EFFECTIVENESS OF PARTICIPATORY EXTENSION APPROACH IN DISSEMINATION AND ADOPTION OF UPLAND RICE AMONG SMALLHOLDERS IN ELGEYO MARAKWET COUNTY, KENYA

BY

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DECLARATION

Declaration by the Candidate

I hereby declare and confirm that this thesis is my own original work that has not been submitted or published for any award of a Degree or Diploma in this University or any other University.

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Declaration by Supervisors

This work has been submitted for examination with our approval as University Supervisors.

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DEDICATION

I dedicate this research work to my children, husband and parents. God bless you.

ABSTRACT

The conventional extension approach has achieved minimal success in dissemination and adoption of agricultural technologies. Notably, low adoption level has been experienced, which has led to low production and income levels to the smallholder farmers. The goal of the Community Agriculture Development Project in Semi-Arid Lands (CADSAL) in Kerio Valley was to increase agricultural productivity and revenue in the catchment area, therefore it used the Community Participatory Extension (CPE) method to do so. The goal of this research was to explore, describe and to ascertain the efficiency of CPE approach in dissemination and adoption of NERICA new technologies among smallholder farmers in the Kerio Valley of Elgeyo Marakwet County in Kenya. A survey methodology was used, with an ex-post Facto study design. The population consisted of 480 small-scale farmers who interacted with the project in Kerio valley locations. The sample frame of 80 CADSAL-Participants and 80 Non-CADSAL participants was chosen for the study purposively. Furthermore, the sample from both participants and non-participants was achieved through simple random sampling since each member in the group had equal chance of being a respondent. Personal interviews were used to present a standardized questionnaire to the respondents at their residences. The main dependent variables formulated for the study was effectiveness of Community participatory approaches in acquisition of knowledge and skills promoted by CADSAL project and adoption level of NERICA. The main independent variable was dissemination of NERICA rice technology promoted through CADSAL Community Participatory Technology Development (CPTD) and Community Initiated Project (CIP) extension approaches. The two approaches were operationalized to mean community participatory extension training approaches as compared with conventional training packages on selected CADSAL technologies, which included NERICA rice. Moderator variables was socioeconomic factors, such as respondents' age, education level, and gender, household income, CIP training, farm size, frequency of dissemination and attitude towards CADSAL technologies. Percentages, means, and standard deviations were calculated using descriptive statistics. Multiple linear regression and the t-test were utilized as inferential statistics. Hypotheses was tested at $\alpha = 0.05$. Data was analyzed using Statistical Package for Social Scientists (SPSS) Version 24.0. The results indicated positive adoption and dissemination level of technologies when community participatory extension approach is used compared to the convention extension methods. After analyzing the data, a t-test p-value of less than 0.05 was obtained, resulting in the rejection of all null hypotheses. This is therefore an indication that community extension approach had a positive influence to the adoption and dissemination of technologies. This implies that the community extension strategy was critical in increasing the amount of agricultural technology acceptance and dissemination, and that extension agents should use a participatory approach. Further study is recommended to determine the level of NERICA rice production in Kerio Valley.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASAL - Arid and Semi-Arid Lands

AGRA - Alliance for a Green Revolution in Africa

CPTD - Community Participatory Technology Development

CADSAL - Community Agriculture Development Project in Semi-Arid Lands

IPM - Integrated Pest Management

CIP - Community Initiated Project

EMC - Elgeyo Marakwet County

NERICA –New Rice for Africa

KVDA – Kerio Valley Development Authority

CPE – Community Participatory Extension

PTD - Participatory Technology Development

EAS - Extension Approach Service

KEPHIS - Kenya Plant Health Inspectorate Service

ARC - Africa Rice Centre

MOA - Ministry of Agriculture

TCB - Tissue Culture Bananas

LBDA - Lake Basin Development Authority

NIB - National Irrigation Board

GDP - Gross Domestic Product

IRDP - Integrated Rural Development Program

DEFINITION OF OPERATIONAL TERMS

Adoption is acceptance of a new technology to be practiced together with existing one and is usually proceeded by a trial period (Loevinsohn et al., 2013)

Agricultural extension refers to adult learning consisting of a two-way communication process whose aim is to improve knowledge, change attitudes, leading to adoption of new technologies and improving skills for both farmers and extension workers, with a view of increasing and improving farmers' incomes and agricultural productivity on a sustainable basis (Managanta, 2020).

Agricultural Productivity refers to the yield achieved from the farm enterprise due to proper and timely agronomic practices.

CADSAL technologies Is the skills and knowledge promoted by CADSAL project with aim of improving the household livelihood through increased agricultural productivity arising from various interventions or technologies among the small scale farmers in Kerio Valley

CADSAL; Community Agriculture Development Project in Semi-Arid Lands is a project that entailed working with local community within catchment area to improve their livelihoods

CIP is an exercise where the community identifies own projects to expand the technologies of choice in a given area

Conventional extension approach It is basically a top-down approach mainly executed by the government through Ministry of Agriculture.

CP extension approach is a way in which the extension practitioners enjoin the farmers or indented adopters of the knowledge and skills through planning, implementation and closure

CPTD is the involvement of the community in the identification of relevant technology in the area and in the implementation of the identified technology through trials and full adoption

Dissemination. In this study, dissemination refers to an act of spreading agricultural innovations from a source to a farmer's research location.

Farm practices: is related to the existing farming components among farmers in a given locality.

Farm productivity is the extent of production per unit area in at a particular time.

Impact in terms of Knowledge is defined in the context of this study as the knowledge and skills gained by participants through CPTD capacity building activities.

Impact. Change in the level of farmers' knowledge and skills, farm practices, and farm productivity is operationally defined in the context of this research. hence, overall improvement of their income and livelihoods.

NERICA is an acronym which represents: New Rice for Africa is the product of site-specific hybridization between the cultivated rice species of Africa and Asia. Rice breeders in West Africa have finally been successful to cross or combine the local-stress adaptation of African rice with the high yielding potential of the Asian rice (Asian rice crossed with the African genotypes (*Oryza sativa* and *Oryza glaberrima*) respectively.

NERICA Technology is the introduction of growing and carrying out all agronomic and processing activities for the upland rice

Participatory Technology Development (PTD) according to Oduor et al (2018) is defined as the process of combining the indigenous knowledge and modern science knowledge in an interactive way, in order to identify, generate, validate and apply new techniques and practices.

Productivity is used to imply agricultural productivity. In this research, it means output per unit area of NERICA rice technologies promoted through CIP approach. Also, it refers to the household income accruing from the farm enterprises related to the incorporation of NERICA rice farming.

Smallholders for this study mean farmers who have less than twenty five (25) acres of total farm.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Agriculture extension is a deliberate educational endeavor meant to advise, train and pass information to the farmers on farming technologies that can assist to improve farming business and in influencing them to embrace improved techniques in their farming operations. The operations include; livestock management, agricultural production, farm management, environment management and marketing of farm produce. The aim of extension exercise is to improve farmer livelihood through improved production and income (Anderson & Feder 2004, Swamson, 2006 & Muneer, 2014)

Worldwide, technology has played a critical role in improvement of agricultural productivity and in the promotion of agricultural development in various countries. Agricultural extension is a channel of promotion of agricultural technologies. It drives technology messages from research point to the farmer point of use or indented to be used. Participatory extension approach is common in various countries like India, Nigeria and Kenya (Hamisu, et al, 2017; Kaur & Kaur, 2018). An extension approach is a method and way of delivery of technology information to the intended farmer. Previously, the choice of technologies in agricultural extension and their anticipated adoption was to expand production, increase productivity and enhance farm incomes. Currently, evolution of policies for agriculture, agricultural related trade, farmer education, farmer training, agricultural research & development have created a strong

basis in influencing the technology, agricultural production levels, and farm practices are all factors to consider. (Kassie *et al.,* 2011).

There are several agricultural extension approaches available which include: among others, the traditional extension approach, commodity specialist extension, training and visit approach, agricultural extension participatory approach, and cost-sharing approach (Kaur & Kaur, 2018). The conventional agricultural extension approach considers that technology and knowledge that can be used within a locality is available, however, the locals don't want to utilize them. The conventional approach is owned and coordinated purely by the government. Achievement is calculated through the rate of adoption of recommendate technologies and increase in national agricultural production (Dibba et. al., 2015). Community participatory extension approach dwells on the projected needs of farmers and is meant to cause increase in agricultural production and a better quality of life in the community's rural areas. Implementation of community participatory extension approach is in most cases flexible and undertake by various stakeholders. Project success is gauged by the number of farmers embracing active participating in the activities and the long term sustainability of local extension organizations/groups (Kaur & Kaur, 2018).

Community Agriculture Development Project in Semi-arid Lands (CADSAL) used two extension approaches in promotion of agricultural technologies, the Community Participatory Technology Development (CPTD) and Community Initiated Project (CIP). These approaches focused on the expressed needs of farmer groups. The groups under the CADSAL project were named as the CIP and CPTD farmer groups. (JICA, 2007) CADSAL's CIP provided start up inputs as well as training activities for the groups to

enhance their agricultural enterprise development and management. The key objective of CADSAL project was to increase agricultural production in semi-arid lands of Kerio valley and an improved quality of rural life (JICA, 2007). CADSAL record of discussion or Project document of the Ministry of Agriculture guides the implementation to be participatory, spread to local level and flexible in implementation (JICA, 2007).

The number of farmers actively participating and the sustainability of the CIPs among smallholder farmers in Kerio valley are used to determine success. Also, the continued dissemination and increase in adoption rate of the CADSAL project. The CADSAL Project promoted new agricultural technologies such as the New Rice for Africa (NERICA) which is basically upland rice varieties, Tissue Culture Bananas (TCB), Drip irrigation, push and pull technology for control of maize stalk borer, Dairy goats, introduction of camel into the Kerio valley of Keiyo North Sub County, and indigenous chicken known as the 'Kuchi' birds among others (JICA, 2007). Despite the government's efforts through the Ministry of Agriculture and the CADSAL project, as well as other development partners, technology uptake and dissemination remain low (Ogada et al., 2010; Nguezet et al, 2011). It was therefore eminent for a study on the effect of participatory approach on the dissemination and adoption of technologies a case of NERICA rice which this study intended to establish.

According to Olwande et. al., (2009), he reported that though the mean adoption rates of better crop varieties at 65 percent and manufactured fertilizer at 76 percent, appear good, major deviations are available throughout the regions and agro-ecological zones. Further, Alliance for a Green Revolution in Africa (AGRA), (2012), found out that agricultural

technology adoption levels were as low as 12 per cent for inorganic fertilizer and 30 per cent for new crop varieties in some regions of Kenya. Given the link between technology distribution, adoption, and productivity, several countries desire to push for agricultural technology development and adoption. Clear view of circumstances that determines new and/or improved technology adoption in various households and society at large is of urgent interest (Ouma et al., 2002).

In promotion of New Rice for Africa, CADSAL project used Community Participatory Technology Development (CPTD) approach in Kerio valley. CPTD is a process of sourcing demand driven technologies from generators such as Agricultural Research Institutions and Universities. The technologies are then introduced to a group of interested farmers to carry out verification trials on selected farmers among the participating groups. The trials can go on for at least two to three seasons to record and ensure that recorded yields are of value to the farmers. The successful verification trials are then documented in a technical manual and the group are allowed to expand the area under the new technology. This stage is called the upscaling phase which may be promoted as an enterprise or as a commercial enterprise among the interested farmers. The extension agents are allowed to carry out more demonstration as a means of dissemination or upscaling of the proven new agricultural technologies. In the CADSAL project, the initial groups that carried out verification trial were named Community Participatory Technology Development (CPTD) groups. The CPTD groups may graduate to the Community Initiated Project (CIPs) and more training pertaining to the new technology such as NERICA was done. CADSAL facilitated CPTD groups contributed 20% of the total project cost either in cash or kind accumulated together. The CPTD's

were graduated to CIPs who qualified to 40% of the total cost in monetary terms. This was to ensure commitment of the CIP group to the project activities and enhance a feeling of belonging, hence sustainability of the project. The two project approaches of dissemination and training was meant to improve the rate of adoption and sustainability of the introduced technologies by the project.

Community participatory technology development (CPTD) is a process where knowledge and research activities are combined at the community level. This is carried out through identifying, creating, providing some test, adapting and having the approved skill be promoted between and among the community members (Kaptui & Omondi, 2018). On the other hand, community-initiated project (CIP) is an endeavor by the community to create a solution to a challenge that is agreeable as existing in the society. CIP has a linkage to technology development with a focus on the existing problem as interpreted by the affected parties (Hanson et al, 2006). Furthermore, Community participatory extension (CPE) approach is a process which recognizes the community as the owners of the challenges, solutions and effect of the technology implementation. This therefore makes the process value and embed the involvement of the community at every step of the project be it identification, implementation of closure as illustrated by Hagmann et al, (1996). The three aspects therefore are crucial and linked in the identification of an extension problem, solution and in implementation of the project through community involvement and ownership (Cheruiyot, 2020).

Rice is considered the third most crucial cereal crop following wheat and maize. However, rice demand has been increasing steadily among the youthful and urban

population in Kenya (Atera et al., 2018). The country produces rice mainly under irrigation systems requiring large investments in water infrastructure. Introduction of the New Rice for Africa (NERICA) which is suitable for upland conditions without flooding has improved the level of production of rice to meet the ever-increasing demand (Africa Rice Centre, 2008). African Rice Center (ARC) produced the NERICA through inter-specific hybridization of *Oryza glaberrima* and *Oryza sativa*. The cultivar combines the African rice's tolerance features with the Asian rice's productive traits. ARC released the NERICA cultivars to Kenya in 2004 for adaptation testing. In 2007, the Community Agricultural Development Project in Semi-Arid Lands (CADSAL) trialed the New Rice for Africa (NERICA) with the goal of increasing food production and providing food security for the Kerio Valley people.

KARI in liaison with the National NERICA development committee carried out the NERICA national performance trials in various sites. After the trials, four (4) varieties were officially released by Kenya Plant Health Inspectorate Service (KEPHIS). The varieties NERICA 1, NERICA 4, NERICA 10, and NERICA 11 were proven to be suitable, adaptable, and released for farmers to raise (JICA, 2007). The NERICAs' yield ranged from 3.5 to 5.0 t/ha (Atera, et al, 2018).

Therefore, the purpose of the research was to establish if there was any effectiveness of community participatory extension approaches in adoption and dissemination of upland rice among smallholder farmers in Kerio Valley, Elgeyo Marakwet County, Kenya.

1.2 Statement of the Problem

Despite the fact that agriculture extension plays a critical role in the diffusion of information and technologies in most developing nations, adoption rates have been low, particularly in rural areas where agriculture is the primary source of income (Managanta, 2020). This has led to decreasing low production and income levels among small-scale farmers. One such extension approach is Community Participatory Extension (CPE) which was introduced by CADSAL project. Small scale farmers in Elgeyo Marakwet has continued to face many challenges among them pests, weeds, erratic rainfall, Land degradation and loss of soil nutrients. This has led to low production and income hence low rural development rate (Mango et al., 2018; Kemboi et al, 2020). The CPE approach was developed and used by CADSAL project in Elgeyo Marakwet County to disseminate information with hope of increased diffusion and adoption of rice among small scale farmers in the study area. Despite the knowledge dissemination on NERICA rice in Elgeyo Marakwet County for almost a decade, there are no studies to ascertain the effectiveness of community participatory extension approaches in dissemination and adoption of upland rice among smallholder farmers in the study area, hence the need for this study.

Despite the introduction of several projects such as ASAL and SARDEP before the implementation of CADSAL project in 2005-2010, agricultural production has had many issues for example low crop production, reduced soil productivity, pests and diseases, erratic rainfall and degradation among small scale farmers. Conventional extension has been utilized previously by most government guided extension agents through

demonstrations, farm visits and farmer trainings but the results in spreading agricultural technologies from research to farmers through extension agencies has not been successfully felt by the community (Kaur & Kaur, 2018). The conventional extension methods used top-down approach in their extension service delivery strategy from the agents to the farmers, this could have provided the chance for low adoption of agricultural technologies.

This study therefore was interested in Community Participatory Technology Development (CPTD) and Community Initiated Project (CIP) approaches which together formed the community participatory extension approaches in dissemination and adoption of upland rice among small-holder farmers in Kerio Valley, Elgeyo Marakwet County, Kenya.

1.3 Purpose of the Study

The aim of this study was to determine the effectiveness of community participatory extension approaches (CPTD and CIP) through CADSAL project in dissemination and adoption of upland rice within smallholder farming fraternity in Kerio Valley, Elgeyo Marakwet County, Kenya.

1.4 Specific Objectives of the Study

From the background information and literature review the following objectives were formulated for the study:

1. To determine and compare level of knowledge between CADSAL and non-CADSAL participants on NERICA technologies in Kerio Valley of Elgeyo Marakwet County, Kenya.
2. To describe and compare if the CADSAL participants and non-CADSAL participants disseminate knowledge and skills acquired in NERICA technologies to other farmers in Kerio Valley of Elgeyo Marakwet County.
3. To determine the adoption level of NERICA technologies promoted through community participatory extension approaches between CADSAL and non-CADSAL NERICA farmers in Kerio Valley of Elgeyo Marakwet County, Kenya.
4. To analyze the influence of some socio-economic factors towards the adoption of NERICA technologies in Kerio Valley of Elgeyo Marakwet County, Kenya.

1.5 Hypotheses of the Study

$H1_1$ - There is statistically significant difference in the Level of knowledge between CADSAL NERICA participants and non-CADSAL NERICA participants on NERICA technologies due to CPE capacity building approaches in Kerio Valley of Elgeyo Marakwet County, Kenya.

$H1_2$ - There is statistically significant difference between CADSAL NERICA participants and non-participants in dissemination of knowledge and skills acquired in NERICA technologies and extension information to other farmers in Kerio Valley of EMC, Kenya.

$H1_3$ - There is statistically significant difference in the adoption level of NERICA technologies promoted through community participatory extension approaches between CADSAL and non-CADSAL farmers in Kerio Valley of EMC, Kenya.

$H1_4$ - Socio-economic factors have significant influence on the adoption of NERICA technologies in Kerio Valley of EMC, Kenya.

1.6 Significance of the Study

Community participatory extension approach in agriculture has been globally used with limited literature on the usefulness when it comes to dissemination and adoption levels by the CADSAL project stakeholders and the implementing agencies. This study therefore will be of importance in information to the government, non–Government organizations (NGOs), farmers, consultants, and academicians in getting an understanding and provision of information pertaining the level of adoption occurring through projects implementation. The parties involved will be guided on how to improve the use of technologies that are relevant to Nerica Rice. The findings from this study will be valuable to government agents, particularly those working in the Ministry of Agriculture, Livestock, and Fisheries and the devolved County Government units, in their attempt to establish policies aimed at enhancing the knowledge of smallholder farmer groups. This research will be valuable in determining whether community participatory extension approaches in its implementation have been effective in expanding agricultural technology knowledge and improving competent decision-making. Furthermore, through community participatory extension practices in the respective farmer organizations, farmers' access to the agricultural product market has been improved.

Agriculture extension practitioners will find results of the study useful while enhancing agricultural performance aimed at improving the community development level while ensuring that the involvement of the community is key and important in the sustainability of the technology utility. While it is true that Elgeyo Marakwet have had many projects meant to improve agricultural production, the end results have not been commensurate with the efforts hence the results of this study focusing on community participation will guide on the best approaches to improving extension results in the area and beyond. Academicians may also find the outcome of this research useful for enhanced research with intention to increase more knowledge on the studied area.

1.7 Scope of the Study

The study dwelled on the effectiveness of community participatory extension approaches in dissemination and adoption of upland rice among smallholder farmers in Kerio valley, Elgeyo Marakwet County in North Rift Valley, Kenya. The study focused on participants and non-participants of the CADSAL project in Elgeyo Marakwet County. It included members and leaders of the CIPs and CPTDs and NERICA small-scale farmers. The study focused on the project's scope and diffusion of knowledge and technologies, as well as the rate of acceptance. The study units were basically the participants and non-participants who were compared and tested using inferential statistics.

1.8 Assumptions of the Study

The research process was free of prejudice, and it was assumed that the small-scale farmer cooperated and provided accurate information.

1.9 Limitations of the Study

The education level of farmers provided some difficulty in understanding the questions hence might have limited the response to interview questions. Weather conditions and terrain of the study area was also a limiting factor. However, the limitation was reduced by having enumerators who could translate English to local dialect and who understood the terrain of the area well. This therefore led to proper and timely information gathered.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter covers the literature review on the extension approaches and its link to CADSAL project and how they interact in influencing technology adoption.

2.2 Agriculture Extension Service

Agriculture is key to the sustenance of African economy for it contributes to major gross domestic product (GDP) and foreign earnings of many countries. Agriculture earnings in Tanzania contribute an approximate of 50 percent of the country's GDP with a contribution of 75 percent export earnings according to Leyaro & Morrissey, 2013). Furthermore, Uganda experiences an agriculture contribution of approximately 37% of Gross Domestic Product (GDP) with a translation of 19% of the country's exports. A total of 47% of GDP in Ethiopia, arises from Agriculture and this provides about and 60% of export earnings (World Bank, 2011). More so, Ghana economy by GDP is sustained at 28.3% in 2011 (World Bank, 2011). In South Africa, a total of 3% of the GDP is from agriculture and remains a key provider of employment, mainly in the rural areas and along the value chain and a major earner of foreign exchange. Furthermore, Agriculture is a source of food as well as employment among the majority of Sub-Saharan African population (Diao *et al*., 2007). In total, about 75 percent of rural residents of Tanzania depend on agriculture as their main source of employment and livelihood (Amani, 2005).

Agriculture is carried out mainly by smallholder farmers who sums up almost 90 percent of the rural population (Rutatora & Mattee, 2001; Kabuye & Mhango, 2006).

Kenya depend on agriculture with about 80 per cent of Kenya's population live in rural areas and surviving on farming and farm activities. Agriculture sector is dominated by the small holder farmers and contributes 26 per cent of the Kenyan Gross Domestic Product (GDP) (FAO, 2020). Despite agriculture being the most important economic contributor and livelihood supporter, its productivity has continuously been declining in Kenya (FAO, 2019). The most affected when it comes to agricultural decline are the smallholder farmers through deficiency in food, income and nutrition security (Kemboi et al, 2020).

Kenyan government has emphasized on crop diversification and value addition in agriculture especially through vision 2030 blue print. Key areas in Kenya Vision 2030 include increased agricultural productivity, enhanced food security and high income growth improved technology utilization. Elgeyo Marakwet county in particular has developed a strategic plan on promoting high-value crop diversity and livestock enterprise (EMC (Elgeyo Marakwet County), 2019). The identification of crops or livestock enterprises is done based on its value to the community (Njeru, 2013). Optimal temperature and other factors suit NERICA rice production and that is why it was fronted through the project (Farmlink, 2017).

According to Mwangi & Kariuki (2015), Previous studies on agriculture extension services in dissemination of technology and adoption have eported the cost being a hinderance to adoption. The study carried out by Makokha *et al*. (2001) on determinants of fertilizer and manure use in cereal farming in Kiambu county, Kenya indicated

increased cost of labor and other inputs, scarcity of demanded packages and untimeliness in the delivery as the key hindrance to fertilizer adoption. Increased cost of outsourced labor was also highlighted by Ouma *et al*. (2002) as one of the key factors affecting adoption of inorganic fertilizer and improved seeds in Embu county Kenya. Furthermore, Wekesa *et al.* (2003) when analyzing determinants of adoption of improved maize variety in coastal region of Kenya concluded that high cost and scarcity of seeds was a key factor responsible for delayed rate of adoption. Kemboi et al. (2020), established that agriculture extension enhancing diversification was key in enabling increased production and food security in Elgeyo Marakwet county whose inhabitants depends more on agriculture.

According to Leyaro & Morrissey (2013), smallholder farmers in Africa cultivates a mean farm size ranging from 0.9 to 3.0 hectare per household. Based on this, smallholder farmers remain a critical player within the economic dynamics in the region. In a matter of improving agricultural productivity and rural development, the use of agricultural extension is key. Agriculture extension is a means in which the smallholder farmers' get knowledge of new farming technologies created outside the conventional environment of operation. The low level of literacy among smallholder farmers creates a necessity for agriculture extension staff to play a key role in agriculture development and enhancement. This is envisioned to continue for some time in Africa (Davidson & Ahmad, 2003; Amoako-Tuffour & Armah, 2008). Despite various efforts undertaken, the agricultural extension systems in most African countries have encountered many challenges that have rendered them slow and ineffective in dissemination of technologies

and improving the rural farmer economy (Rutatora & Matte, 2001; Davidson & Ahmad, 2003).

Extension services if well utilized in terms of design and implementation have a potential to improve agricultural productivity (Romani, 2003). Extension means giving advisory and other services' which can help farmers to make use of the available resources within their disposal to better lives (Katz 2002). Agricultural extension services give farmers information that is necessary for the crop or livestock value chain, which include prices, seed varieties, crop management, and product marketing. Agricultural extension is important in enhancing production, income and better life. There are various agriculture extension approaches that can be employed in knowledge dissemination. These approaches include; general extension approach, commodity extension approach, project extension approach, participatory extension approach, training and visit extension approach, education institutional extension approach and cost sharing extension approach (Mwangi & Kariuki, 2015). CADSAL utilized community participatory extension approach, which this research tries to investigate its effectiveness in the level of adoption.

2.3 Extension Approaches

Extension approaches can be described as systems and measures created to form and enhance the knowledge and skills of the rural farmers and other stakeholders. This is fulfilled through clear access to information and knowledge while enhancing agricultural skills and practices throughout the process. Capacity to formulate practices that are new and innovative and that address varied rural development challenges through training programs, improved coordination and strategic techniques is what agricultural extension

approaches are all about (Christoplos, 2010). Agricultural extension approaches are key in enabling the link between farmer-based organizations and other key players in the industry. The many players in the agriculture industry include, government agencies, private sector actors, Non-Governmental Organizations (NGOs), agricultural research agencies and education centres who in their work carry out agricultural extension approaches delivery activities (Davis & Heemskerk 2012). These services also contribute to agricultural sustainability, livelihood improvement and well-being of populations in rural areas (Dearing & Cox, 2018).

There has been various non-state players that carry out Extension Approach Service (EAS) delivery mechanisms on daily basis. Their work and duties are different from one another based on customers, quality and type of the EAS provision. For example, NGOs, private sector agencies and Religious based groups are key and important actors in extension service provisions. The common thing among them is that they establish common interest farmer groups. The groups are then linked to markets thus improving EAS delivery systems by encouraging demand-driven approaches in agricultural production system (Hassan et. al., 2016). Though there are many players providing different options for EAS delivery systems, there exist a myriad of challenges that affect the optimization of pluralistic agricultural extension systems (Christoplos, 2010). Furthermore, NGOs and FBOs are in most cases affected by low capacity and over reliance of foreign support (Diiro et. al., 2018). The support given by private companies is in most cases geared towards well-off farmers who can afford the service cost. This therefore creates a gap of dealing with high-value agricultural commodities and forgetting the rural poor farmers who cannot afford the services cost (Diiro et. al., 2018).

The government is cardinal in ensuring that service provision is seamless to everyone irrespective of economic status in the society through regulation and effectively coordinating pluralistic extension systems (Thabit, 2015)

2.4 Conventional Extension Approaches

An extension service is an essential production factor in agriculture. Farmers need extension advisory services by providing relevant information to improve their current farming practices. The work of an extension agent is to extend to the farming community information pertaining to the possible working technologies already developed through their research institutions. According to the Anderson & Feder (2004) extension can be defined as an on-going process of getting useful information to the people, assisted them to acquire the necessary and relevant knowledge, skills and attitude to utilize the information or technology for their own benefit.

Rather than trying to define conventional extension, Anderson & feder, (2004) identified five common factors for all extension services: (i) it is an intervention; (ii) it uses communication for change; (iii) change must be voluntary; (iv) it works through planned process and outcomes; and (v) it is institutionalized (Kaur & Kaur, 2018). From the factors identified as affecting adoption of technologies, many governments have made tremendous efforts of reaching their farmers through transferring technologies through the public sector extension. In Kenya, extension services are basically a public sector operated service through the Ministry of Agriculture and Livestock development (Atera et al., 2018).

The listed characteristics of conventional extension service are generally hierarchical with extension agents as instructors rather than farmers' advisers or facilitators. The scope of activity is defined functionally and in addition to the disseminating agricultural information, officers are frequently engaged in administrative and regulatory duties (i.e. collecting statistics and supervising credit, inspecting crops). An administrative task of this type must deal with many side issues, which from a theoretical standpoint have little to do with educative role usually assigned to "extension". (Kaur & Kaur, 2018; Atera et al, 2018).

Conventional extension approach utilizes mostly the "top down" model in transfer of technology (TOT), which conforms to the basic assumption that its important role is passing superior technologies into conventional farming practices. Farmers here are seen as the recipients of "expert" decision-making, either adopters or rejecters of innovations, and not the founders of either technical knowledge or superior practices (Kaur & Kaur, 2018; Atera et al, 2018). The conventional extension approach has had its shortcomings as evaluated and illustrated in various research findings (Atera et al, 2018). The conventional extension approaches ignore working with group and institutions. They tend to dwell so much on individual farmers or households, who are chosen based on the of likelihood of accepting the innovation. They are in turn expected to provide and encouragement to other community members to accept through demonstration in their farms (Dearing & Cox, 2018). Due to the poor performance of the conventional extension approaches, arose the need to search for alternative approaches, which basically are interventions to improve the current conventional extension approaches and more sensitive to the needs of the farmers. Among such approaches were the Training and Visit

(T&V), National Soil and Water Conservation through the Catchment approach, Farming System to Research and Extension, Participation approaches (i.e Farmer Participatory Research (FPR), Farmer Field School and Focal Area Approach) among several others (Atera et al, 2018).

Therefore, in context of this study, the conventional extension approach, which is basically a service operated by the Ministry, was the current system in existence before the introduction of CADSAL project in Elgeyo Marakwet County.

2.5 Participatory Approach on Promotion of Agricultural Technologies

Farmers and extension workers communicate and make a shared decision and share information in a non-formal educational approach known as participatory extension (White, 1994; Leuuwis, 2004). Because of its democratic decision-making process, participatory extension is gaining favor (Lindner, & Dolly, 2012). In terms of operations, participatory extension leaves a lot to be desired in terms of making all players happy and enjoying the process. Participatory extension as an international development concept dates back to a statement made by Robert McNamara, then-president of the World Bank, to the Bank's Board of Directors in Nairobi, Kenya, in 1973. He underlined that no program can help small-scale farmers if it is created by people who don't understand their difficulties and implemented by people who don't care about their future (World Bank, 2011). This led to the idea of local engagement being adopted by the international development community as the cornerstone for the success of most of the integrated rural development programs (IRDPs) that were developed at the time. This model was

emphasized by Arora (2015) who insisted in talking to people about the project and how it is going to be actualized.

According to Hassan et al., (2000), the main benefit of the participatory approach compared to conventional approach is the use of many and diverse brains to achieve a single goal. Kaur & Kaur, (2008) suggested that enhancing using participatory approaches is one way of increasing rural innovation strategy, whereby such approaches may entail enhanced accessibility by smallholder farmers to embrace and create technology, the combined creation of related and necessary technology by smallholder farmers and researchers, or the strengthening of localized knowledge base to overcome local issues and improvise solutions that can lead to a major improvement in promoting agricultural technologies among small scale farmers.

Research undertaken by Oduor et al., (2018), argues that participatory approach results to many technologies and types of knowledge and skills because local farmers have opportunities to unleash vast opportunities available than researchers. The innovations can be experimented further through various cultural and environmental conditions to prove its worth. On the contrary, various research reports have detailed challenges of the participatory approach**.** Firstly, it is not easy to pin point what point the participatory approach practice contributed to the success of the innovation adoption. This is because most technologies created participatory approach are born locally to adjust to the environmental conditions and social set up. This makes it difficult to be promoted as it is to another area or socio economic set up especially in the highly varied environments in which many poor small holder farmers live (Thabit, 2015).

Several studies have demonstrated the impact of a participative approach on productivity and income levels in diverse regions; all of the research are qualitative case studies (Damba et al, 2020). Ozor et al. (2007) conducted a quantitative study that used statistical approaches to analyze data from a survey of 170 Ugandan agricultural producers. The goal of these investigations, however, was to clarify the elements that influence farmers' willingness to contribute to initiatives. The study's findings confirmed that participatory approaches gave farmers the ability to express what they wanted out of a project, necessitating a higher level of adoption of intensive technological farming practices among agricultural small scale farmers (Ishola & Arumugam 2019). However, there is still debate about the roles of formal and informal research and development (Damba et al 2020).

Mansuri & Rao (2003) conducted a study of 138 papers on community-driven development (CDD) programs. The findings of the review research confirm the participants' high expectations for the project. The findings show that CDD initiatives result in more effective and long-lasting community infrastructure as well as enhanced livelihood outcomes. The findings of the study demonstrate that an all-inclusive approach continues to improve the rate at which agricultural produce is created, hence raising the living standards of rural small-holder farmers.

Confirmation of the key-agent issue has been proven real in many studies. The need for project actualizers is in most cases poorly oriented with the intention of the projects. Somehow, those who benefit and those who implement projects do so based on a benefit to show that the project is successful to the outsiders, and may sometimes collude for this

reason. Lindner and Dolly's (2012) presentation demonstrates a trend at the World Bank for project designers to illustrate a best operation that works well in one country and deploy it in a variety of contexts rather than making tacit efforts at concrete project design. Manipulation of consumer needs has been found in all of the research that have been reviewed. Even in initiatives with a higher level of participation, recognized common requirements might be influenced by local power dynamics, partner agendas, or consumers' perceptions of the project's goals.

2.6 Overview of CADSAL Project

Community Agriculture Development project in Semi-arid lands (CADSAL) is a project that was implemented by the Ministry of agriculture in conjunction with JICA and was operated in Elgeyo Marakwet County between the years 2005-2010. The research was carried out ex-post to find out the extent of the perception as and when the project was undertaken. This is with view that the duration would accord the respondents good time to synthesize the pros and cons of the NERICA rice production in relation to the project implementation. It was aimed at livelihood support for communities in semi-arid lands in enhancing food self-sufficiency and economic empowerment. The main outputs were to strengthen participatory project planning and implementation, promoting pluralistic extension service delivery system, verifying appropriate technologies, to increase crop and livestock production and preparing guidelines for community agricultural development. CADSAL utilized two main approaches Community Initiative Project (CIP) and Community Participatory Technology Development (CPTD). The main activities under CIP were crop and livestock production including irrigation and

environmental issues requiring the group efforts for implementation. CIP emphasized on improvement of group management skills and inculcate the sense of ownership for the group sustainability. The main crop promoted during the project lifespan was upland rice whose aim was to enhance agricultural production in the region and project area. The key varieties that were promoted were NERICA 1, 4, 10 and 11.

The main activities of CPTD were to float agricultural technologies to the farmers through consultation. These technologies included New Rice for Africa (NERICA), Tissue Culture Bananas (TCB), Drip irrigation, push and pull technology, Dairy goats, Camel farming and indigenous chicken in Kerio valley of Keiyo North Sub County.

2.7 CADSAL Cost-Sharing Approach on Promotion of Agricultural Technologies

One other factor that could interfere with promotion of technologies in agricultural extension is the cost which could be solved through cost sharing approach (Ozor et al, 2007). Rice farmers could coalesce and negotiate through farmers' associations or cooperatives that makes them enjoy the economics of scale in messages and cost (Attah, 2018). The term "cost-sharing" refers to a relationship between beliefs and behaviors that influence public-private sector relationships in order to ensure society's progress and well-being (Attah, 2018). The comprehension of such interactions, including the portion handled by key actors in collaborating that creates successful partnerships or otherwise, was one of the conceptual parts of cost sharing (Ajani, 2015). Continuous availability of agricultural extension and other socio-economic services and products in developing countries, such as Kenya, can be achieved through cost sharing, in which the government provides the bare minimum of services, products, and or care, and the private sector,

including farmer organizations, contributes skills and core competencies, while donors and businesses provide funding and other resources. Collaborations like these are very effective at reducing poverty and ensuring food security (Ajani, 2015).

Improved seed and credit can also be made available to farmers by the government and NGOs (non-governmental organizations) who are active in the implementation of food security programs in Kenya and Elgeyo Marakwet in particular, according to Ejembi et al (2014). Farmers should join organizations in order to continue lobbying for the reinstatement of farm input subsidies, which would lower the high cost of extension and inputs. Farmers would use more inputs as a result, resulting in higher rice productivity in the targeted areas. It is advised that nations and their partners build all-inclusive farm input stations within each agricultural community for simple access to seed, inorganic fertilizers, and pesticides, as well as for leasing farm machinery in the area, to formulate an easier access to farm inputs approach.

In order to improve the transmission and acceptance of innovative technologies, the demands of farmers and the community must be expressed in a more efficient and appropriate manner (Okwu et al, 2006). Several studies on adoption and impact conducted in West Africa revealed that the introduction of rice variety agricultural technologies had a positive impact on rice output in the region. However, if larger farmer organizations had been exposed to the new rice technique, there would have been a greater uptake of the technology in the regions (Nguzuet et al, 2011). As a result, the CADSAL initiative encouraged farmers to work together in groups to improve the uptake of established rice technology in the Kerio valley (Kemboi et al, 2020). The project

participants were at various stages of building their rice acceptance capacities and access to extension services. The project built a collaboration between Africa Rice and the Extension Services from both Ministries of Agriculture and private organizations responsible for improving the food industry and agricultural production in Kenya to provide a chance to formulate and share knowledge on food security issues (Kemboi et al, 2020).

2.8 NERICA Rice farming

Agricultural growth is vital in enhancing economic development and provision of food for the ever increasing global populations especially in most developing countries. Land area for expansion and irrigation have already become a very scarce. As a result, agricultural expansion will continue to be increasingly reliant on yield-increasing technical advancements (Nguezet et, al 2011). The call for the introduction and adoption of new agricultural technology, such as NERICA rice, could result in significant increases in agricultural productivity in Africa, accelerating the transition from low-productivity subsistence agriculture to high-productivity food production and a more prosperous economy (World Bank, 2008). According to Mendola (2007), adopting high yielding cultivars improves household well-being in both food and economic terms. New agricultural technologies directly benefited poor rural inhabitants by improving farm household incomes and indirectly by increasing employment and wage rates of landless laborers. Furthermore, technology adoption in agriculture reduces price of food staple as well as enhancing the nutrient diversity (Bellon et al., 2006; Diagne et al., 2009).

In recent past, rice production has been increasing significantly through production and productivity (Okoruwa et al., 2007; Nguezet et, al 2011). This is coupled with the increasing demand for rice products that is higher than its production. Most African countries including Kenya depend mainly on the imported rice products. The importation of rice is attributed to various aspects that include the fast population increase, high poverty levels in the rural areas and lack of high yielding varieties that has good grain qualities. Furthermore, there is a significant competition of local and imported rice, a situation that is coupled with inadequate post-harvest processing. Soil degradation and poor land preparation, inconsistent and irregular rainfall distribution, weeds, insect pests, illnesses, birds, and a lack of training for key stakeholders are all contributing factors to low rice output (Nguezet et, al 2011).

NERICA types are interspecific hybrids or hybridizations between the native African rice (*Oryza glaberrima*) and the Asian rice (*Oryza sativa*) that provide a unique and fresh possibility for rice farmers, notably in Kenya. When compared to standard rice types, NERICA cultivars have unique properties such as shorter duration, higher yield, tolerance to severe shocks, more protein, and good flavor (Wopereis et al., 2008). The qualities could help Kenya, particularly Elgeyo Marakwet, bridge the rice demand and supply imbalance. The implementation of NERICA could be one way to double rice production in accordance with the National Rice Strategy (Ogada, 2010). Researchers have observed that these NERICA cultivars had steady yields under a variety of management settings, and their introduction into farmers' fields was seen as a first step toward stabilizing and sustainable intensification of Africa's vulnerable upland rice production (Ogada, 2010).

2.9 Adoption of Agricultural Technologies

Technology innovation adoption has gotten the attention of various management and innovation fields from varied perspectives. These perspectives include institutional theory as stated by Attah (2018). Innovation is a critical factor that is shared in different fields including agriculture (Atera et al, 2018). Atera et al, (2018) defines an innovation as a new idea, practice, or object presented to improve the livelihood of people. Furthermore, Luecke & Katz (2003), defines innovation as an introduction of a new thing or method, this include introduction of NERICA rice in Kerio Valley area.

A review of development economics literature that emphasized the importance of assessing fundamental issues in overcoming poverty in general and improving low-income smallholder agriculture performance in particular. Various scientifically validated technology and sound farming methods hold considerable potential for raising agricultural production and reducing poverty in emerging countries. However, small-holder farmers in Sub-Saharan Africa, in particular, have been slow to adopt such technologies (Regina et al, 2009). Reduced adoption contributed to Sub-Saharan Africa's persistently low agricultural productivity (World Bank, 2008). Poor understanding, lack of access to markets, significant credit limits, many uninsured risks, and coordination challenges with neighbors are all important confirmed drivers of low adoption (World Bank, 2008; Kassie et al, 2020). Several research on this topic have focused on the adoption of high-value agricultural inputs including high-yield variety (HYV) seeds and commercial chemical fertilizers. However, research on startup acceptance and the effects of enhanced basic farming methods is sparse.

Unlike other publications in the literature that look at the adoption of high-value inputs and new crops, this one looks at the adoption of high-value inputs and new crops (Aref, 2010; Arora, 2015). This research focuses on the level of technology adoption that requires a minimal initial capital expenditure. While some studies have looked at the impact of agricultural training on the adoption of improved cultivation methods (Li et al, 2020) or production outcomes (Ngombe et al, 2014), few have looked at both at the same time and provided rigorous causal evaluations of these methods' yield-improving impact in the field. For NERICA rice in Elgeyo Marakwet just like in other areas, there have been slow adoption and production increase (Kaur & Kaur, 2018; Atera et al, 2018)

2.10 CADSAL Training Approach on Promotion of NERICA Technologies Among Small Scale Farmers

The participation extension approach used by CADSAL project had various stages of training which included the identification of the technology to be disseminated to the farmers within groups; this is followed by an inception meeting to sensitize the groups on the CPTD and its selection of enterprises among various alternatives (choices) available (Nguezet et al, 2011). The third stage is the action planning of the activities to be undertaken in the groups and then development of action plan to be approved by the entire group. After the action plan is developed it is approved by the members who are possibly going to be part of the adoption and implementation of the technologies (Hassan et al, 2016). The developed action plan is finalized taking into consideration the views and comments by the stakeholders namely the farmers, groups and institutions that will participate in the project process. Upon final agreement the action plan is implemented

following the laid down procedures as agreed by all stakeholders involved in order to actualize plan. While implementation is carried out, monitoring and evaluation is factored in to ensure the process goes on as laid down and as agreed in the planning stage

Evaluation gives the project implementors and interested parties an opportunity to understand the project progress, upon which if rightly done leads to an inception meeting for the CPTD dissemination to the farmers (Kaptui & Omondi, 2018). Dissemination is done based on the action plan that is drawn in a participatory manner by the stakeholders. The plan is subject to approval by the stakeholders that include e.g Dairy/tree nursery/NERICA/ Cooperative CIPs or members) involved in the project and the approved plan is shared once again by the various stakeholders in the project to ensure each participant in the project is aware of the undertakings and majority concurrence. If majority of the participants agree with the action plan, then it is implemented and evaluation is done progressively to ensure every part of the plan is adhered to the satisfaction of the stakeholders (Kaptui & Omondi, 2018).

2.11 Theoretical Framework

The diffusion and adoption theories are used as the framework for analyzing technology uptake in this study. The decision was made while keeping in mind the challenges as well as the impact on agricultural research and extension (Tscherning & Damsgaard 2008; Dearing & Cox, 2018) that is regarded as new by an individual or other unit of adoption (Tscherning & Damsgaard 2008; Dearing & Cox, 2018). The flaws were addressed using a variety of communication strategies, such as face-to-face and telephone interactions with farmers and others engaged.

Tscherning and Damsgaard (2008) defined diffusion as the act of passing a technology through diverse channels among members of a social system over time. The Diffusion of Technology Theory aims to explain how, why, and at what rate new ideas and inventions spread across cultures (Dearing & Cox, 2018). The theory's origins are diverse and span numerous fields. Gabriel Tarde, based on the literature, was the first to study the concept of diffusion in 1890, followed by anthropologists Friedrich Ratzel and Leo Frobenius. Later, Rogers conducted significant research that led to the discovery of four primary components that accelerate the spread of an innovation: the idea in issue, the information channels, total time, and the current social system. These components act in tandem with one another. This indicates that in order for any innovation to be adopted, it must first be passed through a channel for a length of time, and that this process occurs inside a social system network. The process is primarily reliant on human capital, and in order to be self-sustaining, the innovation must be broadly embraced (Sahin, 2006).

Dearing & Cox (2018) used the terms innovators, early adopters, early majority, late majority, and laggards to categorize the adopters. Inventors are frequently the first to adopt a new technology when it is first introduced across a communication channel, followed by early adopters. These two groups are risk takers who would use a technology even if they were unsure of its capabilities. After some time has elapsed and some good advantages have been realized, the early majority, followed by the late majority, joins. The laggards join in when technology has proven to be superior without a shadow of a doubt. Despite the potential benefits of the technology, some people may be unwilling to adopt it.

Knowledge, persuasion, choice, implementation, and confirmation are the five stages of innovation acceptance outlined by Dearing and Cox (2018). That is, when a new technology is introduced, potential adopters must be aware of its advantages and disadvantages (Bennett & Bennett, 2003). He or she must be convinced that the advantages greatly outweigh the costs after learning information. He or she decides to accept the technology if he or she is convinced; otherwise, he or she rejects it. Once a positive decision has been taken, he or she follows through on it. This usually comprises a small piece of the farmer's land being used to evaluate the technology. If it is a success, the technique has been proven, and the farmer will be able to enlarge the portion of his or her field in the next farming season.

Finally, five qualities of a good technology were established by Sahin (2006) and Dearing and Cox (2018): simplicity, compatibility, trialability, relative advantage, and observability. That is, the innovation should not only be apparent, but also easy to comprehend and implement. It should also fit in with the farmer's current farming methods. Furthermore, the farmer should be allowed to try the new technology for himself or herself to judge its utility and viability. Rogers' diffusion of innovations theory indicates that the most appropriate adoption of technology is done through training and peer influence among members of groups. CADSAL project encouraged dissemination of technological innovations on upland rice and its adaption among small scale farmers (growing) in Elgeyo Marakwet. According to Bhatti et al (2011) and Dearing & Cox (2018) they noted that a technology is a calculated design for instrumental action or process that reduces uncertainty in the community in the cause-effect relationships while working towards achieving a desired outcome. The study is therefore aimed investigating

the level of diffusion and adoption of technologies on upland rice based on participatory extension approach.

2.12 Conceptual Framework

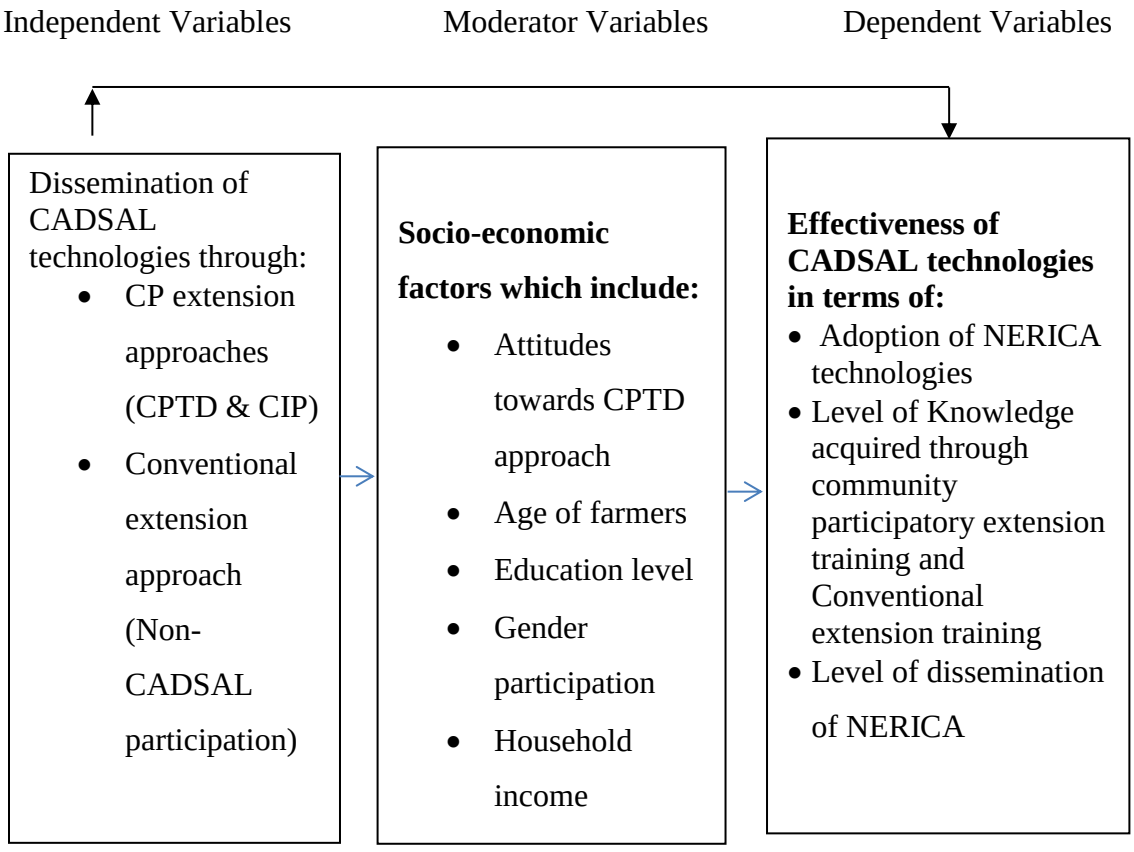

Figure 1: Conceptual Framework showing the relationship of the formulated variables.

The study focused on dissemination of extension messages and technologies in Elgeyo Marakwet through participatory extension approach in advancing the technologies related to upland rice production. The Ministry of Agriculture used a participatory approach while implementing the CADSAL project, which aimed to introduce and expand rice production in the study area in order to improve food security and income. The study will compare the level of adoption of upland rice technologies using a community

participation approach to a traditional extension approach, particularly in Elgeyo Marakwet County.

The moderating variables will be analyzed to establish how they influence the adoption rate and retention of the adopted technologies by the community of Elgeyo Marakwet County.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter covers all of the study processes and stages that were used to achieve the research's goal. Identifying the research area, research design, target demographic of the study, sample size, sample design, sampling strategy, data collection processes and research instruments utilized, data processing methodologies, and presentation of results were all part of the research methodology. The chapter concludes by specifying multiple linear regression model derived from the study.

3.2 Research Design

The research adopted descriptive approach, according to Akhtar (2016), descriptive research purposes to give statistical information that interests policy makers and practitioners of agriculture extension. The study used a survey research methodology with ex post facto research design. Descriptive survey design is a method of carrying out collection of information by undertaking interviews or administering questionnaire to a sampled respondents in a given area (Orodho, 2009). The design was used to collect information concerning change in attitudes, opinions, habits or knowledge of the respondents in Kerio Valley, (Orodho and Kombo, 2002). Survey research designs provides a researcher a chance to gather data, collate, present and provide an interpretation clarifying the findings and processes (Orodho, 2009). The research process utilized both quantitative and qualitative approach. The qualitative approach was used

while collecting data by use of structured closed and open-ended questionnaire and the interview schedules. This provided an opportunity for verification, clear explanation and establishing appropriate information. The survey information was sought in order to achieve accuracy of interpretation of data provided by the respondent (Kerlinger & Lee, 2000). Quantitative approach was employed in computing and tabulating the collected data into numerical frequencies with aid of questionnaire which was used to gather data. The achieved data was analyzed using t-test and multiple linear regression analysis. The supervisors used expert analysis to ensure the questionnaire's validity. The data was then processed using a 95% confidence level.

3.3 Study Area

The research was conducted in Kerio Valley, Elgeyo-Marakwet County. Kerio Valley runs through Keiyo South, Keiyo North, Marakwet East, and Marakwet West in Elgeyo-Marakwet County's basin. A deeper basement lies beneath the Kerio Valley Basin on the western side of the County, which is covered by a sequence of sandstones/shales and volcanoes. High gravity anomalies can be seen in the western and southern regions of the basin, where sedimentation is hampered by two normal faults. The Kerio Valley Basin is limited to the west by a dipping fault system that runs north-south. Lower rocks and upper covers of volcanoes have higher densities than infilled sedimentary sections in the lower basin. The valley's basin floor is marked by a vertical fault that runs parallel to the Elgeyo fault.

The four Sub Counties of Keiyo South, Keiyo North, Marakwet West and Marakwet East have conducive characteristics of soil, rainfall and temperature for upland rice

production. This are the sub counties that CADSAL project focused on in upland rice technology transfer. The area is used to maize farming as a stable food crop but owing to the erratic weather changes and nutritional need among the residents the NERICA rice technology was necessary to enable the area residents get a diversifying crop that can assist in boosting food security, income and livelihood. A total of 160 respondents were targeted with 80 of them having participated in the NERICA rice technology. NERICA varieties promoted during the project were NERICA 1, NERICA 4, NERICA 10 and NERICA 11. They were promoted in Arror, Tot Division, Kabulwo SubLocation of Keu Location and Rimoi Sub Location of Kamogoch Location, Tambach Division. Figure 2 illustrates the divisions of Elgeyo Marakwet County where NERICA rice was promoted.

Figure 2: Map of Elgeyo Marakwet County adopted from ResearchGate (Chepwambok, et. al., 2020)

3.4 Target Population

The target population of the research was 480 farmers who participated in NERICA growing technology adaptability trials and demonstrations in Elgeyo Marakwet County as shown in Table 1. The sample size was achieved from the population in a proportionate manner depending on the participants of the technology trials. The sample therefore was in a ratio form from each sub county. The total sample size from the four sub counties was 160 members. Table 1 shows the total population per Sub County and its proportionate sample size.

Table 1: Study area, population and proportionate sample size

Sub county	Population	Sample
Keiyo South	108	36
Keiyo North	99	33
Marakwet West	147	49
Marakwet East	126	42
Total	480	160

Source: CADSAL Manual

3.5 Sample and Sampling Procedure

The researcher used maximum variation purposive sampling technique to identify NERICA technology participants and non-participants. The variation was to differentiate the extend of adoption between those respondents who participated in the project and those who didn't participate in the project and get to acquire their views on dissemination and adoption rates. Stratified sampling followed the purposive sampling. Stratification came about through the Sub Counties they come from and the groups they are affiliated to. Simple random sampling was carried out in the selection of respondents from the

categories prior identified through purposive and stratified techniques. The process was carried out at random to achieve the respondents at a sample frame of 80 NERICA-Participants and 80 Non-NERICA technology participants. The sample was achieved from a total population of 480 spread across the four sub counties of Elgeyo Marakwet County. The sample was acquired through proportionate among the target population in the four Sub Counties.

3.6 Data Collection Procedures

This section provides an overview of how data was collected from the identified respondents. A brief introduction was given to the respondents explaining the need of objective information and how the data will be used. The researcher further clarified that the data and any information provided was purely for academic purpose and that confidentiality was going to be upheld fully. The researcher used questionnaires to collect information and interview schedule to achieve clarification at a focus group discussion.

The researcher carried out data collection by administering a structured questionnaire that was administered to 160 respondents. Among the 160 respondents were 80 CADSAL project participants and 80 non participants of the CADSAL Project. The copies of questionnaire were administered to the randomly chosen participants from the list of the intended population. The respondents were requested to cooperate in answering questions asked by the researcher. The researcher administered questionnaire face to face to the respondents. The respondents were encouraged to be truthful in answering the questionnaires asked. The questionnaire were filled during the exercise to enhance efficiency and accuracy of data for analysis purpose.

The researcher through interviews conducted at respondents' homes or farms were administered with a structured questionnaire. The mode of interviews was by meeting the respondents face-to-face and introductions were done by the field officer who also acted as a guide in locating the homes of the respondents and a translator in case there were farmers who were not competent in the official language of Kiswahili or English.

3.6.1 Farmers Interview Schedule

The questionnaire's content and structure were in line with the study's goals. For this study, a fully structured interview schedule ensured that a systematic data collection technique was followed and that the data acquired was internally consistent, resulting in a uniform and coherent outcome when analyzed. Experts tested the authenticity of the open and closed ended questions on the interview schedule. The interview schedule was administered by the researcher assisted by the enumerators who understood the area well. The closed questions/statements in the questionnaire administered had were to be answered with a true/false option, levels for example between level 1-5, and choices among the provided options. Open-ended inquiries, on the other hand, contain free-form responses such as the number of children or age. The test comprised of eighteen basic questions about common agricultural knowledge and NERICA technologies that were communicated to farmers in Elgeyo Marakwet County through CADSAL participatory Extension trainings. The interviewer attentively read the assertions to the respondents, and their responses were recorded as true or false.

3.6.2 Focus Group and Observation

During the administration of the study questionnaire, the researcher used observation. Furthermore, focus group discussions were used to clarify terminologies and situations used in the Elgeyo Marakwet research coverage area. It was attended by eight people drawn from the agriculture office, opinion leaders, and farmers.

3.7 Validity and Reliability of Research Instruments

Validity is the production of relevant information related to an objective while reliability is the consistency of a test results over time. This was meant to increase consistency, objectivity and integrity of the study.

3.7.1 Validity

Validity refers to the degree to which differences observed with a measuring instrument represent genuine differences among people being tested (Akhtar, 2016). This indicates that the research method produced data that was relevant to the study's goal. Validity is a measure of how well a certain measurement of a concept accurately depicts the concept itself, according to Akhtar (2016). Expert advice was employed in this study to align the questions in the questionnaire with the objectives and the overall research procedure.

3.7.2 Reliability

The reliability of a test is a measure of how consistent the results are over time (Akhtar, 2016). A pilot study with 20 respondents was conducted to assess the instrument's reliability. The reliability test was performed using SPSS to determine the Cronbach

correlation coefficient, the results of which informed questionnaire correction if the value was less than 0.7.. The acceptable level of correlation coefficient was to be equal or over 0.7. The tool therefore was adopted since the value was more than 0.7 after the pilot test of the questionnaire was undertaken at Biretwo local area in Keiyo South subcounty.

3.8 Data Analysis and Presentation

Both descriptive and inferential statistics were utilized in the data analysis of the variables concerned. At a significance threshold of 0.05, the null hypotheses were tested. The Statistical Package for Social Sciences (SPSS) version 24 was used to code and analyze the data. Frequencies, percentages, means, and standard deviation were used to describe the data. The sample means of NERICA technology participants and non-participants were compared using the T-test to see if there were statistically significant differences in mean scores between the two groups in terms of NERICA technology dissemination and adoption in Kerio Valley locations where NERICA was grown by CADSAL beneficiaries. Multiple regression was utilized to see if the identified independent and moderator factors could predict the defined dependent variables when they were combined. The difference between the two means of both NERICA and Non-NERICA participants in knowledge acquisition, diffusion, and adoption of NERICA technologies in Study sites was tested using a T-test. The null hypothesis was rejected or the alternative hypothesis was allowed to win at a significance level of 0.05. A multiple regression analysis was used to predict the impact of socioeconomic variables on the adoption of upland rice growing and management technologies.

The data from the questionnaire was coded and entered into SPSS for computerized analysis, where a conversion was performed using a computer package, the SPSS version 24 application, which aided in data analysis. The analysis included processes such as data preparation and tabulation. In the statistical study, descriptive statistics such as means, frequencies, and standard deviation were employed. In addition, data was inferentially evaluated using multiple Linear Regression and the t-test. Following the coding of the replies, the T test and regression were used to project what could be a true representation of the complete population. The findings were given in the form of a description, frequency tables, charts, and tables displaying the significance level.

3.9 Ethical Considerations

The information collected from participants was kept confidential and was solely utilized for the study's aims. The study began with a brief conversation with the participants to ensure that they were aware of what would happen and what the expected outcome of the study was. Without the participants' permission, the information was not shared with anyone. The participants were informed about the research's goal, and the researcher safeguarded the informant's identity by not recording the identities of everyone participated in the study.

3.10 Data Analysis Summary

Objective/Hypothesis	Independent variables	Dependent	Method of analysis
OBJ 1: To describe and compare the Level of performance between the CADSAL participants and non-CADSAL participants in information acquired in NERICA technologies in Kerio Valley of EMC, Kenya. **$H1_1$** - There is statistically significant difference in Level of performance between CADSAL NERICA participants and non-CADSAL participants in knowledge acquired in NERICA technologies as result of CPE training approaches in Kerio Valley of Elgeyo Marakwet County, Kenya.	Participation in project Performance	Level of Knowledge acquired	t- test means SD Percentage
OBJ 2: To describe and compare if NERICA technology participants and non-NERICA technology participant disseminate knowledge and skills acquired in NERICA technologies and extension packages to other farmers in Kerio Valley of EMC, Kenya. **$H1_2$** - There is statistically significant difference between CADSAL NERICA participants and non-participants in dissemination of knowledge and skills acquired in NERICA technologies and extension packages to other farmers in Kerio Valley of EMC, Kenya.	Participation Knowledge acquired	Level of Disseminati on to other farmers	Descriptive SD Percentage Means Ratio t-test
OBJ 3: To determine the adoption level of NERICA technologies promoted through community participatory extension approaches between NERICA technology participants and non-NERICA technology participant farmers in Kerio Valley of EMC, Kenya. **$H1_3$** - There is statistically significant difference in the adoption level of NERICA technologies promoted through	Participation Knowledge disseminated as a result of NERICA dissemination package	Level of adoption	Descriptive SD Means Ratio t- test

Objective/Hypothesis	Independent variables	Dependent	Method of analysis
community participatory extension approaches between NERICA technology participants and non-NERICA technology participant farmers in Kerio Valley of EMC, Kenya.			
OBJ 4: To analyze the influence of selected socio-economic factors on the adoption NERICA technologies in Kerio Valley of EMC, Kenya. **$H1_4$** - Socio-economic factors have significant influence on the adoption of NERICA technologies in Kerio Valley of EMC, Kenya	Socio economic factors	Level of adoption	Multiple Linear Regression t -test Ratio

CHAPTER FOUR

RESULTS PRESENTATION

4.1 Introduction

The outcomes of the study based on an interview-scheduled questionnaire for data collection are reported in this chapter in relation to the study's objectives and hypotheses. The descriptive statistics, which include the respondents' socioeconomic characteristics, are covered in the first section. The results and comments based on inferential statistical analysis of the objectives and test of the hypotheses as stated in chapter one are discussed in the second section.

4.2 Descriptive Statistics

This section presents the descriptive parameters of the respondents' socio-economic characteristics. The socio-economic characteristics of interest for the study were; the Questionnaire filling, return rate, sex, age, relationship with household head, house hold population and educational level.

4.2.1 Questionnaire Return Rate

A total of 160 questionnaires were administered to the selected respondents in Kerio Valley where the CADSAL project took place and a total of 157 questionnaires were returned having been sufficiently filled to provide relevant information pertaining the research objectives. The return rate therefore translated to 98.1 percent of the total

questionnaires and indication that the respondents and community at large had a good will to the research objectives and process.

4.2.2 Response by Age

The mean age of the farmers who responded was 45 years an indication that many of the CADSAL target population was of the middle age category and who are energetic enough to adopt and carry out the farming activities. The minimum age of respondent was 26 years and the maximum age was 67 years. This is a productive age of the community and can be of great benefit to agricultural production, food security, income and sustainability.

4.2.3 Response by Sex

Table 2 shows that higher number of respondents were male compared to female. A total of 65 percent of the respondents were male while 35 percent of the respondents were female. This could imply that higher ration of male participates in the various events in the area as compared to the female counterparts. Pertaining the participation in the NERICA technology, there were more participants than non-participants. The results indicate 36 percent of male respondents participated in the NERICA rice technology compared to 29 percent of female participants. Female respondent on the level of participation indicated 20 percent of the total response as having participated in the technology while 15 percent did not participate. A total of 88 respondents participated in the NERICA rice technology while 69 respondents did not participate. This is an indication that the research focused on the individuals who had an interest in the NERICA technology in the project. The response return rate was high an indication of

acceptability of the research exercise with an almost equal ratio of male/female representation.

Table 2: Sex of the Respondents

Sex	Frequency (NERICA technology participation)		Percent	
	Participants	Non participants	Participants	Non participants
Male	57	45	36	29
Female	31	24	20	15
Total	88	69	56	44
Grand Total	157		100	

4.2.4 Relationship of the Respondent to the Household Head

The results of the study showed that out the total 157 respondents, 58 percent were male household heads who responded on behalf of the household. A total of 31.8 percent were female respondents who indicated as being the wives of the household heads, a total of 8.3 percent of the respondents were the sons of the household heads and a total of 1.9 percent were daughters of the household heads during the survey. This is an indication that most the respondents to questions in the community were male as compared to female with a total of 66.3 percent being male household category and 33.7 percent of the respondents were female household members during the research exercise. This is illustrated in Table 3 below.

Table 3: Relationship of Respondent to the Household head

Relationship to the household head	N	Percent
Self	91	58.0
Wife	50	31.8
Son	13	8.3
Daughter	3	1.9
Total	157	100.0

4.2.5 House Hold Population in the Study Area

As illustrated in Table 4, the research findings established that most families in the area had an average of 9 members each, with minimum family population being four and the highest being Twenty members in a family. However, the findings established further that most families had members being or exceeding nine members an indication that the population per family was straining the resources available for use and for the basic needs like Food, medical, education and social. The strain in the lookout for basic needs by the larger family households could have an implication on the low attendance to the agriculture extension meetings or in adopting of the technologies.

Table 4: House Hold Population in the Study Area

House hold population	Frequency (NERICA Technology)		Percent	
	Participants	Non Participants	Participants	Non Participants
0-5	15	11	9.5	7.0
6-10	46	36	29.3	22.9
11-15	22	18	14.0	11.5
16-20	5	4	5.0	2.5
Total	88	69	56.1	43.9
Grand total	157		100	

4.2.6 Educational Level of Respondents

Results of the study indicate that 67.6 percent of the respondents are primary school and below in terms of education level as shown in Table 5. A total of 19.1 percent were of secondary school level while 21 percent were of tertiary level education qualification. The findings further established that 9.3 percent of the participants of NERICA rice technology participated in the responding to the questionnaire had no education at all. On the other hand 7.3 percent of those who had not participated in the technology did not have any education but respondent to the questionnaire filling. Respondents who had primary education level were 28.6 percent participants and 22.4 percent non-participants. Moreover, 10.6 percent of the respondents participated in the NERICA technology while 8.4 percent did not participate in the NERICA technology. On tertiary education qualification, 7.5 percent participated while 5.9 percent did not participate in the NERICA rice technology. This provided a balanced participation between those who participated and those who did not participate in the NERICA technology and in assessment of eth level of influence between those who participated and those who did not participate. The participants in general indicated 56 percent participated in the technology while 44 percent did not participate.

Table 5: Educational Level of Respondents

Educational Level	Frequency (NERICA Technology)		Percent	
	Participants	Non Participants	Participants	Non Participants
No formal	15	11	9.3	7.3
Primary	44	36	28.6	22.4
Secondary	17	13	10.6	8.4
Tertiary	12	9	7.5	5.9
Total	88.0	69.0	56.0	44.0
Grand Total	157.0		100.0	

4.3 Economic Factors

This section presents results on the level of income and expenditure of the respondents. The income of interest during the study includes farming source of income, Salary source of income, small scale business source of income, petty trade source of income, assistance from relatives as well as unclassified source of income or that income which the respondents could not explain well. This section also presents the expenditure items preferred by the respondents in the study area. Economic factors determine how much disposable income is available for use in the farming activities and in the household management. The household income further gives the farmer confidence to take up new technology and in venturing into new ideas upon its introduction. That was the basis of the analysis of the income level of the respondents during the study process and analysis. The results are presented in Table 6.

4.3.1 Source of Income

The findings of the study in Table 6 indicate that all the respondents had an income form farming with various range of income. The minimum farming income per annum was 12,000/= and maximum income of the respondents was 360,000/= per annum with a total 100 percent responding to the farming as a source of income. A total of 1.9 percent of the respondents had income as salary as source of income during the study time. When it came to small business as source of income, a total of 3.8 percent of the respondents had small scale business to supplement the farm income. The small-scale business provided an average income of 120,000/= annual income. Petty trade attracted 39 respondents

representing 24.8 percent of the total respondents with low income of 1,000/= and maximum petty trade income of 20,000/= as illustrated in Table 6.

Furthermore, 32.5 percent of the total respondents indicated being supported by relatives with minimum relatives' annual support being 1,000 and maximum of 120,000/=. Significant number of respondents had other sources of income that they could not explain or describe well. A total of 21.7 percent of the total respondents had other income with minimum of 5,000 being gotten from other sources while maximum other source income was 108,000/=.

Table 6: Annual Income for the respondents

Source of income	No.	%	Min	Max	Mean for Participants & Non participants	SD error
Farming	157	100	12,000	360,000	73,529	53,535
Salary	3	1.9	30,000	30,000	30,000	4,120
Small Scale Business	6	3.8	120,000	120,000	120,000	23,080
Petty Trade	39	24.8	1,000	20,000	5,154	3,326
Assistance from relatives	51	32.5	1,000	120,000	12,176	16,603
Other sources	34	21.7	5,000	108,000	38,647	21,503
Total income	157	100	1,000	360,000	15382	6177

N=157

4.3.2 Expenditure by the Respondents

Results of the study in Table 7 indicates an average of the income by the respondents was used in land preparation at a rate of 55.4 percent. They indicated moderate level of utilization of the expenditure on land preparation a response which was followed by low expenditure on the same activity. Most response was of the opinion that on moderate, the

farmers spent money and any other income on purchasing farm inputs for the continuity of the farm practices in the area. A total of 35.7 percent of the response showed that they spent moderately on the house hold purchase of food while those who indicated as not spending on food in the household was 1.3 percent. this indicated therefore that many used the farm income in the food. Most respondents agreed a high level that that they spend their income on school fees payment. A total of 30.6 percent of the total respondents indicate high expenditure on school fees while the level response was very low expenditure of 1.9 percent of the total response rate.

A total of 47.1 percent of the respondents showed low level of usage of the farm income on medical bills by the family members of the farming community in the area. The response is followed by those who respondent the usage as moderate. Most of the respondents totalling 63.1 percent indicated very low usage of income from farm on leisure. This could be an indication that the income is low, insufficient or leisure is not a priority of income usage in the area. A few of the respondents indicated moderate use of the income for leisure at 10.8 percent of the total response rate. On response towards whether there was any other way of expenditure by the farmers of the income, a total of 62.4 percent of the respondents didn't have any other expenditure while 20.4 percent had very low expenditure on other areas which were not related to the farm activities and basic related activities, as illustrated in Table 7.

Table 7: Expenditure by the Respondents on Various Farm Related Activities

	Land preparation		Purchasing farm inputs		Purchase of food		School fees		Medical bills		Leisure		Other expenditure	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
V/Low	3	1.9	3	1.9	2	1.3	3	1.9	17	10.8	99	63.1	32	54.2
Low	44	28.0	46	29.3	37	23.6	25	15.9	74	47.1	41	26.1	15	25.4
Moderate	87	55.4	72	45.9	56	35.7	35	22.3	46	29.3	17	10.8	12	20.3
High	23	14.6	36	22.9	42	26.8	48	30.6	20	12.7	0	0	0	0
V/High	0	0	0	0	20	12.7	46	29.3	0	0	0	0	0	0
Total	157	100.0	157	100.0	157	100.0	157	100.0	157	100.0	157	100.0	59	100.0

4.4 Selected Socio-Economic Factors related to the Respondents

The selected socio-economic factors related to gender and its influence on farming of upland rice was analyzed. This was to guide the determination of the extend of the factors of determination of dissemination and adoption of technologies. Socio economic factors was analyzed during the study to understand the roles that each gender plays when it comes to farming activities. This was crucial because it describes how the technology adoption and dissemination is influenced within the household level. There are various activities carried out in the farms during the agricultural stay or even when off season. The agronomic activities carried out are inclined towards a specific gender depending on the community and region of operation. This is the main reason why it was necessary to carry out the survey on it so that the research could exonerate or pinpoint the areas that could really be influencers of dissemination and adoption of technologies.

Extension workers do the work of information sharing and problem picking from the farmers but the real adoption is dependent on the farmers characteristics and willingness

to absorb the new ideas. It is not only absorption but also retention of the already gotten technologies. Retention ensures there is sustainability of knowledge within the target community and hence easy to refer or modify it at convenience. Since CADSAL project was phased out, it was prudent to establish whether there was any sustainability of the technology disseminated through CADSAL among the respondents.

4.4.1 Gender roles in agricultural and household activities

Gender roles in agricultural households includes domestic activities that were studied and whose results are presented in Table 8. The results in Table 8 shows that, male carries out more bush clearing than female household members. A total of 76.5 percent of the respondents indicated male household members carried out bush clearing. The response was followed by combined synergy by both gender at a response rate of 21.7 percent. Male house hold members did more purchase of farm inputs than female as indicated by the response rate of 65.5 percent. followed by either gender at a response rate of 32.5 percent with female having small role in the purchase as indicated by 1.9 percent of the response rate. When it comes to planting, both household members participated in the planting exercise and is evidenced by a response rate of 68.8 percent, while male followed doing the planting at a response rate of 22.3 percent of the total response. Both male and female carry out weeding of the farms as shown by a total of 77.1 percent of the respondents. This is followed by male whose response in favour of was 14.6 percent. Female carrying out weeding was given a response of 8.3 percent of the total response rate.

Both female and male had a high ratio of combined participation in pest control as indicated by a response rate of 49.0 percent. Research findings further indicated that male participated as shown by a response rate of 45.9 percent. Female alone participated at a low rate of 5.1 percent. On matters of watering of the crops and harvesting of the produce, the response rate indicated high level of both gender participation on both watering and harvesting of produce with the rate being 72.0 percent both gender watering and 78.3 percent both gender harvesting crops. Marketing of farm produce was done by both the male and female as evidenced by the findings whose rate was71.4 percent of the total response rate. However, female carrying out the marketing of the farm produce was highly limited with only 1.9 percent indicating in favour of female marketing the produce.

Male carried out most of the soil conservation measures in the area with 51.0 percent of the respondents indicating so in the findings of the study, however, they could also do together with female counterparts with 49.0 percent of the respondents confirming it form the findings. Female alone on the other hand did not fully participate in soil conservation. The findings of the study indicated that both male and female had a shared expenditure role in the area with 59.2 percent of the respondents agreeing to it. This is followed by male alone spending on farm income with 38.9 percent of the respondents agreeing to it. On the other hand, female had very limited role in the expenditure of farm income having only 1.9 percent of the respondents agreeing to the female spending the income. Male household members played a key role in the purchase of farm implements as compared to female. The findings indicated 53.5 percent of the respondents confirmed the purchase of farm implements as being male household members. If male did not do the purchase the

both male and female did the purchase as confirmed by 46.5 percent of the response rate of the study. Tree planting on the farms was carried out basically by male household members as indicated by 59.2 percent of the response rate of the study. Participation by both male and female was indicated by 38.9 percent of the respondents while 1.9 percent of the respondents indicated female as the ones planting trees in the study area.

The study findings of the study indicated that male dominated the sale of farm produce in the area having 65.6 percent of the respondents agreeing to it. However, 30.6 percent of the response indicated both male and female participates in the sale of the farm produce in the area and only 3.8 percent of the total response indicated female household members participating in the sale of the farm produce. Female in the area are used to collect firewood as illustrated by a response of 93.0 percent. A total of 5.7 percent of male respondents indicated male as the once's who collect firewood while 1.3 percent confirms both male and female as the ones collecting firewood in the area. Female takes a key role in the cooking of food in the area as shown by the response rate of 98.1 percent. Male takes a low rate of cooking at 1.9 percent of the total response. This is an indication that deciding what to cook and eat is based on the determination by the female household member in the research area.

According to the findings of the study, female household members in the region take the lead in fetching domestic water, with 98.1 percent of the response skewed to female household members in the area. According to the findings of 98.1 percent, female household members play a critical role in the care of the area's young children. Only 1.9

percent of the respondents said male household members helped care for the children in the neighbourhood. Table 8 demonstrates this.

4.4.2 The response and measures on gender roles

This section illustrates the influence of gender roles on the adoption of the NERICA rice technologies. Results illustrated in Table 9, indicate higher influence for the participants of the project than non-participants. The findings on whether gender had an influence on the adoption of agricultural technologies in the area, it was found that a total of 63.1 percent indicated positive influence results categorised as 35.4 percent being participants and non-participants being 27.7 percent. This is followed by very high influence response of 26.8 percent of the total results having split of 15.0 percent participants and 11.8 percent non-participants. A total of 8.3 percent (4.7 percent participants and 3.6 percent) of the findings was of the view that they were uncertain of whether there was any influence of gender to the adoption rate or not. Furthermore, 1.9 percent of the findings showed minor influence option among the residents of the area with 1.1 percent of them being participants while 0.8% being non participants as shown in Table 9

Table 8: Gender Roles in Upland Rice Production

Agricultural & HH	Male				Female				Both				Total	
activities	P	NP	%P	%NP	P	NP	%P	%NP	P	NP	%P	%NP	N	%
Bush clearing	67	53	43	34	2	1	1	1	19	15	12	10	157	100.0
Purchase inputs	58	45	37	29	2	1	1	1	29	22	18	14	157	100.0
Planting	20	15	12	10	8	6	5	4	61	47	39	30	157	100.0
Weeding	13	10	8	6	7	6	5	4	68	53	43	34	157	100.0
Pest control	40	32	26	20	5	3	3	2	43	34	27	22	157	100.0
Watering crops	21	17	14	11	3	3	2	2	63	50	40	32	157	100.0
Harvesting	13	10	8	6	6	5	4	3	69	54	44	34	157	100.0
Market produce	23	18	15	12	2	1	1	1	63	49	41	32	154	100.0
Soil Conservation	45	35	28	22	0	0	0	0	43	34	27	22	157	100.0
Expenditure income	34	27	22	17	2	1	1	1	52	41	33	26	157	100.0
Purchase of farm implements	47	37	30	24	0	0	0	0	41	32	26	20	157	100.0
Tree planting	52	41	33	26	2	1	1	1	34	27	22	17	157	100.0
Sale of produce	58	45	37	29	3	3	2	2	27	21	17	13	157	100.0
Collection of firewood	5	4	3	3	82	64	52	41	1	1	1	1	157	100.0
Cooking food	2	1	1	1	87	67	55	43	0	0	0	0	157	100.0
Fetching water	2	1	1	1	87	67	55	43	0	0	0	0	157	100.0
Caring children	2	1	1	1	87	67	55	43	0	0	0	0	157	100.0

Table 9: Influence on Distribution of Gender Roles on Adoption of Technologies

Influence on distribution of gender roles on adoption of technologies	Frequency		Percent		Total Percent
	P	NP	P	NP	
Very significant	24	18	15.0	11.8	26.8
Significant	55	44	35.4	27.7	63.1
Uncertain	7	6	4.7	3.6	8.3
Insignificant	2	1	1.1	0.8	1.9
Total	88	69	56.1	43.9	100
Grand Total	157		100.0		

4.4.3 Comparing the Response Rate of Participants and Non-Participants

The purpose of the study was to learn about the respondent's involvement in the CADSAL project activities in the study region. According to the results shown in Table 10, a total of 56.1 percent of the respondents said that they had engaged in the CADSAL project, while a total of 43.9 percent answered that they had not participated in the project. This means that nearly half of the respondents took part in or did not take part in project activities in the area. Table 10 summarizes the findings.

Table 10: Participated in the CADSAL project

Participated in the CADSAL project	Frequency	Percent
Yes (Participated)	88	56.1
No (Did not participate)	69	43.9
Total	157	100.0

4.4.4 Level of Performance Between CADSAL and non-CADSAL Participants in Knowledge Acquired in NERICA Technologies.

Results of this section is illustrated in Table 11. The findings of the study whose respondents were 157 in all the questions relating to determining and comparing the level of performance between CADSAL and non CADSAL participants in the knowledge

areas about NERICA rice technology adoption in Kerio valley area of Elgeyo Marakwet County, the results indicated the participants and non-participants were of almost equal level with participant mean of 1.60 and non-participant mean of 1.97. The findings on knowledge areas of adoption indicated most of the NERICA technologies knowledge areas were Moderate level.

The rate of agricultural knowledge acquired through CPE was established as shown in Table 11, with planting, seed selection and spacing being with moderate mean rate of 2.05, 1.74 and 1.99 for participants respectively. On the other hand, the non-participants had a mean rate of 4.23, 3.88 and 3.99 respectively. The results were presented by 26.1 percent, 23.5 percent and 28.755 as true for the participants and 33.2 percent, 30.0 percent and 36.6 percent for non-participants of the CADSAL project. On areas of disease & pest control, weeding and harvesting the mean were moderate (1.88, 1.98 and 2.10) for participants respectively while the mean findings for non-participants were 3.57 percent, 4.09 percent, 4.01 percent respectively. Post-harvest measures are presented with mean of 1.99 for participants and 3.79 for non-participants.

On the question of whether the project targeted all farmers irrespective of the status in the community, the findings indicated a true mean of 1.19 for participants and 1.01 for non-participants. Furthermore, the selection of NERICA was important in achieving the higher yields with a mean of 1.28 for the participants and 1.10 for on participants. The respondents did not agree with the statements that NERICA rice is grown only in flood areas, neither did they agree that all insects were harmful to rice as a plant. The mean response for the growing conditions being floods only and all insect infestation being

harmful was false with response means of 1.56 and 1.58 with respective SD of 0.498 and 0.495. On the question of soil conservation increasing agricultural yields and control weeds helping in the development of rice growing in the Kerio Valley, the response was true to the statements with mean response of 1.27 and 1.67 for participants and 1.09 and 1.42 for non-participants respectively. Termites were not the worst pests and enemy to rice plantation in Kerio Valley according to the response mean of 1.56 for participants and 1.33 for non-participants. It was also true from the findings that two ploughs in the area was important for soil to hold water necessary for rice production, the response mean of 1.45 for participants and 1.24 for non-participants.

Respondents during the research denied that the most recommended planting methods was broadcasting with response rate of 2.02 for participants and 1.73 for non-participants. In Kerio Valley area, NERICA rice was not difficult to handle after harvesting similarly, weeds were not a key challenge to manage and indicated by a response mean of 1.99 for participants and 3.79 for non-participants and 1.27 for participants and 1.09 for not participants respectively. The findings of the study indicated there were several stages of rice growth, more so the findings established that spacing was not so important in rice production in the area, the mean response for the two questions was 1.28 for participants and 1.10 for non-participants as well as 1.58 for participants and 1.35 for non-participants respectively. Birds could destroy rice field in the area with mean of 1.40 and 1.20 for participants and non-participants respectively. Indeed, any sight of insects in the field should cause spray with insecticides as indicated by mean response of 1.31. The study established that there was relationship between high density of rice and its production with mean of 1.50 for participants and 1.28 for non-participants. The community through

the study were aware that wearing protective clothing during mixing and application of pesticides was very important with response mean of 1.75 for participants and 1.50 for non-participants. CADSAL project used participatory extension approach during the in promoting the technology adoption of rice in the area, the mean response rate was 1.26 for participants and 1.08 for non-participants. Most of the technologies were important in ensuring that upland rice was well grown with most response tending towards true.

Table 11: Mean and Standard Deviation on Farmer Performance Level Based on Knowledge Acquired

Respondent have technological knowledge acquired in NERICA or agree/disagree on the statements indicated.	% Freq of participants			% Freq of N/participants			Std. Dev
	True	False	Mean	True	False	Mean	
Seed rate of planting	26.1	68.1	2.05	33.2	86.9	4.23	1.138
Seed selection	23.5	72.4	1.74	30.0	92.3	3.88	1.22
Spacing	28.7	64.0	1.99	36.6	81.6	3.79	1.332
Disease and pest control	28.7	64.0	1.88	36.6	81.6	3.57	1.201
Weeding	26.1	68.1	1.98	33.2	86.9	4.09	1.14
Harvesting	28.7	64.0	2.10	36.6	81.6	4.01	1.18
Post-harvest measures	28.7	64.0	1.99	36.6	81.6	3.79	1.35
Project meant for all categories of farmers	64.0	28.7	1.19	81.6	36.6	1.01	0.312
Higher yields from seed selection	64.0	28.7	1.28	81.6	36.6	1.10	0.404
Four Varieties were introduced	64.0	28.7	1.27	81.6	36.6	1.09	0.394
NERICA Grown in flood land	64.0	28.7	1.67	81.6	36.6	1.42	0.498
Insects harmful to rice	64.0	28.7	1.69	81.6	36.6	1.44	0.495
Soil conservation increase production	64.0	28.7	1.34	81.6	36.6	1.14	0.433
Weeds Control increase rice development	64.0	28.7	1.27	81.6	36.6	1.09	0.392
Termites not worst pests	64.0	28.7	1.56	81.6	36.6	1.33	0.5
Ploughs and Harrowing prepare tilth	64.0	28.7	1.45	81.6	36.6	1.24	0.481
plant rice through Broadcasting or Drilling	64.0	28.7	2.02	81.6	36.6	1.73	2.625
Difficult to thresh	64.0	28.7	1.56	81.6	36.6	1.33	0.5
Weeds not main challenge	64.0	28.7	1.42	81.6	36.6	1.21	0.472
Several stages of rice	64.0	28.7	1.28	81.6	36.6	1.10	0.404
Spacing is not important	64.0	28.7	1.58	81.6	36.6	1.35	0.501
Birds destroy rice fields	64.0	28.7	1.40	81.6	36.6	1.20	0.462
Spray rice field on insect sight	64.0	28.7	1.35	81.6	36.6	1.15	0.441
High plant density increases yields	64.0	28.7	1.50	81.6	36.6	1.28	0.492
Not wearing protective cloths is ok	64.0	28.7	1.75	81.6	36.6	1.50	0.482
Participatory extension approach was used	64.0	28.7	1.26	81.6	36.6	1.08	0.389
Overall average mean			1.60			1.97	

T-test was carried to establish the knowledge acquired during the community participatory extension training packages on NERICA rice technologies between CADSAL and Non CADSAL participants and the results as shown the Table 12 indicate significant difference in the knowledge with *p*=value being (P=0). The degree of freedom for all the sets of response was 156 (df=156) and mean of 1.60 for participants and 1.97 for non-participants. The null hypothesis was rejected owing to $p<0.05$ as shown in Table 12.

Table 12. Test of significance of performance level based on knowledge and skills acquired through participatory extension trainings by CADSAL and non-CADSAL participants in Elgeyo Marakwet County

Categories of participants	N	Mean	Standard dev	T-value	2-tailed probability
NERICA participants	88	1.60	1.332	1.138*	.000
Non-NERICA participants	69	1.97	0.389		

Legend: (*) Significant at the .05 levels.

4.4.5 Dissemination of Knowledge and Skills Acquired in NERICA Technologies to other Farmers

The research sought to find out the level of dissemination of knowledge and skills on NERICA rice technologies. The findings shown in Table 13 established few respondents totaling 21.1 percent of participants and 4.1 percent of non-participants had disseminated the knowledge to other farmers with a mean of 1.02 (SD 0.477) for participants of the project and mean of 1.94 for the non-participants. The average total number of farmers the respondents had disseminated the information to, was between 11-15 individuals this

was categorized with a mean average of 2.49 for participants and 4.02 for non-participants. Those who had shared information to at least one person was 26.1 percent and 6.3 percent for participants and non-participants respectively. The prevalent mode of communication was face to face interaction with 26.1 percent and 6.3 percent of respondents indicating so.

The study sought to find out on the type of technologies related to NERICA rice. Land preparation methods response was found to be 21.1 percent true response for participants and 4.1 percent true response for the non-participants. Soil conservation technology was found to be 13.4 percent true response for participants of CADSAL project while non participants response was 1.7 percent Furthermore, Rice seed selection produced 23.5 percent true response against 5.1 percent positive disseminated response. Results of the study further indicated planting method technology in NERICA rice as low disseminated with participants of the project 26.1 percent true and non-participants represented by 6.3 percent as shown in Table 13.

Results of Stages of NERICA, disease and pest control, weeding and harvesting and post-harvest activities for participants of the project indicated 26.1 percent, 24.3 percent, 26.1 percent, 26.1 percent and 28.7 percent respectively indicated having disseminated to farmers the knowledge. For those who did not participate in the project, results indicated 6.3 percent, 5.5 percent, 6.3 percent, 6.3 percent and 7.6 percent.

Table 14 indicates the T-Test on the dissemination technologies on NERICA rice through participatory extension approach in Elgeyo Marakwet. The results indicated significant difference ($p<0.05$) leading to the rejection of null hypothesis.

Table 13: Dissemination of Knowledge and Skills Acquired

Dissemination of Knowledge and Skills	% Freq for P			% Freq for NP			Std. Deviation
	True	False	Mean for P	True	False	Mean for NP	
Shared NERICA knowledge	21.1	76.8	1.02	4.1	97.9	1.94	0.477
Trained many farmers	26.1	68.1	2.49	6.3	86.9	4.02	1.358
Used diverse mode of communication	26.1	68.1	1.51	6.3	86.9	2.45	1.963
Disseminate land preparation methods	21.1	76.8	1.25	4.1	97.9	2.38	1.31
Disseminate soil conservation methods	13.4	94.1	0.91	1.7	120.0	2.41	1.227
Disseminate knowledge on rice seed selection	23.5	72.4	1.33	5.1	92.3	2.34	1.352
Disseminate skills on planting methods	26.1	68.1	1.48	6.3	86.9	2.39	1.392
Train others on stages of NERICA	26.1	68.1	1.48	6.3	86.9	2.39	1.477
Share knowledge on disease and pest control	24.3	70.9	1.32	5.5	90.5	2.26	1.281
Share knowledge on weeding	26.1	68.1	1.46	6.3	86.9	2.36	1.356
Share knowledge on harvesting	26.1	68.1	1.53	6.3	86.9	2.47	1.446
Share knowledge post-harvest activities	28.7	64.0	1.58	7.6	81.6	2.36	1.442
Average Overall Mean			1.45			2.45	

Table 14. Test of significance for dissemination level of NERICA rice technologies through participatory extension trainings by CADSAL and non-CADSAL participants in Elgeyo Marakwet County.

Categories of participants	N	Mean	Standard dev	T-value	2-tailed probability
NERICA participants	88	1.45	1.12	1.66*	.000
Non- NERICA participants	69	2.48	0.04		

Legend: (*) Significant at the .05 levels.

4.4.6 Analysis of adoption Level of NERICA Technologies Promoted Through CPE

The study sought to find out the level of adoption technologies associated with NERICA rice production and the findings indicated medium level of adoption for all the 15 technologies that were selected for the study.

Results Presented on Table 15 indicates that planting was indicated by participants as well adopted 73.8%. Similarly, Disease management, pest management, source of water, time of water application and method of irrigation was agreed by many participants as having been adopted well by the farmers. This is presented in the showing 57.3 percent, 54.8 percent, 51.1 percent, 51.1 percent and 51.1 percent respectively as illustrated in Table 15. Non participants of the project indicated seed selection, fertilizer application, mechanical weeding, chemical weeding, tillering stage, threshing, bagging, storage, milling and marketing as true adopted technologies for the non-participants in the county. This is illustrated in Table 14 showing 59.1 percent, 60.6 percent, 63.6 percent, 79.8 percent, 62.1 percent, 57.6 percent, 51.9 percent, 62.1 percent and 51.9 percent respectively. The average mean for the respondents is 2.6 for participants and 2.4 for non-participants.

Table 15: Response on Adoption level of NERICA rice technologies through practice

Practices of NERICA rice growing by respondents. Farmers practice the following;	Frequency				Mean		Std. Dev
	True %P	False %P	True %NP	False %NP	P	NP	
Seed selection techniques	42.9	57.1	59.1	40.9	2.5	2.5	1.189
Planting techniques	73.8	26.2	28.9	71.1	3.2	1.8	0.942
Fertilizer application	41.8	58.2	60.6	39.4	2.4	2.6	1.11
Disease management	57.3	42.7	42.7	57.3	2.8	2.2	1.063
Pest Management	54.8	45.2	45.2	54.8	2.8	2.2	1.056
Mechanical weeding	39.6	60.4	63.6	36.4	2.4	2.6	1.128
Chemical weeding	29.6	70.4	79.8	20.2	2.0	3.0	1.084
Source of water	51.1	48.9	49.2	50.8	2.7	2.3	1.192
Time of water application	51.1	48.9	49.2	50.8	2.7	2.3	1.142
Method of irrigation	51.1	48.9	49.2	50.8	2.7	2.3	1.333
Tillering stage	40.7	59.3	62.1	37.9	2.4	2.6	1.279
Threshing	44.0	56.0	57.6	42.4	2.5	2.5	1.257
Bagging	48.7	51.3	51.9	48.1	2.6	2.4	1.2
Storage	40.7	59.3	62.1	37.9	2.4	2.6	1.227
Milling and marketing	48.7	51.3	51.9	48.1	2.6	2.4	1.29
Overall mean					2.6	2.4	

N=157; n P= 88, n NP= 69

The results in Table 16 indicate that there was significant difference between the mean scores for NERICA -participants and non- NERICA participants at the alpha level of 0.05 ($t=2.58$, $P<0.05$). Therefore the null hypothesis (HO_3) was rejected.

Table 16. Test of significance for the adoption level of NERICA rice technologies through participatory extension trainings by CADSAL and non-CADSAL participants in Elgeyo Marakwet County

Categories of participants	N	Mean	Standard dev	T-value	2-tailed probability
NERICA participants	88	2.6	1.3	2.58*	.000
Non- NERICA participants	69	2.4	0.9		

Legend: (*) Significant at the .05 levels.

4.4.7 Level of Influence of CADSAL project on Adoption of NERICA Technologies

The findings of the study found out that the respondents agreed that CADSAL participatory extension approach was key and important in the dissemination of NERICA rice technologies in the Kerio Valley catchment area. A high percent of respondents strongly agreed or just agreed that participatory extension was better than conventional methods. The results further showed that those who participated in the project activities agreed that that CADSAL project was a beneficial endeavor in the enhancement of NERICA rice farming in the area and hence improved food security and potential income source. A total of 67.8 percent of those who participated in the project strongly agreed while 53.2 percent of those who did not participate strongly agreed as illustrated in Table 17. High number of respondents represented by 53.8 percent of participants and 42.2 percent of non-participants strongly agreed that the project participatory extension increased farmer knowledge on NERICA Rice as further illustrated in Table 17.

CPTD and CIP empowered the farmers, increased networking, it was useful in knowledge dissemination as well as well as encouraging farmer communication as illustrated in Table 17. The response is represented by 47.6 percent participants and 37.4

percent non-participants strongly agreed for CPTD/CIP empowerment to farmers. A total of 49.3 percent participants and 38.7 percent non-participants strongly agreed on network increase and usefulness of CADSAL project in knowledge dissemination among farmers as a result of participatory extension. A total of 46.0 percent participants and 36.0 percent nonparticipants strongly agreed on CPTD and CIP encouraging farmer communication and group formation which was represented by 54.4 percent participants and 42.6 percent non-participants.

Table 17:Level of influence of adoption of technologies of NERICA rice

Attitude/Influence Response	Percent									
	SA		A		U		DA		SD	
	%P	%NP	%P	%NP	%P	%NP	%P	%NP	%P	%NP
Participatory extension is better	67.8	53.2	7.8	6.2	1.7	1.3	3.4	2.6	7.3	5.7
CADSAL Did little	7.8	6.2	26.3	20.7	12.3	9.7	17.9	14.1	23.5	18.5
CPTD and CIPS are key	40.9	32.1	21.3	16.7	15.7	12.3	8.4	6.6	1.7	1.3
NERICA Is not important	3.4	2.6	28.6	22.4	15.1	11.9	25.8	20.2	15.1	11.9
NERICA is tedious to grow	7.8	6.2	15.1	11.9	11.8	9.2	31.4	24.6	21.9	17.1
CADSAL did not train farmers	9.5	7.5	16.8	13.2	11.8	9.2	30.3	23.7	19.6	15.4
CADSAL had little impact on livelihood	13.5	10.5	25.8	20.2	9.5	7.5	18.5	14.5	20.7	16.3
CADSAL increased farmer Knowledge	53.8	42.2	10.1	7.9	3.4	2.6	16.8	13.2	3.9	3.1
Attending CADSAL increased Knowledge	40.9	32.1	7.8	6.2	14.0	11.0	20.7	16.3	4.5	3.5
Joined CIP and CPTD due to CADSAL	34.8	27.2	11.2	8.8	9.0	7.0	23.5	18.5	9.5	7.5
CADSAL enhances experimentation	56.1	43.9	3.4	2.6	1.7	1.3	22.4	17.6	4.5	3.5
CADSAL is fair to all	49.3	38.7	10.1	7.9	1.7	1.3	19.1	14.9	7.8	6.2
CADSAL trainers useful	47.6	37.4	13.5	10.5	0.0	0.0	21.9	17.1	5.0	4.0
CPTD/CIP empower farmers	47.6	37.4	10.1	7.9	1.7	1.3	22.4	17.6	6.2	4.8
CADSAL increases network	49.3	38.7	8.4	6.6	1.7	1.3	19.1	14.9	9.5	7.5
CADSAL is useful in knowledge dissemination	49.3	38.7	8.4	6.6	3.4	2.6	23.5	18.5	3.4	2.6
CADSAL CPTDS and CIPS encourage farmer communication	46.0	36.0	13.5	10.5	0.0	0.0	21.9	17.1	6.7	5.3
Participatory approach encouraged group formation	54.4	42.6	6.7	5.3	0.0	0.0	12.3	9.7	14.6	11.4

Key: **SA**= Strongly Agree; **A**= Agree; **U**= Uncertain; **DA**= Disagree; **SD**= Strongly Disagree

4.4.8 Influence of participation in the project on adoption of technologies of NERICA rice

$H1_4$ -There is statistically significant difference in performance between CADSAL project participants and non-participants in knowledge and skills acquired in NERICA rice technologies as a result of participatory approach/extension in Elgeyo Marakwet County.

A simple test was administered to all respondents to assess common agricultural knowledge acquired through participatory extension between CADSAL participants and non-CADSAL participants. The goal was to determine the impact of Participatory extension packages on respondents' knowledge acquisition, retention, and application. The two groups' means and standard deviations were determined. To compare the means, the t-test was used.

Table 18 shows that at the alpha level of 0.05, there was a significant difference in mean scores between CADSAL participants and non-CADSAL participants (t=2.623, P0.05). As a result, the null hypothesis (HO4) was disproved.

Table 18. Test of significance for the NERICA knowledge gained, retained and utilized in common agricultural through participatory extension trainings by CADSAL and non-CADSAL participants in Elgeyo Marakwet County

Categories of participants	N	Mean	Standard deviation	T-value	2-tailed probability
NERICA participants	88	1.640	1.279	2.623*	.000
Non-C NERICA participants	69	2.940	0.556		

Legend: (*) Significant at the .05 levels.

The findings Through Multiple regression in Table 19 established that there was significant relationship between technology transfer method and level of adoption with an P value being $P < 0.05$.

Table 19: Regression Model Summary showing significance coefficients of influence

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.840[a]	.706	.699	.306	.706	91.378	4	152	.000	1.896

The regression results indicated p value of 0 ($P<0.05$) with R square value being 0.699 as illustrated in Table 19. This is an indication that CADSAL Community participatory extension approach in Kerio Valley had significant influence on the technology adoption and dissemination of NERICA rice technology.

The terms of the weight of influence, sharing of knowledge was more prevalent in the participatory extension approach in the area and on NERICA rice as shown in Table 20. The model focus on the technology adoption through as may be influenced by the community participatory extension approach. This was analyzed based on the whether the respondents were aware that CPE was in use during the CADSAL project. The interest

was also in establishing whether CPE was in any was better and if the knowledge acquired was adequately shared among the farmers. This therefore was summarized as in the equation below

$$Y = C + PE_U + PE_b + S_E$$

Where Y= Technology adoption

C= Constant

PE_u = Participatory Extension use

PE_b= Participatory Extension being better

S_E = Sharing Extension Knowledge

The coefficients obtained from the multiple regression were C=0.009, PE_u=0.164, PE_b=0.034 and S_E=0.940 as illustrated in Table 21. Hence,

$$Y = 0.009 + 0.164PE_U + 0.034PE_b + 0.940S_E + e$$

Table 20:Coefficients of Regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	.009	.167		.054	.957	-.322	.340
All categories of farmers	-.159	.162	-.089	-.983	.327	-.479	.161
Shared Nerica knowledge	.940	.054	.805	17.439	.000	.833	1.046
Participatory extension approach was used	.164	.075	.114	2.185	.030	.016	.311
Participatory extension is better than conventional	.034	.044	.076	.784	.434	-.052	.121

CHAPTER FIVE

DISCUSSION

5.1 Background Information

A total of 98.1% of the questionnaires that were administered and returned with sufficient response indicated acceptance of the survey by the targeted community. This meant that the respondents and the community were willing to work and give relevant information that was necessary for the research objective to be achieved. The return rate affirms research findings by Greer et al (2000) and Baruch & Holton (2008) who established that response rate will higher if the respondents are well informed of the reasons for the study being undertaken. This was carried out in the case of the current research through public Baraza and personal communication. The mean age of the farmers who responded was 45 years an indication that many of the CADSAL target population was of the middle age category and who are energetic enough and are expected to be fast in adoption and carrying out the farming activities especially using new techniques like NERICA rice growing.

The present research findings concur with research by Ojo et al (2018) on adoption of NERICA Rice in Ekiti State of Nigeria. Nwalieji & Uzuegbunam (2012) in their research in Anambra state in Nigeria reported that most of the rice farmers were in the productive age. More respondents were male during the survey and questionnaire filling. This could imply that higher ration of male participates in the various events in the area as compared to the female counterparts hence earn more income from rice farming than the female

counterparts as reported by Medagbe et al (2020). Couper et al (2007) found out that male were likely to consider high value towards separation of events while female were likely to participate much in connectiveness through emotional attachment. Furthermore, according to Ojo et al (2018), male have more rights to land ownership hence make decisions on what enterprises to undertake. The survey effectiveness of community participatory extension approaches in upland rice dissemination and adoption among small-holder farmers in Kerio Valley was associated with separation of whether it was effective or not. This was conjoined with the essence to the household headship hence present study concurred that male participated more than female as in the study by Tu & Liau, (2007)

There were high male household respondents than female household members. Out the total 157 respondents, 58% were male household heads who respondent on behalf of the household. Henning et.al., (2019) established that male were key decision makers in Africa than female household members hence were the once responding to any questions concerning a family business including farming enterprises. This could therefore be assumed that they also decide whether to adopt a new technology or not. Families are basic entities of rural development and especially agricultural development. The family members determine what to adopt and what not to adopt and infact the rate of adoption and its extent. Household membership determines the strain or ease in accessing the resources available and basic needs like Food, medical, education and social. The strain in the lookout for basic needs by the larger family households could have an implication on the low attendance to the agriculture extension meetings or in adopting of the technologies (Akinyemi, et al, 2016).

Education and extension are crucial in the agriculture sector value chain players. It helps farm families to understand the new technologies and keep records for proper follow up and guidance on whether technologies were implemented at the right time and scope. Proper records help in efficient retrieval of relevant information such as the one the study sought to get during the face-to-face interview. For example, many of the respondents could not respond to what they used to earn as the income from the farm especially and in other areas of expenditure. The research findings were in tandem to the findings by Oduro-Ofori et al (2014) who studied effect of education on agricultural productivity in Offinso Municipality in Ghana. These findings differ with one carried by Hasnah et al (2004) on oil palm production in west Sumatra, they indicated no positive correlation between education and agricultural productivity. A skew towards basic education and lower affects the rate and level of adoption of agricultural technologies and use of the knowledge and skills. This could therefore be attributed to the slow decision making, uptake level of technologies and low level of diffusion of technologies within Elgeyo Marakwet County.

Most of the farm families in Kenya leave in the rural areas and Elgeyo Marakwet is not exceptional. This therefore puts farming income as key and enhancing farming will actually enhance household income hence livelihood sustenance. This is the reason why technology transfer through effective strategies and approaches is vital in dissemination and adoption of skills and knowledge (Ishola & Arumugam, 2019). Living in the rural areas therefore means majority of the household's dependents on the income from the agriculture business. Even if there was diversification then it meant diversification of various agricultural enterprises a situation which confirms research findings by Nyambari

(2008). Improving agricultural production is directly related to improving household livelihoods and hence improving positivity in adoption of new technologies. Despite the income from agricultural enterprises, rural farmers could engage also in small-scale business for example kiosks and Mpesa services that is possible to be carried out and is viable in the varied areas. Households' heads who are male majority participate in petty trade that is related to agriculture. The most common petty trade related to agriculture in the ASAL areas include trading in livestock and agricultural produce as well as basic household items (Achiba, 2018). Most farmers in the area do not have any other income or support from relatives out of the county hence they depend more on their own source of income.

The study established that Income from farming is on average spend on purchase of farm inputs to plough back for future income and food security. Furthermore, the income is spent in food purchase, offsetting medical bills with very low expenditure on leisure activities which is considered a waste of money. These findings are in tandem with the findings by Thabit (2015) in his study on factors affecting the farmer income under traditional farming in Darfur state of Sudan. Furthermore, Diiro et. al., (2018) in a study carried out in western Kenya reported that women economic empowerment was key in agricultural productivity. The study findings established that male carries out more bush clearing than female household members, results which agree with findings by Diiro et. al., (2018). They further carry out purchase of farm inputs more than female household members. However, when it comes to planting and weeding, they both carry out the activities together. Pest control and watering & harvesting is a shared responsibility of both male and female household members in the area. Furthermore, marketing of farm

produce and soil conservation is a shared responsibility in the area. The findings is in agreement with findings by Kassie et al (2020) who studied technology adoption in rural parts of Kenya and women empowerment.

Furthermore, when it comes to farm income expenditure, the study established that male took lead or they carried together with household counter parts with limited number of female households taking lead. These findings concur with that of Diiro et. al., (2018). This is a situation that happens equally when it comes to purchase of farm implements and planting of trees in the farms as well as sale of farm produce, this is agrees with findings by Achiba (2018). The findings indicate that collection of firewood, cooking and fetching of water was almost a preserve of the female household members in the area. The findings agree with that of Akinyemi et. al., (2016). Caring of young children was equally the preserve of the female house hold members in the area. The findings agree with Nyambari (2008), that gender has significant influence on the technology adoption. This is because of the orientation the work load and the space they occupy in the community at large. The current study agrees with. The findings by Arora (2015) who reported from his study on gender difference in time poverty in Mozambique, that despite equal allocation of time for both male and female on economic activities, female were disadvantaged through house chores which is almost exclusive to them.

In this study, participation in the CADSAL project had a balance between male and female among those who participated in the project. This is contrary to the finding by Arora (2015) and can be attributed to the time of participation and the season of operation in the area. On the other hand, the findings by Baruch & Holton (2008) differed with the

current study. This was an indication that the exercise of data collection was fairly selected to give a fair quality of data. This is in reference to the adoption rate of NERICA rice technologies arising from the CADSAL project Community participatory extension approach in Elgeyo Marakwet County.

5.2 Level of Performance between the CADSAL and non-CADSAL Participants in Knowledge Acquired in NERICA Technologies

The objective of CADSAL project was to enhance the dissemination and adoption of NERICA rice growing in Kerio Valley. Community participatory extension approach in the project was meant to increase technology adoption. This was important because it provides an opportunity for one to get primary information and may be able to seek clarification as agreed by findings by Naemi et al, (2017) who reported that participation in plant breeding exercises in Iran enhanced the adoption level. The findings of the study agree with Naemi et al, (2017) about how important it is to participate in the ongoing activities of the project especially when it comes to understanding the concepts and accepting to adopt the technology. Adoption of technologies in the agriculture extension is progressive in nature with the initial duration being low to moderate then it progresses to high and very high as time goes by. This is experienced in the research findings whose results indicate moderate rate of adoption of technologies. The results concur with those established by Lahmar (2010).

The study established that farmers are aware of what is right or wrong in their area of residence and enterprise under consideration during the extension process. This is considered to be in the case of NERICA rice technology and intervention by the

CADSAL project. This is why it is important to always consider enquiring what could be the gap that is needed to be emphasized during the project implementation cycle as asserted by Morris & Bellon (2004) and Aref (2010). This was confirmed by the results of the agricultural knowledge test questions and statements that were posed to the respondents. The results of the response about the importance of project participation were relevant to the conventional general knowledge and information on crop agronomy through improved adoption and implementation. There is significant difference on the level of knowledge between those who participated in the CADSAL project and those who did not participate in the same project as illustrated by the results of p value = 0 and as illustrated by Morris & Bellon (2004) and Naemi et al (2017) who reported importance of participation in the dissemination and adoption of technologies including NERICA rice.

5.3 Level of Dissemination of Knowledge and Skills Acquired in NERICA Technologies

The community participatory extension approach was used in the dissemination of technologies during the CADSAL project. The research sought to find out the level of dissemination of knowledge and skills about NERICA rice technologies. The findings established that people who participated in the NERICA rice technology transfer in CADSAL project disseminated information to a larger number of people as compared to those who did not participate. When farmers participated in the project, they developed a sense of belonging and ownership. They further removed any doubt by seeking clarification about the technology from the extension staff or CADSAL project staff. This

finding concurs with Chen et al., (2010) who asserted that community based participatory approach is important in ensuring that dissemination rate increased.

The level of dissemination of the extension technologies as found out by the research results confirms that the more the farmers participate in an event the more, they get the knowledge and disseminate to the peers of friends. According to Damba et al (2020), the proper dissemination and adoption of technologies should start with the preparation of the technology disseminator and logistics for dissemination. In this case the Common Interest Groups who identified NERICA as of interest were key in being involved in the entire process of technology preparation and transfer.

NERICA rice was a new crop in Elgeyo Marakwet and it was expected that there was still some fear of unknown about the crop as an alternative to other crops common and which are conventional. Chen et al (2010), found out that dissemination of information through participatory approach helps to dispel any fear and enhances the dissemination and adoption of technologies in the community. The findings of the current study showed that community participatory extension approach enhanced the dissemination of NERICA.

5.4 Adoption Level of NERICA Technologies Promoted Through Community Participatory Extension Approaches.

The study findings about the level of adoption of technologies associated with NERICA rice growing indicated medium level of adoption for all the 15 technology aspects that were selected for the study. The level of adoption of technologies about NERICA rice was found to be medium and which could be attributed to the socioeconomic factors within the Elgeywo Marakwet County. Despite the moderate level of adoption of

NERICA technology, Community participatory extension approach to the dissemination of technologies and its adoption was key in achieving it. Participation approach guarantees sustainability and continuity of the CADSAL project set. The findings agree with those of Oduor et al (2018) who established that community participation in irrigation project in Busia county was key in sustainability of the project.

According to Ngombe et al (2014), when farmers discuss the benefit and find out that the enterprise is better paying than the conventional, then the adoption level will certainly improve. Dissemination of technology particularly on NERICA rice was the main aim of CADSAL project and was meant to increase the diversification of production in the area which did through practices of upland rice farming. Besides diversification the project was meant to increase food production and income to the community that initially dependent on the maize as main food crop and source of income. The technologies that were disseminated was meant to boost rice production in the area through increased acreage and productivity. The average level of adoption is encouraging as it means the production of acceptance to the new technology was on the better part with hope that as time goes by, the adoption level will be high.

5.5 Influence of Selected Socio-economic Factors on the Adoption of NERICA Technologies.

The findings of the present study found out that the respondents agreed that CADSAL participatory extension approach was key and important in the dissemination of NERICA rice technologies in the Kerio Valley catchment area. This was based on P- value $p<0.05$ in all the subjects of interest. The findings therefore were in agreement that the more the

farmers participate in the project the more the level of adoption and dissemination. The regression results indicated p value of 0 ($P<0.05$) with R square value being 0.699 and indication that CADSAL participatory extension approach in Kerio Valley had significant influence on the technology adoption and dissemination. The regression R value of 0.699 means the deviation from the adoption level line is not too far from the best of fit. This is an indication that adoption level based on the numbers of participants was well on time and process.

The mean age of the farmers who responded was 45 years an indication that many of the CADSAL target population was of the middle age category and who are energetic enough to adopt and carry out the farming activities. More male made response to the study questions than female. A total of 65 percent of the respondents were male while 35 percent of the respondents were female. Low female participation could be attributed to the time poverty encountered by the female than the male. Majority of the households are headed by male who therefore guide decision making as per the current study. This agrees with report by Mazibuko et al (2018) who indicated that household heads determine what enterprise to be established and sustained by the family in their study on socio economic factors in agricultural infrastructure in south Africa.

According to Farid et al (2015), in their study in Bangladesh on factors affecting the adoption of technologies, family size had no influence on the technology adoption. However, in the current study with an average family size of 9 members each, the study revealed that family size affect technology adoption since it has direct linkage to resource use in the family and need for resources to be used. The strain in the lookout for basic

needs by the larger family households could have an implication on the low attendance to the agriculture extension meetings or in adopting of the technologies. Education key in getting written information which could enhance the adoption level of the technologies being advanced. The current research established that there was relationship between education and the adoption rate. The findings concur with that carried out by Li et al., (2020) while studying the factors influencing farmer behaviour in China.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

This chapter presents the conclusion of the study and recommendation for research and practitioners in the area of extension.

6.1 Conclusion

Based on the objectives of the study, the following conclusion were drawn.

Community participatory extension approach increased NERICA rice technology adoption. Community participation provided primary information and clarification hence understanding the concepts and accepting to adopt the technology. The overall adoption level through participation was moderate. There was significant difference on the level of knowledge between those who participated in the CADSAL project and those who did not participate in the same project.

Community participation in extension increased dissemination of information to a larger number of people as compared to those who do not participate. When farmers participate in the project, they develop a sense of belonging and ownership and remove any doubt. Farmers who participate in an extension event acquire the knowledge and disseminate to the peers and friends. Participatory approach helps to dispel any fear and enhances the dissemination and adoption of technologies in the community.

The level of adoption of technologies associated with NERICA rice growing indicated medium level of adoption. Community participatory extension approach enhanced dissemination of technologies and its adoption since it provided guarantee to sustainability and continuity of the CADSAL project. Participatory approach of extension provide farmers with an opportunity to discuss the benefit of the enterprise.

CADSAL participatory extension approach was key and important in the dissemination of NERICA rice technologies in the Elgeyo Marakwet. Therefore, the more the farmers participate in the extension process the more the level of adoption and dissemination. There exists difference of adoption level between participants and non-participants at the CADSAL project with participants exhibiting high adoption and dissemination rate.

6.2 Recommendation

Based on the research finding in this study extension agents need to involve the stakeholders in the process of technology dissemination and adoption so that the level of adoption is enhanced and sustained.

To increase the rate of adoption and dissemination of technologies, community participation is key and important. Participation increases sense of ownership and confidence in taking up the technology. This is because participation further remove any fear that the technology could be non-beneficial in any way hence making it easy to adopt and even disseminate to other people within the catchment area.

6.3 Recommendation for further study

- Further research could be carried out on the level of rice production in the Elgeyo Marakwet County.
- Further study could be done on the influence of community participation in agricultural projects in Elgeyo Marakwet County.
- Study on socio-economic impact on the various undertaken projects in Elgeyo Marakwet County.

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APPENDICES

Appendix I: Farmers (Household Questionnaire)

Effectiveness of Community Participatory Extension Approaches in Dissemination and Adoption of Upland Rice among Smallholder Farmers in Kerio Valley, Elgeyo Marakwet County, Kenya

PART A

1. BIO DATA

Fill in or circle appropriately

Date…….

Time spent……

Name of respondent:.. ……

a) Farmers code number:…….

b) Gender of respondent:…….

Key: 1 = Male 2 = Female

c) Age of respondent in years……

d) Relationship of respondent to household……. ……

1. Self 2. Wife 3. Son 4. Daughter 5. Relative

6 Others (Specify)

e) Household structure – No of household members……..

Adults above 18 years……

Children……..

d) Educational level No. of years spent at school:. ……

Key: 1 - None,

2 - Primary level

3 - Secondary level

4 - Tertiary level (college and above)

5- other specify:……

2. ECONOMIC FACTOR

Income Received by the CADSAL and Non-CADSAL farmers.

Indicate the income category that best present your total earnings per month including that from supplementary sources. (Key provided below)

2.1 What are your main sources of income and earnings?

SOURCE OF INCOME	AMOUNT EARNED (Kshs)	
	Monthly	Yearly
1. Farming		
2. Salary from employment		
3. Small-scale business i.e. (Kiosks, Hotels, Shop, bar.		
4. Petty trade (hawking, sale of charcoal, illegal brews).		
5. Assistants by relatives/Lenders		
6. Others (specify)		
TOTAL ANNUALLY.		

2.2 State how you spent your income on the following: - (Circle one only)

Expenditure	Income Expenditure.
1. Land preparation	1 2 3 4 5
2. Purchasing of farm inputs	1 2 3 4 5
3. Food for the household	1 2 3 4 5
4. School fees	1 2 3 4 5
5. Medical bills	1 2 3 4 5
6. Leisure	1 2 3 4 5
Others specify	1 2 3 4 5

Key:

1. Very low 2. Low 3. Moderate 4. High 5. Very High

<10% 10-30% 31-50% 51-70% >71%

3.0 SOCIO-ECONOMIC FACTORS

3.1 Gender roles or division of labour of agricultural and household activities between male and female respondents for each household.

Who in the household carry out the following activities (scores as per given key below).

Activity	Male	Female
1. Bush-clearing/land preparation		
2. Purchases of farm inputs i.e. seeds/fertilizers		
3. Planting		
4. Weeding		
5. Pest control/ITK		
6. Watering crops/small irrigation		
7. Harvesting of crops		
8. Marketing of farm produce I.e. cereals and straws		
9. Decision making on:		
i) Soil conservation measures		
ii) Farm income expenditure		
iii) Purchasing of farm implements		
iv) Tree planting.		
v) Sale of produce		
10. Collection of firewood		
11. Cooking food		
12. Fetching domestic water		
13. Caring of young children		

Key : 0 = No role 1= Very little role 2 = Little role 3 = Moderate role

4 = Larger role 5 = Largest role

3.2 What influence does the above decisions/distribution of gender roles have on the adoption of NERICA technologies as a result of participation in Community Participatory extension/CADSAL activities? Tick appropriate response

(1) Very significant influence (2) Significant (3) Uncertain

(4) insignificant (5) Very insignificant

PART B

OBJECTIVE 1

Knowledge acquired in the community participatory extension training packages on NERICA technologies by CADSAL and NON-CADSAL participants Knowledge gained about NERICA by CADSAL and Non CADSAL Participants.

a) How do you rate the Agricultural knowledge acquired (through Community participatory extension approach promoted through CADSAL Project on NERICA Technology?

NERICA Technology/Recommended practices	Level of knowledge				
1) Planting	1	2	3	4	5
2) Seed selection	1	2	3	4	5
3) Spacing	1	2	3	4	5
4) Disease and pest control	1	2	3	4	5
5) weeding	1	2	3	4	5
6) Harvesting	1	2	3	4	5
7) Shelling	1	2	3	4	5
8) Drying	1	2	3	4	5
9) Milling	1	2	3	4	5

Key: 1 = None 2 = Low 3 = Moderate 4 = High 5 = Very high

Common agricultural knowledge test

Instructions: Tick (√) appropriately the correct answer to the given statement.

Statement /Item Related to basic rice technical knowledge	True	False
1) CADSAL NERICA Project was meant for all categories of farmers irrespective of age, gender and economic status.		
2) NERICA seed selection is important in achieving higher yields. The procedure is done through water flotation test where heavier seeds are selected.		
3) The four varieties NERICA 1, 4, 10 and 11 were introduced to Kerio valley after adaptability on farm trials in 2005/2006.		
4) NERICA is grown under flood condition like Mwea rice in Kerio valley		
5) All insects are harmful to plants especially rice		
6) Soil conservation increase agricultural yields in the long run		
7) Control of weeds early in the season helps the development of the rice plants		
8) Termites are not the worst pest and enemy of a rice plant in Kerio Valley.		
9) Two ploughs and harrowing to prepare the land to a fine tilth similar for finger millet land and should be level to hold water especially in Kerio valley		
10) There are two methods of planting NERICA in Kerio valley that is: Broadcasting and Drilling but broadcasting is the most recommended since it easier in terms of labour		
11) NERICA is difficult to thresh. Threshability is difficult than lowland rice		
12) Weeds are not a main challenge of rice farmers. Rice can be weeded once		

Statement /Item Related to basic rice technical knowledge	True	False
before harvest		
13) There are several stages of rice growth from planting to harvesting: Maturity period takes 90-110 days in Kerio valley.		
14) Spacing of rice is not important it can be spaced like maize say 75 cmx 30cm.		
15) Birds if uncontrolled through bird scaring can destroy a whole field of rice crop.		
16) Every time we see insect in the rice fields or vegetable fields we should spray insecticides to make certain that we have a good crop yield.		
17) Higher plant density of rice will always result in higher yields.		
18) It is safe to mix and apply pesticide without wearing protective clothing's eg boots		
19) Participatory extension approaches of on-farm trial and rice interest groups was used to promote adoption of rice in Kerio Valley.		
20) Rice milling is not a critical factor in rice adoption		

OBLECTIVE 2: To describe and compare if CADSAL participants/non-CADSAL participants disseminate knowledge and skills acquired in NERICA technologies and extension packages related to NERICA to other farmers in Kerio Valley of Elgeyo Marakwet County, Kenya.

a) Have you shared the NERICA acquired knowledge with other farmers?

1. Yes
2. No.

if Yes go to (b)

b) How many Non-CADSAL farmers have you teach/shown/passed the NERICA agronomic practices /technologies learnt from the CADSAL training in Kerio valley to date

1) None
2) 1-5
3) 6-10
4) 11-15
5) > 15.
6) Others specify……

c) What channel(s)/mode of communication did you use in dissemination of NERICA technology to other farmers?

Key: You may tick (√) more than one

(1) Verbal (face to face)
(2) Individual farm visit
(3) Through written (pamphlets and leaflets)
(4) Role play and/drama
(5) Music/Video
(6) Group visits/tour
(7) Social media-(Tick the mostly used (√)FB…Whatsapp… SMS….. phone call…..)
(8) Others (specify)……

d) **Which of the following NERICA technologies learned through CP Extension approach have you disseminated to other farmers and the frequency of dissemination**

Key: 1) None 2) Low(1-5) 3) Moderate(6-10) farmers 4) High (11-15) 5) Very high >15 farmers

NERICA- technologies/ Extension packages/practice	Frequency of dissemination of SM/Agricultural technologies to other farmers				
1. Land preparation methods (ie ploughing, harrowing, leveling and soil conservation	1	2	3	4	5
2. Soil conservation methods (Terracing. Contour planting, mulching)	1	2	3	4	5
3. Rice seed selection techniques	1	2	3	4	5
4. Planting methods/techniques	1	2	3	4	5
5.Knows the growth stages of NERICA Rice (stage and days after sowing) i. Germination, ii. Emergence, iii. Seedling,Tillering, Stem elongation, Panicle initiation, Heading, Flowering, Milk stage, Dough stage, Mature grains and Harvesting	1	2	3	4	5
6. Disease and pest control	1	2	3	4	5
7. Weeding (stages and Methods of weeding-hand or herbicides	1	2	3	4	5
8.Harvesting	1	2	3	4	5
9. Threshing	1	2	3	4	5
10. Drying	1	2	3	4	5
11. Milling	1	2	3	4	5

OBLECTIVE 3: To determine the adoption level of NERICA technologies promoted through community participatory extension approaches between CADSAL and non-CADSAL NERICA farmers in Kerio Valley of Elgeyo Marakwet County, Kenya.

a) Which of the following NERICA technologies learned through CPE training approach have you adopted on your farm? Extend of adoption and rate the overall level of adoption of NERICA Agronomic practices from seed to harvesting.

Circle each option appropriately. Key 1 = None, 2 = Low, 3 = Medium, 4 = High, 5 = Very high

NERICA Agronomic practices & management	Level of adoption of NERICA technologies				
1. NERICA Seed selection techniques:					
(i) Knows the seed selection methods	1	2	3	4	5
(ii) Utilization on the farm	1	2	3	4	5
2. NERICA Planting techniques:					
(i) Know the spacing	1	2	3	4	5
(ii) Thinning techniques,	1	2	3	4	5
(iii) Contour farming to avoid erosion	1	2	3	4	5
3. Organic/inorganic Fertilizer applications					
i. Time of fertilizer application	1	2	3	4	5
ii. Rate of fertilizer application	1	2	3	4	5
4. Disease management	1	2	3	4	5
5. Pest management	1	2	3	4	5
6. Weeding techniques					
i. Mechanical weeding	1	2	3	4	5
ii. Chemical weeding	1	2	3	4	5

7.Irrigation					
i. Source of water	1	2	3	4	5
ii. Time of water application	1	2	3	4	5
iii. Method of irrigation	1	2	3	4	5
8. Tillering stage	1	2	3	4	5
9.Threshing	1	2	3	4	5
10.Bagging	1	2	3	4	5
11.Storage	1	2	3	4	5
12. Milling and marketing.	1	2	3	4	5

OBLECTIVE 4: To analyze the influence of selected socio-economic factors (Farm size, age of household head, Level of education, gender participation, attitude towards dissemination and adoption of rice) on the adoption of NERICA technologies in Kerio Valley of Elgeyo Marakwet County, Kenya.

Instrument to gauge the attitude towards dissemination and adoption of rice.

SOCIO–ECONOMIC FACTORS Influencing adoption of NERICA technologies.

Attitude: towards the introduction through dissemination by CADSAL project of NERICA and adoption as one of the food crop in the farming system among smallholder farmers in Kerio Valley.

Instructions For each statement chose from the following possible answers:

Key: 1) Strongly agree (SA) 2) Agree (A) 3) Uncertain/undecided (U)
4) Disagree (DA) 5) Strongly Disagree (SD)

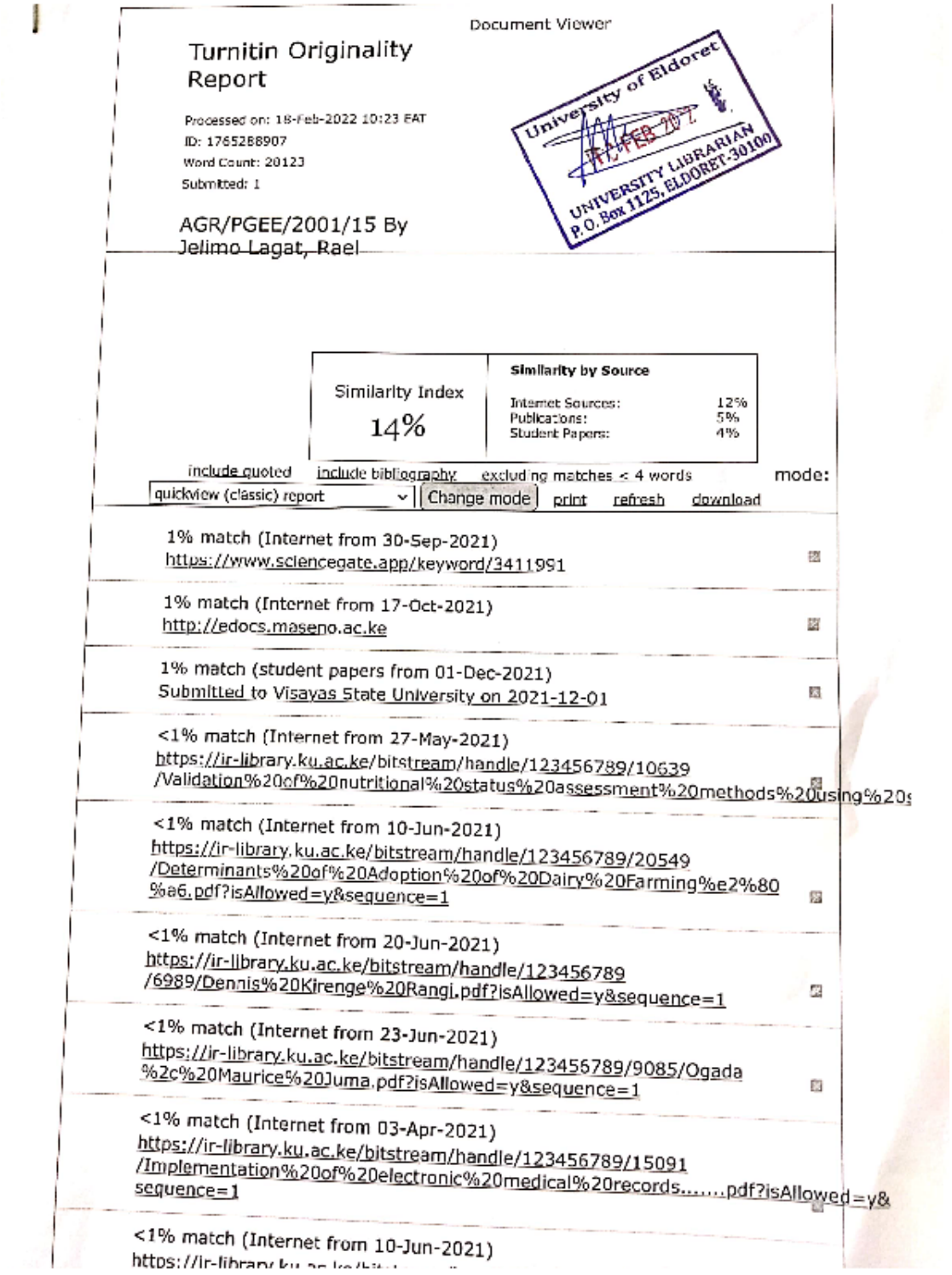
Check (√) the column that you believe best represents your feelings about CADSAL?

Item	SA	A	U	DA	SD
1. CADSAL participatory extension approach is better than the normal extension teaching methods					
2. CADSAL did very little in introduction of upland rice in Kerio valley.					
3. CADSAL CPTD and CIPs approaches were key in introduction of CADSAL technologies such as NERICA.					

4. NERICA is not important as a food crop in Kerio Valley and has a minimal acceptance and hence adoption by farmers					
5. Growing NERICA is tedious and a waste of time and resources.					
6. CADSAL was a project which did little to train farmers on rice growing among other technologies					
7.CADSAL project which promoted NERICA rice and other technologies such as irrigation, Dairy goats and camel had little impact on livelihoods of farmers in Kerio valley.					
8. CADSAL training increases farmer knowledge on NERICA					
9. If I did not attend the CADSAL training I would not have known much about NERICA growing and other good farm management practices.					
10. If I did not attend CADSAL-training, I would not have joined a functional CIP and CPTD group and register them to our own advantage.					
11. CADSAL participation empowers the farmers in terms of experimentation and discovery-based learning and introduction of new technologies such as rice in Kerio Valley					
12. CADSAL Project welcomed all farmers irrespective of gender, age to participate					
13. The CADSAL trainers were very useful and we can see their impact in terms of technologies such as rice introduction in Kerio valley.					
14. CPTD/CIP Participatory extension methodologies empowers farmers in terms of decision making in relation to their farming activities					

15. CADSAL participation has increased farmers networks and contacts with extension agents, NGO's and all interested partners					
16. CADSAL was the most effective project in empowering farmers in terms of knowledge dissemination and adoption of NERICA					
17. CADSAL CPTDS and CIPs encourages farmer to farmer communication/information exchange hence increased diffusion of technologies in Kerio valley.					
18. CPTD/CIP Participatory approaches encouraged group formation and enhanced economic welfare of their members to improve agricultural technology adoption and productivity such as NERICA growing					

Appendix II: Similarity Report



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