ASSESSMENT OF INFORMATION AND KNOWLEDGE IN SCALING UP CSA AMONG SMALLHOLDER FARMERS IN NORTHERN UGANDA (NWOYA)

REPORT

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ABSTRACT

Uganda can be characterized as agriculture-based, that is agriculture is the back bone of the economy. Agriculture is dominated by smallholder farmers who occupy the majority of land and produce most of the crop and livestock products. The key long-standing challenge of the small holder farmers is low productivity stemming from the lack of information and knowledge on climate, lack of credit facility and technology which is causing low productivity, low income and low standard of living.

Climate change, resulting mostly from global warming has been among the major causes of reduced agricultural production and productivity in many parts of Africa including East Africa. In Uganda, most crops and livestock farming is rain-fed and therefore susceptible to weather fluctuations. If the sectors of farms like livestock, forestry and fishery are used sustainably, it would enhance the country's capacity to realize its adaptation and resilience, necessary in fighting against climate change. The best way to achieve the sustainability and self-sufficiency status is practicing Climate Smart Agriculture.

The proposed research work seeks to access the impact and effectiveness of knowledge and communication skills pertaining to CSA in East Africa. For purposes of knowledge dissemination, a comprehensive capacity development approach that builds on the thorough assessment of the needs of all stakeholders is required.

Keyword: Information, knowledge, climate smart agriculture, income and food security.

EXECUTIVE SUMMARY

This project was carried out in Northern Uganda Nwoya district. This district can be characterized as an agricultural-based district that is, agriculture is the back bone of the economy. Agriculture is dominated by smallholder farmers who occupy the majority of land and produce most of the crop and livestock products and 90% of their income is gotten from agriculture. The key long-standing challenge of the small holder farmers is Climate change, resulting mostly from global warming which has been among the major causes of reduced agricultural production and productivity in many parts of Africa including East Africa. In Northern Uganda, most crops and livestock farming is rain-fed and therefore susceptible to weather fluctuations. Because of the negative effect climate change has caused in these communities, farmers has diverted from farming to other small scale businesses since agriculture is not paying off. It is of note that if people stop agriculture in these communities, there will be lot of challenges in terms of food security, income for family necessities, health etc. in this study, the major work is evaluate the past projects that has been done in these communities to check if it has helped them increase their level of livelihood.

In this study, 5 CSA practices were examined which are; Row planting, Inter-cropping, Mulching, Minimum tillage and Improved variety. If the sectors of farms like livestock, forestry and fishery are used sustainably, it would enhance the country's capacity to realize its adaptation and resilience, necessary in fighting against climate change. The best way to achieve the sustainability and self-sufficiency status is practicing Conservation Agriculture.

The study methodology includes a desk review of relevant information, in-depth key informant interviews, collection of primary qualitative and quantitative data, as well as field visits to the sub-counties in Nwoya district undertaking agricultural activities pertinent to CSA.

This study indicated that, as part of the improvement of livelihoods and food security, numerous traditional as well as innovative climate adaptation and mitigation agricultural development activities are conducted. Conservation agriculture is one of the key CSA activities conducted in Uganda. Since then numerous trials and development work on conservation agriculture have been undertaken.

Conservation agriculture is promoted mainly by NGOs and the private sector with support from agricultural offices at all levels. This study found that the promotion of conservation agriculture technology has been affected by a lack of common understanding as well as other social and environmental issues that include open grazing and complete removal of crop residues. The study also indicated that there is untapped opportunity for the wide-scale promotion of conservation agriculture.

Major stakeholders promoting climate-smart agricultural activities in Uganda include the ministry of agriculture, International Fund for Agricultural Development (IFAD), International Centre for Tropical Agriculture (CIAT), European Commission /Consultative Group on International Agricultural Research (CGIAR), International Institute of Tropical Agriculture (IITA), Climate change, Agriculture and Food Security (CCAFS) and numerous NGOs

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Background of the Study

Uganda is a landlocked country located in the East African region bordering Kenya to the east, Tanzania to the south, Rwanda to the south-west, Democratic Republic of Congo to the west, and South -Sudan to the north. Uganda lies across the equator with a total surface area of 241,550.7 km2 of which 199,807.4 km^2 are land (arable land is only 21.6%), while water and swamps cover a total of 41,743.2 km^2. It is important to note that over 80% of Uganda's population is rural and depends on rain-fed agriculture, which is particularly vulnerable to impacts of adverse effects of climate change.

Uganda is naturally gifted in contrast to most other African countries with regards to its climatic and ecological conditions. Uganda has substantial natural resources including fertile soils, regular rainfall, small deposits of copper, gold, and other minerals. More recently, the country discovered considerable commercial quantities of oil. However, some areas in the country experience extreme temperatures and rainfall. The northern region is especially vulnerable, being prone to both floods and droughts as a result of high rainfall variability. Uganda's overall climate is equatorial and experiences relatively humid conditions and moderate temperatures throughout the year, with mean daily temperatures of 26°C. Average temperatures in the cooler regions of the south-west are below 20°C and reach 31°C in the northern parts of the country, also considered the warmest. The country experiences a wet climate with two distinct rainy seasons in a year in the southern parts of the country, which merge into one rainy season further north of the equator. The rainy period falls between October and December is described as the long rainy season, while the short season is between March and May. The areas around Lake Victoria are wetter than other areas of in country.

The Lake Victoria region receive more than 2,100 mm of rain annually, whereas the arid and semi-arid north receives only 500 mm per year, reducing considerably to as low as 200 mm in the north-eastern part of the country. Uganda's rainfall is influenced by a range of broader weather trends and phenomena.

The country's bimodal rainfall is driven by the oscillation over the equator of the Inter-tropical Convergence Zone (ITCZ). The pattern of the zone's oscillation is in turn sensitive to the El Niño Southern Oscillation: El Niño brings about a wet phase in Uganda between October and December, which could cause flooding, while La Niña (the converse) brings about a dry phase, which leads to drought. The effects of the oscillation in rainfall patterns can vary due to the influence of the Indian Ocean Dipole, an irregular oscillation of sea-surface temperatures in which the western Indian Ocean becomes alternately warmer and then colder than the eastern part of the ocean. Lake Victoria also affects rainfall patterns due to differential heating and vapor transport. Climatic conditions vary considerably within Uganda.

The three main types of climate found in Uganda are highland, savannah tropical and semi-arid. Most parts are on average height of 1,200 m above sea level. The lowest altitude is 620m (within the Albert Nile) and the highest altitude (Mt. Rwenzori Peak) is 5,110m above sea level. Highland climates have cool temperatures and moderate rainfall; this climate is mostly found around Mount Elgon and the Rwenzori Mountains. Regions with a savannah tropical climate have moderate average temperatures and high mean annual rainfall. This climate is present in the central and western parts of the Lake Victoria Basin where most of Uganda's rainforests and wetlands can be found. Regions with semi-arid climates experience high average temperatures and low mean annual rainfall. Animal husbandry is common in this type of climate, and such areas are commonly referred to as the "cattle corridor" of Uganda. The corridor runs from the Karamoja region in the north-east, to the Ankole region of south-west. Uganda's highland and semi-arid climates receive an average of approximately 900 mm of rainfall per year, while savannah tropical climates receive 1200 mm per year. Social and economic activities in Uganda are more sensitive to rainfall than to any other climate variable.33 Semi-arid climates experience extreme temperatures. Temperatures as high as 33° C have been recorded in Mbarara (south-west of the country), while in the north-east regions of Gulu, Kitgum and Moroto, high temperatures of 35°C and above have been recorded.

Highland climates may experience extreme lows in temperature reaching as low as 4° C in Kabale of the western highlands and temperatures below freezing are regularly experienced in the Rwenzori and Elgon ranges.

The challenge of food and income security has compelled government and development agencies to promote initiatives centered on climate smart agriculture(CSA) since sustainable agriculture and

climate change are intrincly linked (Terdoo and Adekola,2014). CSA is one of the approaches that have been championed as the "holy grail" of agricultural development (Naess, 2011) and according to FAO (2011) CSA not only sustainably increase production and resilience but also remove greenhouse gases while enhancing national food security and developmental goals. (FANRPAN, 2013) describes CSA as farming that sustainably increases productivity, incomes and resilience (adaptation); reduces/removes greenhouse gases (mitigation) and improves likelihood of national food security and development goals. FAO (2013) identifies CSA as an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. The CSA approach is designed to identify and operationalize sustainable agricultural development within the explicit parameters of climate change. FAO (2013) adds that CSA contributes to the achievement of sustainable development goals by integrating the three dimensions of sustainable development (economic, social and environmental) to maximize the benefits and minimize the trade-offs by jointly addressing food security and climate challenges.

1.2 Aim and Objective of the Impact Assessment

The general objective of this survey is to assess the information and knowledge in scaling up CSA among smallholder farmers in Northern Uganda (Nwoya)

The specific objectives are;

- To generate evidence of the effects of climate change on communities.
- To identify the existing and accessible communication channels used by the farmers.
- To examine the approach of the CCAFS/IFAD project to help community to mitigate the effect of climate change.
- To examine if there are any lessons learnt that can be used in other projects.

1.3 Context and Importance of the Problem

Uganda has been described as one of the most vulnerable countries to climate change. Unreliable rainfall, frequent drought, precarious water supply, seasonal fires and endemic poverty are all major climate-related issues. Already it has been observed that during the period 1900 to 2000, the frequency of years with significantly below normal rainfall increased from once every 20 years to as often as once every five years, with severe impacts on agricultural production. In addition to

changes in rainfall patterns, consistent warming trends have been observed across the country and climate projections indicate that this trend is likely to continue.

Farmers in Uganda lack knowledge and skills pertaining to climate smart agricultural practices and conservation agriculture in particular. For purposes of knowledge dissemination, a comprehensive capacity development approach that builds on the sound assessment of the needs of all stakeholders is required. Within diversified extension service delivery there is a need to build the capacity of all NGOs and conservation agriculture implementing organizations with major emphasis on the extension directorate of the Ministry of Agriculture. It is through the extension system that the technologies reach the wider community.

However, Information is a powerful tool for enhancing adaptation to climate change and variability (Ngigi, 2009). However, African smallholder farmers either do not have access to appropriate information or are unable to fully utilize existing information. Successful adaptation requires recognition of the necessity to adapt, knowledge about available options, the capacity to assess the options, and the ability to choose and implement the most suitable ones (Lee, 2007). In terms of climate change, this can be demonstrated through acquisition and dissemination of information on weather hazards. Once such information becomes more available and understood, it is possible to analyze, discuss, and develop feasible adaptation measures.

2.0 COMMUNICATION AND KNOWLEDGE MANAGEMENT

2.1 Knowledge

There are three dimensions to sustainable development: social, economic, and environmental. Knowledge sharing is critical to supporting these dimensions, and extension and advisory services are a vital knowledge-sharing institution.

Since ancient times "Knowledge" is considered around basic and universal phenomena such as philosophy and religion. Knowledge appeared because of the human beings' needs; knowing, shaping, classifying and exposing in definite forms of their surroundings, nature and universe. Many philosophers emphasized the importance of knowledge since the time of Aristotle till today as well. Plato first defined knowledge as 'justified true belief', and this concept has been debated over the centuries by Aristotle, Descartes, Kant, Polanyi and others. So, knowledge is needed to be described again and its meaning is modified for the requirement of the present in different periods.

Typically, we can view knowledge traditionally. Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, and forestry." (Convention on Biological Diversity, 2006:n.p.)

Knowledge management has been widely studied in management literature. Although many studies have focused on this emerging discipline and discussed many different dimensions of this concept, there is still no one universally accepted definition for 'knowledge management' (Tsui et al, 2000). Most definitions, however, share the perspective that knowledge management is concerned with the collection and dissemination of knowledge to the benefit of an organization and its individuals (Lueg, 2001).

In agriculture, Knowledge-sharing mechanisms must focus on critical areas including protecting natural resources, productive farming processes, product development, marketing skills, nutritional needs, and household health. Knowledge sharing is a key to attaining the Sustainable development goals, in order to attain success in agriculture by using improved practices one has to have in-depth knowledge on all the practices. In Nwoya district, the farmer's had their believe on existing Knowledge (88.32, in the result below) which can be classified as traditional knowledge, these knowledge has been passed on from generations to generations, although from the study it was observed that some are still using the existing knowledge wisely while some does not use the traditional knowledge appropriately. Also knowledge is been passed on through training (demonstration plot, classroom, materials, pictorials, neighbor) which helps them to build capacity on climate responsive agricultural practices in order to mitigate the impact of climatic change condition.

Knowledge is an important tool to farmers because it helps them to understand the information disseminated, without knowledge in farming, agriculture cannot be improved, and therefore farmers should build up their knowledge capacity building.

> *"For the past 3 years that I have been farming, climate change has not affected my farm because when each season starts I plant on time such that before the calamity of climate change starts my crops are matured already. This is due to the existing knowledge I had."*
>
> OCAYA SAMUEL

2.2 Information

Information is a powerful tool for enhancing adaptation to climate change and variability (Ngigi, 2009). However, African smallholder farmers either do not have access to appropriate information or are unable to fully utilize existing information. Successful adaptation requires recognition of the necessity to adapt, knowledge about available options, the capacity to assess the options, and the ability to choose and implement the most suitable ones (Lee, 2007). In terms of climate change, this can be demonstrated through acquisition and dissemination of information on weather hazards.

Once such information becomes more available and understood, it is possible to analyze, discuss, and develop feasible adaptation measures.

Information on CSA on this project is passed through several sources as already stated below. Information is relevant in the aspect of getting to know the weather patterns, when to plant, how to adapt and mitigate and what type of coping strategy to be used. Without knowledge, there cannot be information and without information there is no communication. The three terms work alongside with each other.

2.3 Communication

The word 'communication' comes from the Latin word '*communis*', which means common. This means by communicating, we are trying to establish a connection with someone through a message. 'Communication' then is a conscious attempt to establish community over some idea, fact, feelings and the like, with others. Consequently it is also a process of getting a source and a receiver tuned together for a particular message or a series of messages.

Before one can communicate any idea or fact, a medium is necessary to be used either verbally or visually. The receiver of this information after listening to what has been communicated will then decode the information in the mind to make a decision if the information is useful or not, this decision is called the effect of communication. As a communicator, the reactions of the the receiver has to be observed in order to evaluate the effectiveness of the communication, this evaluation is called Feedback from the receiver which truly shows that the receiver understand the information being dissemination.

We can explain this whole process in the following way:

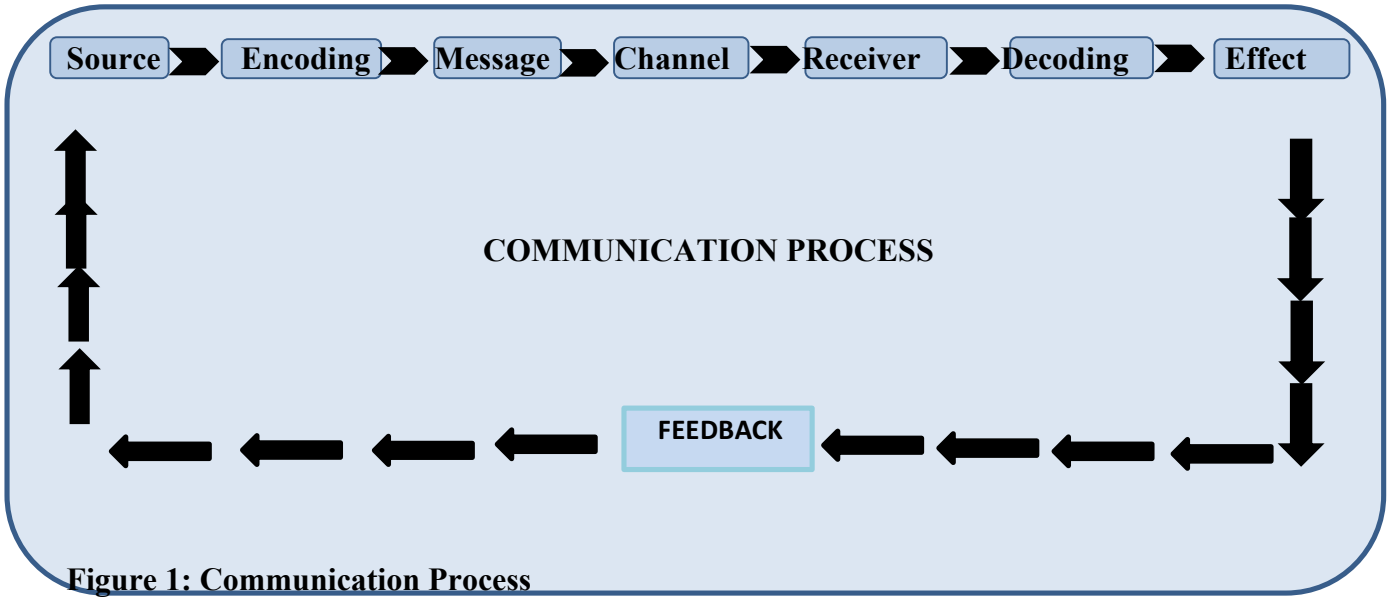

Figure 1: Communication Process

2.4 Importance of Communication in Agriculture

Communication has an important role to play in each type of development process basically in the Social, Economic, Environmental settings. Similarly in the development of a sustainable agricultural sector, communication is an important factor because it plays a significant role.

Agricultural information interacts with and influences agricultural productivity in a variety of ways. It can help inform decisions regarding land, labour, livestock, capital and management. Agricultural productivity can arguably be improved by relevant, reliable and useful information and knowledge. Hence, the creation of agricultural information (by extension services, research, education programs and others) is now often managed by agricultural organizations that creates information systems to disseminate information to farmers so that farmers can make better decisions in order to take advantage of market opportunities and manage continuous changes in their production systems. Therefore, there is a need to understand the functions and use of particular agricultural information systems in order to manage and improve them.

Röling (1988: 33) defines an agricultural information system as a system in which agricultural information is generated, transformed, consolidated, received and fed back to underpin knowledge utilization by agricultural producers. Accordingly, an agricultural information system consists of

components (subsystems), information related processes (generation, transformation, storage, retrieval, integration, diffusion and utilization), system mechanisms (interfaces and networks) and system operations (control and management). In addition, the analysis of the agricultural information system in a specific farming system which may provide the identification of basic components and structure of the system, the different sources of information used by different components in the system, the understanding of how successfully the system works and how to improve system performance (system management) (Demiryurek 2000). This approach is also useful to identify possible defaults and improve the coordination between components (i.e., information management).

In addition, the information exchange (communication) through networks among system components is critically important for successful technology generation and information transfers (Rogers 1995;et al). A communication network consists of interrelated individuals who are linked by patterned flows of information, and its analysis identifies the communication structure in a system (Rogers & Kincaid 1981). Rogers (1995) emphasizes that the exchange of information (communication) and its diffusion take place within a social system. Actors such as individuals, informal groups, organizations and subsystems are the members of the system and the structure of the social system and their actors or members' roles affect the diffusion process.

Agricultural information is an important factor that interacts with other production factors. Productivity of these other factors, such as land, labor, capital and managerial ability, can arguably be improved by relevant, reliable and useful information. Information supplied by extension, research, education and agricultural organizations helps farmers make better decisions. Therefore, there is a need to understand the functioning of a particular agricultural information system in order to manage and improve it (Demiryurek et al., 2008). According to the findings of (Maningas et al. 2000), information within the hands of the farmers means empowerment through control over their resources and decision-making processes. They noted that being an effective and efficient delivery system of essential information and technology services facilitates the clients' critical role in decision-making towards improved agricultural production, processing, trading, and marketing.

Food and Agriculture Organization (FAO) points out information which is very important for rural development, because it improves the income of farming communities which depends crucially upon raising agricultural productivity. Achieving sustainable agricultural development is less based on material inputs (e.g., seeds and fertilizer) than on the people involved in their use. For achieving

this there is a need to focus on human resources for increased knowledge and information sharing about agricultural production, as well as on appropriate communication methodologies, channels and tools.

2.5. Types of Communication Channels Used in Nwoya District

There were various communication channels used to disseminate information to the small-holder farmers in Nwoya district and they are divided into 2 phases which are the Mass media and Inter-personal communication channels.

MASS-MEDIA

The following are the existing and accessible mass media communication channels used to disseminate agricultural information to the farmers;

- Radio
- Television
- News paper
- Text messages
- Internet

INTER-PERSONAL MEDIA

The following are the existing and accessible inter-personal communication channels used to disseminate agricultural information to the farmers;

- Government extension
- Farmer's organization
- NGOs
- Agriculture service
- Agriculture fairs
- Demonstration
- Family
- Neighbors
- Existing knowledge

The result of the study shows that majority (92.62%) of the respondents indicated the use of radio to get information on weather information for use in their farm. The source equally provides farmers with information on market information. 6.82% of the farmer reported the use of television for information on agricultural activities while 13.17% indicated use of newspaper as source of information on their agricultural activities. Similarly, 5.04% and 2.15% of the respondents got information through text messages and internet sources respectively.

The use of radio as observed from the study points the easy access, yet affordability of the medium to the farmers. The source proofs to be effective with the farmers. The portability of radio makes it easy for the farmers to carry it along even to farms, helping them to keep up with programs of their choice and equally track agriculture market information and weather-related information.

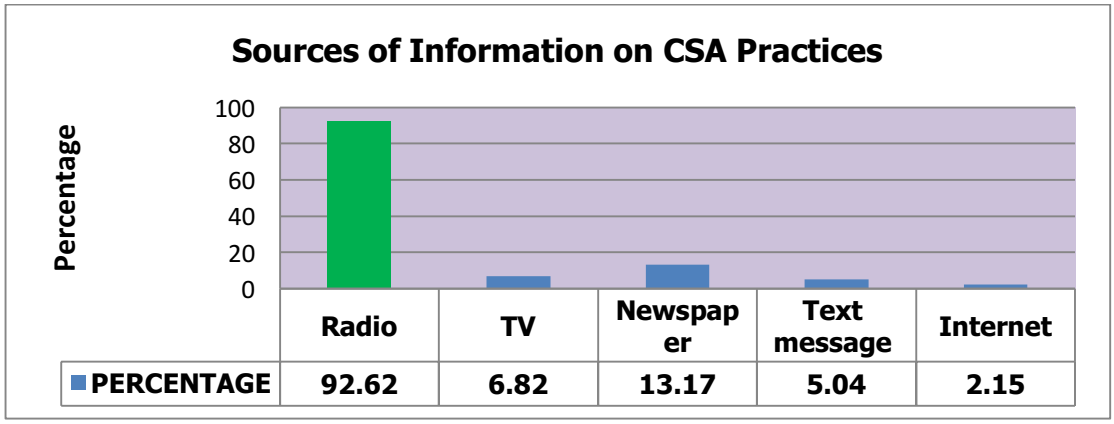

Figure 2: Sources of information on CSA practices

In the chart below, various inter-personal communication channels were used in getting information by the farmers in Nwoya district. This study indicated that Neighbor which is 95.14% is the highest source of inter-personal channel used in disseminating information to the framers. During the study it was observed that in each sub-county, a person represent them in order to be trained by the NGOs and in return he goes back to his sub-county to transfer the knowledge to his neighbors which they use also on their farms respectively. This is said to be an effective and more accessible inter-personal medium of transforming information.

Similarly, Family tends to be the next highest means of inter-personal communication channel (89.45). This is because it is easier for a family that is into agricultural business to do better than a

single farmer, simply because it involves the whole family members. In this scenario, either the head of the household or the spouse to the head will receive the training or information about agricultural related information, then will disseminate it to the rest of the household.

Existing knowledge is the indigenous knowledge that has been used since ancient days, these type of knowledge has been used by fore fathers and the present generations. Existing knowledge can never be wiped off from farmer's memory because that's what they have been used with and it sometimes pay them using it. As stated in the chat below, existing knowledge which is (88.32) has been stated as the next in line to the rank of inter-personal channels been used. Also, NGOs (60.69), farmer's organization (57.89), Government extension (37.72), agricultural service (33.99), demonstration (16.53), and agricultural fairs (10.55) have also contributed in disseminating information to farmers respectively.

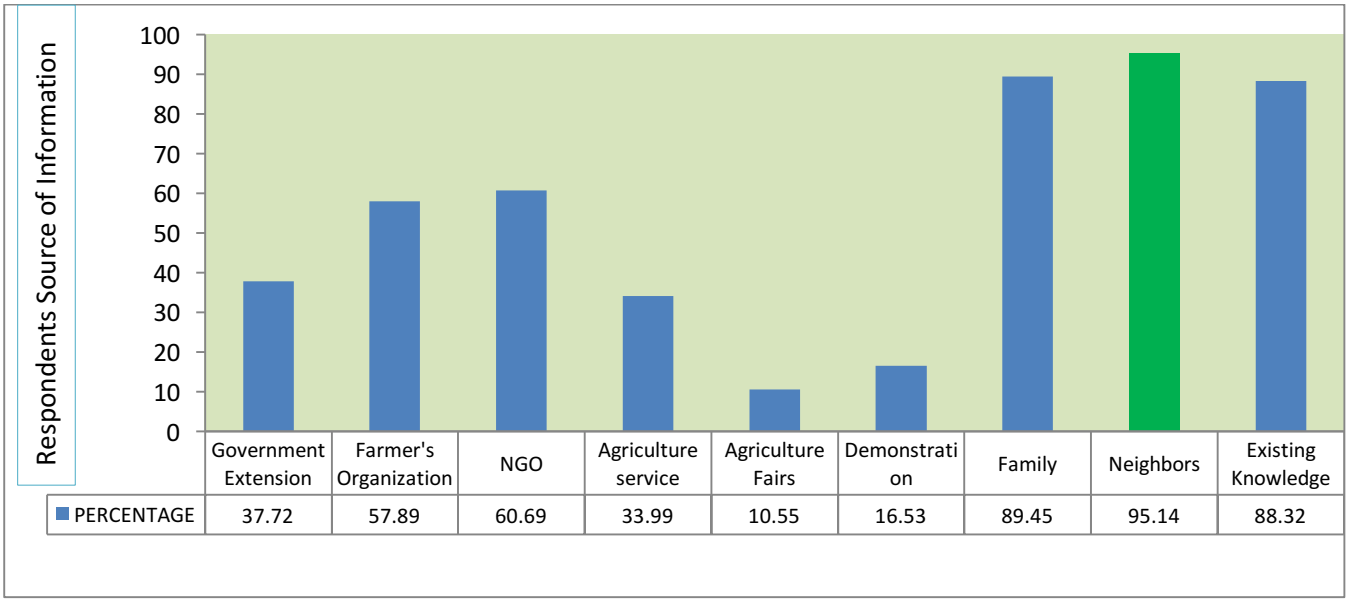

Figure 3: Stakeholders involved in information on CSA practice.

2.6. Channels of Communication Used By Gender

This information is extracted from the interview gathered from the farmers

Female

- Radio
- Husband's mobile phone

- Neighbors
- Farmer's group

Male

- Radio
- Mobile phone
- Newspaper
- Billboard
- Farmer's group
- Neighbors

2.7 Identified Challenges Associated with Sources of Information Used

Radio is the highest communication channel used by the farmers to access information on weather and market information. Though it is the most effective means but information gotten from radio sometimes is false as explained by farmers during the research.

Newspaper which follows the highest means is not really effective as seen in the chart above and this is because not all the farmers are literate, most of them have little or no educational background, therefore, newspaper is another source of disseminating information but it is not easily accessible and not effective in information dissemination.

Television is also another means of disseminating information but it is not as effective as radio because it was also observed that in most household television was not seen or used.

Most people doesn't have access to mobile phones, especially the female farmers, they normally rely on their spouse mobile phone to get information. If most of them doesn't have access to mobile phones then the text messages sent at any period wouldn't be useful to them here by not making mobile phone an effective means of communication.

Internet shows the lowest percentage of sources of information, this is because farmers doesn't have access to internet information due to lack of medium to access information and they are not yet enlightened towards that path.

The approach of using neighbor in a training of trainer program where certain farmers are selected and trained who afterward are to go back the community to step down the training aligns with best practice. Such approach helps to build local capacity, enhance buy-in and promote ownership and sustainability. Nonetheless, there are challenges that need to be strengthened as observed and indicated in the study. There are losses of information along the way because it is mostly rear to learn something from someone and impact that same knowledge to someone without subtracting or adding to the information initially gotten.

2.8 Description of the CSA Project

This study is within the IFAD-funded project titled "Increasing food security and resilience of farming systems and livelihoods to climate change in East Africa through wide-scale adoption of climate-smart agricultural practices." The International Center for Tropical Agriculture (CIAT) in collaboration with the International Institute of Tropical Agriculture (IITA) conducted a rapid appraisal on the CSA practices; this took place between 18th February and 1st March, 2014. The CSA-RA was carried out in four districts: Gulu, Nwoya, Kitgum, and Adjumani. The first three are part of the Acholi sub-region while the latter is in the West Nile sub-region. Selection criteria included encompassing the greatest variability in climate and topography as well as proximity to commercial centres and road networks.

The districts can be distinguished by ethnicity, with the Acholi people dominant in the Acholi sub-region and the Madi in Adjumani district. The CSA practice has been on going in Northern Uganda some years back through indigenous learning and transfer of knowledge. However, the practice were not implemented well by the farmers as they know little about the practice hereby not yielding enough yields for consumption and sale. Due to the climate change affecting this region severely, the main objective was to improve food security and income level in the targeted region.

Climate-smart agriculture (CSA) is defined by FAO (2010) as agriculture that sustainably increases productivity, enhances resilience of livelihoods and ecosystems, reduces and/or removes greenhouse gases (GHGs) and enhances achievement of national food security and development goals. CSA includes proven practical techniques such as mulching, intercropping, conservation

agriculture, crop rotation, integrated crop-livestock management, agroforestry, improved grazing and improved water management. CSA also involves innovative practices such as improved weather forecasting, early-warning systems and climate-risk insurance. CSA aims to get existing technologies off the shelf and into the hands of farmers, as well as to develop new technologies such as drought-tolerant or flood-tolerant crops to meet the demands of the changing climate.

As part of livelihoods and food security improvement, a multitude of agricultural development activities are conducted in Uganda, both traditionally and innovatively. Currently, agricultural development activities carried out in the country are supported by a number of policies, strategies and institutions. Of the numerous agricultural development activities conducted, mention should be made of those that are considered important in addressing issues related to climate change and are contributing to climate change adaptation and mitigation. Such agricultural practices in Uganda include many practices but mostly conservation agriculture.

2.9 Conservation Agricultural Principles, Practices and Technologies

Out of numerous CSA practice, 5 CSA practice was introduced in the sub-region, Nwoya. The practices are;

- ✓ Row planting
- ✓ Mulching
- ✓ Minimum tillage
- ✓ Intercropping
- ✓ Improved variety

- Row planting: This involves planting crops in straight line which has enough spacing between each crops for easy growth.

- Mulching: This is a process of using left over plant material which can be used to spread or laid over the surface of the soil as a covering, e.g grass, twigs, crop residue, straw etc. It is used to retain moisture in the soil, suppress weeds, keep the soil cool, and make the garden bed look more attractive. Organic mulches also help to improve the soil's fertility, as they decompose. Benefits of Mulch are;

- ✓ Protects the soil from erosion
- ✓ Reduces compaction from the impacts of heavy rains
- ✓ Conserves moisture, thus reducing the need for frequent watering
- ✓ Maintains a more even soil temperature
- ✓ Prevents weed growth
- ✓ Keeps fruits and vegetables clean
- ✓ Reduces GHG emissions from exposed soil surface

- Minimum tillage: This is a soil conservation system like Strip-till with the goal of minimum soil manipulation necessary for a successful crop production. It is a tillage method that does not turn the soil over. It is contrary to intensive tillage, which changes the soil structure using ploughs.

- Intercropping: This is the process of planting two different crops, though they are complementary crops on the same plot of land, either in a mixed row or strip intercropping system. It requires technical knowledge and spacing between crops. The benefit for practicing intercropping is production diversification, reduces risks of total crop failure, and reduces pest and diseases.

- Improved variety: These are seedlings that has been improved upon to resist the climate change and to help give a better yield compared to the traditional seeds. However, these seeds are said to be too expensive for some farmers because of the additional use of herbicides for the improved seeds.

"During the training, I learnt a practice that helped reduce the negative impact of climate change, which was mulching. Mulching helps to retain moisture in the soil for crops to germinate and yield well. Ever since I have been practicing it, it has really saved my crops from being destroyed by the weather".

ADONG FLORENCE

2.9.1 Socio-Economic and Environmental Impact of Conservation Agriculture

- **Environment, biodiversity and soils:** Conservation agriculture has a significant impact in reducing soil erosion through increased rainwater infiltration and buildup of soil organic matter for increased soil moisture storage. Conservation agriculture can improve biodiversity at farm and community level and support improved ecosystem services such as water and nutrient cycling. It can also support flood control through improved water infiltration in agricultural fields.
- **Climate change mitigation:** Evidence on conservation agriculture, greenhouse gas (GHG) emissions and carbon sequestration indicates that conservation agriculture can help mitigate climate change by reducing existing emission sources and sequestering carbon in soils and plant biomass. Baker *et al*. (2007) estimate that the conversion of all croplands to conservation tillage globally could sequester 25 Gt C over the next 50 years. This is equivalent to 1 833 Mt CO2-eq/yr, making conservation tillage among the most significant opportunities from all sectors for stabilizing global GHG concentrations. Scaling down these global estimates to the continental, landscape or plot scale to estimate the mitigation potential of conservation agriculture in sub-Saharan Africa entails considerable challenges. Overall there is insufficient information on the GHG impacts of conservation agriculture practices, especially for developing countries in the tropics and subtropics (Milder *et al*., 2011).
- **Soil fertility:** In terms of soil fertility, the improved soil structure resulting from conservation agriculture enhances aeration and other conditions required for efficient nutrient cycling. Soil organic matter has been found to increase significantly over time in conservation agriculture systems, primarily due to the introduction of additional organic matter as crop residues or mulch and to the reduction or elimination of tillage, which tends to accelerate the oxidation of soil organic matter (Hobbs *et al*., 2008; Kassam *et al*., 2009). Zero tillage systems are also associated with increased levels of available phosphorus in the upper soil layer (e.g. 0-5 cm), due largely to the role of biological processes in phosphorus cycling (Milder *et al*., 2011).

- **Water management:** Conservation agriculture has been found to have beneficial effects on water management and water-use efficiency. With an increase in soil organic matter and root density under conservation agriculture, water infiltration and water holding capacity are improved, making water more available throughout the farming cycle. Kassam *et al*. (2009) reported that for each percent increase in soil organic matter, an additional 150 m3/ha of water can be stored in the soil (Sintayehu et al, 2011). Surface mulches and improved soil pore structure also increase infiltration and absorption capacity, while reducing evaporation. These benefits help reduce the risk of erosion and flooding during heavy rains, contribute to aquifer recharge and make more water available for crops.
- **Food security:** Sustained and stable food production generated by conservation agriculture systems can significantly improve the food security and nutritional status of vulnerable households and communities. Conservation agriculture can help stabilize yields in the face of climate shocks such as droughts by reducing evapotranspiration and regulating soil temperatures as well as supporting the management of pests and diseases in crop production if appropriate crop rotations and combinations are used. These benefits are especially important for poor and vulnerable smallholder farming household.

3.0 METHODOLOGY

3.1 Timeframe of the Survey

The survey was conducted within three months which is the period of the researcher's internship program.

Table 1: Time Line for the Survey

S/N	Date	Activity
1	16th July	Arrival at Kampala
2	17th-21st July	IITA's office
3	23rd July-11th August	Field work
4	12th-16th August	Data entry, data analysis &report writing
5	17th August	Preliminary presentation
6	18th August	Departure

3.2 Description of the Study Area

Nwoya District is one of the newest districts in Uganda. It was established by Act of Parliament and began functioning on 01 July 2010. Prior to that date, it was part of Amuru District. The district lies in the Acholi sub region. It is bordered by Amuru District to the north, Gulu District to the northeast, Oyam District to the east, Kiryandongo District, Masindi District and Buliisa District to the south. Nebbi District lies to the west of Nwoya District. Nwoya, the main political, administrative and commercial centre in the district, is located approximately 44 kilometres (27 mi), by road, southwest of the city of Gulu, the largest metropolitan area in the sub-region. This location is approximately 330 kilometres (210 mi), by road, north of the city of Kampala, Uganda's capital and largest metropolitan area. The coordinates of the district are: 02 38N, 32 00E. The district is predominantly rural.

3.2.1 Nwoya's People & Livelihood

According to the National population and housing census (2014), the total population in Nwoya district is 128,094. Nwoya district has one livelihoods zone, which is the 'Agriculture livelihood zone', it is dominated by crop farming and less livestock farming. Its topography is relatively flat

characterized with streams, swamps, rocks and game reserves. Its vegetation is savannah characterized by long grass, thickets and trees of albizia species with a bi-modal rainfall pattern.

The main soil type in this district is the sandy loam with some areas having black cotton soils. The area has two agricultural seasons from March to June and August to November, the first rains of March to April characterize the main production season in the year. The main crops grown for food include; cassava, sweet potato, beans, groundnuts, sesame, sorghum and millet while those grown for cash include groundnuts, rice, maize, beans, sesame and to lesser extent cassava and millet. The main livestock products for home consumption in the livelihood zone are poultry and eggs, pork, meat, mutton and cow's milk. The livestock and livestock products mainly sold for household cash income includes poultry, pigs, goats, cow's milk and beef. Local farmers within the livelihood zone mainly practice subsistence farming and majorly labour on rich people's farms to meet their non-food needs. Poultry keeping is mainly associated with poorer households compared with piggery, goats, sheep and cattle which are a domain of the wealthier households. The Zone is sparsely populated except at trading centres, where it is densely settled.

This district is not far from the main markets of Gulu and Pakwach with local markets running on weekly basis while other run on a day to day basis. There are very many middlemen who exploit the small holder farmer by offering low prices in their raw produce since they do not bulk for sale. The main constraints to development of livelihoods include poor feeder road conditions and limited access to markets including inadequate marketing infrastructure. Overall main hazards in the area include human and livestock diseases.

3.3 Sampling method/Sample Location

The study area covers three sub-counties in Nwoya district, Northern Uganda;

Table 2: sample Locations

Sub-region	District	Sub-counties
Acholi	Nwoya	Anaka, Purongo and Alero

The study followed purposive sampling methods. District and sub-counties visited were purposively selected and Informants were purposively selected from these sub-counties on the basis of farmers who participated in CSA demonstration and gender survey project.

Sample size was 9 farmers, 5 focus group discussion (male and female) and 3 resource personnel (with these from each Sub-county) Anaka- 3, Alero- 5 Purongo -1, Resource personnel-3.

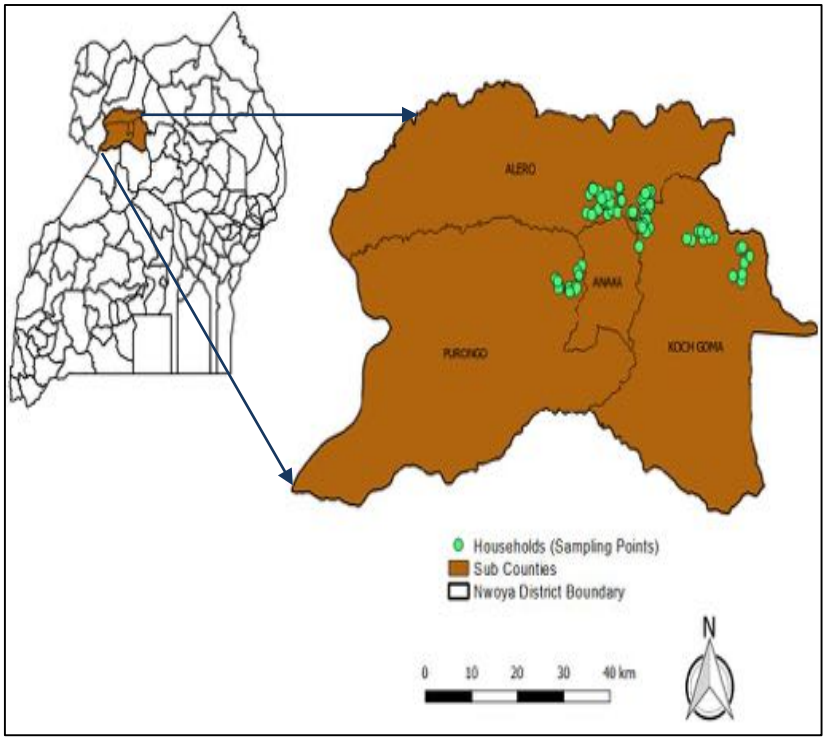

Figure 4: Map of Nwoya district

3.4 Sources of Data/Data collection methods

The study lead worked in cooperation with an IITA officer based in the area of study and with local experts, including Town council agricultural extension officer, ZOA staff, farmer's organization who was engaged in the scaling up of CSA and development of data collection. A combination of methods was used to collect both primary and secondary data, namely: secondary data review (journals, reports, newsletters, base-line survey, published research works, internet and books), focus group discussion, and key informant interviews, individual farmers' interviews, semi-structured questionnaires, observations and participatory impact assessment (PIA).

Adopting a mixed-method evaluation design, quantitative and qualitative data collection methods were used. Semi- structured Questionnaires were in the form of some guiding interview questions which was asked by interviewing few farmers from each sub-county. Interview guiding questions will be shown in Annex.

Meeting with farmers groups and other stakeholders in the study area were facilitated by personnel of CIAT and IITA. The focus group discussions and interviews with beneficiaries were conducted by the researcher through an experienced interpreter.

Secondary Data Review

A preliminary review was made in order to capture a better understanding of the Climate smart agricultural practices, to have a better view on the advantages and disadvantages of the practices towards farming activities of the farmers in Northern Uganda, Nwoya. This study examined the relevant literature such as reports published on CSA practices by CIAT, IITA, NGOs. The outcomes of these studies were used to do a preliminary mapping of the relevant CSA practices and helped identify its specific constraints.

Focus group discussion

In each selected sub-county, the focus group discussion was divided into 3 groups, comprising of male farmers, female farmers and the youth farmers. In each group comprising of minimum 6 farmers which in total 30 farmers was involved in the FGD. Focus group discussion was conducted closely with an IITA staff in the field. This cooperation helped organizing and facilitating the meetings with the farmers.

Data Analysis

Data was collected and analyzed both qualitatively and quantitatively. Qualitative analytical methods included the compilation and classification of the collected information from the farmers and personnel while the quantitative analytical methods involved the use of communication media for dissemination of information to compute the most available and effective.

4.0 RESEARCH FINDINGS

- In this study, it was observed that Climate change really affected farmers activities negatively in terms of their crop produce. Majority of the farmers that was interviewed bitterly complained how their groundnut crop has refused to increase because of drought

instead they get little or nothing from their farm to sell or to consume. Also the change in weather has discouraged the youths from going into farming business because they believe it cannot pay them off, so they rather embark on small scale businesses which brings them little income for survival.

- Though the farmers have had traditional knowledge of these practices but were not practicing it correctly due to lack of knowledge. After CSA practices was introduced to them by the NGOs here by training them using a demo plot, the CSA practices has turned very effective for them in terms of improved yields and income for their basic needs and want. Mulching was proved to be the most effective CSA practice in reducing the negative impact of climate change in their agricultural system.

- However, in this study, observation was made that there is still need for more adequate training in this project area for the smallholder farmers and appropriate information in implementing these CSA practice effectively because during the demonstration, few farmers were selected from each sub-county, they were being trained in the demo and the idea is to also teach their fellow farmers in their sub-county. It was clearly observed that there was loss of information along the line because during the interview with the farmers, it was noticed that all the farmers were practicing the same CSA practices which didn't include all. So therefore it was what the leader finds interesting that he taught other farmers hereby not giving them the full information.

- In this research study, the existing and accessible mass media and inter-personal communication channels used by farmers are mass-media (Radio, Mobile phone, Newspaper, Bill board) and inter-personal (Mulching has been an effective CSA practice in reducing the negative impact of climate change). It was proved that farmer's most accessible mass-media communication channel was Radio and the most accessible inter-personal communication channel used by farmers was Neighbors.

5.0 CONCLUSION

- This study showed that many farmers were not practicing all the CSA practices because of inadequate training gotten from their co-farmers.

- There was loss of information in the process of training some selected farmers who trained other farmers.

- Study showed that their most used mass-media communication channel is radio but the messages being disseminated about the weather are not reliable a times. Also their most used inter-personal communication channel is Neighbor.

5.1 LIMITATIONS OF THE STUDY

The study encountered a number of difficulties along the field work

- ✓ Time constraint: there was no enough time for data collection and proper analysis before the preliminary presentation as there was little I could present on. Also, I and my team were supposed to have a training at CIAT, Kenya, to have an idea on what information we are to gather from the field but due to the limited time, we were not able to meet up which caused a loop hole in the research carried out.
- ✓ Language barrier: although there was an interpreter during the interview section but it was still discovered that the interpreters didn't understand English deeply as they were still giving information that were not accurate, this also wasted time.
- ✓ Lack of access to the project baseline report: the baseline report was not released even after we carried out the research. This limited the access of some information.
- ✓ Data collection: interviewing the right farmers was a little bit difficult because I was in search of farmers that participated both in the gender survey project and the CSA project.

5.2 RECOMMENDATION

- Strengthen local government funding and capacity for implementing climate change adaptation.
- Enhance content and pace of dialogue between national level and meso-level policymakers on climate change adaptation.
- Create opportunities for local governments to collaborate in response to the trans-boundary nature of climate change.
- Better understanding of who are vulnerable to climate change and tailor adaptation to
  Produce regular CSA information and communication materials for key stakeholders to support and inform policies, planning and agricultural advisory services.

- Produce CSA information and communication materials to strengthen capacity of researchers, private sector, CSOs and farmer organizations to influence policy.
- Develop practical and applied training materials and packages for training on CSA.
- Support the development of a communication strategy and communication tools on CSA.
- Make an inventory of available materials at all levels
- Strengthen CSA knowledge and information sharing networks/forums.
- Develop a portfolio of information sharing technology tools to support sharing of CSA information and learning resources.
- Establish CSA knowledge partnerships on knowledge generation, sharing and mobilization with governments, international organizations, research institutions, farmer organizations, private sector and civil society organizations.
- Support establishment of regional CSA learning/ demonstration centers.

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