EFFECTIVENESS OF AGRICULTURAL EXTENSION SERVICES AMONG SMALLHOLDER FARMERS IN HOIMA DISTRICT

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KAIJA Catherine
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Supervisor: Lubega Gerald

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DEDICATION

This Research is dedicated to: My late father Mr Phenehas Kaijabahoire for the encouragement he gave me to study to attain the best in life. Without your love and unconditional commitment and support it would be impossible for me to get where I am today.

It is also dedicated to my beloved children Timothy, Arthur and Laura for the endurance during the research study.

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LIST OF ABBREVIATIONS

ATAAS	–	Agricultural Technology and Advisory Services
FAO	-	Food and Agricultural Organization
ILO	-	International Labor Organization
MAAIF	-	Ministry of Agriculture Animal Industry and Fisheries
Mt	-	Mountain
NAADS	-	National Agricultural Advisory Services
NARO	-	National Agricultural Research Organization
OWC	-	Operation Wealth Creation
PMA	-	Plan forModernizationof Agriculture
PRA	-	Participatory Rural Appraisal
PWDS	-	People with Disabilities
SPSS	-	Statistical Package for Social Research
Tacc	-	Territorial Approach to Climate Change
AES	-	Agricultural extension services
UBOS	-	Uganda Bureau of Statistics

ABSTRACT

This study assessed the effectiveness of agricultural extension services among smallholder farmers inHoima District. The specific objectives of this study were:

I) To determine the contribution of agricultural extension services on adoption of new technologies among farmers in Hoima district.

II)To examine the effect of agricultural extension services on improved crop yields among smallholder farmers in Hoima district.

II)To assess the contribution of agricultural extension services on adoption of agronomic practices amongsmallholder farmers in Hoima district.

A descriptive research was used where both qualitative and quantitative methods were used for data analysis**.** Questionnaires and interviews were used as major instruments for data collection. The study found out that agriculturalextension services had not significantly improved on adoption of new technologies ($r=.744$, $p<.01$). On the influence of agricultural extension services on yield in crops, a bigger proportion of farmers indicated having realized enhanced crop yields and improvement in the quality of crop produce which was a result of better crop technologies and contact with extension service providers through the agricultural extension services. However the study findings show that the contribution of agricultural extension services to improved crop yields was not significant ($r= -.643$, $p<.01$). On the effect of agricultural extension services on adoption of agronomic practices, findings indicated that agricultural extension services had not effectively improved on adoption of new agronomic practices ($r=.511$, $p<.01$).

The overall findings indicate that much as the Operation Wealth Creation Programme seem to have provided support in form of technologies to farmers and communities were well mobilized to participate in training activities offered by extension agencies, agricultural extension services did not seem to improve the quality of extension contact yet the major objective of the approach was to better the quality of technical advice provided and to make extension messages more widely disseminated through the contact-farmer approach. The study recommends that the government should urgently improve the quality of extension services and consequently technology adoption and productivity, through joint efforts by MAAIF, NAADS program managers and the local governments.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study assessed the effectiveness of agricultural extension services (AES) amongsmallholder farmers in Hoima District. Specifically, the studyfocused on the initiatives under the Operation Wealth Creation (OWC)programmeaimed at leading to adoption of improved technologies and farm production practices with an aim to realize increased crop yield that would lead to improved livelihoods amongst small holder farmers in Hoima District.The effectiveness of AES was measured based on the level of technology adoption,use of new agronomic practices by farmersand improvement in crop yields.

This chapter covers the background of the study, the problem statement, the research objectives (general and specific objectives), the research questions, and the scope of the research, the significance of the study, justification and the conceptual framework of the study.

1.1. Background of the study

Agricultural extension is defined as the entire set of organizations thatsupport and facilitate people engaged in agricultural production to solve problemsand to obtain information, skills and technologies to improve their livelihoods and well-being. Extension services are provided by different agencies in the public, commercial and voluntary sectors (Akinnagbe&Ajayi, 2010). Akinnagbe and Ajayi (2010) viewed extension as a service to“extend” research-based knowledge to the rural sector to improve the lives offarmers. It thus included components of technology transfer, broader rural development goals, management skills and non-formal education. The traditionalview of extension in Africa was very much focused on increasing production,

improving yields, training farmers and transferring technology. Today'sunderstanding of extension goes beyond technology transfer to facilitation; beyond training to learning and includes assisting farmers to form groups, dealing with marketing issues and partnering with a broad range of service providers and other agencies (Davis, 2008).

In Uganda, agriculture extension services play an important role in enhancing food security, poverty reduction and ruraldevelopment (FAO, 2003). In 2014, agriculture accounted for approximately 25 percent of Uganda's Gross Domestic Product (GDP), representing more than 40 percent of the country's exports (MoFPED, 2014). The contribution of AES has been determined at 11% among smallholder farmers (MAAID, 2016). Furthermore According to ILO 2007, about 60% of African labor force still derives their livelihood from agriculture making it the largest employer in most developing countries.In the 1990s, developing countries, including Uganda, witnessed wide-ranging reforms in the agricultural sector. In Uganda, these reforms include among others, liberalization of trade in agricultural inputs services and output; privatization of state-owned enterprises that supported production and marketing; and downsizing of civil servants who provided extension services. The reforms had both positive and negative consequences(Republic of Uganda, 1997).

Some of the negative effects of the reforms were income inequality and an increase in the proportion of the very poor in the early 1990s; the collapse of public extension, credit and marketing services (Semana, 2004); and falling agricultural productivity, according to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF, 2010). The Sector culminated in 2001 with the establishment of the National Agricultural Advisory Services (through an Act of

Parliament, the National Agricultural Advisory Services Act of 2001) as a semi-autonomous agency of the MAAIF. This was intended to manage the 25-year National Agricultural Advisory Services (NAADS) program. In the Private Public Partnership arrangement, the government contracted out extension service provision to private individuals and agencies, which were hailed as an efficient means of delivering services to only those farmers who would demand the service, hence creating a demand-driven extension system that would minimize costs (WorldBank 2001).

With emergence of NAADs, a number of practices through agricultural extension services began and these included, training smallholder farmers the importance of adopting new technologies, obtaining increased crop yields and adoption of agronomic practices (MAAIF, 2015). Given that NAADS was a long-term program, its implementationwas planned to take place in phases. The firstphase of its implementation was originally designed tolast seven years (2001-2007), at a cost of $108 million,but the project stretched on to June 2010. The secondphase of NAADS (July 2010-June 2015), under theAgricultural Technology and Agribusiness Advisory Services(ATAAS) project, which cost at least $450 million. Besides NAADS, the ATAA S project had another component focusing on agricultural research as well as joint activities on research and extension and this was done in conjunction with NARO, and the whole project cost $666 million (Okoboiet al.,2013). The total budget for implementing the current NAADS Strategic plan 201/16- 2019/20 as projected in the Medium-Term Expenditure Framework (MTEF) is UGX 1,682,136,000,000 (MAAIF 2017). Despite the attention and resources devoted to the interventions to support households in accessing technologies and extension services to improve productivity and their welfare, there is limited information on the impact these interventions have made on farming communities. The scarcity of information has heightened

public concern regarding the effectiveness of the program in augmenting household productivity and incomes. This was particularly significant considering general speculation regarding the quality of services offered under extension Vis a Vis the improved support to Extension staff under the agricultural extension system.However, the researcher was interested to establish whether training of farmers in extension services had caused an impact on improved agricultural practices among smallholder farmers in Hoima district.

1.2 The problem statement

The government of Uganda through the plan for the modernization of agriculture (PMA) enacted the NAADs act in 2001 as one of the seven pillars with a mandate to increase farmer access to information,knowledge,and technology for increased and market oriented production through effective,efficient,sustainable,and decentralized extension system. It was later directed to coordinate implementation of the OWC Programme aimed at contributing to rapid reduction of poverty and enhance transformation of the economy while working with the Directorate of Extension in Ministry of agriculture Animal industry and Fisheries whose mandate is to provide extension services to farmers. It must be emphasized that agricultural extension services have been officially organized in the country since 1987,agricultural transformation has not been achieved. It is therefore envisaged that effective provision of agricultural extension services can bridge the productivity gap. For instance, the yields obtained among smallholder farmers remains below average. For instance, according to NAADS Annual Report (2015), crop yields among its customers had remained below average (42.8%) which is below the set target of 80% by NAADS among its farmers. The rate at which agronomic practices are adopted has also remained low whereby many smallholder farmers are still complaining for limited rainfall, pests and diseases, losses due to drought and many others(Action Aid Annual Report, 2018).

1.3 Objectives of the study

To assess the effectiveness of agricultural extension services (AES) on adoption of modern farm production practices among farmers in Hoima District.

1.3.1. Specific objectives

i) To determine the contribution of agricultural extension services on adoption of new technologies among smallholder farmers in Hoima district

ii) To examine the contribution of agricultural extension services on improvement of crop yields among smallholder farmers in Hoima district

iii) To assess the contribution of agricultural extension services on adoption of agronomic practices among smallholder farmers in Hoima district

1.3.2. Research questions

i) What is the contribution of agricultural extension services on adoption of new technologies among smallholder farmers in Hoima district?

ii) What is the contribution of agricultural extension services on improvement of crop yields among smallholder farmers in Hoima district?

iii) What is the contribution of agricultural extension services on adoption of agronomic practices among smallholder farmers in Hoima district?

1.4. The scope of the study

1.4.1. Content Scope

The study focused on the effectiveness of the agricultural extension services amongstsmallholder farmers in Hoima District particularly considering the knowledge and adoption of new technologies, the influence of the agricultural extension services on increased yield in crops, and the effect of agricultural extension serviceson diffusion and transfer of improved agronomic practices.

1.4.2 Geographical Scope

The study was carried out in three sub counties ofKigorobya, Kitoba and Kyabigambire ofHoima District. This area was chosen due to its history of being among the sub counties in Hoima district to pioneer the implementation of the NAADs program and have since received a lot of technologies under the OWC Programme. It was against this the researcher found it necessary to establish the fate of technologies given out to communities in the area under study.

1.4.3. Time Scope

The study focused on the period between 2009 and 2018 when distribution of technologies to farmers in Hoima district was done under different government programmes including the OWC.

1.5. Significance of the study.

The findings of the study may be useful to the extension workers on issues of disseminating technology to farmers while considering the right extension approaches.

It is hoped that the study yielded data and information that may be useful for proper planning and decision making at the Ministry level to develop an approach that best suits the farmers in order to accelerate adoption of technologies.

It is hoped that the research may contribute a lot towards the district and the lower local governments(LLGs) in finding out the best approaches to co-opt in the field by the respective extension staffs in the field.

Furthermore, the outcome of this research may act as the tool for the local governments and the nongovernmental organizations (NGOs) in formulating strategies of encouraging farmers to adopt improved technologies in order to meet the ever-increasing demands for food and livelihoods by the ever-increasing population in the area following the oil exploitation activities.

The results of this research study may act as the guide to the interested parties such as researchers who may want to carry out deeper analyses in specific factors as far as extension methods are concerned.

1.6. Justification of the study

It should be noted that the overall development objective of the NAADSextension system was to assist poor male and femalefarmers become aware of and be able to adapt to improved technologies and management practices in theirfarming enterprises so as to enhance their productiveefficiency, their economic welfare and the sustainabilityof farming operations (World Bank 2001). In particular,according to the legal act that established the NAADS program was to pay more attention to women, peopleliving with disabilities (PLWDs) and young people who were considered to be those most affected by theeconomic reforms of the 1990s (Okoboi et al,2013)**.**Therefore, this study was carried out to provide information on the effectiveness of agricultural extension services on adoption of improved farm production approaches among smallholder farmers particularly focusing on the Operation Wealth Creation of the NAADS Programmein Hoima District.

1.7. Conceptual framework

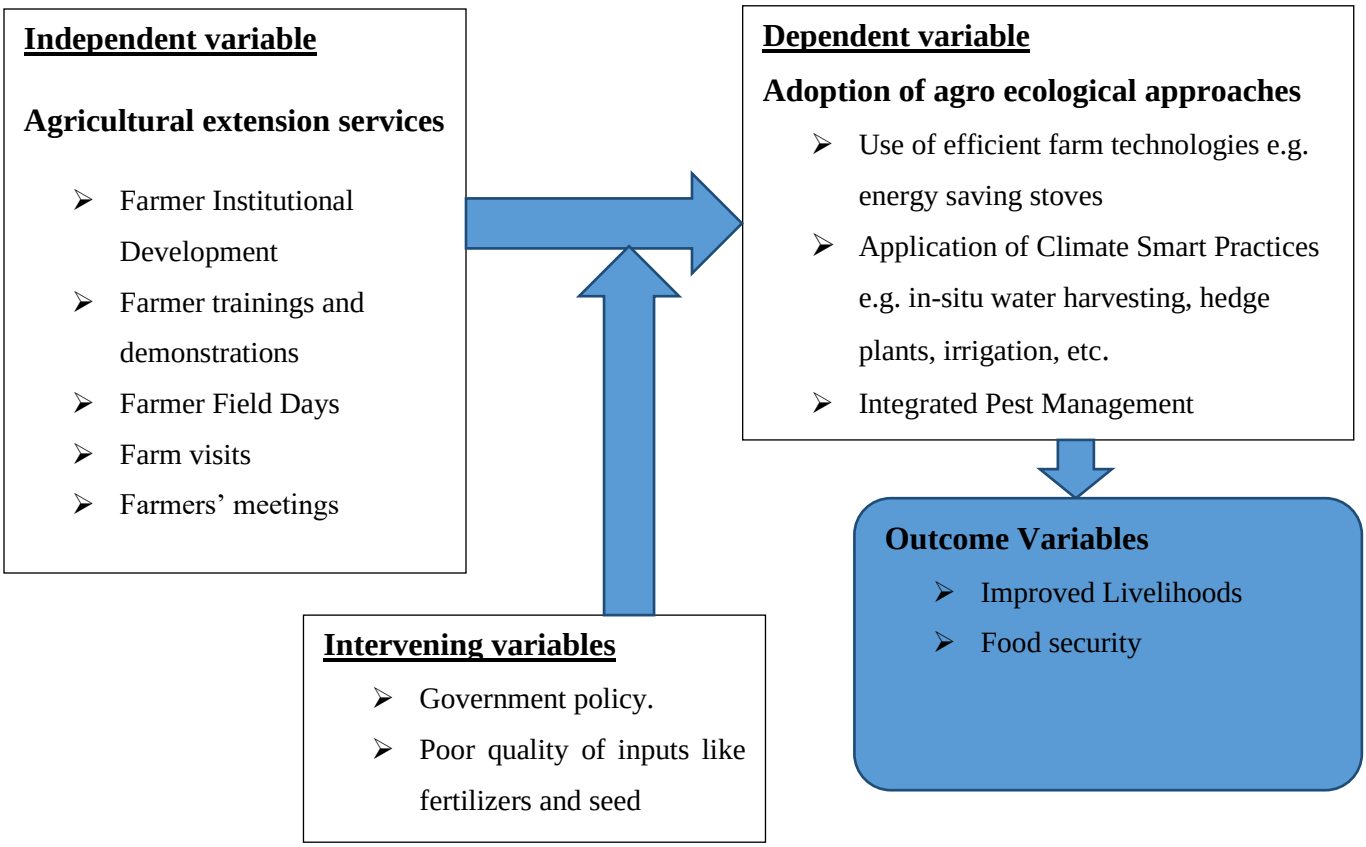


Figure 1: Conceptual framework

From the conceptual framework in the figure 1 above, adoption of agro ecological practices such as the use of modern and efficient farm technologies like energy saving stoves,application of Climate Smart Agriculturalpractices like in-situ water harvesting, drip irrigation,that are required to overcome water stress during drought periods;planting of hedge crops to augment ecological systems on-farm,and practicing of Integrated Pest Management (IPM) are practices that can lead to improved crop yields. These itemswere therefore treated as the dependent variables (DVs) while extension methods such asfarmer institutional development, farmer trainings and demonstrations, farm visits and meetingswere treated as the independent variables (IVs) because

the type of extension method employed certainly influences knowledge dissemination and adoption of technologies and practices under the OWC program in Hoima district. Theinteractive processes between the (DVs) and (IVs)ultimately translate to improved livelihoods and food security.

However, it is important to take to consideration the intervening variables such as government policies and quality of inputs made available,which if compromisedmightnegatively influenceknowledge dissemination and utilization by farmers.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter discusses the literature related to the effectiveness of agriculture extension services amongst smallholder farmers in Hoima District particularly focusing on adoption of technologies and improved agronomic practices under the OWC/NAADS program and influence on increased crop yield. The sources of literature reviewed include textbooks, reports, articles journals and other sources. The review is in themes, as per the objectives and lastly a summary of the whole chapter.

2.1 Theoretical framework

The study was guided by adoption diffusion theory (also diffusion of innovation, DOI) which provides the theoretical tools for exploring these links. DOI helps determine what could be important (which factors) and the why (how are these factors influencing decision making). Rogers (2003) outlines four major influences in the adoption process—the innovation itself; how information about the innovation is spread; time; and the characteristics of the society in which the innovation is introduced. Each of these influences speak to the specific context of the time and place of introduction. This framework provides an initial tool for assessing potential barriers. However, Rogers' (2003) theory of perceived attributes outlines specific areas of potential resistance to the adoption of an innovation: (1) perceived *relative* advantage; (2) compatibility; (3) complexity; (4) triability; (5) and observability. Use of this theory provides specific options for targeted and proactive troubleshooting. Each of these areas is intimately tied to mechanisms for mitigating farmers' perceptions of risk associated with the innovation and are influenced by the types and delivery methods of information.

This theory further argues that access to information on agricultural innovations is one of the most critically examined aspects of adoption and diffusion, especially in the developing world (see Rogers 2003; Napier and Cockerill 2010; Simpson 2015). Increased access to information and improved knowledge on the use and potential benefits of a technology allow farmers to properly assess, and to some extent mitigate, the (potential) risk associated with adoption of new innovations (Schultz 1964; Bandiera and Rasul 2006; Foster and Rosenweig 1995; Moser and Barrett 2006). Information, both theoretical (textbook, oral presentation, etc.) and applied (demonstration, on-farm trial, farmer field days), is critical to overcoming complexities associated with using the innovation, and accurately assessing its advantages and ability to meet famers' needs (Rogers 2003). Perhaps most important is the ability of farmers to see the new innovation in action—the ability to try the technology or process before committing scarce resources and observe tangible benefits are important to long-term and systematic adoption of the practice (Rogers 2003). Weir and Knight (2000) and Krishnan and Patnam (2012) noted the ability to observe neighbors using the practice, successfully, was particularly important for less educated farmers in Ethiopia.

2.2. Agricultural extension services on adoption of new technologies

There exist vast literatures on factors that determine agricultural technology adoption. According to Loevinsohn et al. (2013), farmers' decisions about whether and how to adopt new technology are conditioned by the dynamic interaction between characteristics of the technology itself and the array of conditions and circumstances. Diffusion itself results from a series of individual decisions to begin using the new technology, decisions which are often the result of a comparison of the uncertain benefits of the new invention with the uncertain costs of adopting it (Hall and Khan, 2002). An understanding of the factors influencing this choice is essential both

for economists studying the determinants of growth and for the generators and disseminators of such technologies (Hall and Khan, 2002).Adoption refers to a decision by individual farmer to employ a new technology. Bohlen argued: “The adoption of a new idea or practice is not a simple unit act, but rather a complex pattern of mental activities combined with actions before an individual fully accepts or adopts a new idea” (Bohlen, 1964). For Buttel et al. (1990), the more complex an idea is, the more likely the farmers have to change their attitude and belief to receive timely information before adopting the innovation. In contrast, the easier an innovation is for farmers to test, the more likely the innovation will be adopted.

Loevinsohn*et al*., 2013 defines adoption as the integration of a new technology into existing practice and is usually proceeded by a period of‘trying’ and some degree of adaptation. Citing the work of Feder, Just and Zilberman (1985), Bonabana-Wabbidefines adoption as a mental process an individual passes from first hearing about an innovation to finalutilization of it. Adoption is in two categories; rate of adoption and intensity of adoption. The former is the relative speed with which farmers adopt an innovation, has as one of its pillars, the element of ‘time’. On the other hand, intensity of adoption refers to the level of use of a given technology in any time period (Bonabana-Wabbi 2002). Defining technology adoption is a complicated task since it varies with the technology being adopted. For instance, the study by Doss (2003), showed that adoption of improved seed in a survey done by CIMMYTclassified farmers as adopters if they were using seeds that had been recycled for several generations from hybrid ancestors. In other studies adoption was identified with following the extension service recommendations of using only new certified seed (Doss, 2003; Bisanda 1998; Ouma 2002).

Therefore, in defining agricultural technology adoption by farmers, the first thing to consider is whether adoption is a discrete state with binary response variables or not (Doss, 2003).

According to Van Den Ban and Hawkins (2009), the goal of extension is to ensure that increased agricultural productivity is achieved by stimulating farmers to use modern and scientific production technologies developed through research. Williams (2016) viewed extension as an out-of-school system of education for teaching farmers (adult, women and youths) how to raise their standard of living by their own effort using their own resources and providing them with scientific knowledge to solve their problems. For farmers to use or adopt the findings of research institute, there are a number of factors that influence the extent of adoption of improved practices such as characteristics or attributes of technology; the adopters or clientele, which is the object of change; the change agent (extension worker, professional, etc.); and the socio-economic, biological, and physical environment in which the technology take place Cruz (2017).

Farmers have been seen as major constraint in development process, adoption for them is viewed as a mental process which an individual passes through in deciding to use an innovation. (Cruz 2017). Koppel (2018) opined that the predominant role of technology is facilitating major improvement in agriculture productivity. Therefore, it is important to know how farmers perceived improved practices for better understanding of their choice in decision of adoption or not. Improved practices are one of resources for agricultural production. According to Ingold(2012), transfer of technology is that which embraces all efforts to make sure that the farmers adopt new technology. He stressed the fact that for transfer of technology to occur, it must embrace inputs, support, advice and other essentials so that the farmer would have no

reason to reject the technology. For any innovation or technology to be adopted, Van Den Ban and Hawkins (2009) opined that it must pass through a process of adoption, which involves awareness, interest, evaluation, trail and adoption. The success of the adoption process depends very much on effective training by extension agents. Effectiveness of training is determined by the methods and techniques used. Different media can be used in training the farmers.

These include farm or home visit, farmers meetings, use of radio, television, video tapes, process demonstration, and flip chart. Farm or home visit creates room for interpersonal communication (Nnadi and Akwiwu, 2015). It gives the farmers liberty to ask and answer questions for further discussion or verification of ideas, process, etc. Farmers' meetings have the advantages of creating opportunity for farmers to interact among themselves and aids adoption of improved farm practice. Radio, television, tapes (audio and visual) can be used to reach out to a large number of target audiences at the same time, but it has the disadvantage of lack of feedback.

Method of training farmers according to (Nnadi and Akwiwu, 2005) varies from practical demonstration to result demonstration, the use of drama, photographs, film shows, tapes, tours, group discussions, conferences, etc. It may involve a combination of more than two methods for effective training to take place. In order to promote food and raw materials production, extension approach had to be modified. From this modification, the training and visit approach evolved. This entails training the farmers in groups, members of this group train other farmers on the improved extension training innovations. This effort is to create desired change in the behavior of farmers. In spite of these efforts, which are expected to result to increased food production, farmers continually lack ways to improve their own processes. The result of this study may be a

guide to extension service management in their training policy design and training program designing in the future.

The effectiveness of a training program depends not only on the number of farmers that receive information but also on how successful that approach and or methods influences farmers' decision to adopt a given technology (Ricker-Gilbert *et al*., 2018; Doss, 2016). Different technologies have different attributes of knowledge and information requirement sets. These sets are likely to objectively determine the types of methods used in sharing them for use, if the adoption of the technology in question is to succeed. For relatively 'knowledge-based' innovations like PPT1, the uptake is likely to depend on how extensive and intensive farmers are trained and the effectiveness of approach employed (Padel, 2011). If ineffective methods are used, farmers are likely to spend more time searching for more relevant information thus increasing the information search costs. This, therefore, implies the need to evaluate the effectiveness and efficiency of the methods being used in order to isolate the ones which are not only effective but also efficient, contingent on resource availability. Given that information is packaged and presented differently in different ways, there is likelihood of variations on the effects these methods could have on technology adoption (Daberkow and McBride, 2011; Mauceri*et al.*, 2015).

Furthermore, it has been found that adopters of improved technologies increase their productions, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as

earnings for landless laborers (Kasirye, 2010). Adoption of improved technologies is believed to be a major factor in thesuccess of the green revolution experienced by Asian countries (Ravallion and Chen, 2004; Kasirye, 2010).Onthe other hand, non-adopters can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation (Jain *et al.*, 2009).

2.3. Agricultural extension services and increased yield in crops

According to Mahmood (2005), extension services have developed theories, approaches and methods which have assisted many farms and ranches in adopting management system frameworks such as dairy herd improvement programme, irrigation, water management, feed management and integrated pest management. These existing frameworks have facilitated the transformation of rudimentary agricultural practices into modern one for increased farm yields. Although agriculture extension has been implemented in over time, there has been surprisingly little rigorous evaluation of its effectiveness. Some qualitative evaluations have questioned the approach as being 'top down ‘and lacking a means for organizing farmers to express their own demands for extension advice (Axinn, 1988; Roling, 1988).

Other studies have noted problems in implementation of agricultural extension services, especially the choice of contact farmers (Moore, 1984), poor research-extension links (Chapman, 1988; Goodell, 1983), and weak linkages with farmers at the field level (Dejene, 1989). In other cases, the information content of extension messages given to contact farmers is not disseminated to neighboring farmers in the area (Luhe, 1991).Some studies have made quantitative assessment of the impacts noting improvement in the number of extension contacts (e.g., Dejene, 1989) and, in some cases, increases in technology adoption and yields (Dueet al., 1987). However on the other hand none of these studies has attempted to isolate the effects of

extension from the effects of other factors that may influence extension contact and adoption, or even to compare changes in technology adoption or productivity with the situation that might have prevailed in the absence of implementation of the agricultural extension services

The strong relationship between high agricultural productivity and poverty reduction is wide (see Datt&Ravallion, 2008; Salami et al., 2010). For instance, agricultural productivity benefit farmers through increased production, creation of employment opportunities or indirectly, boosting their relative wages or reducing food prices. In developing countries, investments in extension services have the potential to improve agricultural and increase farmers' incomes (Anderson &Feder, 2014). It is this fact that enormous investment, funding and policy reforms have been directed into agricultural extension in many developing countries. Rausser (2012) classifies agricultural policies into groups: those that correct market failures, lower transaction costs, or enhance productivity, and other policies that result from manipulation by special interest groups.

Anderson (2007) defines the terms agricultural extension and advisory services as "the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods" (Waddington *et al*, 2010). In its broadest sense, extension is an educational process with communication being its core component. The authors Van den Ban and Hawkins (2016) define the term extension as the conscious use of communication of information to help people form sound opinions and make good decisions. Moris (2011) defined extension as the mechanism for information and technology delivery to farmers. A more comprehensive definition of extension

service is given by the World Bank as a 'process that helps farmers become aware of improved technologies and adopt them in order to improve their efficiency, income and welfare'.

While there is considerable interest and efforts to understand the issues related to agricultural extension in developing countries and the literature is growing, rigorous impact evaluations of agricultural extension interventions are less common (Anderson &Feder, 2004). The impact evaluation face a wide range of difficulties including how to control for factors that influence agricultural outcomes such as agro ecological climate, weather events, availability and prices of inputs, market access, farmers' characteristics, and so on. Furthermore, impact evaluation of extension impact is undermined by a number of inherent methodological challenges such as endogenous placement bias, selection bias and heterogeneity issues related to farm characteristics (see Birkhaeuser*et al.*, 1991; Owen *et al.*, 2001; Anderson &Feder, 2004; Cerdán-Infantes*et al.*, 2008; Betz, 2009). The empirical literature on the productivity effects of agriculture extension services from a number of studies is not conclusive. For instance, Betz (2009) has noted that previous studies on productivity effects of agricultural extension have varying results. The mixed results regarding the impact of agricultural extension on productivity is as a result of how the methodological issues of endogeneity, heterogeneity and measurement of productivity variable are addressed. Productivity - agriculture extension literature reveals a number of methodological challenges that make it difficult to make broad generalizations about the productivity effects of agricultural extension services (Odhiambo&Nyangito, 2003; Betz, 2009; Anderson &Feder, 2004; World Bank, 2011). For example, the available empirical research on the effect of agricultural extension services, show large positive rates of return to extension services (CerdánInfantes*et al.*, 2008). However, in the absence of random assignment

to treatment and control groups, this methodology is likely to provide biased estimates of causal effects, due to endogeneity of program participation and the presence of unobservable characteristics that might determine participation and be correlated with the outcome variable (see e.g Betz, 2009, Cerdán-Infantes*et al.*, 2008, Dercon*et al.*, 2008, Owen *et al.*, 2001).

Nevertheless, Evenson&Mwabu, (1998) argued that previous studies on extension effects of farm yields have ignored an important policy issue that farmers may be affected differently by extension service due to their unobserved personal endowments such as cognitive and physical abilities. Evenson and Mwabu's study addresses this issue using quintile regression, although without controlling for endogeneity problem. However, using either meta production function or the total productivity index, previous studies that have addressed the relationship between agricultural productivity and extension services have mainly used the traditional ordinary least squares (OLS), instrumental variable (IV) approaches, propensity matching scores (PMS), quintile regression and treatment analysis. Both OLS and IV are designed to estimate the mean or average causal effect of agricultural extension on productivity. This provides the researcher with an estimate of how efficient an improvement in access to agricultural extension workers is at boosting the production of the average farmer. There is enough evidence that the use OLS fails to account for the heterogeneity in the effect of agricultural extension services on farm output as well as the bias introduced due to the endogeneity of agricultural extension services. Therefore, the widely used strategy to address the selection bias and identify heterogeneous treatment effects has been instrumental variable estimation (Xie et al, 2011, Heckamn et al, 2006). This procedure involves identifying a variable that affects assignment to treatment exogenously but affects the outcome only directly through treatment.

2.4 Agricultural extension services andagronomics practices

Technology diffusion is the Spread of new technology use within a given geographical area or population. Loevinsohn*et al*., 2013 define technology as the means and methods of producing goods and services, including methods of organization as well as physical technique. According to these authors new technology is new to a particular place or group of farmers, or represents a new use of technology that is already in use within a particular place or amongst a group of farmers. Technology is the knowledge/information that permits some tasks to be accomplished more easily, some service to be renderedor the manufacture of a product (Lavison 2013). Technology itself is aimed at improving a given situation orchanging the status quo to a more desirable level. It assists the applicant to do work easier than he would have inthe absence of the technology hence it helps save time and labor (Bonabana-Wabbi 2002).Traditional research on diffusion puts farmers at the center of the diffusion process.Goss (1979) argued that traditional systems tended to hold farmers responsible for their actions in adopting an innovation. Understanding the nature of the innovation diffusion process in agriculture and the factors that affect it helps predict the likelihood of adoption of an innovation. Without a good understanding of how an innovation and users interact in their own context before and during an innovation process, an attempt to transfer an innovation to the target users will likely fail. Unexpected consequences may arise as a result of that. Understanding of the process of innovation, as such, is useful for projecting whether a new technology will succeed (Sevcik, 2004).Rogers (2003) defined diffusion of an innovation as the "process by which an innovation is communicated through certain channels over time among the membersof a social system," whereas an innovation itself is "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003).According to Rogers, innovation diffusion is a type of

communication in which the new idea is expected to be diffused to the target audience to achieve a desired social change in the structure and function of a social system. In reality, however, other exogenous factors may affect the decision to adopt a new technology, irrespective of whether or not the technology is tested and its advantages (over an existing technology) are evident. Change agents and opinion leaders are two among those exogenous factors. A change agent refers to "an individual who influences clients' innovation-decisions in a direction deemed desirable by a change agency" (Rogers,2003,). Changeagents generally encourage adoption of a new idea.

Not surprisingly, access to information on agricultural innovations is one of the most critically examined aspects of adoption and diffusion, especially in the developing world (Rogers 2013; Napier and Cockerill 2010; Simpson 2015). Increased access to information and improved knowledge on the use and potential benefits of a technology allow farmers to properly assess, and to some extent mitigate, the (potential) risk associated with adoption of new innovations (Bandiera and Rasul 2016; Foster and Rosenweig 2015; Moser and Barrett 2016). Information, both theoretical (textbook, oral presentation, etc.) and applied (demonstration, on-farm trial, farmer field days), is critical to overcoming complexities associated with using the innovation, and accurately assessing its advantages and ability to meet famers' needs (Rogers 2013). Perhaps most important is the ability of farmers to see the new innovation in action—the ability to try the technology or process before committing scarce resources and observe tangible benefits are important to long-term and systematic adoption of the practice (Rogers 2013).

Weir and Knight (2010) and Krishnan and Patnam (2012) noted the ability to observe neighbors using the practice, successfully, was particularly important for less educated farmers in Ethiopia. The AIS, and specifically agricultural extension, has traditionally been the institutional response to information or knowledge barriers. As a "translator" of institutional knowledge, extension

agents facilitate the flow of information, reducing barriers to access (Rogers 2003). The current Ethiopian Extension System is implementing the National Agricultural Extension Intervention Program (NAEIP), a scaled-up version of the post-civil war system of Participatory Demonstration and Training Extension Systems (PADETES), which focused almost exclusively on technology transfer and cereal production (Gebremedhin et al. 2016; Speilman et al. 2012; Egziabher et al. 2013). NAEIP, which has been in effect since the mid-1990s, relies on the Extension Management and Training Plots model and input packages.

In this model farmers manage demonstration plots as educational tools for the community and extension agents and are supplied with agricultural packages that include information on agricultural technology or practices, the necessary inputs, and information on how to access credit to support their adoption (Alemu and Demese 2015). In the Amhara region, the study region for this research, extension agents typically focus on a type of input package designed to increase household income above the national poverty line (1 USD) (Gebremedhin et al. 2009).

This package tends to focus on adoption and implementation of improved technology or management practices and input use (Gebremedhin et al. 2009). As the purveyors of these input packages extension agents often see themselves as little more than fertilizer suppliers, rather than extension specialists (EEA/EEPRI 2016; Spielman et al. 2012). The continued emphasis in extension on input-use rather than efficacy and profitability, though perhaps better suited to the agro ecological context, has resulted in limited adoption of new methods and technologies generally (Spielman et al. 2010; Bonger et al. 2014). Additionally, research suggests extension still focuses little on resource poor farmers and as extension agents are responsible for selecting

participants for on-farm demonstrations and participation in extension activities, the impact on the most vulnerable farmers is likely to be minimal (Assefa et al. 2008; Belay and Abebaw 2004).

Bonye et al. (2011) argued that extension provides a source of information on new technologies for farming communities which when adopted can improve production, incomes and standards of living. Extension service providers make an innovation known to farm households, act as a catalyst to speed up adoption rate and also control change and attempt to prevent some individuals in the system from discontinuing the diffusion process (Bonger et al., 2014). In reaching farmers, extension officers demonstrate a technology to farmers but with much concentration on early adopters since the laggards would learn later from the early adopting farmers. Through extension services, farmers' problems are identified for further investigation and policy direction. Swanson (2015) argued that extension service goes beyond technology transfer to general community development through human and social capital development, improving skills and knowledge for production and processing, facilitating access to markets and trade, organizing farmers and producer groups, and working with farmers towards sustainable natural resource management. Where market failures such as limited access to credit and non-competitive market structures that provide a disincentive to farmers to produce exist, extension services tend to provide solutions.

However, they also may be oneswho, in some cases, slow down or even hold up the adoption of an innovation that is, in their own opinion, undesirable. Change Agents usually work with opinion leadersto enhance the impact of their diffusion activities in a social system. They are typicallymore innovative than others and their communication may pose challenges tothe

diffusion process. Characteristic of a technology is a precondition of adopting it, trialability or a degree to which a potentialadopter can try something out on a small scale first before adopting it completely is a major determinant oftechnology adoption (Doss, 2003).

Another study concluded that extension approaches increasedextension contact and led to more rapid diffusion of knowledge in the area served.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This chapter presents the methods that were used to enable the researcher gather data for the study. It consists of the research design, study area, study population, sampling procedures, data collection instruments, validity and reliability of data, ethical consideration and Data analysis.

3.2 Research Area

Hoima district is located in the Western region of Uganda bordering districts of Kikuube(newly carved out from the Greater Hoima) in the South and Kiboga in the east, Masindi in the North-east and Lake Albert in the West forming a border with the Democratic Republic of Congo. It is located between $33^0$48'E-$34^0$18'E and $1^0$38'N-$2^0$20'N. Hoima district lies at an altitude of 680-1400 meters above sea level, with lowest altitude in Lake Albert at 682 meters above sea level. The district consists of 5 sub counties and a town council.

The district has a sharp variation in rainfall amounts, mainly due to variations in the landscape. The landscape ranges from the low-lying Rift Valley floor to the rift escarpment, and the raised hill ranges. The Rift Valley floor lies in a rain shadow and has the least amount of rainfall. The district receives a bimodal rainfall pattern with totals ranging from about 800 mm in the Lake Albert flat rising rapidly the further away East above the Escarpment to between 1250-*1500 mm*per annum before tapering off to 1000mm in the Eastern border areas of the district. The peak periods are between MarchtoMay and September to December. However, the rainfall pattern has become more erratic and less predictable. In general, the second peak rainfall (August to November) is higher than the early peak. This presents a very important potential for agricultural development.

Hoima district has two distinct Food Economy and livelihood zones namely; the mixed farming zone at higher altitude and the agro pastoral fishing zone at the shores of Lake Albert. The soils are generally acidic, shallow with coarse mixture and some loam areas. Pastoral areas have clay soils with high water table mainly characterized by nomadic pastoralism and growing of some few crops such as cotton and cassava and fishing at the shores of Lake Albert. The main source of livelihood at higher altitude is growing of a variety of food crops such as bananas, cassava, sweet potatoes, beans, upland rice, G.nuts, maize, tobacco, tea, coffee, cocoa.

According to the National population and Housing Census 2014, Hoima district has a total human population of 572,986 people of which 287,906 are males, while 285,080 are females (UBOS,2014).

3.3. Research design

A cross sectional study design employing both quantitative and qualitative data collection techniques was used for this study. This kind of design was selected based on the fact that it was best suited to assess effectiveness of AES at appoint in time.In addition to that, a cross sectional study provides results in the shortest possible and it is also very in-expensive and easy to conduct and it's for such reason that it was preferred.

3.4. Study population

Different sub-counties including Kigorobya, Kitoba and Kyabigambire Sub Counties are majorly farming communities and they majorly rely on farming as source of livelihood. Therefore, the study comprised of 536 smallholder farmersbenefiting under OWC, 28 local leaders,10 opinion leaders and 07 sub county officials (OWC Small-scale Statistical Abstract, 2016).

3.4.1. Research sample

A sample is part of the target population that has been procedurally selected as a representative of the whole population study, therefore the 238 respondents were categorized as follows in the table below;

Table 1: Research sample of respondents

Category	**Estimated population**	**Sample size**	**Method of sampling**
Smallholder Farmers under OWC	536	224	Simple random
Local leaders	28	07	Purposive
Opinion leaders	10	04	Purposive
Sub county officials	07	03	Purposive
Total	581	238	

Table adapted fromR.VKrejcie and DW Morgan (1970) determining the sample size for research activities

The sample size was comprised of 224 participating smallholder farmers under the OWC program, 7 local leaders, 04 opinion leaders and 03 sub county officials. These categories were believed to be resourceful with information regarding the performance of the OWC program and farm visits in particular.

3.4.2. Sampling technique

For the case of farmers and local leaders, random sampling was used as they were spread throughout the selected sub counties of Kigorobya, Kitoba and Kyabigambire.While for the case of opinion leaders and sub county officials including the extension staff, purposive sampling was employed because of them being few in number and they are knowledgeable about the study under investigation.

3.5. Data collection methods and instrument

3.5.1 Questionnaires

These were used to collect data from the respondents. The questionnaire contained closed ended questions. They were prepared in English which is easily understood by the respondents. Datawas collected from both men and women. Local leaders possess the information pertaining areas of their jurisdiction and are certainly believed to answer the questions honestly.

3.5.2 Interview guide

The interview guide was structured to consist of the set of issues on which the researcher wanted to gather data. Here the respondents were interviewed face to face to obtain in-depth information on the efficiency of farm visits as a methodology used under the OWC program in Kigorobya, Kitoba and Kyabigambire sub-counties. This instrument was used to collect data from the sub-county officials and opinion leaders

3.5.3 Observation

This involved the use of naked eyes by the researcher to be able to make meaning out of what was seen in relation to the research.

3.6. Reliability and validity of data instruments

Questionnaires were pretested by having them given out to some colleagues who responded accordingly. This was used to assess whether the questions were clear or not. There was also pilot testing whereby a sample of people from a situation that is similar to the one being examined were given questions to answer. All these helped the researcher to update the questions.

3.7. Data analysis

Data was analyzed both in a qualitative and quantitative manner and the information got from the research was described according to the research questions and the objectives. Data collected with the use of interview schedules was put to meaningful categories. Content analysis was the main method of analyzing data collected (Miles &Huberman, 2004).

Data collected was categorized according to the emerging variables from the questions in the interview guide. After data collection, the data was coded, edited, classified, and tabulated. Information was cross examined with the use of questionnaires, with a purpose of turning it into meaningful data with the formation of figures, frequency tables, and percentages. The descriptive statistics was run in SPSS (version 17) software. To understand whether agricultural extension services were being effective under theOperation Wealth Creation in the study area investigations to generate responses in form of percentages, mean and standard deviation were made. The mean scores used referred (Mean score=1.00 meant strongly disagreed; Mean score= 2.00 meant disagreed; Mean score =3.00 meant Neutral; Mean Score=4.00 meant agreed and Mean at 5.00 meant strongly agreed by most of the respondents). The standard deviation above 1 meant higher deviation than standard deviation below 1. The interpretation of standard deviation was based on the rule that the higher the standard deviation, the lower the means and vice versa.

3.8. Ethical consideration

The researcher respected the dignity of the respondents and treated the information given by them with uttermost confidentiality; for research purpose only. The researcher was keen not to ask provocative or sensitive questions to the respondents especially questions concerning private life and even those which degrade some body's dignity.

An introductory letter from the university was used to introduce the researcher to the respondents during data collection**.** Permission was also sought from the respondents before approaching their homes and working premises and only at their convenient time. Besides bribes, undue influence, and cohesion was strongly avoided by the researcher. Permission was also sought from the local authorities before interviews were done.

False and misleading information was critically subjected to validity test to check on the error rate in the research.

3.9. Limitations and ways to overcome them

The researcher encountered the following limitations during data collection;

- **i)** Poor turn-up of respondents for interviews during the study, the researcher made special consideration by making several calls to make sure all respondents participate in the study.
- **ii)** The researcher also forecast the problem of funding data collection since she was self-facilitated student but she utilized coffee harvest to fund the exercise in order to complete the study as scheduled.
- **iii)** The researcher anticipated requests for money by respondents during the study, but endeavored to clearly explain that the research was for study purpose and would provide feed-back to them on issues requiring redress.
- **iv)** The researcher still anticipated some respondents to shy away and hide information during the study. However, rapport was built right from the start, to allay fears and instill confidence.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION

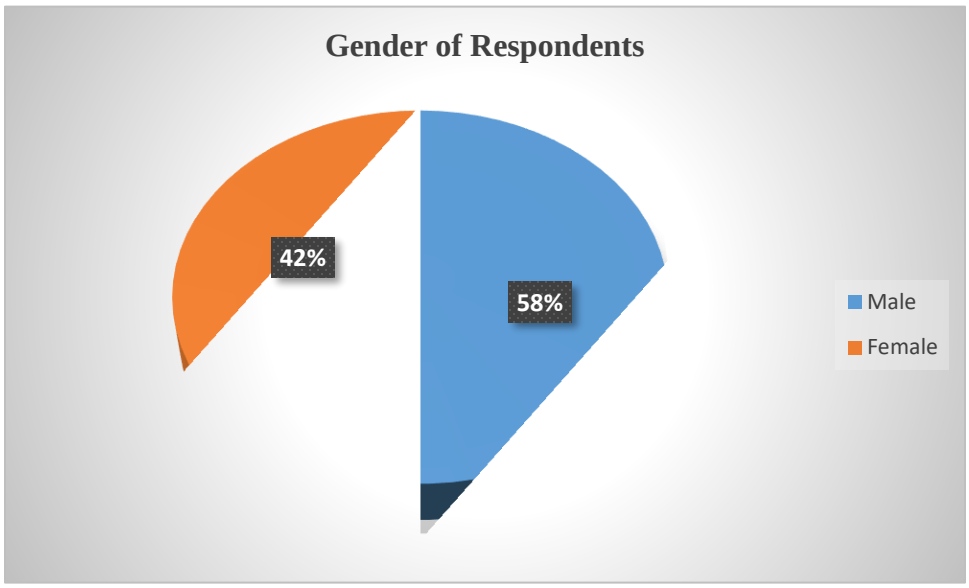
4.0 Introduction

This chapter contains the responses that were obtained from 224 respondents who participated in the research. The findings were analyzed with statistical breakdowns accompanied with detailed qualitative narratives for clear and better understanding of the matter. It contains two sub sections which include the demographic data of the respondents who participated in the research and secondly the assessment of the Agricultural extension services (AES) on smallholder farmers' knowledge and adoption of technologies under the OWC/ NAADS program in Hoima district.

4.1. Socio-Demographic Data of Respondents

The socio-demographic data comprised of the experience of the farmer in years, gender, age range of the respondents, the educational level of the respondents, knowledge about the OWC/NAADs program and the Agricultural extension services in particular and finally the occupation of respondents who were involved in the research.

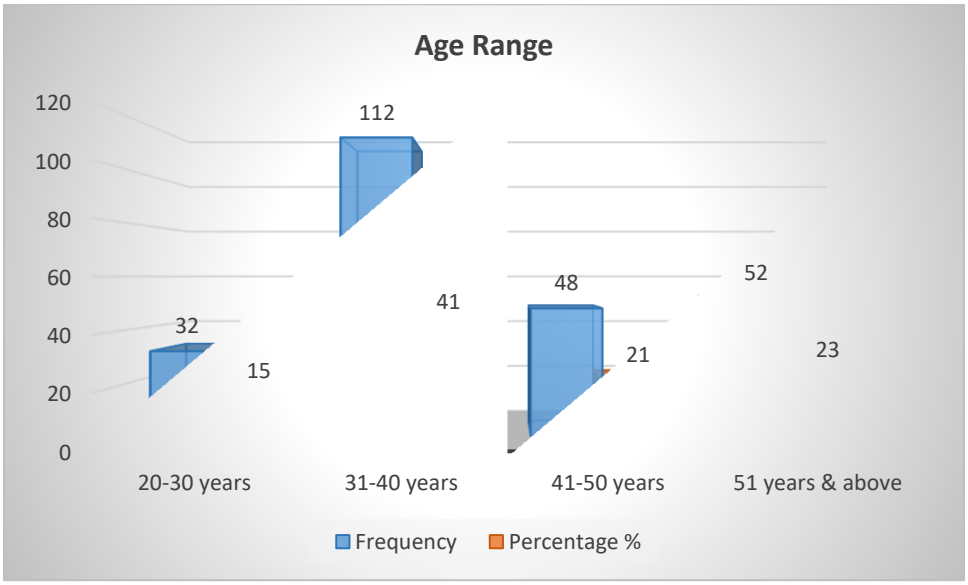
Figure 2.Gender and number of respondents that participated in the study



Source: Primary data 2018

Given the statistics from the study, in the figure above, majority of the224 respondents, 130respondents (58%) were male, while 94 respondents representing (42%) were female.It will be observed that the male respondents were more than female respondents. The reason was that male response towards the programme was positive as they attended most meetings compared to their counterpart, the female who were also engaged in other home chores and were not able to participate fully in the activities of the OWC program.

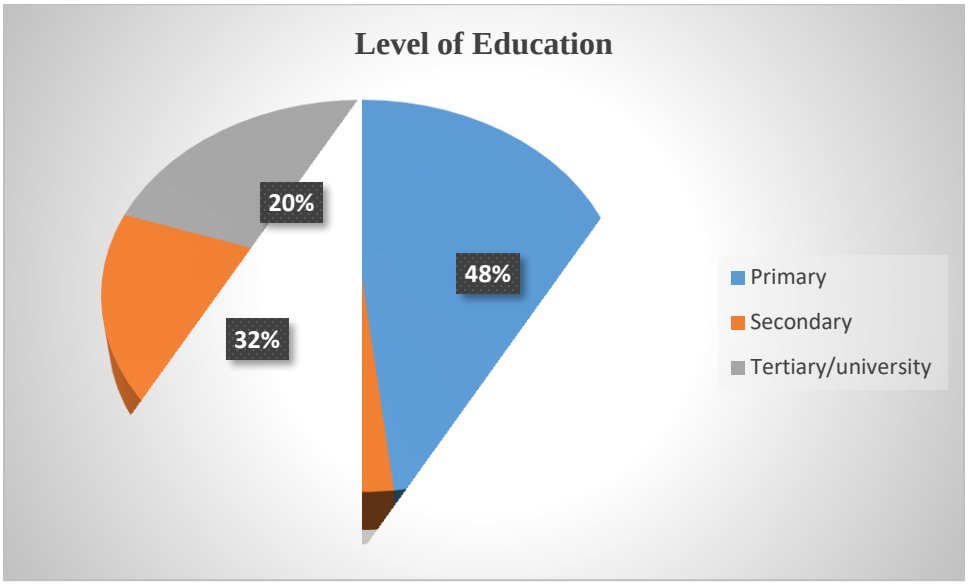
Figure .3: Age frequency of respondents



Source: Primary data 2018

Results from the study reveal that almost all age groups participated in the research study. The leading ones were those in the age bracket31-40 years with 112 respondents representing (41%), followed by those in the age bracket41-50 years with 48 respondents (21%), then those in the age range 51 years and above were only 52 respondents (23%) and the least were those in the age range 20-30 who were 32 respondents (15 %). This shows that the study was representative of all the age groups, which created balanced response in general.

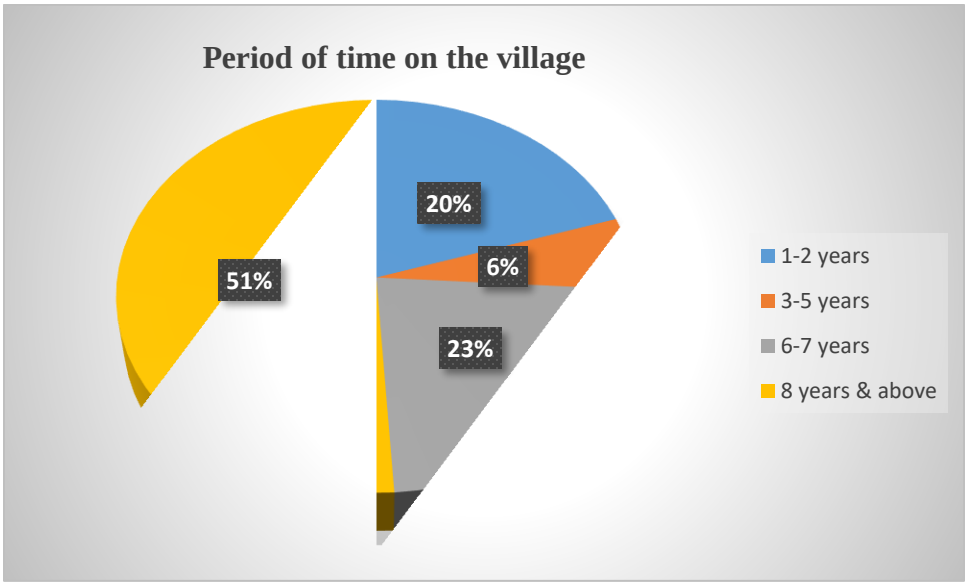
Figure 4: Education level of respondents



Source: Primary data 2018

During the research study as seen in the table above, majority of the 224 respondents had attained formal education, where the leading number of respondents were primary leavers 107 respondents (48%), who were followed by those who had attained secondary education who were 72 respondents (32%) and the least were of tertiary/university education level who were 45 respondents (20%). The study shows that majority of the respondentswere of primary education level, which shows a wide gap in literacy level of the respondents though the educational level of a given respondent is an enabler for the better handling of different technologies and skills, depending on the exposure.

Figure 5: Period of time as a smallholder farmer on the village



Source: primary data 2018

The study reveals that majority of respondents 114 (51%) had been operating as smallholder farmers in the study areafor a period of 8 years and above, followed by52 respondents (23%) who had been in the study area for 6-7 years while 45 respondents (20%) had been smallholder farmers in the study area for 1-2 years and the least respondents were 13(06%) who had been in the study area for 3-5 years. This implies that nearly all residents were aware of the OWCinterventions since its inception in 2014 when it was introduced in the District.

4.2. Empirical findings on agricultural extension services on adoption of new technologies in Hoimadistrict

This section presents the empirical findings of the study according to the objectives. The empirical findings are analyzed using descriptive statistics, correlation and regression analysis for the respective findings. Statements were administered to respondents to establish the extent to which they agreed with them. The responses were measured on a five point Likert scale ranging from (5= Strongly Agreed, 4= Agree, 3= Not Sure, 2= Disagree, 1= Strongly Disagree).

4.2.1 Findings on effectiveness of agricultural extension services under the operation wealth creationin Hoima district

Table 2: Descriptive Statistics on implementation of agricultural extension services

	Percentage responses (%)					Mean	Std Dev.
	SD	D	N	A	SA		
We have been trained by operation wealth creation to form groups and partnering with various service providers	3.9%	3.9%	7.8%	39.4%	43%	4.34	.940
We have been trained by operation wealth creation on how to look for markets for our produces	0%	10%	7.8%	22.2%	60%	4.23	1.206
We have been trained by operation wealth creation on how to use internet for better productions	0%	0%	12%	29.3%	54%	3.75	1.610
We have trained by operation wealth creation on how to increase our production in all forms of crops	61.8%	3.9%	1.3%	1.3%	31.5%	3.04	1.651
We have trained by operation wealth creation on best ways of animal feeding	58.8%	42.2%	0%	0%	0%	2.30	1.476
We have trained by operation wealth creation on the best of using agricultural inputs	49.9%	42.2%	0%	5.7%	2.2%	2.18	1.550
We have trained by operation wealth creation on healthier sources of energy	87.3%	12.6%	0%	0%	0%	1.09	1.665

Key. SA-Strongly Agreed, A= Agree, NS= Not Sure, D= Disagree, SD= Strongly Disagree

To analyze the findings, a total sum of respondents who strongly disagreed and those who disagreed was computed into one category “opposed to items” and another total sum of respondents who strongly agreed and those who agreed was computed into one category “concurred with items”. Thus, three categories of respondents were compared, which included

“Respondents who opposed the items”, “Respondents not sure with the items” and “Respondents who concurred with the items”. The scales were combined for easy presentation, analysis and interpretation (Amin, 2005) as shown in the following paragraph.

Findings relating to whether farmers have been trained under the operation wealth creation to form groups and partnering with various service providers in Table 2 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 85.2% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 6.8%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are trained under the operation wealth creation to form groups and partnering with various service providers. This is interpreted to mean that agricultural extension services were being utilized in Hoima District.

Further, to establish whether farmers have been trained by operation wealth creation on how to look for markets for their produces in Table 2 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 82.2% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 10%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items.

Thus, from this analysis, findings show that most of the farmers are trained by operation wealth creation on how to look for markets for their produces. This is interpreted to mean that agricultural extension services were being utilized in Hoima District.

On whether farmers have been trained under the operation wealth creation on how to use internet for better productions in Table 2 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 81.3% while the percentage that were not sure was 2.1% and the percentage of those who opposed were 12%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are trained by operation wealth creation to on how to use internet for better production. This is interpreted to mean that agricultural extension services were being utilized in Hoima District.

On whether farmers have been trained under the operation wealth creationprogramme on how to increase their production in all forms of crops grown,in Table 2 show that most of the farmers opposed to this items compared to farmers who concurred and not sure about the statement. A comparison on these items shows that the percentage of farmers that opposed was 61.3% while the percentage that were not sure was 3.1% and the percentage of those who concurred were 34.2%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are lower compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are not

trained by operation wealth creation on how to increase production in all forms of crops. This is interpreted to mean that agricultural extension services were not being utilized in Hoima District.

Findings relating to whether farmers have been trained under the operation wealth creation on best ways of animal feeding in Table 2 show that all the farmers opposed to this items compared to farmers who concurred and not sure about the statement. A comparison on these items shows that the percentage of farmers that opposed was 100% while the percentage that were not sure was 0% and the percentage of those who concurred were 0%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are lower compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers lacked best ways of animal feeding. This is interpreted to mean that agricultural extension services were not being utilized in Hoima District.

Generally, from above comparisons, it can be seen that total percentage for respondents that opposed to the items and the percentage for those that were not sure about the items are higher compared to the percentages for respondents that concurred to the items. Thus, from this analysis, findings show that majority of the farmers in Hoima Districtlacked extension knowledge in relation to agricultural productivity. This was assumed to have an impact on adoption of improved farm production practices among farmers under the Operation Wealth Creation in Hoima district.

4.2.2 Findings on agricultural extension services and adoption of new technologies in Hoima district.

Empirical findings about agricultural extension services and adoption of new technologies in Hoima District are presented in detail in Table 3 below:

Table 3: Descriptive Statistics on adoption of new technologies in Hoima district

	Percentage responses (%)					Mean	Std Dev.
	SD	D	N	A	SA		
I have labor saving technologies on my farm	2.6%	3.9%	7.8%	59%	26.3%	3.32	1.619
I can adequately use internet to find out the prices of my produces in the market	1.3%	1.3%	31.5%	61.8%	3.9%	3.79	1.345
I use drip irrigation technology at my farm	1.3%	1.3%	3.9%	71.8%	21.5%	4.38	.865
I have water harvesting technology in my farm	0%	0%	7.8%	50%	42.2%	47	.428
I currently use hybrid seed	2.6%	30.3%	0%	42%	25%	2.73	1.446
I use Post-harvest technologies at my farm	26.9%	28.8%	0%	20%	26.3%	2.45	1.4224
I have planted new trees which are friendly to my crops	3.9%	26.2%	0%	35.5%	26.3%	4.43	1.006
I have applied fertilizers where necessary	14.4%	12.3%	0%	34.2%	30.2%	21	.888

To analyze the findings, a total sum of respondents who strongly disagreed and those who disagreed was computed into one category “opposed to items” and another total sum of respondents who strongly agreed and those who agreed was computed into one category “concurred with items”. Thus, three categories of respondents were compared, which included “Respondents who opposed the items”, “Respondents not sure with the items” and “Respondents who concurred with the items”. The scales were combined for easy presentation, analysis and interpretation (Amin, 2005) as shown in the following paragraph.

Findings relating to whether farmers have adopted labor saving technologies on their farm

Table 3 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 85.3% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 6.7%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers utilize a number of labor saving technologies. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

On whether farmers can adequately use internet to find out the prices of my produces in the market. Table 3 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 65.7% while the percentage that were not sure was 31.5% and the percentage of those who opposed were 1.3%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers use internet in undertaking their agricultural activities including marketing. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

On whether farmers can use drip irrigation technology at their farms. Table 3 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 93.3% while the percentage that were not sure was 3.9% and the percentage of those who opposed were 2.6%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers use drip irrigation technology at their farms. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

Further, to establish whether farmers have water harvesting technology in their farms, they were asked questions and Table 3 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 92.2% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 0%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers utilize water harvesting technology in their farms. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

Findings relating to whether farmers use hybrid seeds in their farms, they were asked questions and Table 3 shows that most of the farmers concurred to this items compared to farmers who opposed and were not certain about the statement. A comparison on these items shows that the percentage of farmers that concurred was 67% while the percentage that were not sure was 0% and the percentage of those who opposed were 33%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are using hybrid seeds in their farms. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

In addition, to establish whether farmers use post-harvest technologies in their farms, they were asked questions and Table 3 shows that most of the farmers were opposed to this items compared to farmers who concurred and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 46.3% while the percentage that were not sure was 0% and the percentage of those who opposed were 53.7%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are lower compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are using post-harvest technologies in their farms. This is interpreted to mean that the adoption of new technologies in relation to post-harvest technologies among farmers under operation wealth creation in Hoima Districtis reportedly minimal.

Further, to establish whether farmers have planted new trees which are friendly to their crops, they were asked questions and Table 3 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 61.8% while the percentage that were not sure was 0% and the percentage of those who opposed were 39.2%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have engaged in modern afforestation in their farms. This is interpreted to mean that the adoption of new technologies among farmers under operation wealth creation in Hoima Districtis reportedly high.

Further, to establish whether farmers have been trained by operation wealth creation on how to look for markets for their produces in Table 2 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 82.2% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 10%. From these comparisons, it can be seen that percentages of respondents that concurred to the items and the percentage of those that were not sure about the items are higher compared to the percentages of respondents that opposed to the items. Thus, from this analysis, findings show that most of the farmers are trained under the operation wealth creation on how to look for markets for their produce. This is interpreted to mean that agricultural extension services were being utilized in Hoima District.

Lastly, on whether farmers have applied fertilizers in their farms. Table 2 show that most of the farmers concurred to this item compared to farmers who opposed and not sure about the statement. A comparison of these items shows that the percentage of farmers that concurred was 64.4% while the percentage of respondents that were not sure was 0% and the percentage of those who opposed were 35.6%. From these comparisons, it can be seen that percentages of respondents that concurred to the items and the percentage of those that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have applied fertilizers in their farms. This is interpreted to mean that there is an increasing rate of adopting new technologies in Hoima District.

Generally, from above comparisons, it can be seen that percentages of respondents that concurred to the items and the percentage of those that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that majority of the farmers in Hoima Districthave adopted a number of new agricultural technologies that are essential in agricultural productivity and food security.

The theme below examines whether the adoption of new technologies is associated with agricultural extension services inHoimaDistrict.

4.2.2.1. Correlation analysis on agricultural extension services and adoption of new technologiesin Hoima district

A correlation analysis was conducted to establish the effectiveness ofagricultural extension services on adoption of new technologies in Hoima district. Table 4 provides the details.

Table 4: Correlation results for agricultural extension services on adoption of new technologies in Hoima district

		Agricultural extension services	Adoption of new technologies
Agricultural extension services	Pearson Correlation	1	.744
	Sig. (2-tailed)		.000
	N	224	224
Adoption of new technologies	Pearson Correlation	.744	1
	Sig. (2-tailed)	.000	
	N	224	224

***. Correlation is significant at the 0.01 level (2-tailed).*

Findings show that there was a positive correlation ($_r$= 744) between agricultural extension services and adoption of new technologies in Hoima district. These findings were subjected to a test of significance (p) and it is shown that the significance of the correlation (p = .000) is less than the recommended critical significance at 0.01. Thus, the relationship was significant. Due to the results of correlation test, it can be established that agricultural extension services hadeffectively improved on adoption of new technologies in Hoima district. Thus, the implication of the findings was that the higher theagricultural extension services, the higher the adoption of new technologies in Hoima district.

4.2.2.2. Regression results for agricultural extension services and adoption of new technologies inHoima district

A further analysis was conducted using a regression to determine the extent to which agricultural extension services determines the adoption of new technologies in Hoima district, findings are presented in Table 5 below, accompanied by analysis and interpretation.

Table 5: Model summary of extent to which agricultural extension services determine adoption of new technologies inHoima district

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	744[a]	.554	.545	.62848

a. Predictors: (Constant), Agricultural extension services

The study findings R^2= 0.554 and adjusted R^2= 0.545 implies that for every unit change in adoption of new technologies in Hoima district, agricultural extension services contributes 55.4% as shown in Table 5. This further confirms that agricultural extension services had effectively contributed to adoption of new technologies in Hoima district. This reflects a need to improve the implementation of agricultural extension services by Operational Wealth Creation in Hoima district.

4.4.3 Findings on agricultural extension services and improved crop yields in Hoima district

Empirical findings of the contribution of agricultural extension services to improved crop yields in Hoima District are presented in Table 6:

Table 6: Descriptive Statistics on improved crop yields in Hoima district.

	Percentage responses (%)					Mean	Std Dev.
	SD	D	N	A	SA		
My crop yields have been increasing overtime	15.7%	17.6%	12.8%	22%	39.8%	10	1.394
The quality of my crop yields has highly improved	10%	12%	38.5%	21.5%	9%	3.09	1.552
My crop yields have a ready market	0%	11.8%	20%	48.6%	40.7%	3.67	1.137
The size of my farm has expanded	3.9%	3.9%	7.8%	52.6%	31.5%	4.30	.984
I can now produce a lot of yields with a less labor	6.5%	3.9%	23.6%	36.8%	30.2%	3.94	1.029
My income from my harvests has been increasing over time	21%	18.4%	22.3%	30.2%	21%	4.21	.893

To analyze the findings, a total sum of respondents who strongly disagreed and those who disagreed was computed into one category "opposed to items" and another total sum of respondents who strongly agreed and those who agreed was computed into one category "concurred with items". Thus, three categories of respondents were compared, which included "Respondents who opposed the items", "Respondents not sure with the items" and "Respondents who concurred with the items". The scales were combined for easy presentation, analysis and interpretation (Amin, 2005) as shown in the following paragraph.

Findings relating to whether farmers have had their crop yields increase over time in Table 6 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 61.8% while the percentage that were not sure was 12.8% and the percentage of

those who opposed were 33.3%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have had their crop yields increase over time. This is interpreted to mean that there has been crop yields improvement among farmers under operation wealth creation in Hoima District.

On whether the quality of crop yields highly improved findings in Table 6 show that most of the farmers remained neutral to this item, compared to farmers who opposed and those who concurred with the statement. A comparison on these items shows that the percentage of farmers that concurred was 31.4% while the percentage that were not sure was 38.5% and the percentage of those who opposed were 22%. From these comparisons, it can be seen that percentages that remained neutral to the items and the percentage that concurred about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have had the quality of crop yields increase over time. This is interpreted to mean that there has been quality of crop yields improvement among farmers under operation wealth creation in Hoima District.

Further, to establish whether farmer's crop yields have a ready market. Finding in Table 2 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 69.3% while the percentage that were not sure was 20% and the percentage of those who opposed were 11.8%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared

to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers produce high quality produce which have always obtained a ready market.

On whether the size of the farm has been expanding for farmers under operation wealth creation in Hoima District, Findings in Table 6 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 84.1% while the percentage that were not sure was 7.8% and the percentage of those who opposed were 7.8%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show due to increased crop yields, they have had to increase the size of land they use in Hoima District.

On whether farmers knowledge regarding labor saving had improved on the yields obtained, Findings in Table 6 show that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that opposed was 71% while the percentage that were not sure was 23.6% and the percentage of those who concurred were 10.4%. From these comparisons, it can be seen that percentages that opposed to the items and the percentage that were not sure about the items are lower compared to the percentages that concurred to the items. Thus, from this analysis, findings show that most of the farmers have learnt several labor saving technologies which are essential in crop productivity in Hoima District.

Generally, from above comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that majority of the farmers in Hoima Districthave had their crop yields improved. This was assumed to have a relationship with agricultural extension services as demonstrated in the following theme.

4.4.3.1. Correlation analysis on effectiveness of agricultural extension services on improved crop yields inHoima district

A correlation analysis was conducted to establish the effectiveness ofagricultural extension services on improved crop yields inHoima district. Table 7below provides details:

Table 7: Correlation results of the effectiveness ofagricultural extension services onimproved crop yields in Hoima district

		Agricultural extension services	Increased crop yields
Agricultural extension services	Pearson Correlation	1	-.643*
	Sig. (2-tailed)		.040
	N	224	224
Increased crop yields	Pearson Correlation	-.643*	1
	Sig. (2-tailed)	.040	
	N	224	224

*. Correlation is significant at the 0.01 level (2-tailed).

Findings show that there was a negative correlation ($_r$= -.643) between agricultural extension services and improved crop yields inHoima district. These findings were subjected to a test of significance (p) and it is shown that the significance of the correlation (p = .040) is greater than

the recommended critical significance at 0.01. Thus, the relationship was not significant. Due to the results of correlation test, it can be established that agricultural extension services had a negative effect on crop yields inHoima district. Thus, the implication of the findings was that the lower theagricultural extension services, the lower the crop yields obtained by farmers in Hoima district.

4.4.3.2. Regression results for agricultural extension services and improved crop yields inHoima district

A further analysis was conducted using a regression to determine the extent to which agricultural extension services determines improved crop yields inHoima district, findings are presented in Table 8, accompanied by analysis and interpretation.

Table 8: Model summary of the extent to which agricultural extension services determine improved crop yields in Hoima District

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.643[a]	.413	.359	1.12213

a. Predictors: (Constant), Agricultural extension services

The study findings R^2= 0.413 and adjusted R^2= 0.359 implies that for every unit change in crop yields inHoima district, agricultural extension services contributes 35.9% as shown in Table 8. This further confirms that agricultural extension services had not effectively contributed to improvement in crop yields among farmers in Hoima district. This reflects a need to improve the implementation of agricultural extension services under the Operational Wealth Creation in Hoima district.

4.4.4 Findings on agricultural extension services and adoption of new agronomic practices inHoima district

Empirical findings about agriculture extension services on adoption of new agronomic practices are presented in Table 9below:

Table 9: Descriptive Statistics on adoption of new agronomic practices in Hoima district.

	Percentage responses (%)					Mean	Std Dev.
	SD	D	N	A	SA		
I can now use modern crop spacing at my farm	0%	5.2%	16.6%	44%	33.1%	3.73	1.098
I have managed to utilize new crop varieties that are more productive	2.6%	2.6%	6.5%	53.9%	34.2%	3.94	1.029
I can adequately use row planting	2.5%	2.7%	6.5%	50.2%	37.6%	4.21	.893
I can successfully control weeds in my farm without much hassle	15.7%	17.6%	12.8%	22%	39.8%	3.76	1.146
I can now control all diseases affecting my livestock/crops	0%	1.5%	9%	31.5%	58.5%	3.39	1.029
I can now prevent and control any pests in my farm	0%	11.8%	0%	48.6%	40.7%	3.52	.834
I can adequately use all tillage practices as required in my firm	3.9%	3.9%	7.8%	52.6%	31.5%	4.27	.674
I can now successfully apply fertilizers for better crop production	9.2%	32.8%	19.7%	25%	14.4%	3.15	1.176

To analyze the findings, a total sum of respondents who strongly disagreed and those who disagreed was computed into one category “opposed to items” and another total sum of respondents who strongly agreed and those who agreed was computed into one category “concurred with items”. Thus, three categories of respondents were compared, which included “Respondents who opposed the items”, “Respondents not sure with the items” and “Respondents who concurred with the items”. The scales were combined for easy presentation, analysis and interpretation (Amin, 2005) as shown in the following paragraph.

Findings relating to whether farmers in Hoima District can now use modern crop spacing at their farms, Table 9 shows that most of the farmers concurred to this items compared to farmers who

opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 77.1% while the percentage that were not sure was 16.6% and the percentage of those who opposed were 5.2%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have tried to adopt modern crop spacing which is vital in new agronomic practices.

Further, to establish whether farmers have managed to utilize new crop varieties that are more productive under operation wealth creation in Hoima district, Table 9 shows that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 85.1% while the percentage that were not sure was 6.5% and the percentage of those who opposed were 5.2%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers utilize new crop varieties that are more productive under operation wealth creation in Hoima district. This is interpreted to mean that they partly utilize agronomic practices in Hoima District.

On whether farmers can adequately use row planting in Hoima Districtin Table 9. Findings showed that most of the farmers concurred to this items compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred was 87.8% while the percentage that were not sure was 2.7% and the percentage

of those who opposed were 2.5%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers are using row planting which is an essential agronomic practice.

Further, on whether farmers can successfully control weeds in their farms without much hassle. Findings in Table 9 show that most of the farmers concurred to this item compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred were 61.8% while the percentage that were not sure was 12.8% and the percentage of those who opposed were 33.1%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers have adopted new weed control practices which are essential in agricultural productivity and food security.

In addition, on whether farmers can now control all diseases affecting their livestock/crops. Findings in Table 9 show that most of the farmers concurred to this item compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred were 89.5% while the percentage that were not sure was 9% and the percentage of those who opposed were 1.5%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis,

findings show that most of the farmers can control all diseases affecting their livestock/crops which are essential in agricultural productivity and food security.

In the same direction, on whether farmers can now prevent and control any pests in my farm. Findings in Table 9 show that most of the farmers concurred to this item compared to farmers who opposed and not sure about the statement. A comparison on these items shows that the percentage of farmers that concurred were 89.3% while the percentage that were not sure was 0% and the percentage of those who opposed were 11.8%. From these comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that most of the farmers use a number of new ways of controlling pests which are essential in agricultural productivity and food security.

Generally, from above comparisons, it can be seen that percentages that concurred to the items and the percentage that were not sure about the items are higher compared to the percentages that opposed to the items. Thus, from this analysis, findings show that majority of the farmers in Hoima Districthave adopted a number of new agronomic practices which are assumed very vital in improving food production and security. However, the study wanted to go extra mile to establish the extent to which the adoption of agronomic practices can be explained by agricultural extension services. This is detailed in the next theme.

4.4.4.1. Correlation analysis on agricultural extension services and adoption of new agronomicpractices in Hoima district

A correlation analysis was conducted to establish the effectiveness ofagricultural extension services on adoption of new agronomic practices inHoima district. Table 10 provides details.

Table 10: Correlation results of the effectiveness of agriculture extension services on adoption of new agronomic practices in Hoima District

		Agricultural extension services	New Agronomic practices
Agricultural extension services	Pearson Correlation	1	.511
	Sig. (2-tailed)		.000
	N	224	33
New Agronomic practices	Pearson Correlation	.511	1
	Sig. (2-tailed)	.000	
	N	33	33

Findings show that there was a positive correlation ($_r$= .511) between agricultural extension services andadoption of new agronomic practices in Hoima district. These findings were subjected to a test of significance (p) and it is shown that the significance of the correlation (p = .000) is greater than the recommended critical significance at 0.01. Thus, the relationship was significant. Due to the results of correlation test, it can be established that agricultural extension services hadcontributedto improved adoption of new agronomic practices inHoima district. Thus, the implication of the findings was that the higher theagricultural extension services, the higher the adoption of new agronomic practices inHoima district.

4.4.4.2. Regression results for agricultural extension services and adoption of new agronomicpractices in Hoima district

A further analysis was conducted using a regression to determine the extent to which agricultural extension services determines the adoption of new agronomic practices inHoima district, findings are presented in Table 11, accompanied by analysis and interpretation.

Table 11: Model summary of extent to which agricultural extension services determine the adoption of new agronomic practices in Hoima district

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.511[a]	.252	.238	.47769

a. Predictors: (Constant), Agricultural extension services

The study findings R^2= 0.252 and adjusted R^2= .238 implies that for every unit change in adoption of new agronomic practices inHoima district, agricultural extension services contributes 25.2% as shown in Table 11. This further confirms that agricultural extension services had not effectively contributed to adoption of new agronomic practices in Hoima district. This reflects a need to improve the implementation of agricultural extension services under the Operational Wealth Creation in Hoima district.

CHAPTER FIVE

DISCUSSION OF STUDY FINDINGS

5.1 Introduction

This chapter presents the discussions of objectives set for the study. In this chapter, discussion of the contribution of agricultural extension services on adoption of new technologies, improvement of crop yields and adoption of agronomic practices among farmers under Operation Wealth Creation in Hoima district was done.

5.2 Discussion of the study findings

The discussion of the study findings has been made as per the study objectives below;

5.2.1 The contribution of agricultural extension services on adoption of new technologies amongfarmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services has significantly improved on adoption of new technologies among farmers under Operation Wealth Creation in Hoima district ($r=744$, $p<.01$). This means that any positive change in agricultural extension services is associated with a positive change in adoption of new technologies among farmers under Operation Wealth Creation in Hoima district. The findings are not at variance with Adebo and Ewuola (2006). This significant correlation shows that timeliness of training is accompanied by increases in adoption of improved crop production technology. It also indicates that increase in number of training method used increased adoption rate. Further increase in the number of media used brought increase in adoption rate. The implication is that timeliness of training and method of training could help to stimulate the interest of the farmers, which stimulate trial and successful trial leads to adoption. This translates into increase in yield and income positive correlation between availability of inputs and timeliness of training an improved crop. Production practices

indicate that as farm inputs are available to farmers, it enhances the time of training and adoption of improved crop production practices. This is in agreement with the works of Adebo and Ewuola, 2006; Okoy, 2013).

According to Van Den Ban and Hawkins (2009), the goal of extension is to ensure that increased agricultural productivity is achieved by stimulating farmers to use modern and scientific production technologies developed through research. Williams (2016) viewed extension as an out-of-school system of education for teaching farmers (adult, women and youths) how to raise their standard of living by their own effort using their own resources and providing them with scientific knowledge to solve their problems. For farmers to use or adopt the findings of research institute, There are number of factors that influence the extent of adoption of improved practices such as characteristics or attributes of technology; the adopters or clientele, which is the object of change; the change agent (extension worker, professional, etc.); and the socio-economic, biological, and physical environment in which the technology take place Cruz (2017).

Farmers have been seen as major constraint in development process, adoption for them is viewed as a mental process which an individual passes through in deciding to use an innovation. (Cruz 2017). Koppel (2018), opined that the predominant role of technology is facilitating major improvement in agriculture productivity. Therefore, it is important to know how farmers perceived improved practices for better understanding of their choice in decision of adoption or not. Improved practices are one of resources for agricultural production. According to Ingold (2012), transfer of technology is that which embraces all efforts to make sure that the farmers adopt new technology. He stressed the fact that for transfer of technology to occur, it must

embrace inputs, support, advice and other essentials so that the farmer would have no reason to reject the technology. For any innovation or technology to be adopted, Van Den Ban and Hawkins (2009) opined that it must pass through a process of adoption, which involves awareness, interest, evaluation, trail and adoption. The success of the adoption process depends very much on effective training by extension agents. Effectiveness of training is determined by the methods and techniques used. Different media can be used in training the farmers.

These include farm or home visit, farmers meetings, use of radio, television, video tapes, process demonstration, and flip chart. Farm or home visit creates room for interpersonal communication (Nnadi and Akwiwu, 2015). It gives the farmers liberty to ask and answer questions for further discussion or verification of ideas, process, etc. Farmers' meetings have the advantages of creating opportunity for farmers to interact among themselves and aids adoption of improved farm practice. Radio, television, tapes (audio and visual) can be used to reach out to a large number of target audiences at the same time, but it has the disadvantage of lack of feedback.

Method of training farmers according to (Nnadi and Akwiwu, 2005) varies from practical demonstration to result demonstration, the use of drama, photographs, film shows, tapes, tours, group discussions, conferences, etc. It may involve a combination of more than two methods for effective training to take place. In order to promote food and raw materials production, extension approach had to be modified. From this modification, the training and visit approach evolved. This entails training the farmers in groups, members of this group train other farmers on the improved extension training innovations. This effort is to create desired change in the behavior of farmers. In spite of these efforts, which are expected to result to increased food production,

farmers continually lack ways to improve their own processes. The result of this study may contribute to extension service management, in training policy design and training program designing.

5.2.2 The contribution of agricultural extension services on improvement of crop yields amongfarmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services has significantly improved on crop yields among farmers under Operation Wealth Creation in Hoima district ($r=-.643$, $p<.01$) This means that any negative change in agricultural extension services is associated with a negative change in crop yields obtained among farmers under Operation Wealth Creation in .Hoima district. The findings of the study was found in line with what Datt&Ravallion (2008); Salami *et al*, (2010) found that agricultural productivity benefit farmers through increased production, creation of employment opportunities or indirectly, boosting their relative wages or reducing food prices. In developing countries, investments in extension services have the potential to improve agricultural and increase farmers' incomes (Anderson &Feder, 2014). It is this fact that enormous investment, funding and policy reforms have been directed into agricultural extension in many developing countries. Rausser (2012) classifies agricultural policies into groups: those that correct market failures, lower transaction costs, or enhance productivity, and other policies that result from manipulation by special interest groups.

Anderson (2007) also acknowledged the role of agriculture extension services in improving crop production as "the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods" (Waddington *et al*, 2010). In its broadest sense, extension is an

educational process with communication being its core component. Van den Ban and Hawkins (2016) define the term extension as the conscious use of communication of information to help people form sound opinions and make good decisions. Moris (2011) defined extension as the mechanism for information and technology delivery to farmers. A more comprehensive definition of extension service is given by the World Bank as a 'process that helps farmers become aware of improved technologies and adopt them in order to improve their efficiency, income and welfare'.

While there is considerable interest and efforts to understand the issues related to agricultural extension in developing countries and the literature is growing, rigorous impact evaluations of agricultural extension interventions are less common (Anderson &Feder, 2004). The impact evaluation face a wide range of difficulties including how to control for factors that influence agricultural outcomes such as agro ecological climate, weather events, availability and prices of inputs, market access, farmers' characteristics, and so on.

Betz (2009) has noted that previous studies on productivity effects of agricultural extension have varying results. The mixed results regarding the impact of agricultural extension on productivity is as a result of how the methodological issues of endogeneity, heterogeneity and measurement of productivity variable are addressed. Productivity - agriculture extension literature reveals a number of methodological challenges that make it difficult to make broad generalizations about the productivity effects of agricultural extension services (Odhiambo&Nyangito, 2003; Betz, 2009; Anderson &Feder, 2004; World Bank, 2011). For example, the available empirical research on the effect of agricultural extension services, show large positive rates of return to extension services (CerdánInfante*s et al,* 2008). However, in the absence of random assignment to treatment and control groups, this methodology is likely to provide biased estimates of causal

effects, due to endogeneity of program participation and the presence of unobservable characteristics that might determine participation and be correlated with the outcome variable (Betz, 2009, Cerdán-Infantes*et al*, 2008, Dercon*et al*, 2008, Owen *et al*, 2001).

5.2.3 The contribution of agricultural extension services on adoption of agronomic practicesamong farmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services has not significantly improved on adoption of agronomic practices among farmers under Operation Wealth Creation in Hoima district ($r=.511$, $p<.01$). This means that a positive change in agricultural extension services is associated with a positive change in adoption of agronomic practices obtainedamong farmers under Operation Wealth Creation in Hoima district. The findings of the study was found in line with what Weir and Knight (2010) and Krishnan and Patnam (2012) noted that the ability to observe neighbors using the practice, successfully, was particularly important for less educated farmers in Ethiopia. The AIS, and specifically agricultural extension, has traditionally been the institutional response to information or knowledge barriers. As a "translator" of institutional knowledge, extension agents facilitate the flow of information, reducing barriers to access (Rogers 2003). The current Ethiopian Extension System is implementing the National Agricultural Extension Intervention Program (NAEIP), a scaled-up version of the post-civil war system of Participatory Demonstration and Training Extension Systems (PADETES), which focused almost exclusively on technology transfer and cereal production (Gebremedhin et al. 2016; Speilman et al. 2012; Egziabher et al. 2013). NAEIP, which has been in effect since the mid-1990s, relies on the Extension Management and Training Plots model and input packages.

The effectiveness of a training program depends not only on the number of farmers that receive information but also on how successful that approach and or methods influences farmers' decision to adopt a given technology (Ricker-Gilbert *et al*., 2018; Doss, 2016). Different technologies have different attributes of knowledge and information requirement sets. These sets are likely to objectively determine the types of methods used in sharing them for use, if the adoption of the technology in question is to succeed. For relatively 'knowledge-based' innovations like PPT1, the uptake is likely to depend on how extensive and intensive farmers are trained and the effectiveness of approach employed (Padel, 2011). If ineffective methods are used, farmers are likely to spend more time searching for more relevant information thus increasing the information search costs. This, therefore, implies the need to evaluate the effectiveness and efficiency of the methods being used in order to isolate the ones which are not only effective but also efficient, contingent on resource availability. Given that information is packaged and presented differently in different ways, there is likelihood of variations on the effects these methods could have on technology adoption (Daberkow and McBride, 2011; Mauceri*et al.*, 2015).

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summaries of the findings, conclusions derived from the findings, and the recommendations that will help in improving on adoption of new technologies, improvement of crop yields and adoption of agronomic practices among farmers under Operation Wealth Creation in Hoima districtbased on the findings of the study.

6.2 Summary

Below is the summary of the major findings the study obtained from the field and it is presented specific objective by specific objective.

6.2 Summary of the study findings

The discussion of the study findings has been made as per the study objectives below;

6.2.1 The contributionof agricultural extension services on adoption of new technologies amongfarmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services have not significantly improved adoption of new technologies among farmers under Operation Wealth Creation in Hoima district. This means that any positive change in agricultural extension services is associated with a positive change in adoption of new technologies among farmers under Operation Wealth Creation in Hoima district.

6.2.2 The contribution ofagricultural extension services on improvement of crop yields amongfarmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services have not significantly improved on crop yields among farmers under Operation Wealth Creation in Hoima district. This means

that any negative change in agricultural extension services is associated with a negative change in crop yields obtained among farmers under Operation Wealth Creation in Hoima district.

6.2.3 The contributionof agricultural extension services on adoption of agronomic practicesamong farmers under Operation Wealth Creation in Hoima district

The study findings revealed that agricultural extension services have not significantly improved on adoption of agronomic practicesamong farmers under Operation Wealth Creation in Hoima district. This means that any negative change in agricultural extension services is associated with a negative change inadoption of agronomic practicesobtained among farmers under Operation Wealth Creation in Hoima district and vice versa.

6.3 Conclusions

In conclusion, variables like education level and farm size are important in influencing extension contact underlining the well-known bias of extension toward better educated and wealthier farmers. Farmers' educational level, measured in terms of years of formal schooling, also has a consistently large and significant effect on farmers' technical knowledge and adoption.Other variables such as age do not appear to directly affect farmers' technical knowledge and adoption, once differences in education and extension contact have been taken into account.

Furthermore, agriculture extension services increased the quantity of extension contact, presumably because the frequency of contacts with farmers had increased in the sub counties analyzed in Hoima district. Farmers who have more extension contact tend to have better technical knowledge and have also adopted the technologies. However, extension services do not seem to improve the quality of extension contact yet the aim is to increase the quality of

extension advice and to make extension messages more widely known through the contact-farmer approach.

Despite the fact that the OWC Programme has had commendable support to farmers' access to agricultural inputs, the quality of extension services was still inadequate due to limited response given to farmers by extension staff due to poor mobility, and the theoretical nature of the trainings provided. This perhaps is the main reason for the programme's limited impact on increasing technology adoption and use of modern agronomic practices that normally are realized with regular contact between extension agents and the farmers. As a result, there is generally low productivity of enterprises and low output that overall limit commercialization by the beneficiaries.

Nevertheless, households that continuously participate in OWC exhibit relatively higher consumption expenditure outcomes than those receiving piecemeal or no support from OWC. This suggests that piecemeal support to farmers from OWC has only a limited impact on productivity and income.

6.4 Recommendations

In light of the above conclusions, below are the suggested recommendations;

1. There is need for joint efforts by MAAIF, NAADS program managers and the Local governments to urgently address bottlenecks impairing the capacity of extension staff to offer adequate extension services in order to improve technology adoption and improved productivity. The bottlenecks among others include the following:

- Inadequate logisticalsupport in terms of materials for training and fordemonstrationswhichlimit dissemination of good practices to farmers on regular basis.

- High farmer-extension ratio that leads to compromised services as a result of large area and high population expected to be served by anindividual extension staff.
- Quarterly release of operational funds which leave extension staff virtually with no resources to support farm visits and follow up at a given point in time.
- In some areas extension staff lack means of transport or have un-repairable motorcycles which limits mobility. As such a number of technologies given to farmers are not properly followed to support farmers on proper utilization and to encourage technology adoption.

2. If the government is committed to using OWC as a vehicle to improve household income, then program participants should not only be provided with continuous technical and input support but also with the whole package of services in the value chain in terms of technical knowledge to improve onfarmers expertise and capacity to adopt and manage the technologies.
3. Government should reinforce the importance of investment in formal schooling to produce a work force that is enlightened and can readily adopt innovations for increasing productivity in post-Green Revolution agriculture.

6.5 Areas recommended for further study

i) The study recommends that further research in this area could maintain the variables and the same methodology but larger samples and a broader geographical area preferably from all the four regions of Uganda

ii) The study recommends research into how result based monitoring and evaluation can affect the implementation of other government programmes in Uganda.

iii) The study also recommends that further research in this area could maintain the variables and the same methodology but use another study population and target mostly literate

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QUESTIONNAIRE

FOR SELECTED FARMERS

Dear Respondent,

My name is **KAIJA CATHERINE** a student at Uganda Martyrs University, pursuing a Master's degree in Agro Ecology. I am carrying out research on: '*'An Assessment of the Agricultural extension services (AES) on Farmers knowledge and Adoption of Technologies under the OWC program in Hoima District.* I kindly request you to provide me with information. The information you give will be treated with utmost confidentiality and used for academic purposes only.

SECTION A: PERSONAL DATA

1. Sex: Male ☐
   Female ☐

2. Age range: a) 16 – 30yrs ☐
   b) 31 – 45yrs ☐
   c) 46 – 60yrs ☐
   d) Above 60yrs ☐

3. Level of education
   a) Primary ☐
   b) Secondary ☐
   c) College/university ☐

4. Occupation
   a) Peasant / Farmer ☐
   b) Self employed ☐
   c) Student ☐
   d) Government employed ☐

In the following sections please tick in the box that corresponds to your opinion/view according to a scale of 1 = Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, 5 = Strongly Agree.

SECTION B: AGRICULTURAL EXTENSION SERVICES						
	Agricultural extension services					
1	We have been trained by operation wealth creation to form groups and partnering with various service providers	1	2	3	4	5
2	We have been trained by operation wealth creation on how to look for markets for our produces	1	2	3	4	5
3	We have been trained by operation wealth creation on how to use internet for better productions	1	2	3	4	5
4	We have been trained to operation wealth creation on how to look for markets for our produces	1	2	3	4	5
5	We have trained by operation wealth creation on how to increase our production in all forms of crops	1	2	3	4	5
6	We have trained by operation wealth creation on best ways of animal feeding	1	2	3	4	5
7	We have trained by operation wealth creation on the best of using agricultural inputs	1	2	3	4	5
8	We have trained by operation wealth creation on healthier sources of energy	1	2	3	4	5

SECTION C: ADOPTION OF NEW TECHNOLOGIES						
1.	I have labor saving technologies on my farm	1	2	3	4	5
2.	I can adequately use internet to find out the prices of my produces in the market	1	2	3	4	5
3	I use drip irrigation technology at my farm	1	2	3	4	5
4.	I have water harvesting technology in my farm	1	2	3	4	5
5.	I currently use hybrid seed	1	2	3	4	5
6.	I use Post-harvest technologies at my farm	1	2	3	4	5
7	I have planted new trees which are friendly to my crops	1	2	3	4	5
8.	I have applied fertilizerswhere necessary	1	2	3	4	5

SECTION D: IMPROVED CROP YIELDS						
1.	My crop yields have been increasing overtime	1	2	3	4	5
2.	The quality of my crop yields has highly improved	1	2	3	4	5
3.	My crop yields have a ready market	1	2	3	4	5
4.	The size of my farm has expanded	1	2	3	4	5
5.	I can now produce a lot of yields with a less labor	1	2	3	4	5
6.	My income from my harvests has been increasing over time	1	2	3	4	5

SECTION E: NEW AGRONOMIC PRACTICES						
1.	I can now use modern crop spacing at my farm	1	2	3	4	5
2.	I have managed to utilize new crop varieties that are more productive	1	2	3	4	5
3	I can adequately use row planting	1	2	3	4	5
4	I can successfully control weeds in my farm without much hassle	1	2	3	4	5
5.	I can now control all diseases affecting my livestock/crops					
6.	I can now prevent and control any pests in my farm					
7.	I can adequately use all tillage practices as required in my firm	1	2	3	4	5
8.	I can now successfully apply fertilizers for better crop production	1	2	3	4	5

THANK YOU!

APPENDIX II: INTERVIEW GUIDE

My name is **KAIJA CATHERINE** a student at Uganda Martyrs University, pursuing a Master's degree in Agro Ecology. I am carrying out research on:"**An Assessment of the Effectiveness of Agricultural Extension Services (AES) on Farmers'Knowledge and Adoption of Technologies under the OWC program in Hoima District".** I kindly request you to provide me with information. The information you give will be treated with utmost confidentiality and used for academic purposes only.

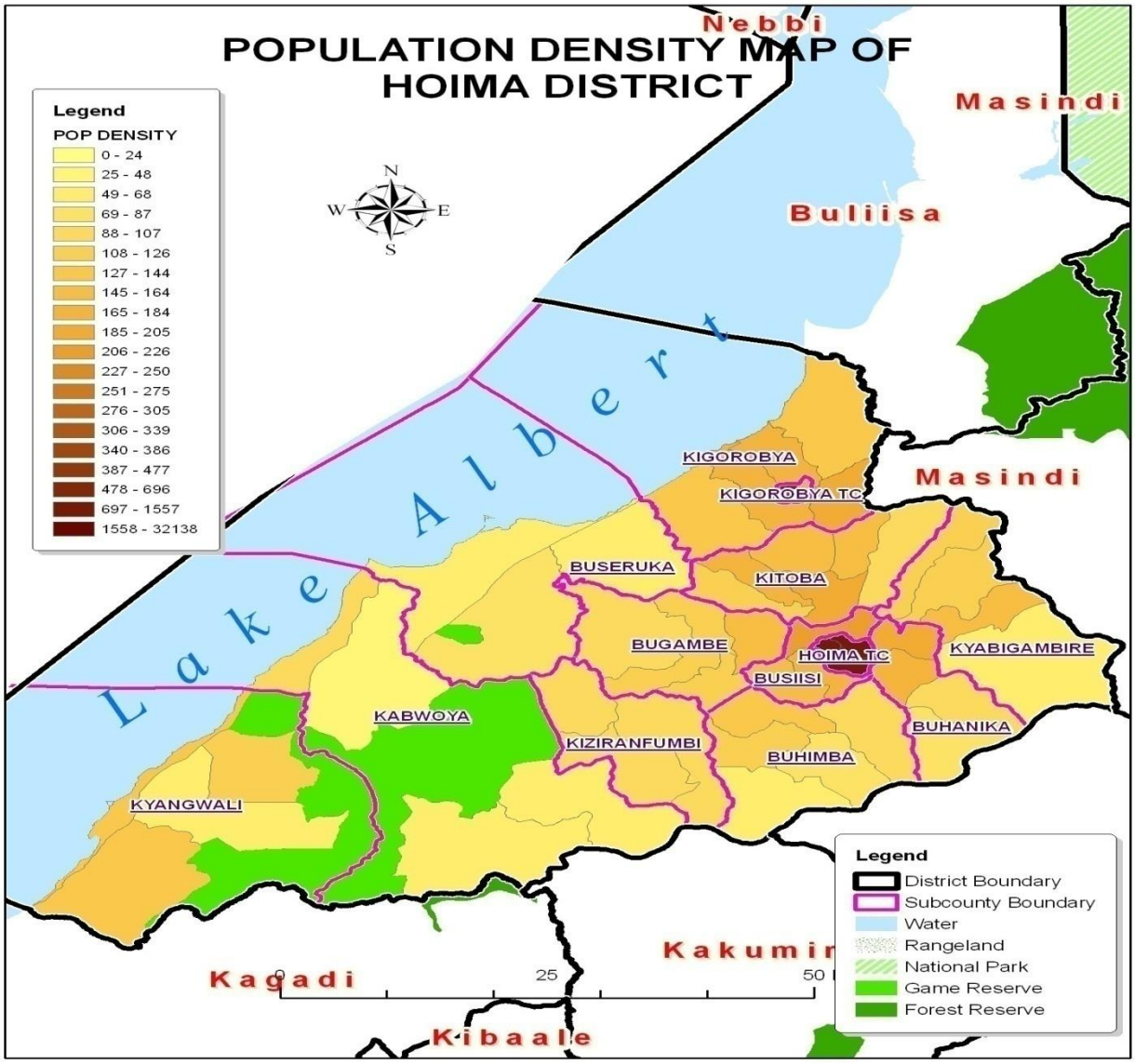
QUESTIONS

1. How do you always access information on improved technologies?
2. What are the different extension approachesemployed in this area?
3. What is the state of extension in this area?
4. How are the trainings conducted in this area?
5. How have you been helped to deal with the problem of low adoption of technologies?
6. How many training on improved technologies do you attend in a month?
7. As a farmer, how are you being helped to ensure you adopt the new technologies?
8. What are the challenges you are facing concerning adoption of new technologies in your area?
9. Other than agricultural extension services, is there any other approach that suits your training needs?
10. What is the farmers' response towards the agricultural extension services under OWCProgramme?

Thank You for your cooperation!

APPENDIX III

Map of Hoima showing location of Kigorobya, Kitoba and KyabigambireSub Counties



APPENDIX IV:

TABLE: SAMPLE SIZE (S) REQUIRED FOR THE GIVEN POPULATION SIZES (N)

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	2224	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1000	285	5000	357
40	36	160	113	380	191	1100	291	6000	361
45	34	170	118	400	196	1200	297	7000	364
50	44	180	123	420	201	1300	302	8000	367
55	48	190	127	440	205	1400	306	9000	368
60	52	200	132	460	210	1500	310	10,000	370
65	224	210	136	480	214	1600	313	15000	375
70	59	220	140	500	217	1700	317	20000	377
75	63	230	144	550	226	1800	320	30000	379
80	66	240	148	600	234	1900	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384

Source: Adopted from R.V. Krejcie& D.W. Morgan (1970). Determining sample size for research activities Educational and psychological measurement. 30.608.