongly disagree and disagree were collapsed into the 'disagree' (DA) column. However, 'Not Sure' (NS) was not collapsed in the analysis on the basis that respondents being unsure could not be represented in either the Agree or Disagree column. They were coded as; 1= Agree, 2=Not Sure and 3=Disagree.

[15] *, **Significant at α =0.05 and α =0.01 probability levels respectively

4.3.2 Characterization of Extension Agencies

All the four extension agencies that were consulted for information to cope with drought described themselves to have helped in the distribution of farm inputs such as seeds, fertilizers etc. to farmers in the face of drought with the exception of the private sector company (i.e., Mukwano) that was among the agencies which focused on providing market information to farmers. The Local Government agency (NAADS[16]), Farmer Organizations (MADFA[17]) and NGO[18] (BUILD Africa) acknowledged to have promoted: income diversification, livelihood improvement through agriculture development programs, affordable agricultural and market information services. While Local Government and Farmers' Organization's agents described their mandates as helping farmers to access agricultural knowledge and technology, the NGOs and Farmer Organizations focused on sustainable natural resource use. The Farmer Organization's mandate included promoting energy saving technologies like stoves, agronomic practices such as agro-forestry, and equity for both men and women. The NGO BUILD Africa helped communities to: build schools and access financial services.

The most frequently contacted extension agencies had networks with other private and public organizations. Surprisingly, the Private sector agents admitted not having any networks with other organization or extension agencies. Specifically, the NGO and Farmer organization (MADFA) networked with Grameen foundation for climate and market information often relayed on the agents' smart mobile phones, while Local Government Extension agency and the Farmer organization networked with NFA[19] for tree planting. The extension agencies had specific organizations they networked with (***Table 24***). MADFA a farmers' organization networked with

[16] National Agricultural Advisory Services
[17] Masindi District Farmers' Association
[18] Non-Governmental Organization
[19] National Forestry Authority

NAADS for input supply, the Farmer Field Schools (FFS) program for climate change adaptations innovations, FIT Uganda for inputs and market information, and Farm Gain Africa for market information. BUILD Africa an NGO specifically networked with the metrological center for climate information and designing IEC[20] materials, MADFA on gender training issues, and PUFCO[21] for sustainable soil conservation methods. The Local Government Extension agency (NAADS) networked with only the National Agricultural Research Organization (NARO) for supply of inputs like drought resistant crop varieties of Banana, beans, maize and Cassava. In this case, the Farmers' organization and NGO had more connectivity to other organizations as compared to the Local Government Extension agency and the Private sector companies.

Although a variety of communication methods existed, through which extension agents could interact with farmers, only media and posters in local languages were used by all the four extension agencies. The Private Sector Company, Local government agency and Farmers Organization were observed to have demonstrated to farmers certain farming practices such as 'how to apply fertilizers to avoid burning of crops. They also used group extension approach through meetings and workshops with farmers, used channels like radio and phones to pass on weather forecasts. They at times were approached by farmers at their district offices for agricultural information. The Local government Extension agency - NAADs and MADFA visited and trained particular individuals at their homes and also used intervention plans adapted to changing market. MADFA and BUILD Africa used visual aids to fully demonstrate ideas on climate change adaptation. NAADS relayed weather forecasts on smart phones from meteorological Centre and Grameen foundation. MADFA designed messages for both men and women, conducted training and

[20] Information Education Communication
[21] Pakanyi United Farmers cooperatives

discussions for farmers on climate change emphasizing kitchen gardens for women to ensure food security at home level. BUILD Africa used brochures, seasonal calendars to determine onset of planting seasons, and Participatory Rural Appraisal (PRA) approach to help farmers identify the major challenges affecting their farming.

While all the extension agencies concurred that they did not have a direct climate change strategy, NAADS, MADFA and BUILD Africa indicated that they promoted environmental sustainability through use of conservation practices such as minimum tillage, zero tillage, tree planting etc. MADFA and NAADs emphasized natural resource management and sustainable farming. NAADs and MADFA indicated that they promoted crop diversification, tree planting, environmentally sustainable climate sensitive farming, early planting, use early maturing seed, enterprise mixing to spread the climate risks, growing of fruit trees and other indigenous trees like *Musizi*, growing of quick maturing fruit trees for income and food and climate adaptation messages before the drought disasters struck.

Table 24: Characterization of extension agencies

Characteristics of extension service Agencies	LG agencies (NAADS)	NGO (Build Africa)	Farmer Org (MADFA)	Private Sector (Mukwano)
Main mandate				
Design specific drought adaptation options	×	×	×	×
Increase farmers' access to agricultural knowledge and technology	√	×	√	×
Give out inputs to farmers in times of calamities like; - seeds etc.	√	√	√	√
Markets information for agricultural products	×	√	√	√
Provide financial services to farmers	×	√	×	×
Building schools and improve education capacity	×	√	×	×
Energy saving technologies like stoves to avoid negative impacts on forests	×	×	√	×
Improve people's livelihoods through agriculture development	√	√	√	×
Promoting agronomic practices such as agro forestry for climate change	×	×	√	×
Provide affordable agricultural information services	√	√	√	×
Focus on natural resource solutions and practices	×	√	√	×
Promote Income Diversifying activities	√	√	√	×
Emphasizes equity for both men and women	×	×	√	×
Networks				
NARO to supply inputs like drought resistant crop varieties of Banana and Cassava.	√	×	×	×
Grameen foundation for climate and market Information relayed on phones	×	√	√	×
NFA involved in tree planting	√	×	√	×
NAADS for input supply	×	×	√	×
Pakanyi United Farmers cooperatives for soil conservation	×	√	×	×
MADFA especially on gender issues	×	√	×	×
Metrological center for climate information and designing I.E.C materials	×	√	×	×
Farm Gain Africa on market information	×	×	√	×
FIT Uganda for inputs and market information	×	×	√	×

Characteristics of extension service Agencies	LG agencies (NAADS)	NGO (Build Africa)	Farmer Org (MADFA)	Private Sector (Mukwano)
Farmer Field Schools (FFS) for climate change adaptations like planting trees	×	×	√	×
Communication methods				
Visit and train particular individuals at their homes	√	×	√	×
Use channels including the radio and phones to emphasize weather forecasts	√	√	√	×
Use languages understood by most farmers in area via media and posters	√	√	√	√
Use Intervention plans adapted to changing market	√	×	√	×
Relaying weather forecasts on smart phones from meteorological Centre & Grameen	√	×	×	×
Men and women Farmers approaching district extension offices for information	√	√	√	×
Group extension approach using meetings and workshops with farmers	√	√	√	×
Demonstrations e.g., when applying fertilizers to avoid burning of crops.	√	×	√	√
Emphasize kitchen gardens for women to have enough food staffs in home	×	×	√	×
Liaise with farmers for climate change training and discussions	×	×	√	×
Designed messages for both men and women	×	×	√	×
Participatory Rural Appraisal (PRA) approach where problems were identified	×	√	×	×
Used Information Education Communication (IEC) materials like brochures etc.	×	√	×	×
Use of visual aids to fully demonstrate ideas on climate change adaptation	×	√	√	×
Seasonal calendars to determine onset of planting seasons	×	√	×	×
Technology Policy on climate change				
Emphasis on environmental sustainability including use of minimum tillage	√	√	√	×
Emphasis on natural resource use and management	√	×	√	×
Direct policy on climate change and adaptation	×	×	×	×
Key message disseminated				
Climate adaptation messages before the drought disasters	√	×	√	×
Promoting tree planting and sustainable – environment & climate sensitive farming	√	×	√	×
Promote Agronomic practices. E.g., early planting, use early maturing	√	×	√	×
Promote improved crop varieties e.g., bananas, rice, cassava, maize etc.	√	√	√	×
Promote Enterprise mixing to spread the risk and maximize income.	√	×	√	×
Promote growing of fruit trees and other indigenous trees like *Musizi*	√	×	√	×
Promote growing of quick maturing fruit trees for income and food	√	×	√	×
Post-harvest handling technology especially on food.	√	√	√	√
Encourage diversification through rural innovations on crops like; maize & soybeans	√	×	√	×

Information that farmers obtained from extension agencies

A specific piece of information was considered to be most obtained if more than 35% of either men or women sourced for that information from the extension agencies. The reference percentage was lowered because of the few men and women farmers that contacted the different categories of extension agencies for information to cope with drought. The findings in ***Table 25*** reveal that the most obtained information for men and women farmers from the two most contacted extension agencies that is NAADs and MADFA included for NAADS: early planting, planting early maturing crops like maize, planting drought resistant crops like cassava and growing fruit crops like mangoes and avocadoes. For MADFA the most obtained information included, early planting, use of early maturing crops, planting drought resistant crops, planting fruit crop trees, fertilizer

use, spray of pesticides to control drought related pests, crop diversification, post-harvest handling to avoid wastage of food, information on the occurrence and duration of drought, planting perennial crops, making nursery beds, and irrigation.

Table 25: Information that farmers obtained from extension service organizations

Information from extension Agencies	Men (n=107)		Woman (n=71)		Men (n=107)		Woman (n=71)		Men (n=107)		Woman (n=71)		Men (n=107)		Woman (n=71)	
	Local Gov. Ext.				Farmer orgs				NGO				Private Sector Company			
	f	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Early planting	40	**37**	34	**48**	45	**42**	40	**56**	9	8	7	10	19	17	8	11
Early maturing crops	41	**38**	29	**41**	45	**42**	37	**52**	9	8	10	14	12	11	8	11
Fertilizer use	25	23	18	25	48	**45**	36	**51**	8	8	8	11	19	17	8	11
Drought resist crops	40	**37**	33	**46**	35	33	20	28	8	8	7	10	11	10	6	9
Spray herbicides	30	28	19	27	41	**38**	32	**45**	9	8	8	11	19	17	8	11
Crop diversification	34	32	22	31	44	**41**	31	**44**	8	8	8	11	13	12	4	6
Post-harvest handling	25	23	12	17	41	**38**	31	**44**	8	8	6	9	17	16	8	11
About drought	26	24	16	23	39	**37**	26	**37**	7	7	10	14	15	14	6	9
Fruit crop trees	37	**35**	26	**37**	30	28	30	**42**	5	5	5	7	8	8	0	0
Plant perennial crops	28	26	11	16	40	**38**	31	**44**	6	6	3	4	15	14	8	11
Mulching	36	34	18	25	31	29	23	32	6	6	6	9	6	6	9	12
Mixed farming	27	25	22	31	35	33	25	**35**	3	3	5	7	6	6	6	9
Making nursery beds	31	29	12	17	31	29	26	**37**	4	4	7	10	12	11	6	9
Irrigation	21	20	12	17	37	**35**	27	**38**	5	5	7	10	11	10	4	6
Livestock treatment	31	29	16	23	24	23	21	30	5	5	6	9	5	5	2	3
Income gen. livestock	23	22	17	24	23	22	20	28	2	2	6	9	4	4	1	1

According to ***Table 25***, men and women farmers obtained the 4 specific pieces of information on how to cope with drought from NAADs while on the other hand, women obtained 12 specific pieces of information from MADFA compared to 9 specific pieces of information by men.

Men and women perceptions of effectiveness of information obtained from extension agencies

The perception of effectiveness of information obtained from extension agencies was assessed. The assessment was based on farmers' perceptions of timeliness, relevance, usefulness, affordability, accuracy and ability of the information to address all the farming problems that manifested as a result of drought. ***Table 26*** indicated that the respondents judged the extension agencies as having provided useful, accurate, affordable and relevant information. However, aspects of timeliness of information and ability of the information from extension agencies to address problems brought about by drought had the least score for men and women farmers.

Table 26: Assessment of aspects that described effectiveness of information from extension agencies

Aspects describing effectiveness	Men (%) (n=107)			Women (%) (n=71)			Overall (%) (n=178)		
	A	NS	DA	A	NS	DA[22]	A	NS	DA
Usefulness	94	-	7	86	1	13	96	1	3
Timeliness	79	7	14	70	2	28	95	1	4
Affordability	84	6	10	78	5	17	94	2	4
Accuracy	86	1	13	86	3	11	93	1	6
Relevancy	87	5	8	72	4	24	91	2	7
Addresses problems	70	9	21	72	1	27	68	2	30

The difference in men and women's perception of effectiveness of information obtained from extension agencies was tested using Mann-Whitney *U* statistic. The findings in relation to the comparison of the mean ranks of the two gender groups highlight that women perceived the information obtained from extension agencies to be more relevant as compared to the men (*U*=3264.500, *p*=.020) as indicated in ***Table 27***.

Table 27: A *U*-test of men and women farmers' perceptions of effectiveness of information obtained from extension agencies

Aspects describing effectiveness	Men		Women		*U*[23]	*Z*	*P ≤ .05*
	Mean Rank	Rank sums	Mean Rank	Rank sums			
Usefulness	86.79	9286.50	93.58	6644.50	3508.500	-1.692	.091
Timeliness	86.88	9296.50	93.44	6634.50	3518.500	-1.115	.265
Affordability	87.27	9338.00	92.86	6593.00	3560.000	-1.048	.295
Accuracy	89.38	9564.00	89.68	6367.00	3786.000	-.062	.951
Relevancy	84.51	9042.50	97.02	6888.50	3264.500	-2.320	.020*
Addresses problems	90.90	9726.50	87.39	6204.50	3648.500	-.560	.575

4.4 Determinants of farmers' use of information sources

In order to determine factors that influenced farmers' use of information sources, a regression analysis was conducted. Furthermore, the determinants of farmers' use of information sources were categorized into socio-economic and institutional factors which were fed into two separate logistic regressions. One was for farmers that used only fellow farmers and the other was for those that used extension agencies. Out of the 252 farmers that contacted fellow farmers, 135 farmers used only fellow farmers which meant that the sample was significant for the model. On the other side, out of the 178 respondents that used extension agencies, 61 farmers specifically used only

[22] A =agree, DA =disagree, NS = Not sure. Following data analysis, strongly agree and agree were collapsed into the 'agree' (A) column, while strongly disagree and disagree were collapsed into the 'disagree' (DA) column. However, 'Not Sure' (NS) was not collapsed in the analysis on the basis that respondents being unsure could not be represented in either the Agree or Disagree column. They were coded as; 1= Agree, 2=Not Sure and 3=Disagree.

[23] *, **Significant at α =0.05 and α =0.01 probability levels respectively

extension agencies, which was insignificant for the model. Therefore, the study considered analyzing the factors that influenced farmers' use of only fellow farmers and also factors that influenced the farmers' generic use of extension agencies for information to cope with drought.

4.4.1 Descriptive statistics of the farmers' use of Information sources

Table 28 showed that majority of the respondents contacted fellow farmers attached to extension agencies (70%), experimented on farming practices (90%), communicated well (96%), used modern agro-technologies (66%) and educated (37%). Majority of farmers were married and in the economically active age group. The average farming experience was 9.8179 years ranging from 1-48 years.

Table 28: Descriptive analysis of factors influencing farmers' use of only fellow farmers (n=313)

Variable	Use (n=135)		Non-Use (n=178)		Overall (n=313)		Mean	Std. Dev	Min	Max
	f	*%*	*f*	*%*	*f*	*%*				
Fellow Farmer being social										
Yes	107	79	90	51	197	63	1.2236	.41735	1.00	2.00
No	28	21	88	49	116	37				
Fellow farmers' attachment to Extension Agency										
Yes	107	79	93	52	200	64	1.3610	.4811	1.00	2.00
No	28	21	85	48	113	36				
Marital status of respondent										
Married	94	70	125	70	219	70	1.6230	1.04623	1.00	4.00
Single	12	9	11	6	23	7				
Divorced	14	10	25	14	39	13				
Widowed	15	11	17	10	32	10				
Fellow farmer Experiments on farming practices										
Yes	121	90	105	59	226	72	1.2780	.44871	1.00	2.00
No	14	10	73	41	87	28				
Fellow farmers communicate well										
Yes	129	96	111	62	240	77	1.2332	.42356	1.00	2.00
No	6	4	67	38	73	23				
Fellow farmer uses modern Agro-technologies										
Yes	89	66	107	60	196	63	1.3738	.48459	1.00	2.00
No	46	34	71	40	117	37				
Fellow Farmer being educated										
Yes	37	27	66	37	103	33	1.6773	.48175	1.00	3.00
No	98	73	112	63	210	67				
Respondents' years spent in farming										
1-10	89	66	114	64	203	65	9.8179	8.95011	1.00	48.00
11-20	34	25	50	28	84	27				
21-30	3	2	7	4	10	3				
31-50	9	7	7	4	12	5				

Table 29 indicates that 44% of the farmers accessed transport, 80% accessed mobile phones, 90% accessed radio and 53% belonged to farmer group. Fifty six percent of the farmers had attained primary education. Farmers' average age was 33 years, with an age range 20 and 68 years. On average, farmers reared 1 cattle, ranging between 0-20 heads of cattle; owned an average of 5.1 acres of land, ranging from 0 – 200 acres. Owning cattle and land is a wealthy indicator and results seem to suggest that few farmers are wealthy.

Table 29: Descriptive analysis of factors influencing farmers' use of extension agencies (*n=313*)

Variable	Users (n=178)		Non-Users (n=135)		Overall (n=313)		Mean	Std. Dev	Min	Max
	f	*%*	*f*	*%*	*f*	*%*				
Access to transport										
Yes	78	44	7	5	85	27	1.7284	.4455	1.00	2.00
No	100	56	128	95	228	73				
Cattle Owned										
1-10	59	33	34	25	93	30	1.1214	2.61859	.00	20.00
11-20	4	2	0	-	4	1				
None	115	65	101	75	216	69				
Access to Mobile phone										
Yes	142	80	80	59	222	71	1.2907	.4548	1.00	2.00
No	36	20	55	41	91	29				
Access to radio										
Yes	161	90	92	68	253	81	1.1917	.3943	1.00	2.00
No	17	10	43	32	60	19				
Membership to farmer group										
Yes	95	53	10	7	105	34	1.6645	.4729	1.00	2.00
No	83	47	125	93	208	66				
Education of respondent										
Primary	99	56	79	59	178	57	1.5527	.7147	1.00	5.00
O' Level	57	32	42	30	99	32				
A' Level	22	12	13	10	35	11				
Tertiary	-	-	1	1	1	-				
Age										
18-40	93	53	76	56	169	54	33.096	11.51937	20.00	68.00
41-60	69	39	43	32	112	36				
>61	16	8	16	12	32	10				
Land Ownership (acres)										
< 1	7	4	4	3	11	4	5.0454	15.36671	.00	200.00
1-10	119	67	88	65	207	66				
11-20	11	6	4	3	15	5				
21-30	1	1	0	-	1	1				
>31	5	3	0	-	5	6				
None	35	19	39	29	74	19				

4.4.2 Logistic analysis of factors influencing farmers' use of information sources

A binary logistic regression analysis was conducted to determine the factors that influenced farmers' use of information sources in Masindi District, Uganda. The dependent variable (Use) was captured as Use = 1 or otherwise = 0. The Chi-square was used to test the null hypothesis (H_0)

which stated that, farmers' use of information sources is likely to be influenced by the same social, economic and institutional factors. The results indicate that the logistic regression models achieved a goodness of fit owing to the Chi-square test statistics being highly significant at 1% ($p < 0.00001$) for both models. The values of the Chi-square models, in accordance with the Maximum Likelihood methodology, were Chi-square (χ^2) = 166.72 (df = 14, p = 0.0000) for only fellow farmer users and Chi-square (χ^2) = 156.9 (df = 12, p = 0.0000). This technically meant that at least one of the coefficients of the independent variables was not zero, and demonstrates that the model was suitable for the analysis as also collaborated in Rayasawath, (2018). It can be concluded that adding the predictors to the models significantly increased our ability to predict farmers' use of fellow farmers or extension agencies.

The Likelihood ratio (LR) test is the most common assessment of overall model fit in logistic regression, which is simply the chi-square difference between the null model with the constant only and the model containing the predictors. Under the model summary**,** the Log Pseudolikelihood statistics were given as -130.63395 for fellow farmers user model and -134.83922 for extension agencies user model. A combination of the LR Chi^2 and Log Pseudolikelihood ratio tests also showed that the estimated models including constants and the set of explanatory variables fit the data better compared with the model containing the constants only. This implies a better relationship between the log of odds (odds ratio), the probability of factors influencing farmers' use of information sources and the explanatory variables included in the model collectively contribute significantly to the explanation of smallholder farmers' use of information sources.

Also, the model classification ascertained the goodness-of-fit of the model where 79.2% of respondents' use of fellow farmers and 79.9% use of extension agencies were correctly classified by the model. When the value of the Percent Correction Prediction is high, this meant that the ability or the accuracy of the prediction was high. Majorly, the logistic models in this study were used to predict the outcome for any new observation. In this case, a classification table that showed the number and percentage of observed cases that are correctly or incorrectly classified were used to check if the models were well fitted to the data or not. The outcomes in this study were either a farmer used information sources or otherwise. For observed; it indicates the number of use and non-use that are observed in the dependent variables (use of fellow farmers or Extension agencies) while predicted, indicates the predicted values of the dependent variable based on the full logistic regression models.

In this study, pseudo R^2 was considered as an analogous statistic in logistic regression to the coefficient of determination R^2 in linear regression, but not close analog in which the model summary provided some approximation of R^2 statistic in logistic regression. The pseudo R^2 attempted to imitate multiple R^2 based on likelihood. Despite some coefficients not being significant, the pseudo-R^2 value (0.39 for fellow farmers users) and (0.37 for extension agencies users), highly significant chi-square results and the overall percentage of correct prediction suggested that the estimated models have outstanding explanatory power. So, pseudo R^2 indicates that 39% and 37% of the variation in the dependent variables - use of fellow farmers and use of extension agencies were respectively explained by the combined effects of all the explanatory variables in the models specified.

Furthermore, given that binary logistic regression requires that independent variables should not be highly correlated with each other, but to some degree, a multicollinearity diagnosis for

explanatory variables was inspected using the variance inflation factor (VIF) and tolerance statistics and in this case, the result indicated absence of multicollinearity problem among the explanatory variables. Multicollinearity in logit models is a result of strong correlations between independent variables and can thus undermine the statistical integrity of the model. The Variance Inflation Factor (VIF) and Multivariate Correlation Analysis were generally used to detect multicollinearity in the two models. The VIF measured how much of the variation in one variable was explained by the other variable as indicated in ***Tables 30***. Variables with VIF = 1 or < 5 were considered for the model, while variables with VIF > 5-10 were rejected on the grounds that the predictors were highly correlated. In other words, VIF = 1.027 and VIF = 3.460 were respectively the lowest and highest VIF values for explanatory variable that were included in only Fellow farmer users' model, While VIF = 1.039 and VIF = 1.358 were respectively the lowest and highest VIF values for explanatory variable that were included in Extension agencies users' model. The results suggest no multicollinearity among the explanatory variables included in the models.

Table 30: VFI test results for multicollinearity among explanatory variables used in models

Variable	Collinearity Statistics-VIF values	
	Fellow Farmer User model	Extension agencies user model
SOC (Social)	2.330	-
GND (Respondent Gender)	1.151	1.323
EXP (Experiment)	2.254	-
MAR.STAT (Marital status)	1.144	1.184
EDR (Resp. Education)	-	1.039
EDF (FF Educated)	1.282	-
COM (FF Communicates well)	3.460	-
TEC (FF uses Technologies)	1.937	-
TRSP (Access to Transport)	-	1.202
MPH (Access mobile phone)	-	1.153
RAD (Access to Radio)	-	1.106
ATE (FF Attached to Ext)	1.476	-
FGP (Farmer Group)	1.046	1.111
YSP (Years spent in Farming)	1.027	-
AGE (Age of respondent)	-	1.119
LND (Land ownership)	-	1.324
CTL (Cattle owned)	-	1.358

Also, multivariate correlation analysis was one of the tests used to check the existence of multicollinearity among independent variables, so that if the Pearson's value (*r*) is equal to 0.8 or

above, then there is a serious problem of multicollinearity as also opined in Kibet *et al.,* (2019) and Rayasawath, (2018) as indicated in ***Table 31 & 32***.

Table 31: Multivariate correlation coefficients of variables influencing farmers' use of only fellow farmers[24]

Variable	ATE	SOC	EXP	GND	FGP	EDF	COM	MAR	TEC	YSF
ATE	1	.395**	.454**	-.143*	-.015	.214**	.529**	-.111	.437**	.063
SOC		1	.625**	-.087	-.090	.280**	.637**	-.041	.504**	.066
EXP			1	-.037	-.088	.298**	.620**	-.042	.523**	.038
GND				1	.040	.001	-.046	.325**	-.087	.034
FGP					1	.100	-.056	-.023	.059	-.043
EDU						1	.307**	.006	.450**	.065
COM							1	-.069	.620**	.068
MAR								1	-.063	.117*
TEC									1	.063
YSF										1

The results show that all the Pearson's values (r) are below r =0.8, and hence, multicollinearity was not a problem among the explanatory variables that were tested to determine if they had any influence on smallholder farmers' use of information sources or otherwise.

Table 32: Multivariate correlation coefficients of variables influencing farmers' use of Extension agencies[25]

Variable	GND	TRP	MPH	RAD	EDR	MAR	FGP	AGE	LND	CTL
GND	1	.326**	.262**	.147**	-.042	.325**	.040	.000	-.058	-.065
TRP		1	.122*	.188**	-.061	.117*	.220**	.009	-.105	-.123*
MPH			1	.171**	.066	.090	.127*	.124*	-.110	-.137*
RAD			.	1	-.093	.075	.140*	.160**	-.047	-.057
EDR					1	-.076	-.066	-.049	.090	.019
MAR						1	-.023	.207**	-.037	-.028
FGP							1	.000	-.107	-.195**
AGE								1	.095	.107
LND									1	.480**
CTL										1

Table 33 presents the estimated coefficients of the logit models, together with the standard error, 2-tailed *p*-value and marginal effects. Standard error is associated with the coefficients and was used for testing whether the parameter is significantly different from 0. Also, *p*>|z| donated 2-tailed *p*-value that were used in testing the null hypothesis to prove that the coefficient (parameter) is 0. The Coefficients having *p*-values less than alpha were considered to be statistically significant. Furthermore, when one continuous variable and one dummy variable are interacted, the interaction effect is the discrete difference of the single derivative in which standard errors are derived for the

[24] *, **Significant at α =0.05 and α =0.01 probability levels respectively

[25] *, **Significant at α =0.05 and α =0.01 probability levels respectively

interaction effect in logit models through application of delta method (Singh *et al*., 2007). Also, the marginal effect of an explanatory variable represents the effect of a unit change in the explanatory variable on the dependent variable (Liliane *et al.,* 2020; Lemessa *et al.,* 2019; Bruin, 2006). However, the coefficients in the Logit model only provided the signs of the explanatory variables but did not show the relevant marginal effects. Therefore, the marginal effects were computed and presented in **Table 33**.

Logistic analysis of factors influencing farmers' use of fellow farmers for information

Membership to a farmer group (**FGP**): This variable has a negative coefficient of −2.567268 and a significance of 0.0001 which is below 0.01. This means that farmers that have membership with farmer groups tend not to contact fellow farmers for information as compared to farmers that do not belong to any farmer group. With the marginal effect of −.344833, this implies that if the respondent is a member of a farmer group, the chances of contacting fellow farmers reduces by 34.5%, compared to farmers that did not belong to any farmer group ***(Table 30)***.

Fellow farmer being a good communicator (**COM**): This variable had a positive coefficient of 3.049322 and a significance of 0.0001 which is below 0.01. The results demonstrated that farmers tend to contact fellow farmers that communicate well. With the marginal effect of .409582, the tendency of farmers contacting good communicators for information to cope with drought increased by 41%, as compared to contacting fellow farmers that were poor communicators.

Fellow farmer experiments on farming practices (**EXP**): This variable had a positive coefficient of .9342365 and a significance of 0.059 which is below 10%. This means that farmers contacted fellow farmers that happened to experiment on farming practices as compared to farmers that did not. With the marginal effect of .1254857, the tendency of farmers contacting fellow farmers that

experiment on farming practices acquired elsewhere increased by 12.6%, as compared to contacting fellow farmers that rarely experiment on farming practices.

Fellow farmer being attached to different extension agencies (**ATE**): This variable has a positive coefficient of .9912868 with a significance of .009 which is below 1%. This implied that farmers were likely to contact fellow farmers that were attached to extension agencies as compared to contacting fellow farmers that were not. With a marginal effect of .1331487, the chances of a farmer contacting fellow farmers attached to extension agencies increased by 13.3%, as compared to contacting farmers that did not.

Fellow farmers used agro-technologies (**TEC**): This variable had a negative coefficient of−1.542045 with a significance of 0.001. The results reveal that farmers tended not to contact fellow farmers that use advanced agro-technologies compared to contacting fellow farmers that did not use modern ago-technologies. With a marginal effect of−.207126, this implies that farmers' contact with fellow farmers that use modern agro-technologies reduced by 20.7%, as compared to farmers contacting fellow farmers that use ordinary farming practices.

The fellow farmers being educated or literate (**EDF**): This variable had a negative coefficient of−.8610077 with a significance of 0.006 which is below 1%. This means that farmers did not contact fellow farmers that were educated or literate. With a marginal effect of−.1156497, it implies that farmers' contact with literate or educated fellow farmers reduced by 11.6%, compared to when farmers contacted an illiterate or less educated fellow farmers.

Gender of the respondent (**GND**): This variable had a negative coefficient of−1.176046 with a significance of 0.000 which is below 1%. The results suggest that being a man reduced the chances of being contacted by women fellow farmers and vice versa for women. With a marginal

effect of−.1579654, it implies that a farmer being a man will reduce his contact with fellow female farmers while a farmer being woman will reduce her contact with fellow male farmers by 15.8% as compared to when men and women farmers contact fellow farmers of the same genders for information to cope with drought.

Logistic analysis of factors influencing farmers' use of extension agencies for information

Access to radio (**RAD**): This variable had a positive coefficient of 1.21428 with a significance of 0.008 which is below 1%. This meant that farmers' access to radio increased their chances of obtaining drought management information through programs aired over radio waves specifically from extension agents. With a marginal effect of .1696532, the chances of farmers obtaining information from extension agencies through their agricultural programs aired over radio increased by 17%, as compared to farmers with limited or no access to radio.

Access to transport (**TRP**): This variable had a positive coefficient of 2.6682 with a significance of 0.000 which is below 1%. The results implied that a farmer having access to any mode of transport such as bicycle, motorcycles, vehicles, transport fares etc., increased his or her contact with extension agencies as compared to farmers with limited means of transport. The marginal effect of .3727867 means that farmers' access to transport increased their contact with extension agencies by 37.3% as compared to farmers that had limited or no access to transport for mobility purposes.

Membership to a farmer group (**FGP**): This variable had a positive coefficient of 2.53989 with a significance of 0.000 which is below 1%. This meant that a membership to farmer group increased farmers' contact with extension agents for information to cope with drought as compared to non-farmer group members. With a marginal effect of .3548593, the chances of farmer group members contacting extension agencies increases by 35.5%, as compared to non-farmer group members.

Access to mobile phones (**MPH**): This variable had a positive coefficient of .6645709 with a significance of 0.088 which is below 10%. This meant that having access to mobile phones increases farmers' chances of contacting extension agencies for information to cope with drought as compared to farmers with limited or no access to mobile phones. With a marginal effect of .0928503, it implies that access to mobile phones increases the farmers' chances of contacting extension agencies by 9.3%, as compared to farmers that have limited or no access to mobile phones.

Table 33: Binary Logistic results on the determinants of farmers' use of information sources to cope with drought (*n*=313)

Variables	Use of Only Fellow farmers				Use of Extension services			
	Coef. est. (S.E)	Pr (>|z|)	dy/dx[a] (S.E)	Pr (>|z|)	Coef. est. (S.E)	Pr (>|z|)	dy/dx[b] (S.E)	Pr (>|z|)
Constant	−2.192665(.349) ***	0.001			−2.27445(.657) ***	0.001		
Farmer Social Characteristics								
SOC (Social)	.5599487(.639)	0.381	.0752118(.086)	0.380	-	-	-	-
GND (Respondent Gender)	−1.176046(.346) ***	0.001	−.1579654(.044) ***	0.000	−.0294643(.349)	0.933	−.0041166(.049)	0.933
EXP (Experiment)	.9342365(.496) *	0.059	.1254857(.066) *	0.055	-	-	-	-
MAR.STAT (Marital status)	.5027178(.361)	0.163	.0675246(.048)	0.159	−.3778104(.365)	0.300	−.0527857(.050)	0.294
EDR (Resp. Education)								
O' Level	-	-	-	-	−.0701181(.369)	0.849	−.0097938(.052)	0.850
A' Level	-	-	-	-	−.0585433(.493)	0.906	−.0081804(.069)	0.905
EDF (FF Educated)	−.8610077(.311) ***	0.006	−.1156497(.040) ***	0.004	-	-	-	-
COM (FF Communicates well)	3.049322(.744) ***	0.000	.409582(.090) ***	0.000	-	-	-	-
TEC (FF uses Technologies)	−1.542045(.475) ***	0.001	−.207126(.060) ***	0.001	-	-	-	-
YSP (Years spent in Farming)								
11-20	−.2392742(.556)	0.667	−.0321915(.075)	0.666	-	-	-	-
21-30	.3030406(.527)	0.565	.0407641(.071)	0.564	-	-	-	-
31-40	−.1686048(.474)	0.722	−.0226951(.064)	0.722	-	-	-	-
41-50	−.2146116(.521)	0.680	−.028879(.070)	0.681	-	-	-	-
51-plus	−.4757354(.349)	0.383	−.0638192(.073)	0.380	-	-	-	-
AGE (Age of respondent)								
41-60	-	-	-	-	.3624734(.336)	0.281	.0511942(.048)	0.286
61-more	-	-	-	-	−.1717238(.542)	0.751	−.0237816(.074)	0.749
Economic and asset endowment factors								
TRSP (Access to Transport)	-	-	-	-	2.6682(.503) ***	0.000	.3727867(.056) ***	0.000
MPH (Access mobile phone)	-	-	-	-	.6645709 (.390) *	0.088	.0928503(.054) *	0.082
RAD (Access to Radio)	-	-	-	-	1.21428(.457) ***	0.008	.1696532(.061) ***	0.005
LND (Land ownership)	-	-	-	-	.0548287(.037)	0.146	.0076604(.005)	0.144
CTL (Cattle owned)	-	-	-	-	−.0008727(.005)	0.860	−.0001219(.001)	0.860
Institutional factors								
ATE (FF Attached to Ext)	.9912868(.377) ***	0.009	.1331487(.049) ***	0.006	-	-	-	-
FGP (Farmer Group)	−2.567268(.382) ***	0.000	−.344833(.035) ***	0.000	2.53989(.390) ***	0.000	.3548593(.038) ***	0.000
Diagnostic Statistics								
LR chi^2 (14)				166.7	LR chi^2 (12)			156.9
Prob > chi^2				.0000	Prob > chi^2			.0000
Pseudo R^2				0.389	Pseudo R^2			0.3699
No. of obs.				313	No. of obs.			313
Prediction probability				79.2	Prediction probability			79.9
Log pseudolikelihood				−130.63395	Log pseudolikelihood			−134.83922

Legend: Robust and Delta standard errors in parentheses for both models; ([a, b]) dy/dx is for a discrete change of dummy variable from 0 to 1 for fellow farmer users' model and extension agencies users' model respectively. A marginal effect indicates the change in predicted probability of using fellow farmers or extension agencies for a unit change in an explanatory variable.
*** p<.001; ** p<.05; * p<.1

5.0 CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Sources of information used in responding to drought among men and women

In determining which of the two common sources farmers use as sources of information to cope with drought was used more, it was found getting information from fellow farmers was most used compared to extension agencies. Similar studies such as Bernard *et al*., (2014); Meena *et al.*, (2016); Ronald *et al*., (2016); McOmber *et al.*, (2013); Mengistu, (2011); Ssemakula & Mutimba, (2011); and Nosheen *et al.* (2010) have shown that, fellow farmers, friends and relatives are often significant and useful sources of agricultural information used by farmers to resolve challenges in agricultural production. The tendency to obtain information to cope with drought from fellow farmers is probably because, fellow farmers are the cheapest means of obtaining information, and do not require much effort nor expense to acquire information from these sources. To meet a fellow farmer within the community does not demand for transport or calling time. Also, farmers being neighbours and sharing the same environment with fellow farmers makes face to face contact easy as observed in Örs, (2008). There is also a lot of trust with a person who does what you also do, that way farmers tend to have more confidence with their fellows than with outsiders. Less use of extension workers speaks first to the low coverage of extension services and lack of access to these services among the majority of ordinary farmers. It also speaks with farmers seemingly preferring more informal forms of information access than the formal ones. Formal ones tend to have costs when it comes to attending meetings, and investing time and resources.

Even among those who used fellow farmers as sources of information, women tended to use fellow farmers more than men, while men tended to use extension workers more than the women. This means that women were obtaining their information to manage drought through the informal easy to go means, while men could access from more structured extension-based arrangements. This

could be explained by social and gender norms that structure men to have more power and rights to access information, mobility, credit, inputs and land. In the process, women face limitations in terms of ownership of resources such as radio to listen to agricultural programs, land for extensive productive enterprises to attract extension agents and transport to reach the extension agencies (Fisher, *et al.,* 2019; Chaudhury *et al.,* 2012). Women tend to depend on their fellow women farmers, who in most cases are of the same socio-economic status and with limited knowledge on improved drought coping practices. This is consistent with the findings of Lamontagne-Godwin *et al*., (2018) where women in Pakistan accessed much less variety and frequency of information from informal sources (fellow female farmers, neighbours relatives, husbands) than men who obtained information from official or technical (public or commercial) services such as extension services. Contacting fellow farmers such as neighbors, relatives, friends can be easier due to the sharing of the same social status and similar limitations (Lamontagne-Godwin *et al*., 2018; Magnan *et al.,* 2013).

Relationship between sex of farmer and sex of fellow farmers contacted for information

For both men and women farmers, male fellow farmers were the main source of information. This shows that there were more men with information to share than women, and it is also likely that the men fellow farmers had more credible information compared to the women. This is because men to have information as they have the opportunity to look for it and are engaged in commercial agricultural production. Men also often have a wider network, and having time to interact, unlike the women farmers who are restricted by social reproductive activities including cooking and looking after households as also observed in Magnan *et al.,* (2013) and Chaudhury *et al.,* (2012). Men also tend to have higher levels of education, high value income generating farming enterprises, more social networks and attachment to extension agencies. Studies by Tsige *et al*.,

(2020); Gebre *et al*., (2019); Lodin *et al*., (2019); Oxfam, (2019); Jost *et al*., (2015); Magnan *et al*., (2013); Tavva *et al*., (2013); Chaudhury *et al*., (2012) argue that due to patriarchal norms, women in rural communities are usually disadvantaged especially in access to productive resources, land rights, and inputs for investment in high value crop production. This keeps women in an insignificant position, limiting their ability to access information that would be useful in challenging times as well as in normal circumstances.

Number of fellow farmers contacted for information to respond to drought

The advantages men had over women in accessing information from fellow farmers was also seen in the number of fellow farmers contacted. More men farmers contacted more than one fellow male farmer for information to cope with drought, while most women mostly contacted only one fellow farmer. Men thus consulted more farmers compared to women. Having multiple sources to consult improves one's chances to obtain a variety of helpful information, as well as to confirm certain recommendations, besides getting complete sets of required information (Mittal & Mehar, 2013; Mittal *et al.,* 2010). This leaves the women with less helpful information in that regard compared to the men. The underlying structural limitations women face perpetuate women's limited access to a variety of information sources.

Extension agencies that men and women obtained drought information from

The extension agencies farmers contacted for information to cope with drought included government extension (NAADs), a farmers' organization (MADFA), private sector company (Mukwano), and an NGO (BUILD Africa). Farmers' organizations were the most common source of information for farmers to cope with drought and particularly the women farmers, followed by NAADs. Since farmers organizations are member owned and member-based organizations they tend to attract women. Women farmers' use of farmers' organizations can be associated to the ease

of access to the agency. Women are also known to join farmers' groups more than men (CRS, 2017).

5.2 Characterization of information sources used to cope with drought

Characterization of key farmers contacted for information to cope with drought

The second objective dealt with characterization of the two key information sources farmers used to cope with drought. Sources of information to cope with drought from fellow farmers were characterized in terms of farmers' perceptions of the fellow farmers' communication behaviour, farming experience and related innovativeness as well as the effectiveness of the information obtained from the fellow farmers.

Communication behavior of the fellow farmers contacted

Both men and women farmers perceived fellow farmers as being good communicators, sharing information willingly, having information that is usable, and sharing information regularly from various sources. However, men had a significantly more positive view of fellow farmers in the above areas than the women. This could be explained by the frequency with which men interacted with fellow farmers more than the women, and also speaks to the amount of time the men spend with fellow farmers compared to the women farmers. It's is also clear the communication attributes of farmers who influence other farmers, they tend to naturally be good communicators and can convince others.

Farming experiences and related innovativeness of farmers used

Both men and women perceived the fellow farmers who provided information to cope with drought as 'knowledgeable about farming', 'provided solutions to farming problems', 'experimented on farming practices', 'had exemplary fields', 'regularly used improved agricultural practices', 'quickly took on new agricultural technologies' and were 'a model farmer in the use of improved

agricultural practices. This speaks to the fact that there are farmers that know the right thing to do, and are also willing to share with others. These farmers are recognizable to both men and women farmers. In the study however, men perceived these attributes more than the women. Could it be that the women had a more honest assessment of fellow farmers than the men farmers? Overall, the farmers that were sources of information to cope with drought are those who were doing the right thing as far as farming was concerned.

Most obtained information from fellow farmers

The most common pieces of information obtained by both men and women farmers from fellow farmers to cope with drought were early or timely planting, early land preparation, growing of short-term crops, growing drought resistant crops and crop diversification. The above are adaptation measures both men and women farmers took up, and other than growing drought resistant crops involved not much extra financial cost other than labor. The message is to focus on food security in such a difficult time. However, it also has a relationship with availability of resources. More men than women obtained such information like spraying with pesticides, planting near streams, growing cash crops, food marketing, and use of inorganic fertilizers. This in part attests to men's inclination to market-oriented farming compared to the women (Nakazzi *et al*., 2017; Ochago *et al*., 2017). As such they sought for information for market-oriented enterprises and purposes.

Men and women's perceptions of effectiveness of information from fellow farmers

The effectiveness of fellow farmers as sources of information for coping with drought was assessed and how that differed between men and women farmers. The assessment was in terms of 'usefulness of information', 'timeliness of information', 'affordability of information', 'accuracy of information', 'relevance of information' and 'ability of the information obtained to address the

problem being faced'. Most of the fellow farmers that were sources of information to cope with drought were highly rated in the above aspects by both men and women. Fellow farmers were therefore a reliable and dependable source of credible information at that level. Women farmers however perceived the fellow farmers more favorably than the men. This is explained as the level of reliance of women on fellow farmers, the level of confidence they had in them, the ease of access they have with them, and their affordability. There might also have been the element of greater trust by women on fellow farmers as sources of information on drought.

Characterization of extension agencies

The four key extension agencies that were sources of information to the farmers in the study that is NAADs, MADFA, MUKWANO and BUILD Africa all gave out inputs such as seed to farmers during times of drought. Apart from MUKWANO a private sector organization involved in produce buying from farmers, the rest worked on improving farmers livelihoods through agricultural development programs, including affordable agricultural information services, promoting diversifying of livelihood strategies. They mainly used radio and phones to give weather information, used local languages on their IEC materials, used group-based extension, promoted the use of improved crops, post-harvest handling, and promoted minimum tillage. These four agencies were not involved in designing drought adaptation options, did not promote energy saving stoves unlike MADFA, were not linked to the NARO except for NAADS, and yet NARO is the government source of new agricultural technologies. They were not linked to market information sources except for MADFA, were not using phones to relay climate and weather information to farmers, had not policy strategy on climate change. MADFA had more of the characteristics under the key mandate, the networks, the communication methods, policy aspects on climate change, and important messages on drought disseminated than others. Most of these

agencies had the right messages to help cope with drought, however they had no clear climate change strategy for farmers, and therefore were handling these as emergencies. They had no clear risk management strategy. Some limited preparation to support farmers facing drought seems to be apparent. Most emergencies from these agencies seem to center on maintaining food security and less on markets for food. This could be because fewer farmers engage in market oriented or commercial farming, and these are more likely women.

5.3 Determinants of farmers' use of information sources

The discussions here deal with the factors that influenced farmers' use of fellow farmers and extension agencies for information to cope with drought.

The factors that influenced farmers' use of only fellow farmers

It was important to determine the factors that influenced the use of fellow farmers as sources of information to cope with drought. Farmers who did not belong to farmers' groups were more likely to rely on fellow farmers as sources of information to cope with drought. A fellow farmer being a good communicator was an influential factor in obtaining information from a fellow farmer. This also relates with good people, listening and social skills, as critical in farmer-to-farmer information exchange (Faqih & Aisyah, 2019; UNICEF, 2018; Suvedi & Ghimire, 2015; Anaeto *et al*., 2012; Bello & Obinne, 2012; Grothmann & Patt 2005). Fellow farmers being attached to an extension agency was also influential. Such connected farmers could be viewed as favorable and reliable and could act as vehicles of information and technologies for drought management. Possibly, farmers having contact with extension agents increase their access to information and knowledge on the application of innovations through field demonstrations as also indicated in Salau *et al*., (2012) and (Idris *et al.,* 2010). Another key factor was when the fellow farmer used modern agricultural technologies and innovations. These would be viewed as reliable, advanced and having what it

takes to advice others besides the cost effectiveness of exchanges with such individual for resource constrained smallholder farmers with small land holdings (El-Enbaby *et al.,* 2019; FAO, 2015; Mirani, 2013; Ashby *et al*., 2012). Literate fellow farmers were not relied on a lot. Farmers did not contact educated fellow farmers, but preferably contacted fellow farmers with the same education level, income and social status as also confirmed in previous studies (Lamontagne-Godwin *et al.,* 2018; Magnan *et al.,* 2013). Fellow farmers experimenting on agricultural practices were another influencing factor for contacting them for information. This was probably because farmers were able to obtain skills and knowledge through field observation and practical application of the innovations. It also implies that farmers were able to innovate after observing fellow farmers' fields in regards to how certain agronomic practices occur on their farms as also posited in (AduAnkrah *et al.,* 2014). Gender had a negative and statistically significant influence on farmers' use of fellow farmers. This implied that limitations still existed among farmers use of fellow farmers, especially women's use of male fellow farmers and *vice versa* possibly due to socio-cultural restrictions that draw boundaries on the farmers' interaction with other farmers usually of differing sex. Such barriers such as unequal power relations among men and women which is deeply embedded in social norms further intentionally or unintentionally prohibit farmers, especially women from freely interacting with other farmers more so the male fellow farmers often equipped with quality information also in agreement with Chaudhury *et al*., (2012; McOmber *et al.,* (2013); UNICEF, (2018). Due to prevailing socio-cultural values and norms, males have freedom of mobility and participation in different meetings and trainings where they easily meet with fellow men unlike women who often have to ask for permission from their husbands before they move out of their households as also observed in Melesse, (2018); Chaudhury *et al.,* (2012); Kyazze *et al.,* (2012); and Koranteng & Naab, (2012). Even in situations where farmers especially women have access to transport modes such as bicycles, their mobility in and out of their

communities is constrained by cultural norms that forbid women from riding bicycles thereby placing a burden on their balance of time between household chores and obtaining information from fellow farmers as also posited in Koranteng & Naab, (2012). This further creates wider gender disparities especially when it comes to women accessing quality information from literate male farmers as also noted in previous findings of Magnan *et al.*, (2013) and Lamontagne-Godwin *et al.,* (2018).

Factors that influenced farmers' use of Extension Agencies

The factors that influenced farmers' use of extension agencies as sources of information to cope with drought have been discussed. Farmers access to radio influenced use of extension sources. This could have been due to extension agencies communicating important information through radio. Those respectful of technical information are likely to access it from extension agencies via radio as long as they owned radios (Isaya *et al.,* 2018; Kyazze *et al.*, 2012; Naab & Koranteng., 2012; and Nyareza & Archie, 2010; Chapman, 2003).

Another influential factor was farmers' access to transport. Having transport must have facilitated movement to places where extension agencies could be accessed. Majority of rural farmers' agricultural enterprises are not in proximity with the extension agents and so require a modest form of transport to reach extension agencies to overcome mobility constraints as also opined in Kimaru-Muchai *et al.,* (2013); Chaudhury *et al.,* (2012); Naab & Koranteng, (2012); Kyazze *et al.,* (2012); and Nalugooti & Ssemakula, (2007). Belonging to a farmers' group was another influential factor. Membership with farmer groups increased farmers' chances of benefiting from farmer trainings on the use of emerging technologies and access to productive resource inputs such as seeds, fertilizers, agricultural finance etc. for increased agricultural productivity as indicated in previous studies (Jost *et al*., 2015; Ntume *et* al., 2015; Talno *et al.,* 2015; Ragasa *et al.,* 2012;

Chaudhury *et al.,* 2012; Kyazze *et al*., 2012; and Naab & Koranteng, 2012). Another influential factor was farmers' access to mobile phones. This meant that a farmer could call an extension worker, or could easily be reached by an extension worker, or receive messages from them. This has been observed in Mittal., (2016). Having mobile phones also addresses the limitations of lack of transport and mobility.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This study was conducted to (a) determine the sources of information used among men and women farmers to cope with drought; (b) characterize sources of information used by men and women to cope with drought; and (c) Identify the factors that influence farmers' use of information sources to respond to drought.

Information sources used by men and women farmers

In conclusion, fellow farmers were an important source of information to cope with drought for both men and women farmers. However, there were more male fellow farmers contacted for information than female ones. Men fellow farmers still have more of the information needed at the farmer-to-farmer level than the women fellow farmers. Due to their mobility men farmers are still able to reach more than one fellow farmer for information unlike the women farmers. Thus, this study recommends that, there is a need to focus on how to connect women to more sources of all types to increase satisfaction with the information they get especially through farmer groups. Men had greater use of extension services than women. Farmers' organizations were the most common source of information for farmers to cope with drought and particularly the women farmers, followed by NAADs. Farmer to farmer exchange and being part of a farmers' organization is important especially for women who have limited mobility and access to extension services.

Characterization of information sources contacted for information

The fellow farmers that were contacted for information to cope with drought generally have most of the positive characteristics in terms of communication behavior, farming experience and innovativeness. They are the type who are good practitioners of recommended agricultural practices. They were relatable to most farmers. What they offered was critical in meeting the food

security strategy during drought. Women farmers perceive fellow farmers more favorably than the men.

The extension agencies that were sources of information to cope with drought focused more on dealing with the emergency aspects farmers faced, they used radio, and group methods to reach farmers. Their networks lacked direct collaboration with the technologies useful to farmers. Their condition was one of not being very strategic in supporting farmers to cope with drought. The risk management strategy is still lacking. Men relied on them more than women.

Determinants of farmers' use of the two key information sources

In the logistic regression, social and institutional characteristics influenced farmers' use of fellow farmers, while economic and asset endowment and institutional characteristics influenced farmers' use of extension agencies for information to cope with drought. Membership to farmer groups was a cross-cutting variable that influenced farmers' use of fellow farmers and extension agencies for information to cope with drought. Thus, this study recommends that farmers should be encouraged to gain membership to farmer groups, to eliminate gendered barriers that limit equal opportunities for vulnerable groups of men and women to access technical information, advisory services, inputs and participation in productive agricultural programs under the facilitation of extension agents.

6.1 Suggestions for further research

For future research, there is need to assess the extent to which information obtained from information sources suits what is considered climate smart farming to strengthen resilience in food systems while maintaining market orientation. Secondly, taking into account the role played by farmer groups to enhance information and technology access and use among men and women farmers, there is need for a broader understanding of the role of farmer groups in supporting men and women farmers to design Climate Smart Agricultural Practices (CSAPs) for building

resilience, reducing poverty level, improving food security and nutrition in the face of climate change events most especially drought. It is recommended that the study is replicated to consider other climate change events such as floods, and other sources of information such as ICTs given the changing times. Deeper studies on the gendered impact of these drought management efforts and sources are also recommended. Finally, factors contributing to gender differences in the use of information sources to cope with drought need to be further investigated.

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APPENDICES

Appendix 1: Interview schedule review expert panel

Name	Qualification
1. Richard Miiro, Ph. D	Senior Lecturer, Department of Extension and Innovation studies
2. Margaret N. Mangheni, Ph. D	Assoc. Professor, Department of Extension and Innovation Studies

Appendix 2: Interview guide Checklist 1

1. Village: ... 2. Parish: ….3. Sub-county: … 4. Date: … 5. Number of men: …6. Number of women: …

1. Brief discussion of the farming system in the area

Identify the key crop enterprises (three key food security and the three key income ones)

Key food crops	Crops that women grow	Income crop enterprises for females	Crops considered for the males	Income crop enterprises for females	Crops grown in 1st season	Crops grown in 2nd season

2. What is the proportion of farmers who grow these?
3. Indicate the crops which are important to the men and which are important to the women
4. Identify the key livestock enterprises in the area (two key food security and the two key income livestock enterprises)

Livestock reared most	Livestock that women rear	Livestock enterprises for income to women	Livestock that men rear	Livestock enterprises for income to the men	Crops grown in 1st season	Crops grown in 2nd season

5. What proportion of farmers rear livestock?
6. Indicate those which are important to the men and which are important to the women
7. Brief discussion of the key extreme weather events that have happened in the area during the last 15 – 20 years
   - 7.1 Indicate the years when extreme temperatures and lengthy dry seasons have occurred, and the months this happened
   - 7.2 Identify periods of extreme high and lengthy rainfall amounts - in which months did this happen and over what months did it last?
   - 7.3 Identify the years when flooding occurred and the months it which it occurred
   - 7.4 Indicate how wide spread the flooding was
   - 7.5 Identify the years when extreme hail storms took place, in which months did this happen?
   - 7.6 What other weather events have you experienced and in which years have they happened?
8. For each of the time that the extremes or variations in weather occurred, discuss the main/widespread effects generally; to men and women's lives, roles and wellbeing; to boys and girls in the community.

	a. High temperatures and drought	b. Extremely high and lengthy rains	c. Flooding	d. Hail storms
Effects - generally (Some specific ways in which men and women were affected): • Live • Roles • Well being	.			

9. For each of the extreme weather events that you have experienced share how you responded and coped in terms of your general wellbeing and as far as food security, crop and livestock production if not already indicated. Identify any responses unique to men or to women

	a. High temperatures and drought	b. Extremely high & lengthy rains	c. Flooding	d. Hail storms
1. Response/coping mechanisms and adaptation options generally as farmers 2. Specific responses/options by men and as women				

10. What are the key sources of information of the adaptation and response options farmers rely upon? Choose some 3 to 4 options/responses for further exploration				
	Response/option 1	**Response/option 2**	**Response/option 3**	**option 4**
1. Key sources of information and or technology for the options for women 2. Key sources of information and or technology for the options for men				

11. What would be men's and women's preferred sources of information before or during such an extreme event?
12. Which are three most relied upon sources of adaptation options to climate change to the men and to the women?
13. Why are they most relied on by men/women?

	Information Source 1	**Source 2**	**Source 3**
14. How do the men/women access this source?			
15. How does the source share information?			
16. What resources are needed to access information from this source?			
	Information Sources 1	**Source 2**	**Source 3**
17. Benefits/advantages of the sources for men and for women			
18. Constraints/disadvantages with the source for men and for women			

19. What other information do they need to cope, adapt and respond to weather variation that they have not yet accessed as men/women farmers?
20. Summary of the exercise – group dynamics that influenced the process, early thoughts and reflections on emerging themes for analysis

Appendix 3: Interview guide for characterization of information sources

A. Original qualitative research guide on characterizing sources of CCAOs.

To identify and characterize those sources of climate change adaptation knowledge, practices and technologies that the farmers depend on, and to characterize such sources

What characterizes the sources of climate change adaptation information, practices and technologies for each of the man and women farmers? *Do they meet the criteria and capacities of the new extensionist?* Are these credible sources? Can they have a role in regular information dissemination and CCA information? Do they pass the key criteria for evaluating an effective source?

Characterizing the main sources of information

(a) Farmers, including star farmers and ordinary farmers, local leaders, CBFs, service providers
(b) Extension Services organizations

Star farmers are those farmers who are mentioned by at least 40% of all the respondents in the group.

Group based characterization of sources

- Name; Target, who do they reach, where do they meet them,
- Jurisdiction, how far do they reach

Socio aspect

- Gender
- Marital status

Economic Aspect

- Income level (this might have to be asked from the source him/herself
- Land acreage (this might have to be asked from the source him/herself)
- Way or method they use to communicate to fellow farmers – radio, ICTs
- What are their key messages about in relation to climate change adaptation?
    - Weather patterns; Weather forecasting; Improved technologies/ practices such as improved varieties; Business oriented aspects (market organization etc)
    - Credit/ resources available

- What channels, what approaches, methods (individual, group, mass), fora do they use to share what they know – ICTs, etc

Key information interviews with the key sources:

Key informant process to characterize the Prominent (star) and Ordinary farmers, CBFs, local leaders (Are there farmers that others learn from?, What do they learn from them? What are the farmers that people rely on for information? What kinds of farmers are effective?

- Name
- Target, who do they reach, where do they meet them,
- Jurisdiction, how far do they reach
- Motivation/Objective of the source to share CCA information (this might have to be asked from the source him/herself)
- Scope or mandate of the source (both the group and the source will answer this)

Socio aspect

- Religion
- Main occupation,
- Networks, sources of agricultural information, even CCA for the source,(this might have to be asked from the source him/herself)
- Education level (this might have to be asked from the source him/herself)
- Leadership role (this might have to be asked from the source him/herself)
- Vision for life (this might have to be asked from the source him/herself)
- Age (this might have to be asked from the source him/herself
- Gender
- Marital status

Economic Aspect

- Income level (this might have to be asked from the source him/herself
- Land acreage (this might have to be asked from the source him/herself)
- What messages do they mainly share about? Agricultural, CCA
    - Weather patterns
    - Weather forecasting
    - Improved technologies/ practices such as improved varieties.
    - Business oriented aspects (market organization etc)
- What channels, what approaches, methods (individual, group, mass), fora do they use to share what they know – ICTs, etc

2. Characterizing the extension services

(a) Are there extension services that farmers learn from to adapt to climate change?
(b) What do they learn from them?
(c) What kinds of extension services are effective?

- Non-Government Organizations
- Public Organizations like NAADS
- Farmer Organizations

(d) What are the extension services that farmers rely on for information?

- Non-Government Organizations
- Public Organizations like NAADS
- Farmer Organizations

(e) Who uses the radio most to disseminate the information?

3. Characterizing the aspects of extension services

- Technology
- Policy on climate change
- Climate change adaptation activities engaged in
- Level of equipment
- Size of organization
- Main mandate

- Jurisdiction
- Networks
- Channel used [radio, workshops or community meetings]
- Target clients [males or females]
- Target extension

Analytical framework for Group characterization of sources of climate change adaptation options

Name of Source Farmer, location	**Target**, who do they reach & motivation /objective Jurisdiction, how far do they reach, Vision for life	**Scope or mandate** of the source	**Networks,** sources of agricultural information, even CCA for the source	**Age, gender & Marital status, Education level, Leadership role**	**Income level & Land acreage**	**Way or method & channel they use to communicate**	**Key messages** in relation to climate change adaptation

Analytical framework for characterizing fellow farmers as sources of climate change adaptation information

Name of Source Farmer, location	**Target**, who do they reach & motivation /objective Jurisdiction, how far do they reach, Vision for life	**Scope or mandate** of the source	**Networks,** sources of agricultural information, even CCA for the source	**Age, gender & Marital status, Education level, Leadership role**	**Income level & Land acreage**	**Way or method & channel they use to communicate**	**Key messages** about in relation to climate change adaptation Technologies

Analytical framework for characterizing extension sources of climate change adaptation options for farmers

Name of Source Type of organization Non-Government Organizations Public Organizations like NAADS Farmer Organizations location	**Jurisdiction Networks**	**Channel used and Target** clients [males or females]	**Technology Policy on climate change**	**Key climate change messages.** Weather patterns Weather forecasting Improved technologies/ practices such as improved varieties. Business oriented aspects (market organization etc) Credit/ resources available

Appendix 4: The cross-section survey

MAKERERE UNIVERSITY

Analysis of Gender differences in Smallholder Farmers use of Information Sources to cope with drought in Masindi District, Uganda

Dear Sir / Madam

My name is ……. I come from……..., I am assisting in a research study on information sources that you as farmers perceive to be the most effective in managing drought experienced within your community. The study is for a Masters student who needs this information as part of his training and to prepare himself to serve in this issue of climate change. We are fortunate that this study is being done in Masindi District – Pakanyi, Miirya, and Kimengo sub counties.

Farmers both men and women rely on various sources of information to deal with the climate events. The purpose of this study will be to evaluate the effectiveness of such sources of information both men and women farmers rely on in Masindi District, Uganda. Your household has been selected randomly to help in answering questions that will be useful to understand the above issues. We have permission from the DAO Masindi, the Local District Leaders, and the University to come here as per the letters you see.

This is therefore to request for your permission to be interviewed as part of this study. If you are not ready you are free to opt out of the interview. However, I kindly request that you stay with me. All the information you will share will be kept confidential and will only be used for study purposes of the student. It is the overall results that will be shared with the district officials.

As a confirmation of your consent to participate in the study, it is required that you sign on these two copies, one will stay with you and I will go back with the other. I have prepared a small token of appreciation, which I will give you after the interview.

Thank you so much.

Time of start _____

Section A: Characterizing of information sources when responding to climate events

Key climatic events that affected farmers

For the last 5 - 10 years, climatic events such as drought, hail, erratic rains and floods have been prevalent and have had negative effects to agricultural production in this area. As far as farming is concerned, farmers have relied on various information sources to help them to respond and adapt to the climate events.

1. Which of the following climate change events did you experience and can vividly recall in the last 5- 10 years? **(Please circle all that apply)**
    1. Drought
    2. Hailstorms
    3. Floods
    4. Erratic/unpredictable rains
    5. Wind storms
    6. Heat stress
    7. Others (specify) _____
2. While you seem to have experienced many events, for this study we will focus on drought which has happened all over Masindi. From your memory, which of the following was a source of information to you? ***Circle all that apply)***
    1. Farmer
    2. Extension service organization
3. Kindly indicate the farmers you have relied on including the information and technologies you have acquired from the farmers in table below.

Source of information	*Kind of information and technologies got from the sources as well as the channels used*
(a) What Fellow farmers if any *were useful important sources of information to respond to drought?* **Name of farmer** **Sex of farmer** **1**……..... …… **2**……..... …… **3**……..... …… **4**……..... …… **5**……..... ……	(b) What information did you get from the indicated farmers**?** (Tick for each of the farmers mentioned) ***Information*** ***Farmer 1*** ***Farmer 2*** ***Farmer 3*** ***Farmer 4*** ***Farmer 5*** 1. Irrigation of crops during drought 1 2 3 4 5 2. Early/ timely planting 1 2 3 4 5 3. Providing weather forecasts 1 2 3 4 5 4. Planting vegetables near water streams 1 2 3 4 5 5. Mulching gardens 1 2 3 4 5 6. Grow drought resistant crops like cassava 1 2 3 4 5 7. Early land preparation 1 2 3 4 5 8. Grow cash crops 1 2 3 4 5 9. Grow short term crops like vegetables and beans 1 2 3 4 5 10. Feed stuff preservation 1 2 3 4 5 11. Inorganic fertilizer use 1 2 3 4 5 12. Spraying pesticides 1 2 3 4 5 13. Stock food stuffs in the cribs after harvest 1 2 3 4 5 14. crop diversification 1 2 3 4 5 15. Marketing food in drought 1 2 3 4 5 16. Information on planting trees 1 2 3 4 5 17. Spraying with herbicides/ superglo 1 2 3 4 5 18. Others (specify) ……. c. Did you get any technology/practice? ***Circle the most appropriate.*** 1. Yes 2. No. d. Which technologies or practices **did you get** from each of the farmers? (indicate for each of the farmers mentioned) ***Technologies/ practices*** ***Farmer 1*** ***Farmer 2*** ***Farmer 3*** ***Farmer 4*** ***Farmer 5*** 1. Used improved seed varieties 1 2 3 4 5 2. I used Fertilizers 1 2 3 4 5 3. Used grasses and banana fibers to mulch 1 2 3 4 5 4. Used watering can to irrigate 1 2 3 4 5 5. Planted drought tolerant cassava 1 2 3 4 5 6. Practiced drip irrigation using tins 1 2 3 4 5 7. Sprayed crops with pests 1 2 3 4 5 8. Learnt how to prune crops like bananas 1 2 3 4 5 9. I store food in cribs 1 2 3 4 5 10. Planted vegetables like *nakati* in wetlands 1 2 3 4 5 11. Planted trees along with crops such as coffee 1 2 3 4 5 12. Changed crops season after season 1 2 3 4 5 13. I learnt how to use organic manure 1 2 3 4 5 14. Others (Specify) …… e. Which of these farmers did you rely on most for information to deal with the event? …… f. Which of the following channels or fora did you use to get information from Mr./Mrs ……..? ***Circle all that apply.*** 1. Face to face between the two of you 2. Farmer group meeting 3. Village LC meeting 4. Community radios 5. Mobile phone calls Others (specify) **……** 6. None

g. On average how often did you meet Mr. / Mrs. _____ on how to respond to drought? **(1)** _____ times before; **(2)** _____ times during and; **(3)** _____times after drought **(season means Feb-June & Aug- Nov cropping period)**

h. What resources did you need when dealing with Mr./Mrs. _____to obtain information? **(Circle resources used first & ask for costs where applicable)**

1. Transport fare **(a)** Average cost per return trip _____; **(b)** _____ trips before drought; **(c).** _____ trips during drought; **(d)** _____ trips after drought

2. Phone calls: **(a)** number of phone calls per season _____ **(b)** cost per call _____

3. Fee for the information **(a)** Amount of fees on information during the season _____ **(b)** Number of times fees were paid _____

i. What advantages did you find in Mr./Mrs ___ as a source of information to respond to the drought compared to the other informers? **(Remember to probe)**

1. Accessible
2. Available
3. Approachable
4. Accurate
5. Flexible
6. Shares information freely
7. Social
8. Timely information provided
9. Reliable
10. Knowledgeable of farming
11. Others …….

j. What difficulties did you find in Mr./Mrs ___ as a source of information to respond to the drought compared to the other informers? **(Remember to probe)**

1. Network problems when using mobile phones
2. Not available always
3. Transport limited to meet him

k. To what extent did distance limit you from working with Mr./Mrs _____ as a source of information?

Distance	*Never at all limited me*	*Never Limited me*	*Not sure*	*Limited me Some extent*	*Limited me to a very Great extent*
Fellow farmer	1	2	3	4	5

4. Indicate the extension organization and the information specific to the organization you relied on to respond to drought

4 a) Which extension organizations by name were important sources of information to deal and respond to drought?	**b)** Which information specific to dealing to drought did you get from each of the organizations? (circle where appropriate)	**Ext1**	**Ext2**	**Ext3**	**Ext4**	**c)** Which technologies or practices to deal with the drought from each of the organizations did you get and applied?	**Ext1**	**Ext2**	**Ext3**	**Ext4**	d) Which of these organizations gave you more information/guidance to deal with the drought?	e) Which of the following channels did …… use? ***Circle all that apply***
1. Local government extension like NAADS Sub county NAADS name……..	1. Fruit crop trees	1	2	3	4	1. Plant improved varieties	1	2	3	4	……	1. Radio
	2. Crop diversification	1	2	3	4	2. Plant early maturing crops	1	2	3	4		
	3. Early maturing crops	1	2	3	4	3. Fertilizer applied	1	2	3	4	……	2. Television
	4. Mixed farming	1	2	3	4	4. Growing crops near streams	1	2	3	4		
	5. Fertilizer Use	1	2	3	4	5. Using a water pumps	1	2	3	4		

2. NGO specify name …… 3. Farmer organization specify name …… 4.Private sector company /entrepreneur specify name ……	6. Planting perennial crops 1 2 3 4 7. Spraying using herbicide 1 2 3 4 8. Occurrence of drought 1 2 3 4 9. Mulching 1 2 3 4 10. Irrigation 1 2 3 4 11. Drought resistant crops 1 2 3 4 12. Livestock treatment 1 2 3 4 13. income generating livestock 1 2 3 4 14. Making Nursery beds 1 2 3 4 15. Early planting 1 2 3 4 16. Post-harvest handling 1 2 3 4 17. Others (specify) ……	6. Splayed crops with superglo 1 2 3 4 7. Irrigation from river/ wetlands 1 2 3 4 8. Irrigation using containers 1 2 3 4 9. Treating livestock 1 2 3 4 10.Drought tolerant crops planted 1 2 3 4 11.Making Nursery beds 1 2 3 4 12.Mulching with dry grasses 1 2 3 4 13.Organic manuring 1 2 3 4 14.Others (specify) ……..	……... …… .	3. Mobile phones 4. Newspapers 5. Internet 6. Group meeting 7. Visiting the source

f) How far from your home were you meeting the **(state organization)** ____ officials who shared with you the information? _____ Miles

g) How often did you meet **(state organization)** _____to obtain the indicated information during drought? **(1)**_____times before drought; **(2)** _____times during drought; **(3)** _____ times after the drought.

h) What resources did you use when dealing or working to address the drought? **(Circle the most appropriate)**

1. Transport
2. Airtime
3. Radio
4. Fee
5. Dry cells
6. Mobile phones
7. Others (specify) ……

i. What advantages did you find with _____ as a source of information to respond to the drought compared to the other organizations? **(Remember to probe)**
   1. Information accurate
   2. Timely provision f techniques
   3. Providing inputs like seeds
   4. Reliable information
   5. Approachable
   6. Access to organization
   7. Easy access to information at organization
   8. Others …….

j. What difficulties did you experience with _____ as a source of information to respond to the drought compared to the other organizations? **(Remember to probe)**
   1. Not timely information
   2. Transport to reach each organization
   3. Don't have information on climate changes/ drought adapt
   4. Bring seeds late
   5. Not useful in times of drought because they only focus on farming only
   6. Poor mobilization of farmers
   7. Their radio programs are missed sometimes
   8. Don't often meet farmers
   9. Network problems
   10. Others (specify) ……

k. To what extent did distance limit your access to the _____ (*Extension*) indicated?

Source	***Extent Distance influenced***				
	Never at all limited me	*Never Limited me*	*Not sure*	*Limited me Some extent*	*Limited me to a very Great extent*
Extension organization	1	2	3	4	5

Characterizing farmers that played a role in drought

5. (a) Now, let us talk about who Mr. / Mrs_____ is.

	Characteristics of most relied on fellow farmer	
1.0	**Social status**	**Circle the number that applies**
1.	Is_____ from this village of yours?	1. Yes 2. No 3. I don't know
2.	Does_____ have a leadership role in the community?	1. Yes 2. No 3. I don't know
3.	In your view, is _____ a highly educated person?	1. Yes 2. No 3. I don't know
4.	In your view, is_____ well off?	1. Yes 2. No 3. I don't know
2.0	**Level of networks**	
1.	Does _____ regularly participate in groups within the community?	1. Yes 2. No 3. I don't know
2.	Does _____work with organizations that hail from outside the community?	1. Yes 2. No 3. I don't know
3.	Does _____ work outside the community?	1. Yes 2. No 3. I don't know
4.	Is _____ a regular traveler around Masindi district?	1. Yes 2. No 3. I don't know
5.	Does _____regularly move outside Masindi district?	1. Yes 2. No 3. I don't know
3.0	**Farming aspects and experience**	
1.	Does _____ sell food throughout the year?	1. Yes 2. No 3. I don't know

2.	Does _____ continue to have food even when drought occurs?	1. Yes 2. No 3. I don't know
4.0	**Level of usage of ICT for agricultural purposes**	
1	**Does _____** uses the internet?	1. Yes 2. No 3. I don't know
2	**Does _____** uses mobile phones?	1. Yes 2. No 3. I don't know
3	**Does _____** uses Television?	1. Yes 2. No 3. I don't know
4	**Does _____** uses Newspapers?	1. Yes 2. No 3. I don't know
5	**Does _____**use radio?	1. Yes 2. No 3. I don't know

b. We are now going to talk about what you think about Mr./ Ms./ Mrs._____ who was the most important source of information? (Try be as honest as possible in your opinion? *(Tick the score as per your perception ranging from 1- 5: 1=strongly disagree, 2= Disagree 3. Not sure, 4=agree, 5= strongly agree)*

	Perceptions of characteristics of fellow farmers as far as you are concerned					
	Social aspects	*Strongly disagree*	*Dis agree*	*Not sure*	*Agree*	*Strongly agree*
		1	2	3	4	5
1	_____ is a sociable person	1	2	3	4	5
2	_____ is approachable	1	2	3	4	5
3	_____is a close-friend of mine	1	2	3	4	5
4	_____ is friendly to others	1	2	3	4	5
5	_____participates in collective work	1	2	3	4	5
6	_____promotes collective action	1	2	3	4	5
7	_____is a flexible person	1	2	3	4	5
	Farming aspects					
1	_____ is an exemplary farmer	1	2	3	4	5
2	_____ is innovative	1	2	3	4	5
3	_____ is knowledgeable about farming	1	2	3	4	5
3.0	**Benevolence or responsibility towards other farmers**	**Extent**				
1	_____ shares farming information freely	1	2	3	4	5
2	_____ is always ready to assist fellow farmers	1	2	3	4	5
3	_____ cares about others	1	2	3	4	5
4	_____ cares about the good of the environment	1	2	3	4	5
5	_____ cares for others in times of disaster	1	2	3	4	5
6	_____ ___cares for others in normal times /life	1	2	3	4	5
4.0	**Communication behavior**	**Extent**				
1	_____ communicates well and easily convinces someone	1	2	3	4	5
2	_is always willing to share what he/she knows or has found out	1	2	3	4	5
3	_____ regularly information from various sources	1	2	3	4	5
4	_____ information can be used by men	1	2	3	4	5
5	_____ information can be used by women	1	2	3	4	5
5.0	**Innovativeness**	**Extent**				
		Strongly disagree	*Dis agree*	*Not sure*	*Agree*	*Strongly agree*
1	_____ experiments on certain farming practices	1	2	3	4	5
2	_____ comes up with solutions of farming problems	1	2	3	4	5
3	____is a regular user of improved agricultural practices	1	2	3	4	5
4	_____ is a regular user of technologies	1	2	3	4	5
5	_____ fields are exemplary	1	2	3	4	5
6	_____ is a model farmer of NAADs/NGO					
7	___ quickly takes on new agricultural technologies & practices	1	2	3	4	5

Measure of effectiveness of most relied on sources

6. To what extent did the information source you relied on meet the aspects such as the ones in the table below? *(The scores will range from 1- 5: 1=very little extent, 2= little, 3=Not so sure, 4= to some good extent, 5= very great extent)*

Aspect of effectiveness of source	*Source of information*									
	1. Fellow farmer most relied on _____					*Extension service org. most relied on named* _____				
To what extent was the information provided by the source timely?	1	2	3	4	5	1	2	3	4	5
To what extent was the information provided by source relevant?	1	2	3	4	5	1	2	3	4	5
To what extent was the information provided by the source useful?	1	2	3	4	5	1	2	3	4	5
To what extent was the information source you relied on affordable?	1	2	3	4	5	1	2	3	4	5
To what extent was the information provided by the source accurate?	1	2	3	4	5	1	2	3	4	5
To what extent did source address all farming problems that came as a result of the drought?	1	2	3	4	5	1	2	3	4	5

7. What other information did you need to respond to the drought as far as farming is concerned that Mr./Mrs_____ never provided? **(Remember to probe)**
8. What other information did you need to respond to the drought as far as farming is concerned that **(refer to organization)** _____ never provided? **(Remember to probe)**

Section B: Background Factors of the respondents

9. Do you have any off-farm income activities? ***(Circle the one that applies)*** 1. Yes 2. No
10. Contribution of off farm income to overall household income (%) _____
11. What types of enterprises mix do you have on your farm? ***(Circle the one that applies)***
    (i) Mixed farming (ii) Mono-cropping (iii) Intercropping (iv) Annual crops (v) Perennial crops
12. Indicate the number of off farm income generating activities you are involved in? _____
13. How many development non-agricultural groups are you a member of? _____
14. How many times a year do you visit a nearby district? _____
15. How many times a year do you participate in an agricultural show whether local or elsewhere? __
16. How many times a year do you visit Kampala city? _____
17. Do you have a mobile phone? ***(Circle the one that applies)*** 1. Yes 2. No
18. Do you have a radio? ***(Circle the one that applies)*** 1. Yes 2. No
19. How many times in a month do you listen to radio for agricultural purposes? _____
20. Do you have a TV? ***(Circle the one that applies)*** 1. Yes 2. No
21. How many times in a month do you watch TV for agricultural purposes? _____
22. Do you have own any form of transport? ***(Circle the one that applies)*** 1. Yes 2. No
23. Which form of personal transport do you own? _____
24. What is the size of land you use for agriculture?
    1. Owned _acres; (2) Rented in _ acres; (3) Rented out _ acres; (4) Cultivated _ acres (5) Squatting _ acres;
25. How many extension outreach farmers group are you attached to? _____
26. What is the estimated proportion of income that comes from;
    1. Crops (%) _____ 2. Livestock (%) _____
27. Which livestock/birds do you possess/rear and how may in each case?
    1. Pigs, # _____ 2. Chicken, #_____ (3) Cattle, #_____ (4) Goats, #_____
28. What is the total number of household members? _____ People
29. State the average age of the people in your household. _____
30. What kind of labor do you depend on and how many of each **(adults >18 years)** do you use?
    1. Hired labour, # _____ 2. Family labour, # _____
31. How many years have you spent farming as an independent adult? _____ Years
32. Which of these below is your most important source of income? ***(Circle the one that applies)*** 1. Agriculture
    2. Non-Agriculture (specify) _____
33. Which agricultural enterprises do you consider most important for the livelihood of your household? ***(Circle the one that applies)***
    1. Mainly Crop production
    2. Mainly Animal rearing
    3. Others (specify)_____

Section C: Demographic Information

34. What is the name of your sub County? _____
35. What is the name of your Village? _____
36. Gender of respondent: ***(Circle the one that applies)*** 1. Male 2. Female
37. What is your highest level of education? (*Indicate number of years of schooling*) _____ years
38. How old are you? _____ years
39. Are you the household head? ***(circle the one that applies)*** 1. Yes 2. No
40. Relationship to the household head? 1. Spouse 2. Relative 3. Child 4. Worker 5. N/A
41. Are you ***(Circle the one that applies)***
    1. Married? (2) Single/ never married? (3) Divorced/ separated? (4) Widowed? (5) Others (Specify)____
42. Name of respondent _____ Mob. Phone No._____
43. Name of interviewer _____ Mob. Phone No. _____

Thanks, you very much for your time **Time of ending: _____**

Appendix 5: Sampling frames for Households, villages and parishes

Table 34: Randomly selected parish samples

Sub-County& parish	Randomly selected Parish
Pakanyi	**Pakanyi**
1. Kyatiri	• Kihaguzi
2. Kihaguzi	• Kyakamese
3. Kyakamese	
4. Kiruri	
5. Labong	
Miirya	**Miirya**
1.Kigulya	• Isimba
2.Bigando	
3.Isimba	
Kimengo	**Kimengo**
1. Kijunjubwa	• Kimengo
2. Kimengo	

Source: (Survey Data, 2014)

Table 35: Population of villages where sample villages were derived in the three sub counties

Pakanyi Sub County		Miirya Sub County	Kimengo Sub County
Kihaguzi parish	**Kyakamese parish**	**Isimba parish**	**Kimengo Parish**
1. Kihaguzi	1. Kyakamese	1. Kyabaswa I	1. Karwara Kididima*****
2. Kituka II	2. Pakanyi	2. Kyabaswa kikyope*****	2. Karangwe
3. Kidwera I*****	3. Kasomoro*****	3. Kasomoro Kitoka	3. Myeba Nyakarongo
4. Kituka I	4. Nyakatogo	4. Kedikyo	4. Kibanja
5. Kijumburwa	5. Kiyuya	5. Kisindizi	5. Kayera
6. Hanga	6. Kisindizi I		
7. Nakyanika II	7. Kisindizi II*****		
8. Bokwe Kasanyu	8. Kyamudikya		
9. Kigunia	9. Katugo		
10. Kigaragara*****	10. Kibirani		
	11. Kyatwenge		
	12. Kibamba		
	13. Kyarumbeiha*****		
	14. Kisindi		
	15. Ibaralibi		
	16. Waiga		
	17. Kaborogota		
	18. Arimugonza		
	19. Katumba*****		

Source: Data, 2014____***** Indicates the villages that were sampled from Pakanyi, Miirya and Kimengo sub-counties