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Socio-economic Impacts of the Kenya Agricultural Carbon Project (KACP) on Small-holder farmers' livelihoods in Bungoma County, Western Kenya.

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Declaration

I, **Anthony K. Chemarum**, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree

Signature……..

Date……

Climate justice is about all of us. It is about acknowledging our personal responsibility in an interconnected world. It is about acting outside the narrow confines of self-interest – even as it becomes clear that our self-interest can destroy the lives of our own children and grandchildren_ Mary Robinson; Former President Of Ireland.

Dedication

I dedicate this work to Vi-Agroforestry Kenya (ViA-K) and the farmers they work with to promote sustainable agricultural systems for improved livelihoods, in both Western and Nyanza regions of Kenya.

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Abstract

Agricultural carbon sequestration projects have been embraced in the recent past seeking to demonstrate how agricultural carbon finance may function to reduce emissions and at the same time generate improved local livelihoods. However, the initiatives have not achieved readily tangible social, economic and environmental impacts. The Kenya Agricultural Carbon Project (KACP) is one flagship initiative in Western Kenya, East Africa. It has aimed at reducing poverty levels of small-holder farmers in Western Kenya by promoting sustainable agricultural land practices to boost their farm yields and increase food security while still generating carbon sequestration and subsequent revenue. This study sought to look into KACPs livelihood consequences/outcomes on the target populations. The study makes an overall assessment of the socio-economic adaptation of households, the impacts of KACP on the livelihoods of poor small-scale farmers and also assessing farmers' understanding of the carbon financing and marketing concepts. It employs a mixed methods approach using household questionnaires, focus group discussions and key informant interviews. Descriptive and analytical models are used to test for significant associations and differences.

The study finds that farmers in Western Kenya are generally both asset-poor and poor in terms of cash and subsistence incomes. The project areas further lack access to developed physical infrastructure especially access to electricity and good road networks and well-functioning markets. Most livelihood activities in the project area are on-farm-oriented (50%) compared to off-farm (18%) and non-farm (32%) activities. On-farm activities feature food crops farming, cash crop farming and livestock keeping while off-farm and non-farm activities feature tradable manual employment and income-generating rural services. Poor people adapt through higher incomes from off-farm and on-farm activities while the wealthier adapt more through non-farm incomes. Looking at variation by location, we do find that areas with more land and better market access (Malakisi division) report wider asset portfolios, higher asset levels and have higher income levels (70% of total income). Concerning adoption of carbon sequestration measures (SALM) generally, it appears farmers achieve quite high adoption rates (on average 54%). There is also variation between measures among groups (ranging from 20%-90%) depending upon their suitability, their labour and financial costs of SALM implementation and farmers general willingness to adopt more or less technically advanced practices. The more

asset-rich and wealthy group tend to adopt more (70% versus around 45%) as does people from locations with higher asset access and better market infrastructure.

The study indicates that KACP farmers were lacking a broader understanding of the interrelationship between soil carbon emissions, SALMs implementation and global climate change. Still, they appreciate the practical economic value of carbon revenue earning through tree planting. The study findings reveal that the annual mean carbon revenue per farmer per year (only Kshs. 216; some USD2/farmer and year) forms no incentive or economic advantage for SALMs adoption (a miniscule 0.17% of total household income). It was however understood and maybe also accepted by many farmers as a symbol of appreciation for their SALM implementation efforts.

So, the project does bring some benefits and incomes to local people. However, this is not because of its carbon sequestration and PES design qualities. The KACP markets itself as a carbon sequestration project but in reality this is not the case. The project is rather undertaken within a traditional ecological or conservation farming frame and as such, the KACP institutionalization legitimizes practice rather than its presupposed transformative orientation.

Table of Contents

List of Tables

List of Figures

List of Acronyms

ABMS - Activity Baseline Monitoring System

CA - Conservation Agriculture

CDM - Clean Development Mechanism

CFs - Community Facilitators

CGIAR- Consortium of International Agricultural Research

ES - Ecosystem Services

FAO - Food and Agricultural Organization

GA – Good Agronomy

IUCN - International Union for Conservation of Nature

KACP - Kenya Agricultural Carbon Project

GHGs - Green House Gases

MEA - Millennium Ecosystem Assessment

NCCRS - National Climate Change Response Strategy

NCCAP - National Climate Changes Action Plan

REDD - Reduced Emissions from Deforestation and Forest Degradation

SALMs - Sustainable Agricultural land management

SCC-ViA - Swedish Cooperative Centre-Vi Agro-forestry

SLA – Sustainable Livelihoods Approach

SOC - Soil Organic Carbon

UNFCCC - United Nations Convention on Climate Change

VSOs - Voluntary Carbon Offsets

WB-BioCF - World Bank BioCarbon Fund

1.0 Introduction

1.1 Background

1.1.1 Global overview

Reduced Emissions from Deforestation and Forest Degradation (REDD) stands out as the common global carbon-related climate change development initiative. In the recent past, however, some development pursuits surrounding climate change mitigation and adaptation have taken a shift from forestry-related carbon sequestration (REDD) to include soil-related carbon sequestration based on agricultural land management systems. This shift in strategies to reduce emissions of Green House Gases (GHG's) seeks to combat climate change through sustainable agricultural land management (SALM) systems. SALM systems are based on what climate change development projects refer to as 'climate smart agriculture'. Climate smart agriculture is claimed by project initiators, to be a 'win-win' development strategy using a set of farming practices that increase soil fertility, boost agricultural yields and secure food security while mitigating climate change.

According to the Kyoto Protocol, countries are allowed to resort to 'supplementary activities', consisting particularly of carbon sequestration in agricultural soils (Ragot & Schubert 2008). Specifically, the Protocol spells out that developed countries have the responsibility of financing Clean Development Mechanism (CDM) projects in developing countries to offset and meet part of their emission targets (Atela 2012). It commits industrialized countries to reduce greenhouse gas emissions (carbon di oxide equivalents) by 5.2% below 1990 levels during the 2008-2012 commitment periods (UNFCCC, 1998 as cited by Atela, 2012). At the onset of responses to promote CDM, the main target was the energy sector. However, this appeared to limit their significance in developing countries and it triggered the emergence of alternative platforms around voluntary carbon exchange in forestry and agriculture sectors (Atela 2012).

The Kenya Agricultural Carbon Project (KACP) is an example of agricultural-related CDM responses which aims at trading carbon credits in the voluntary carbon exchange market. It is a product of Kyoto Protocol's call on industrialized countries commitment to curb GHGs emissions and which chose to lobby for the inclusion of agriculture in the agreement alongside REDD. According to Atela (2012), this lobby was guided by the recognition of climate-related

agricultural issues in strengthening the REDD narrative since most local communities around forests are agriculturalists. It is argued that successful REDD depends more on agricultural development strategies that retain and sustain forests than on forestry strategies autonomously (Atela 2012). As such, agroforestry emerged as a means to curb deforestation and prevent forest degradation through increased production of on-farm timber and fuel wood thereby enhancing the synergies between mitigation and adaptation to climate change. Further, the IPCC 2007 (as cited by Atela 2012) affirms that agriculture itself has the potential to mitigate climate change because farming has a mitigation potential of 5.5-6 Gt CO_2e per year from soil carbon sequestration.

Food and Agricultural Organization (FAO, 2008, cited by Atela 2012) reports that improved agricultural management practices recommended for mitigation under the Kyoto Protocol are often those that are needed to increase productivity, food security and adaptation. Therefore, in 2009, during the 15th Conference of Parties (COP15) in Copenhagen Denmark, FAO advocated for a 'political deal' that would entrench agriculture as a means to cost-effectively mitigate climate change through adaptation and food security. Two years later, in COP17, Durban; South Africa, it is reported that a lobby group comprising of eight Aid agencies, ten international agricultural research organizations and seven farmer advocacy groups pushed FAO's 'political deal' further. They requested the COP negotiators to recognize the important role of agriculture in addressing climate change and asked them to approve a Work Programme for early action on agriculture to meet future climate change challenges (Atela 2012). It was this lobbying process that set the agenda for World Bank's concept of 'climate smart technologies' in agriculture; a solution to climate change rather than a contributor to greenhouse gas emissions and deforestation.

Climate smart agriculture gained more political and donor attention in the context of climate change mitigation and adaptation since World Bank set its agenda. With regards to KACP, the Bank put climate smart agriculture forward as a 'triple win' development initiative. It endorses climate change mitigation, adaptation and food security for small-scale farmers while introducing carbon financing and marketing for agricultural emissions (Sharma & Suppan 2011). It proclaims that it involves agricultural practices that sustainably increase productivity (food security), improve climate change resilience (adaptation) and reduces GHGs (mitigation) for

payment (World Bank 2010, as cited by Atela 2012). However, research has shown that uncertainties in methodology, costs and actual social and environmental impacts abound. It is claimed that the agricultural carbon market approach is a 'very shaky foundation' for climate finance because half of the monetary benefits from the proposed offset credits is absorbed by project developers as transaction costs, with meagre returns or benefits accrued to the farmers who actually implement and bear the costs of the project (Sharma & Suppan 2011).

1.1.2 Kenya Agricultural Carbon Project (KACP)

KACP is the first World Bank supported projects on agricultural carbon finance in Sub-Saharan Africa. Since 2008, the World Bank BioCarbon Fund (WB-BioCF) has worked with groups of smallholder farmers on the ground in Western Kenya (Atela 2012). Termed as 'climate-smart agriculture', carbon finance involves payment received from international donor/aid agencies to small-scale farmers as compensation for adoption of SALM practices that capture and store GHGs.

Conceived in 2007, KACP is a collaborative development initiative established and funded jointly by the Swedish Cooperative Centre-Vi Agro-forestry Program (SCC-ViA) and the WB-BioCF. It is a twenty-year project that aims at reducing poverty while generating carbon credits by incentivizing poor smallholder farmers' to adopt better farming methods in their degraded agricultural lands (Sharma & Suppan 2011). The programme has progressively promoted SALM practices such as tillage and residue management, soil nutrient management, improved livestock management and soil water management.

KACP's implementing agency, SCC-ViA, has worked with farmers in Western Kenya for more than two decades on issues of land degradation and food security around the Lake Victoria basin (Atela 2012). It has aimed to build on this long-term experience about agro-forestry by training farmer groups under KACP on adoption of SALMs which indirectly support carbon sequestration processes while improving livelihood options and reducing poverty (D'Souza 2011). SCC-ViA provides advisory extension services on sustainable agricultural management, marketing and development of farm enterprises (Woelcke 2012). It works with registered farmer groups with whom they have signed partnership contracts that detail the rights and obligations of both parties with respect to SALM implementation (carbon sequestration practices) and carbon

revenue acquisition. The details of the terms and conditions of the sales of emission reductions are specified in the Emission Reduction Purchase Agreement (ERPA) that was signed between BioCarbon Fund and SCC-ViA prior to the commencement of KACP. As such, SCC-ViA sells the emissions reduction to the BioCarbon Fund of the WB on behalf of the farmer groups after the project's validation by an independent third party (Woelcke 2012). Hereafter, all revenues accrued were expected to almost exclusively benefit the smallholder farmers; partly in the form of direct payments and partly through the financing of SCC-ViA's extension services regarding SALMs implementation.

KACP's key element in the ERPA is the monitoring and evaluation system dubbed MRV (Measurement, Reporting and Verification) which was designed to track emissions reductions generated by SALMs implementation. This monitoring and evaluation methodology is based on the first carbon accounting methodology for sustainable agricultural land management established by the WB (Woelcke 2012). It is said to aim at a cost-effective monitoring process of carbon emission reductions in order to minimize the transaction costs and maximize the benefits for farmers. This way, Woelcke (2012) assert, the project focus is the smallholder farmers' interest first (of increased crop yields and food security) then carbon sequestration endeavour, second. He argues that farmers will only adopt and maintain introduced agricultural practices if they realize increases in productivity and incomes. Furthermore, KACP indicated clearly in its ex-ante economic and financial analysis that the amount of carbon revenues were expected to be small in comparison to revenues from increased crop yields. Therefore, farmers were expected by the project to achieve increased crop yields under changing climatic conditions and at the same time provide an environmental service. This service is in the form of carbon sequestration and which deserves a reward in carbon revenues as a co-benefit for the smallholder farmers.

As of 2011, the project involved nearly 20,000 farmers, with the goal of eventually including 60,000 small-holder farmers on a land area covering 45,000 hectares in both Kisumu and Kitale focal project areas. Participants are trained in groups by Vi-Agroforestry extension staff or by voluntary Community Facilitators (CFs) who have been trained by extension staff. Generally, it is reported that all KACP staff on the ground come from the region where the project operates, with field extension staff often coming from the very same villages in which the project operates (D'Souza 2011).

1.2 Carbon Sequestration and Sustainable Agriculture

Sustainable agriculture development is widely acknowledged as a critical component in the strategies to address challenges such as climate change, poverty and environmental degradation (Antle & Diagana 2003). It has been established however, that the real hurdle in addressing these challenges lies in researchers and policy analysts misunderstanding of the actual factors and processes which lead poor peasants to unavoidably resort to unsustainable agricultural practices. A bigger challenge therefore becomes the conception of design mechanisms that will provide farmers in developing countries with the economic incentives needed to adopt more long-term as opposed to short-term sustainable land use and management practices (Antle & Diagana 2003).

A study by the Consortium of International Agricultural Research (CGIAR) notes that there is growing interest globally in the development of agricultural carbon projects to mitigate climate change. Such projects sequester large amounts of carbon dioxide from the atmosphere while contributing to sustainable agriculture and land management for smallholder farmers (Shames et al. 2012). It however argues, like other research studies on agricultural carbon initiatives, that they experience many challenges, especially in their in-built complexity and high costs of project development.

Sharma and Suppan (2011) note that many international development agencies have failed to sufficiently assess the benefits of relying on carbon markets compared to alternative approaches. These alternative approaches are said to be those that need to meet agricultural carbon sequestration project goals of increased climate resilience, increased climate adaptation and mitigation as well as increased crop yields and food security. They suggest that a fact-finding mission on such projects' endeavours to create co-benefits needs to be conducted with a view of understanding the social dynamics of these initiatives on the ground. These co-benefits can for example be increased maize yields through improved soil fertility, the use of hybrid seeds and increased livestock fodder (Sharma & Suppan 2011).

1.3 Justification of thesis

With regard to carbon financing, there is an increasing demand for information about the real economic impact of agricultural carbon sequestration projects in the developing world. However, there are no studies that have shown the potential livelihoods transformation through the economic gains that come with such investments (Antle et al. 2007). Many international agencies and agricultural research organizations have adopted a variety of programmes and funds to demonstrate how agricultural carbon finance can work and produce successful human development outputs. However, there is a divergence between scientific-donor narratives and those of a reality on the ground of smallholder farmers enrolled in such programmes. Contrary to the goals, the funds do not diversify farmers' livelihoods options economically, socially and politically (Atela 2012).

KACP is approximately six years old and has been on-going since 2007. Being a long-term development initiative with a plan projected to 2018, it is important to look into its socio-economic impacts so far on the target population. This can be achieved by assessing the livelihoods of the target group who are poor small scale farmers in Western Kenya. The KACP, implemented since 2008, progressively aims at reducing poverty by boosting farmers' yields and food security through sustainable agriculture and linking small-scale farmers to profitable agricultural markets while generating carbon credits. This is done through monetary incentives for poor farmers to adoption sustainable agricultural land management techniques (SALMs). The poverty reduction aim as a general objective for KACP and its subsequent key background concept based on agricultural carbon sequestration for carbon credits is the core of this research study. An assessment of the socio-economic impacts of KACP will shed light on the projects actual impacts on the ground and inform future project implementation processes. This is crucial in reconciling the divergent narratives of project implementers and the project's beneficiaries bearing in mind that KACP lifespan is long with approximately thirteen years remaining to its completion. This research study will also help widen researchers' and climate change practitioners' varied perceptions on agricultural carbon sequestration initiatives in light of WB's 'climate smart' agriculture concept.

1.4 Thesis outline by chapters

Section one is the study's introduction chapter, which serves as an entry point into the study's narrative on climate smart agriculture by tracing its roots in global climate change mitigation and adaptation nexus. It covers the global, regional and local perspectives surrounding the emergence of soil carbon sequestration, the KACP's background, thesis justification, problem formulation, research objectives, and subsequent research questions of the study. Section two is the theoretical and literature review chapter which reflects on the study's theoretical approaches, literature review and theoretical framework. Section three is the methods and methodology chapter which focuses on the description of the study area, data analysis models and data collection methods related to the research objectives as well as the study's potential limitations and challenges. Section four is the results and discussions chapter which presents the study's findings, analyses and discussions. The last section summarizes the research paper by reflecting on the key findings of the study then briefly suggests areas of tentative recommendations.

1.5 Problem formulation

1.5.1 Problem Statement

Agricultural carbon sequestration projects have been embraced in the recent past as viable GHGs emission reduction strategies for developing countries. They have been taken up by international and national development agencies to promote carbon sequestration while reducing poverty through 'climate-smart agriculture'. However, the real socio-economic impacts of these projects are yet to be realized as researchers and development critics raise questions on their viability. Since its inception, the KACP has aimed at gradually reducing poverty levels of small-holder farmers in Western Kenya by boosting their farm yields and food security. This is done by promoting sustainable agriculture and linking them to profitable agricultural markets while generating carbon credits. KACPs endeavor to improve and transform farmers' livelihoods and eventually reduce poverty levels is the central objective that this research study assesses. This endeavour set the basis of investigating the socio-economic impacts of the KACP on the poor small-scale farmers' livelihoods since the programmes inception.

1.5.2 Objectives and research questions

Objective 1: To assess the present livelihood adaptation strategies of farmers in the KACP area

- What constitutes the present agricultural adaptation and diversification pillars among farmers in the KACP area?
- What is the change in agricultural adaptation and diversification pillars among farmers in the KACP area?

Objective 2: To determine the consequences of SALMs adoption on the livelihoods of farmers in the KACP area

- What are the economic consequences of SALMs uptake on farmers' livelihoods (i.e. share of income from adoption of SALMs)?
- What are the agronomic and environmental consequences of SALMs adoption on farmers' livelihoods (i.e. impacts on food security, local climate and the environment)?
- What are the socio-cultural consequences of SALMs adoption on farmers' livelihoods (i.e. impacts on gender relations and rights to resources)?

Objective 3 To evaluate the understanding of carbon financing and marketing concept by farmers in the KACP area

- Do the farmers understand the carbon market financing concept and how it functions?
- Have farmers received any agricultural carbon revenue? Are monetary incentives by KACP a sufficient motivation to adopt SALMs?
- Are farmers well equipped to use carbon accounting and reporting system in relation to adoption of SALMs?

2.0 Theory and Literature

2.1 Theoretical Approaches

2.1.1 Good Agronomy concept, norms and values

The concept of 'good agronomy' (GA) is founded on the multi-dimensional experience-based competence to master the complexity of managing farmlands (Vedeld & Krogh 2003). It is a social institution built on certain basic social values and norms within specific agricultural societies and reflects a social institution for interaction and exchange of ideas and practical knowledge and skills. According to Vedeld and Krogh (2003), a GA model is based on some basic values that underpin the self-employed life mode practice in agriculture. These basic values are: i) independence and self-reliance, ii) proprietorship (farm as the real asset for core production), iii) proficiency (consistently carrying out appropriate quality farm production), iv) management responsibility (sustainable resources utilization and production) and v) production orientation (mode and purpose of agricultural production).

Good agronomy framework is guided by the self-employed farming version derived from simple mode of production. As a social institution, it encompasses socially constructed and developed norms and rules for adaptation through interaction with other farmers in producer environments (Vedeld & Krogh 2003). Producer environments are important in knowledge generation, assessment and exchange within farmers' social structures. It enables interaction between farmers and advisors (agriculture experts and extensionists) in social contexts and networks that are geographically defined. Through this interaction, the exchange of goods and services and communal labour gives both reciprocal support and creates a sense of security and belonging for the independent farmer (Vedeld & Krogh 2003). Further, norms, values and knowledge may be institutionalized within farmer societies to achieve high yields, sustainable utilization of resource and fast adoption rates of new technologies.

Norms and values within good agronomy are socio-culturally and politically determined i.e. societal exercise of power. Here, power involves distribution of authority, rights, duties and resources seen relative to the legitimacy of good or bad governance (Vedeld & Krogh 2003). As such, good governance is the reasonable distribution of authority, rights, duties and resources

through due consideration of different actors' interests. However, governance can be interpreted according to the means employed to effect compliance within power dimensions i.e. coercive, remunerative and normative powers and their consequent responses (compliances) by subjects of these powers (Vedeld & Krogh 2003). First, coercive power by authorities triggers acceptance of power by subjects in fear of the consequences of non-compliance. Second, remunerative power is the acceptance of power through strategy or calculation where a relative advantage is acquired. Third, normative power entails the acceptance of power use from consensus through shared values, norms and negotiated agreements (Vedeld & Krogh 2003). Therefore, good agronomy will be significant to identify and understand Western Kenyan farmers' agronomic adaptation norms and values within power relations i.e. ViA as SALM implementing authority.

Good agronomy concept is not entirely a smooth path towards good governance or adaptation because it experiences changes and ambiguities. Firstly, changes within rural societies' cultural norms and values render good agronomy a contested institution (Vedeld & Krogh 2003). At the individual level, inconsistency within good agronomy may lead to conflicts between farmers' responsibility ideal and precise aim of production (highest yield or costs and incomes difference?). In other cases farmers' cultural perceptions of values and norms may conflict with the founding principles of good agronomy. Secondly, at the household level, conflict may arise between different members of the family in cases of differential acquisition of social values from within and outside the farm context. For example different members of a household may over time expect income standards and livelihoods corresponding to other families whom they interact with and who have not been socialized through self-employed life mode (Vedeld & Krogh 2003). Lastly, ambiguities may also arise within the producer environment at the societal level. Diversification of individual farming adaptations have been seen as a trend that fragments and dissolves local producer environments through newly acquired production systems (Vedeld & Krogh 2003).

2.1.2 Sustainable Livelihood Approach

Livelihood approach, commonly referred to as Sustainable Livelihoods Approach (SLA) regards the asset status of poor individuals and households as fundamental to understanding the options open to them, the strategies they adopt survivals, and their vulnerability to adverse trends and events (Ellis 2000). A sustainable livelihood refers to capabilities and assets (including both material and social resources) for a means of living (Solesbury 2003). Solesbury further elaborates that a livelihood is sustainable when it can cope with and recover from stresses and shocks. It maintains or enhances capabilities and assets both now and in the future, while not undermining the natural resource base. Scoones (2009) argues that societies combine different activities in a complex bricolage or portfolio of activities whose outcomes and means vary in meeting livelihood ends.

Therefore, based on assets (natural, physical, human , financial and social capitals) which are the basic building blocks upon which households are able to undertake production, engage in labour markets and participate in reciprocal exchanges with other households, livelihoods of farmers in KACP was assessed for sustainability. The framework stems from an earlier analytical framework for sustainable rural livelihoods (Scoones, 1998) which follows that:

> Given a particular *context* (of policy setting or socio-economic conditions), what combination of *livelihood resources* (different kinds of capital) result in the ability to follow what combination of *livelihood strategies* (livelihood diversification and migration) with what *outcomes*? Of particular interest in this framework are the *institutional processes* (formal and informal institutions and organisations) which mediate the ability to carry out such strategies and achieve (or not) such outcomes (Solesbury 2003)

So, in finding out the KACP's social and economic impacts, the sustainable livelihoods framework approach enabled the research to identify the factors that affect livelihoods of the poor farmers involved in the project. This framework (see Figure 1) follows five related livelihoods trajectories i.e. 1) the context in which the farmers live, and factors affecting their vulnerability to shocks and stresses, 2) the farmers' access to social, human, physical, financial and natural capital or assets, and their ability to put these to productive use, 3) the policies, institutions and processes that shape their access to assets and opportunities, 4) the different strategies they adopt (and how they use their assets, coping mechanisms) in pursuit of their

priorities and 5) the priorities that farmers define as their desired livelihood outcomes since KACP's inception. This framework assisted the research study to address its *objective 1 and 2.*

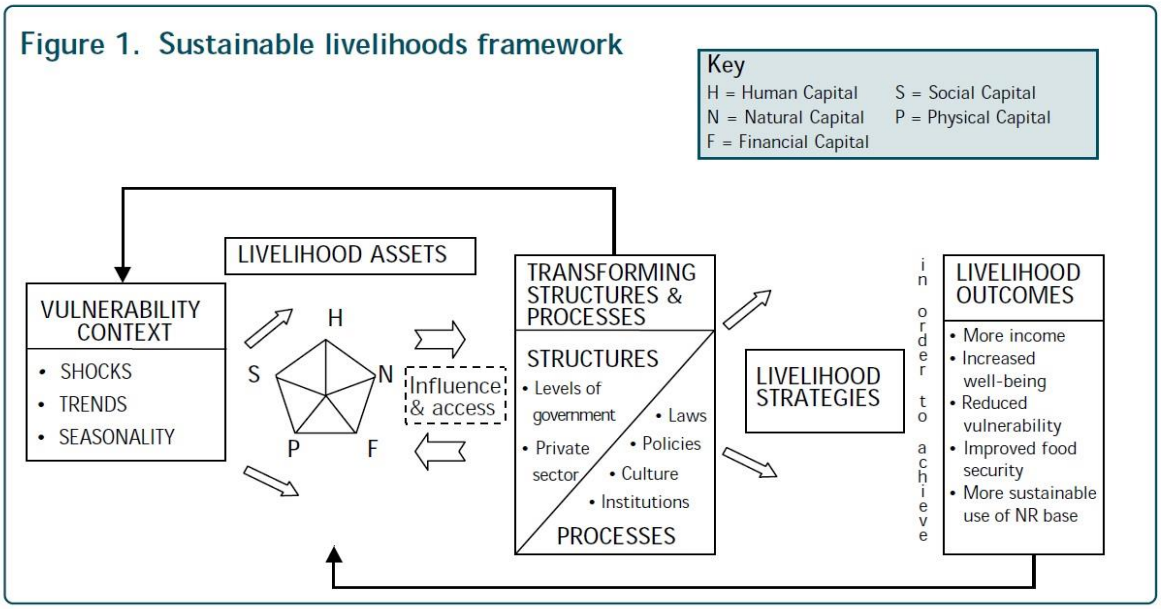


Figure 1: ***DFID's Sustainable Livelihoods Framework*** Source: (Solesbury 2003)

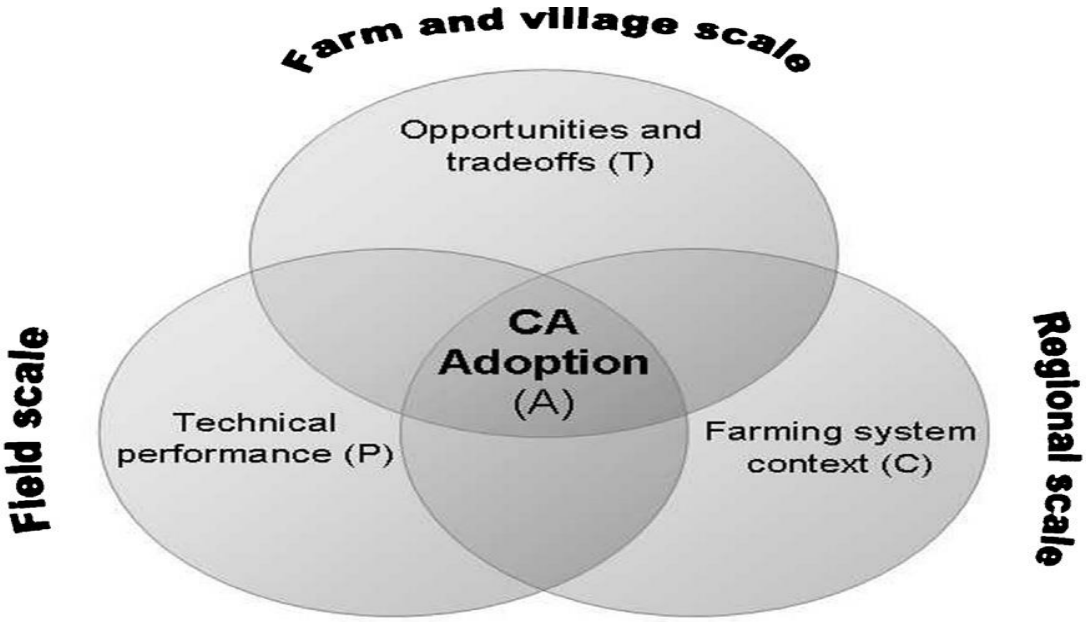
Even though sustainable livelihoods framework and its perspectives on social change has been embraced by development initiatives, it has also received considerable criticism over time. The approach has been criticized by development practitioners on four fronts. As documented by Scoones (2009), sustainable livelihoods framework has not been able to sufficiently engage with processes of economic globalization which has been overrode by capitalism pursuits. Secondly, it does not articulate the balance of power and politics hence often downplays the linkages between poor populations' livelihoods and good governance (bottom-up approach as opposed to top-down approach) in development initiatives. Thirdly, the use of the word 'sustainable' contradicts the need to urgently deal with long-term changes in environmental conditions especially the inevitable development scourge of climate change. Lastly, sustainable livelihoods approach does not explicitly engage in debates about long-term shifts in rural economies and diverse agrarian change constantly experienced in different local contexts around the world (Scoones 2009).

2.1.3 Adoption of Conservation Agriculture (CA)

Adoption is defined as a change in practice or technology used by economic agents or a community (Zilberman et al. 2012). Adoption or uptake of a new technology is often measured as a discrete choice associated with a continuous indicator: the extent of adoption. The extent of adoption i.e. diffusion (a process of imitation), is measured as the share of agents that adopt a technology or allocated share of fixed resources (e.g. land) that utilize a new adopted technology (Zilberman et al. 2012). Adoption, therefore, concerns itself with patterns of technology uptake, the profile of adopters, the timing of adoption and the evolution of the technology once adopted.

According to Corbeel et al. 2013, adoption of Conservation Agriculture (CA), of which KACP's sustainable agricultural land management (SALM) falls within, follows a framework that distinguishes the following scales of analysis: field, farm, village and region. At field scale, focus is on *technical performance*: the biophysical factors that explain short- and long-term yield responses to CA. At farm-scale and village scale, adoptability of an agricultural technology is assessed according to *opportunities and tradeoffs* of a particular agricultural conservation technology. For KACP, farm and field analyses foci were on the economic profitability and maximum utility in the use of SALMs as they determined to a large extent whether or not these practices fit in farmers traditional farming systems. Here, immediate economic benefits were often seen as a major driver behind SALM adoption by smallholder farmers, who often have short-term needs to feed their families (Corbeels et al. 2013). Lastly, at the regional scale, focus is on *farming system context*: the pre-conditions for a widespread adoption of CA. The regional scale analysis informed the research study on the extent to which SALMs had been taken up within space and time.

To gain better insights into the adoption framework, Corbeels et al. 2013 elaborate the major factors and processes that determine whether or not a form of CA like KACP's climate smart agriculture is a viable option for the Western Kenyan smallholder farmers. A better comprehension of why, where, and for whom SALM will work best is a prerequisite for knowing where (and where not) and for whom (and whom not) to promote SALM strategies.



$$Adoption = Performance + Tradeoffs + Context + (P \times T \times C)_{interactions}$$

Adoption (A) is conditioned by its technical performance (P), subject to the opportunities and tradeoffs (T) that operate at farm and village scales and constrained by different aspects of the context (C) in which the farming system operates including market, socio-economic, institutional and policy conditions defining the innovation system and the variability inherent to the physical environment (e.g. climate change).

Figure 2: ***Conceptual representation of the determinants of adoption of conservation agriculture (CA)*** Source: (Corbeels et al. 2013)

The conceptual representation of adoption of CA above shows development and dissemination projects at different scales: field, farm, village and region, which inform the determinants of CA (SALM as one example) adoption and non-adoption by small-scale farmers. However, adoption of CA practices needs to be tailored to local circumstances of the farmers. Contextual factors such as farm input support, subsidies, agricultural policies, and markets often shape the adoptability of new technologies and practices by farmers (Andersson & D'Souza 2013). Farmers in Western Kenya may adopt and implement SALM technologies with their own understanding of the principles, their aspiration and possibilities to integrate them into their farming systems, and their actual access to knowledge, advice and resources from project implementers like VI Agroforestry.

The adoption conceptual framework gives an analysis of adoption or non-adoption of development projects but it does not exhaustively explain them. It must consider the multiple scales at stake (*see Figure 2*) in which technical performance (i.e., crop yields at the field plot level) is but one of the determinants of adoption (Andersson & D'Souza 2013). At each scale, difficulties emerge that impede slowdown or even reverse the adoption process of CA. For example, most often SALM tend to focus heavily on agronomic, field-scale matters, resulting to neglect of issues arising at other scales such as carbon benefits at the regional scale. Priority has often been given to demonstrating SALM technologies rather than to adapting it in a participatory manner to the local context. The lack of an immediate increase in farm income from climate smart agriculture in many cases explain the non-adoption of SALMs (Andersson & D'Souza 2013). In KACP, smallholder farmers have short-term time horizons: future benefits do not adequately outweigh their immediate needs. Another key factor that explains the limited CA adoption in mixed crop-livestock farming systems is the fact that crop harvest residues are preferably used as fodder for livestock, preventing their use as soil cover (Andersson & D'Souza 2013). This example demonstrates clearly the need to target end users i.e. not all farmers are potential end users of KACP's SALM technologies. Farmers' investment capacities vary markedly in the practice of sustainable land management and the compatibility of SALM technologies with their traditional farming production objectives.

2.1.4 Payment for Ecosystem Services Concept

Ecosystem Services (ES) are benefits (goods and services) that people obtain from their environmental surroundings (ecosystems) to satisfy their human needs. These benefits are multiple and are supplied by natural ecosystems as a result of their structure and function to sustain human life on Earth (Chesterman & Hope 2012). ES are functionally considered provisioning (water, food, medicine, building materials, genetic resources and energy), regulating (climate, soil air, water, and wastes), supporting (nutrient cycling and seed dispersal) and cultural (spiritual and recreational). Consequently, Payment for Ecosystem Services (PES) is a policy instrument that creates incentives for public or private entities to conserve or increase the supply of ES and is often viewed as a possible way to alleviate poverty since many of the beneficiaries of key ecosystem services are found in developing countries (Cole et al. 2014). PES as a concept was originally spearheaded as an ecosystem approach by the International Union for

Conservation of Nature (IUCN) and the Millennium Ecosystem Assessment (MEA) and became acknowledged as a component of multi-lateral negotiations under the United Nations Convention on Climate Change (UNFCCC). It is defined as a voluntary, legally-binding contract or agreement under which one or more buyers purchase well-defined ES by providing financial or other incentives to one or more sellers who undertake to carry out a particular land-use to generate the agreed ecosystem service (IUCN as cited by Chesterman & Hope 2012).

In practice, however, PES is characterized by its engagement with previously, limitedly and technically uninvolved communities (beneficiaries of ES) (Chesterman & Hope 2012). It provides incentives for conservation and restoration whilst potentially, simultaneously building the resilience of natural-resource-based livelihoods against changing climates and disasters. As the impact of climate variability and climate change across Africa deepens, there has been a need to address adaptation. This is because majority of African societies' livelihoods depend on rain-fed subsistence agriculture and the complementary use of a wide natural resource base for provisioning, regulating and cultural purposes (Chesterman & Hope 2012). For these purposes to remain fundamentally meaningful, Chesterman and Hope (2012) assert that safety nets and adaptive opportunities like carbon sequestration should be devised as climate change unfolds. Ideally, a PES system is designed so that those who benefit from ES (beneficiaries or users) become the buyers while those who have influence over an ES become sellers (suppliers or providers)(Cole et al. 2014).

Even though PES has in the recent past increasingly shaped the way development practitioners and conservationists think in policy and practice, it has experienced critiques on several fronts. First, there has been a risk in economic arguments about services valued by humans overweighing noneconomic justifications for conservation (Redford & Adams 2009). These writers argued that PES should be one of a set of tools used in pursuit of conservation because multiple conservation imperatives are likely to be more 'resilient and persuasive' than single ones. Further, such multiple conservation imperatives may respond to stakeholder needs from the outset and is more collaborative to take account of the intrinsic values of nature. Second, there is a danger that an economically driven focus on vital ES that are valuable to human in their nature, scope and timing may lead to regulation of these services to 'times and in flows' that match human needs hence detrimental to long-term sustainability of parts of ecosystem (Redford &

Adams 2009). Third, market-oriented valuation of ES is problematic because markets change rapidly, are selective and unpredictable as exemplified by the volatile market for carbon in recent carbon sequestration development pursuits. Moreover, some ES are not amenable to pricing or valuation and where markets do exist, the value of the services from different ecosystems may not reflect their diversity, but their desirability to human consumers (Redford & Adams 2009). Lastly, in cases where PES is privatized, ecosystem payment schemes may have welfare implications. This is because often, ecosystem services become increasingly scarce, valuable and contested hence people compete to gain control over their flows (Redford & Adams 2009).

2.2 Literature Review

2.2.1 The World Bank and Soil Carbon Sequestration

Under Article 3.4 of the Kyoto Protocol, UNFCCC's parties can elect cropland management (CM), grazing land management (GM), forest management (FM) and re-vegetation (RV); all confirmed in the Marrakesh Accords arising from Conference of Parties 7 (COP7), as means to meet their commitments to restoring carbon balances (Farage et al. 2007). With regard to these means to carbon balances restoration, the Kenya Agricultural Carbon Project (KACP) falls directly within the cropland management and indirectly on the rest of the means of addressing GHGs emissions elected by UNFCCCs parties. Farrage (2007) asserts that agriculture is increasingly being used to mitigate climate change hence the technologies employed must at least reduce emissions under the commitment period compared with emission at the 1990 baseline. This is a good choice for development initiatives that may recommendably increase long-term carbon sequestration.

Since the early 2000s, the World Bank (WB) has been trying to establish itself as the carbon broker through the Bio-Carbon Fund, and has actively promoted carbon markets (Sharma & Suppan 2011). KACP received considerable support that may not be replicable in other projects of its nature. The support include more than $1 million USD in pre-financing from the Swedish International Development Cooperation Agency (SIDA). The WB estimated that the KACP would generate $2.48 million USD over the 20-year implementation period when approximately a total of 1.2 million metric tons of carbon di oxide equivalents reductions will be sequestered. Of this, 60% will be discounted to account for reduction impermanence and methodological

estimating uncertainties (Sharma & Suppan 2011). The direct benefit to farmers was estimated to be over $350,000 with a first payment of $80,000 in 2011. However, financial benefits from carbon revenues were expected to be only a small proportion of the benefits of increased crop yields. The WB and SCC-ViA emphasized the primary focus of the project to be increasing agricultural productivity while the carbon revenues serve as an additional incentive and catalyst for adoption and maintenance of improved agricultural practices and technologies.

2.2.2 Carbons Offsets concept and the Kyoto Protocol

The concept of carbon offsets emerged in the Kyoto Protocol's 'flexible mechanisms' that allow industrialized countries to meet their emission-reduction targets by purchasing emission reductions through funding climate change-related projects in developing countries. The Protocol's flexible mechanisms stem from a market logic that carbon offsets create a demand and supply of carbon reductions that can be priced and exchanged within the international climate regimes (Bumpus & Liverman 2008). Most climate change-related adaptation and mitigation initiatives that are meant to sequester carbon are often referred to as Clean Development Mechanisms (CDM). According to Bumpus and Liverman (2008), such CDM initiatives are designed to work with the private sector to promote and enhance the transfer of, and access to, environmentally sound technologies. As a market mechanism that provides an alternative to the more expensive and politically difficult domestic emission reductions, carbon trading is an example of a regulated CDM. (Bumpus & Liverman 2008).

A closely related carbon sequestration strategy alongside the CDM is the Voluntary Carbon Offsets (VSOs). VSO is a system where individuals or organizations can compensate for their GHGs emissions by purchasing carbon credits generated by emission-reduction projects elsewhere (Bumpus & Liverman 2008). These writers argue that countries, companies and individuals decide to reduce carbon emissions due to environmental concerns, competitive advantage, regulations and incentives as cheaper alternatives to expensive or problematic internal reductions. Therefore, KACP as a carbon project falls under this VSO scenario where the World Bank, through its Bio-Carbon Fund acted as the voluntary market. It has been funding farmer groups through ViA to adopt and implement SALM practices which are considered effective carbon sinks. Bumpus and Liverman (2008) observe that the active facilitation of

emission-reduction offset projects by the WB through carbon markets can be seen as part of the bank's support for international flow of natural capital through its 'green developmentalism' program.

2.2.3 Agrarian Change Discourse and Rural Livelihoods Perspectives

In order to establish the emergence of carbon sequestration in agricultural soils, it was paramount to briefly comment on the history of agrarian change in the realm of poverty reduction and development discourses. Scoones (2009) assert that livelihoods studies have 'failed to grapple with' debates about long-term shifts in rural agrarian economies that have undergone numerous transformations in history. He concurs that local level adaptation alleviates poverty, yet he doubts, whether it actually addresses more fundamental transformations in livelihood pathways into the future. He further tackled the emergence of sustainable rural livelihoods approach from a critical lens where he specifically cited the World Bank's 2008 *World Development Report* on agriculture which focused on the importance of livelihoods based on diversified market-oriented and subsistence farming. He traced a strong narrative line which suggests that development or progress is about moving through a series of 'assumed evolutionary stages' with transitions or transformations facilitated by a range of interventions in technology, markets, support institutions and policies (Scoones 2009). Just like 'climate smart agriculture', of which KACP is fundamentally based on, such narrative or framing of development terminologies emanating from influential institutions (coincidentally it is the World Bank in this case too) carries with them major consequences. He argues that the institutional power behind ideas creates particular 'politics of knowledge' in the development field and such dominant framings are in turn reinforced by educational, training and research institutions, and often co-constructed into scientific knowledge, policy and development practice.

2.2.4 Kenya's National Policies relevant to Climate Change Adaptation and Mitigation

A Kenyan national policy that has been at the forefront of the fight against climate change is the forest policy which has undergone transformations since the colonial times (Ongugo et al. 2014). In this policy, reforms in forest governance have aimed at reversing the trend of deforestation and forest degradation. It has gradually promoted sustainable use and management of forest resources through ecosystem management plans, promotion of agroforestry and more

profoundly, establishment of Kenya Forest Service as a national institution mandated to manage forest ecosystem services including their water, biodiversity and climate change values (Ongugo et al. 2014). These writers document that policies and legislation from other sectors, specifically Agriculture, influence trends in forest governance. Notably, Farm Forestry Rules 2009 embedded in the Agriculture Act, aims at achieving and maintaining farm forest cover of at least 10% of every agricultural land holding. This rules regard maintenance of such percentage of forest cover in agricultural holdings as a means of preserving and sustaining the environment and consequently climate change (Ongugo et al. 2014).

Besides the Forest Policy, the Kenya National Climate Change Response Strategy (NCCRS) and National Climate Change Action Plan (NCCAP) are two other related national legislations that were established to specifically address climate change challenges (Ongugo et al. 2014). This NCCRS was established as a framework to harmoniously guide the integration of climate concerns into development priorities, government planning and budgeting. It highlights various climate change measures for adaptation and mitigation in several sectors of the national economy. In agriculture, just like KACPs climate smart practices (SALMs), it proposes the application of a range of innovative agricultural technologies and advocates for diversification of livelihoods. This can be done through sustainable practices such as irrigation, early maturing and high yielding crops varieties as well as drought, pest and diseases-resistant ones for better food security (Ongugo et al. 2014). NCCAP on the other hand was established in 2013 to operationalize the NCCRS. It provides the analysis and enabling mechanisms to make implementation of NCCRS successful in its bid to consolidate all the national efforts and focus on climate change adaptation and mitigation. It most importantly envisions a low-carbon climate resilient development pathway by summarizing mitigation and adaptation options and recommended actions (Ongugo et al. 2014).

Although these policies were enacted to directly combat climate change vagaries, Ongungo et al' (2014) claim that they were not effectively integrated and mainstreamed into other national plans. For instance, NCCRS was deemed weak in addressing both mitigation and adaptation needs in key national sectors impacted most by climate change i.e. forestry, agriculture and energy. However, they report that progressively, strong concerns about possible impacts of climate change triggered strong push for newer policies e.g. climate change unit in the Office of

the Prime Minister in 2008 (Ongugo et al. 2014). This office, which is currently under the Ministry of Devolution and Planning, has reportedly provided political support for climate change interventions and leveraged financial support for the same.

2.2.5 Soil Carbon Sequestration in Western Kenya

The World Bank, through its Bio Carbon Fund uses public/private sector support to demonstrate projects that sequester or conserve carbon in forest and agro-ecosystems (Sharma & Suppan 2011). In KACP, the WB developed a Sustainable Agriculture Land Management (SALM) methodology, in which farmers report on their own adoption and maintenance of sustainable agriculture practices prescribed by a Swedish Non-Governmental Organization (NGO) project implementer the SCC-ViA. SCC-ViA promotes SALM practices within KACP in the form of cropland management (e.g., cover crops, crops rotation, mulching, improved fallows, compost management, green manure, agro-forestry, organic fertilizer, residue management) and soil rehabilitation of degraded land (Sharma & Suppan 2011).

KACP uses Activity Baseline Monitoring System (ABMS) for SALM practices to enable smallholder farmers and Vi-Agroforestry extension services track and improve carbon sequestration as well as farm production. Therefore, based on the development of a carbon accounting methodology, in combination with a carbon model (Roth C), KACP monitors soil and biomass carbon sequestration consistent with the UNFCCCs Verified Carbon Standard (VCS) in a bid to enable poor small-scale farmers in Western Kenya to benefit from international voluntary carbon markets (Tennigkeit et al. 2012). Research shows that when soil is put into cultivation, the associated biological and physical processes result in release of soil organic carbon (SOC) over time. Agricultural science has established that many management practices can increase SOC, including conversion of cropland to woodlots, incorporation of crop residues and agroforestry (Antle et al. 2007). In view of this, it is important to acknowledge the important role small-scale farmers play in African agricultural food production given that incentive mechanisms for carbon sequestration in agricultural soils could simultaneously contribute to goals of alleviating and mitigating GHGs emissions.

In the case of KACP, there are two ways that farmers benefit from entering into contracts with Vi-Agroforestry to sequester carbon (Antle et al. 2007). First, farmers are compensated for the

carbon they sequester, based on the quantity of carbon sequestered and the market price of carbon in the international carbon market. Second, farmers would benefit from any gains in productivity associated with the adoption of carbon-sequestering practices. These writers argue that the magnitude of these latter benefits depends on the soil conditions that exist when carbon contracts become available. They establish that in the case of farmers who are using agricultural production practices that are economically efficient, changing to practices that sequester additional carbon will generally provide lower returns. However, in the case of farmers who are not utilizing efficient agricultural production practices, there may be a gain in productivity from the adoption of practices that sequester carbon.

KACP's approach to carbon sequestration stems from agriculturally induced carbon di oxide release from soils that has contributed to rising levels of GHGs in the atmosphere for generations (Farage et al. 2007). These writers document that carbon is primarily lost from soil through tillage and degradation/erosion. They emphasize that tillage particularly, enhances gaseous exchange between soil and atmosphere and aids the incorporation of plant material into the soil where it is subject to microbial oxidation. However, they assert that agricultural practices can be adapted to reverse these effects and promote soil carbon sequestration; reduction or elimination of tillage and maximizing the return of organic matter can transform farming systems from being carbon emitters to carbon sinks. In addition to carbon sequestration, increasing the quantity of SOC has many other advantages for agriculture and the environment, in particular sustainability and increased crop yields hence food security.

For KACP in general, the real benefits of carbon sequestration however, is projected to progressively be improved soil fertility, resulting crop yields, increased food security, market access for agricultural produce and increased climate resilience to farmers and communities. Vi-agroforestry´s holistic extension approach is centered on the principle of looking at development from a livelihoods perspective. A strong participatory group-extension approach which capacity-builds farmers to own sustainable livelihoods development efforts is a pertinent success factor in KACP which is continuously fostered through farmer field schools, demonstration plots, farmer tours and exposure visits.

2.3 Theoretical Framework

The KACPs overall aim is to progressively reduce poverty levels of small-scale farmers in Western Kenya. This aim consequently set the basis of this study's core objective; to assess the socio-economic impacts of KACP on the livelihoods of small-scale farmers in Bungoma County. Following KACP's specific objectives i.e. i) boosting farmers' yields and enhancing their food security by promoting SALMs, ii) linking them to profitable agricultural markets and iii) generating carbon credits from SALMs implementation, the study built on the four theoretical approaches *(see section 2.1)* in order to sufficiently address its main objectives *(see section 1.5.2).* For *objective 1&2*, SLA framework, good agronomy (GA), and adoption theories were employed. They informed the study on farmers' present agricultural circumstances and contexts, values and norms and adoption patterns within which Western Kenya small-scale poor farmers' livelihoods had been impacted on by KACP. For *objective 3,* the concept of Payment for Ecosystem Services was employed to determine the level of understanding of carbon sequestration in agricultural soils and its subsequent carbon financing and marketing concept by the small-scale farmers in Western Kenya.

2.3.1 Smallholder Farmers' Agronomic Norms and Values

Mapping out the *present livelihoods adaptation strategies of farmers in the KACP area* required the study to illuminate on livelihood strategies, based on the socio-cultural norms and values, within which poor farmers in Western Kenya carry out their adaptation processes. In the practice of smallholder farming production, there is a widely held belief that traditional technologies and institutions are to blame for low productivity and food insecurity like in sub-Saharan Africa region for example (Muzari et al. 2012). Smallholder farmers have been portrayed as 'very rigid, unable and unwilling' in their ways to respond to new ideas or opportunities (Innis, 1997 as cited by Muzari et al.). However, other researches have denounced these claims in support of the relevance of indigenous systems in sustainable agricultural production. They suggest that smallholders using traditional technologies are often more efficient in their use of scarce production resources compared to large-scale farmers who utilize modern agricultural technologies (Muzari et al. 2012).

Limitations to increased agricultural production in smallholder agriculture globally stems from a myriad number of factors. From lack of small-scale irrigation facilities, pests and diseases, post-harvest losses to limited extension and advisory services and inaccessibility to good seeds and fertilizers due to high prices (Muzari et al. 2012). These writers assert that smallholder agricultural production is constrained by poverty, declining soil fertility, higher fertilizer costs, poor crop and fertilizer management and inadequate pest and disease control. Further, they are usually cash poor, if not resource poor in all respects and are often located in ecological niches that are disadvantageously unique in more ways than one (Muzari et al. 2012). Just as it is in the case of KACP as a project in Western Kenya, its location targeted poor small-scale farmers who are situated in areas where rainfall is relatively low and unreliable and soils infertile or their fertility have gradually been decreased in the past decade.

Taking KACP as an institution of governance regarding SALMs implementation and the poor small-scale farmers as receivers of a new technology to foster adaptation, culture plays a pivotal role in integration of these two entities. Culture is seen as a common framework of meaning and values from which action such as SALM implementation arises; a form of human-nature relation cofounded on social construction of meaning. Here, a co-construction of society-nature relation emerges where farmers interact with other farmers and extension workers within environmentally related practices and particular socio-agronomic contexts (Vedeld & Krogh 2003). So, within the social institution of good agronomy in small-scale farmers in Western Kenya vis-à-vis KACP's SALM implementation by ViA, the issue of good governance and dimension of powers emanate *(see section 2.1.1).* Within power relations, there will always be a tension in the society between rulers and the ruled as Vedeld and Krogh (2003) put it. For the case of KACP, the remunerative and normative dimensions of power seem to be the ones guiding the farmers' compliance to SALMs practices. On one hand, remunerative power triggers cognitive response where the acceptance SALM practices implementation by farmers is deemed beneficial and will pay off if one adopts them (Vedeld & Krogh 2003). On the other hand, the normative power dimension triggers normative or strategic responses where farmers adopt SALM practices from consensus or negotiated agreements based on shared values and norms. This may reflect a predisposition means to reach desired livelihood goals relative to other groups in the society (Vedeld & Krogh 2003).

2.3.2 Differential Adoption of New Agricultural Technologies

In the determination of the *consequences of SALMs adoption on the livelihoods of groups of farmers in the KACP area*, the study had to comprehend the relationship between smallholder farmer's livelihood strategies and their perception on new agricultural technologies. As such, the research sought to understand farmers' success and failures in adopting certain SALMs and consequently adapt or mal-adapt to a changing climate. According to Muzari et al. (2012), the factors affecting technology adoption are assets, income, institutions, vulnerability, awareness, labour and innovativeness by smallholder farmers. They claim that technologies that require few assets have a lower risk and are less expensive hence have a higher chance of being adopted by smallholder farmers.

According to Pannell et al' (2006), adoption of agricultural technologies depends on a range of social, cultural and economic factors, as well as on the characteristics of the innovation itself. Adoption occurs when a farmer perceives that the new technology will enhance the achievement of their personal economic, social and environmental goals (Pannell et al. 2006). In the case of KACP, SALMs are more likely to be adopted when they have a high relative advantage (particularly in economic terms) and it is readily trialable (easy to test and learn about before adoption). Consequently, non-adoption of SALM practices occurs when there is failure in the provision of a relative advantage or they are difficult for farmers to implement. Relative advantage refers to the degree to which a technology is perceived as being better than the idea or practice it supersedes (Pannell et al. 2006). It depends on a farmer's unique set of goals and the biophysical, economic and social context where the technology is to be employed. It is also deemed, as Pannell et al' (2006) assert, as the decisive factor which determines the ultimate level of adoption of most technologies. Trialability refers to the characteristics of the technology itself that determine how easily or not a farmer can learn about its performance and running (Pannell et al. 2006). In the course of trialing a technology such as SALM, information is gained on the uncertainty about the relative advantage of employing it.

2.3.3 Payment for Ecosystem Services and Carbon Sequestration in Agricultural Soils

In the *evaluation of the understanding of carbon financing and marketing concept by the groups of farmers in KACP area*, the study explored the concept of Payment for Ecosystem Services (PES). Redford et al' (2009) argue that PES is 'a way of framing conservation imperatives' to convince humans of the value of the natural world. Ecosystems services (ES) are essential to human survival and well-being e.g. forests supply climate regulation, erosion control and aesthetic beauty; wetlands offer protection from storms and floods and grasslands supply habitat and genetic resources (Kemkes et al. 2010). They are functionally considered provisioning, regulating, supporting, cultural, spiritual and recreational (*see section 2.1.4*) According to Chesterman and Hope (2014), PES creates an innovative option to reward communities (either through payments, compensation or exchange between a willing buyer and a willing seller) for ecosystems services or land-use that sustains such service.

The theoretical underpinnings of PES emanate from the neoclassical environmental economic externality framework, in which market failures are considered the root cause of environmental degradation (Van Hecken & Bastiaensen 2010). As such, most economic outputs are in the form of market goods and most ecosystem services are non-market goods, hence, the market system systematically favors conversion over conservation (Kemkes et al. 2010). However, this market system of conversion rather that conservation encourages rapid degradation of natural capitals such as forests, land and wetlands. It is in line with this that the study took KACP as one way of limiting conversion and embracing conservation of agricultural soils as a natural capital resource to foster adaptation to climate change. This way, KACP may be seen as a PES scheme that compensates land users for environmental services a given land use(s) e.g. SALMs provide (Pagiola et al. 2004).

Based on KACP, PES concept as a conservation approach targeted poor smallholder farmers in Western Kenya so as to motivate them to protect their farmlands against degradation from a changing climate. This was done through the introduction of SALMs as a way of sequestering carbon, improving their agricultural output, attaining food security and diversifying their incomes through agribusiness and carbon credits sale. Carbon credits sale in this case were in the form of an opportunity cost cover (incentives) for adoption of more environmentally sound land-use; the exchange of SALMs implementation services by the farmers with direct payments.

Paying land users who adopt recommended practices like SALMs for the biodiversity and carbon sequestration services they generate can tip the balance towards adoption (Pagiola et al. 2004). Generally, PES could provide an income buffer and a source of income diversification and thus aid poor and vulnerable communities in increasing their resilience to environmental shocks socially and economically in a changing climate. So, poverty alleviation is usually not the main objective of PES schemes like KACP but it is increasingly recognized as an important positive side-effect of the environmental market paradigm (Van Hecken & Bastiaensen 2010).

3.0 Methodology, Models and Methods

3.1 Description of study area

KACP is being implemented within Kisumu and Bungoma areas Counties in Western Kenya (Shames et al. 2012). The project is found in Bungoma County (*see Figure 3*) covering Bumula, Malakisi and Sirisia divisions near Kitale and Bungoma townships and also in Kisumu County (*see Figure 3*) covering Wagai, Kombewa and Madiany areas near Lake Victoria. Due to financial and time constraints, the scope of the study was narrowed to Bungoma County. According to Shames et al. (2012) the total project area is 116, 000 hectares and covers mainly agricultural land (86,000 ha), dense vegetation/forest (20, 000 ha), houses and compounds (7,500 ha), rivers (2000 ha) and infrastructure roads (1,300 ha). KACP plans to implement climate-smart SALM technologies on approximately 45,000 ha, 22,500 ha in each of these two regional KACP project areas (Kisumu and Bungoma counties).

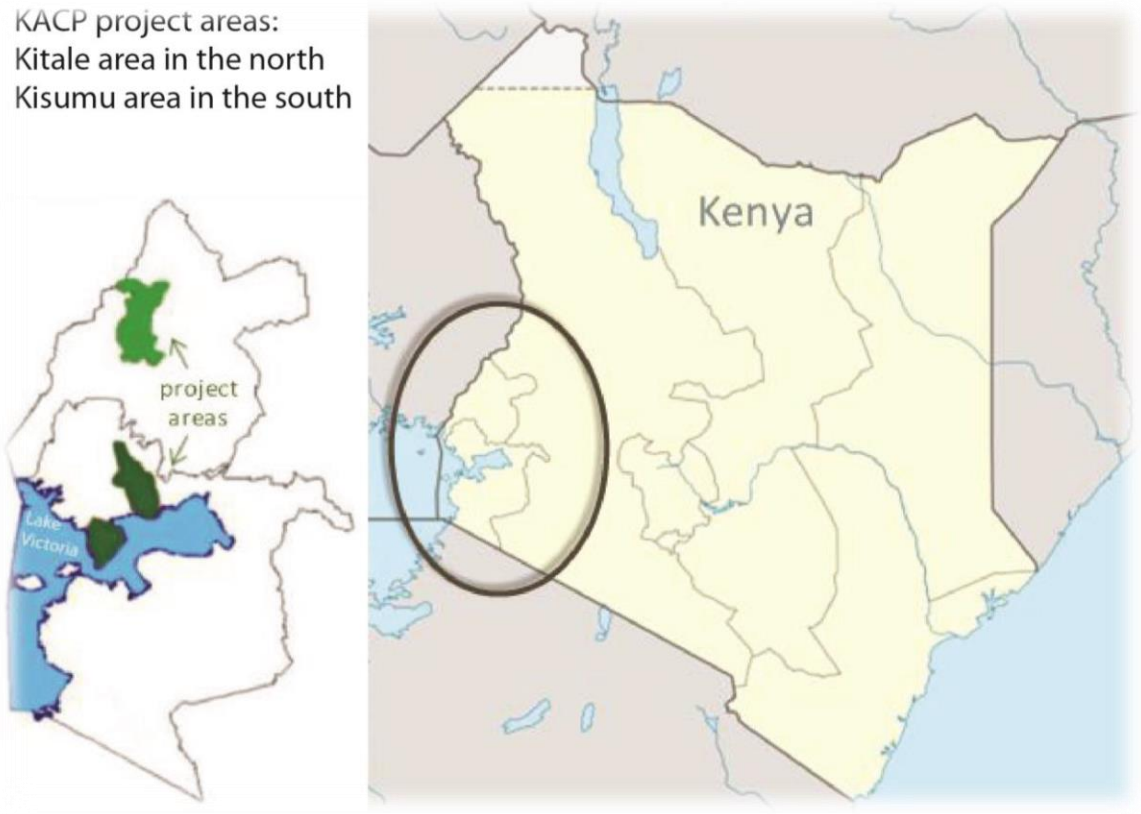


Figure 3: ***Map of the Project Area*** Source: (Nord 2014)

Based on the 2009 Kenya Population and Housing Census Report, Bungoma County covers an area of 3,593 km^2 with a population of 1, 630, 934 people (CRA 2011). Bungoma County has an equatorial-tropical climate dependent upon Lake Victoria basin, the Kakamega tropical forest and the Mt Elgon mountain forest. The County is found within agro-ecological zone III (medium potential) of the Kenyan agricultural land potential and sits at an altitude of between 900m to 1800 m above sea level with a mean annual rainfall ranging between 950mm and 1500mm (NCPD 2013).

3.2 Conceptual and Analytical Frameworks

The study employed good agronomy (GA), sustainable livelihoods (SLA) and adoption theory conceptual frameworks to analyze *objective 1&2*. However, emphasis was on the SLA framework which mapped out the socio-economic impacts of KACP by investigating household economic structures based on different capabilities, capitals or assets (natural, physical, human, financial and social capitals). These are the basic building blocks upon which households are able to undertake production, engage in labour markets and participate in reciprocal exchanges with other households. Good agronomy and conservation agriculture adoption frameworks assisted the study to determine farmers' present agricultural values and norms, the cultural contexts within which the livelihoods of poor small-scale farmers in Western Kenya had been impacted on by KACP and further, the extent of SALMs adoption. For *objective 3*, the concept of Payment for Ecosystem Services was employed to assess the level of understanding and knowledge of agricultural carbon sequestration, financing and marketing concept by the small-scale farmers in Western Kenya. The table below summarizes the study's objectives and their subsequent conceptual and analytical models.

Table 1: ***Study objectives and conceptual/analytical frameworks, Bungoma, Kenya, 2014***

Objective	Conceptual and Analytical Framework
Objective 1: To assess the present agronomic adaptation of farmers in the KACP area	Sustainable Livelihoods Framework and Good Agronomy Framework
Objective 2: To investigate the consequences of SALMs adoption on the livelihoods of farmers in the KACP area	Sustainable Livelihoods Framework, Conservation Agriculture and Adoption Frameworks
Objective 3: To evaluate the understanding of carbon financing and marketing concept by farmers	Payment for Ecosystem Services Concept

3.3 Data Analysis

Code checking and data cleaning are quality control procedures that are an important part of survey research process (Gray et al. 2007). The researcher cross-checked the household questionnaires for inconsistences, verified and coded them before feeding them into two statistical softwares i.e. SPSS and JMP statistical analysis applications. Since the study methodology employed both quantitative and qualitative instruments in data collection, so did the analyses. The quantitative data analysis involved the assessment of the study's objective one and two by quantitatively analyzing the study variables. Further, correlation and regression analyses were run using SPSS and JMP softwares to test level of significances and ascertain models validity and the strength of relationships between variables. Emphasis was especially put on the dependent variable which was income and several independent socio-economic variables such as education levels, household labour inputs, social group membership, and SALMs adoptions among others. The qualitative data analyses was carried out through an in-depth evaluation of the FGD's discussions and contentious issues that arose within them, in line with primarily the study objective three among the first two. The evaluation was then extrapolated with inferences from the key informants' interviews.

3.3.1 Assets, activities and outcomes by locations and wealth groups

The study gives an overview of the socio-economic features of the sample population based on farmers' average ownership of assets and presented quantitatively on frequency tables. The ownership of these assets will be assessed by qualitatively discussing their relative percentages between the three project areas (Bumula, Malakisi and Sirisia) as well as across the farmers' social groups by wealth levels. Wealth groups were determined by dividing farmers' income levels into three earning categories i.e. low-income, middle income and high-income wealth groups (*see Section 4.1.1.4*). Farmers' agricultural activities are descriptively defined and qualitatively discussed based on reported responses from the household survey data and FGD discussions to map out the farmers' livelihood strategies and diversification. These activities are also compared and contrasted between the project locations and across social groups by wealth levels. As for outcomes, farmers' income levels from different sources as well as adoptions rates of SALMs are quantitatively analyzed, presented on tables and their variations qualitatively discussed between project locations and across wealth groups.

3.3.2 Income and SALMs adoption rates measurement

Income measurement is based on mean annual income sources for the farmers' households. The income sources that are quantitatively analyzed are the reported household income levels from on-farm, off-farm, non-farm, remittances and carbon revenue sources. These income sources are presented in tables and analyzed by comparing relative percentages between locations and across wealth groups. Their variation by the relative percentages is discussed in light of mean total averages to establish relative differences and importance of each of the income sources regionally and socially.

Adoption rate is measured as the share of agents that take up different SALM practices and at what rate they utilize them in practice on their land. Farmers' adoption rate of SALMs is calculated as the overall means of reported take-up of the six SALM practices by the study respondents. These adoption rates are then correlated to assets to map out mean levels variations between locations and across wealth groups. Linear regressions are subsequently run between these SALMs adoption levels against assets, locations and wealth groups to test the statistical level of significant differences.

3.4 Study Design

Design is a fundamental and an integral part of actually doing research and in most social research it is likely to evolve as the subsequent phases of a development initiative unfolds and perspectives of the researcher shift (Scheyvens & Storey 2003). This means that any research design requires flexibility and reflexivity hence this study employed both quantitative and qualitative approaches; to make for 'richer' and 'thicker' descriptions of collected data and their subsequent analyses, as Scheyvens and Storey (2003) put it. The integration of quantitative and qualitative research approaches within a single project is often referred to as mixed methods research. Data derived from mixed methods are offsetting and mutually illuminating (Bryman 2008) i.e. it reaps the benefits of both and minimize the deficiencies in each (Gray et al. 2007).

A number of significant advantages of mixed methods research as noted by Bryman (2008) are: triangulation, completeness, integrity/credibility, enhancement and complementarity/offset. Triangulation (often referred to as greater validity), is the key advantage of mixed methods because findings from both approaches when triangulated results in mutual corroboration

(Bryman 2008). Nonetheless, mixed methods research has been unclearly criticized from two fronts namely epistemological commitments and paradigm approaches. First, Bryman (2008) claims that quantitative and qualitative approaches are grounded in incompatible epistemological (social construction of realities) principles. Secondly, he views quantitative and qualitative approaches as paradigms and bases his argument in the epistemological and ontological foundations of both as 'inextricably intertwined' and 'incompatible' (Bryman 2008). Of course, his arguments are subject to debate as it appears they stem from a personal bias in understanding and perception because the significant advantages of mixed methods in practice supersede them.

Mixed methods research encompasses the use of carefully selected methods from both quantitative and qualitative research approaches in order to enhance validity and reliability of data collection. In this study, the quantitative approach used was a household survey questionnaire which was used to collect data on the economic impacts of KACP on farmers' livelihoods before and after SALMs adoptions. This method addressed *Objective 2* (*see section 1.5.2*) of the study by capturing several quantifiable aspects (more importantly income sources and levels) of farmers' livelihoods before and after KACP inception. The qualitative research approaches employed were Focus Group Discussions (FGDs) and key informant interviews which sought to address *Objective 1&3* (*see section 1.5.2*). FGDs convened key community leaders and KACP farmer groups' representatives whose discussions informed the research more on farmers past and present agronomic adaptations and diversification pillars. On the other hand, key informant interviews with KACPs implementing Agency's (ViA) staff tapped KACP'S vital operationalization and management issues especially on *Objective 3* (*see section 1.5.2*).

3.4.1 Sampling procedures and sample frequencies

It is the selection of a relatively small group of individuals from who we obtain data in order to be able to generalize about a larger group (Gray et al. 2007). For the household survey, it was very important for the study to ensure that the chosen respondents from KACP farmer groups gave a relatively accurate picture of the whole Western Kenya project area (the three divisions). This way, the study sought to be considerably representative, replicable and unbiased by gathering information from a substantial number of farmer groups in order to make judgments about the larger Western project area. Therefore, the quantitative part of the research employed

stratified random sampling; a probability sampling (every element of the population has a known, non-zero chance of being selected for the sample) approach relevant to capture subgroups within the population (Scheyvens & Storey 2003). It encompassed choosing farmer groups from the three sub-counties in Bungoma County to serve as representative strata for the total population of farmers involved in KACP. This was done with the help of KACPs Monitoring and Evaluation Officer who did a random selection of farmer groups from the project's total register of 918 farmer groups (approx. 500 from Bumula and 200 each from Malakisi and Sirisia KACP focal areas) using an Excel document application.

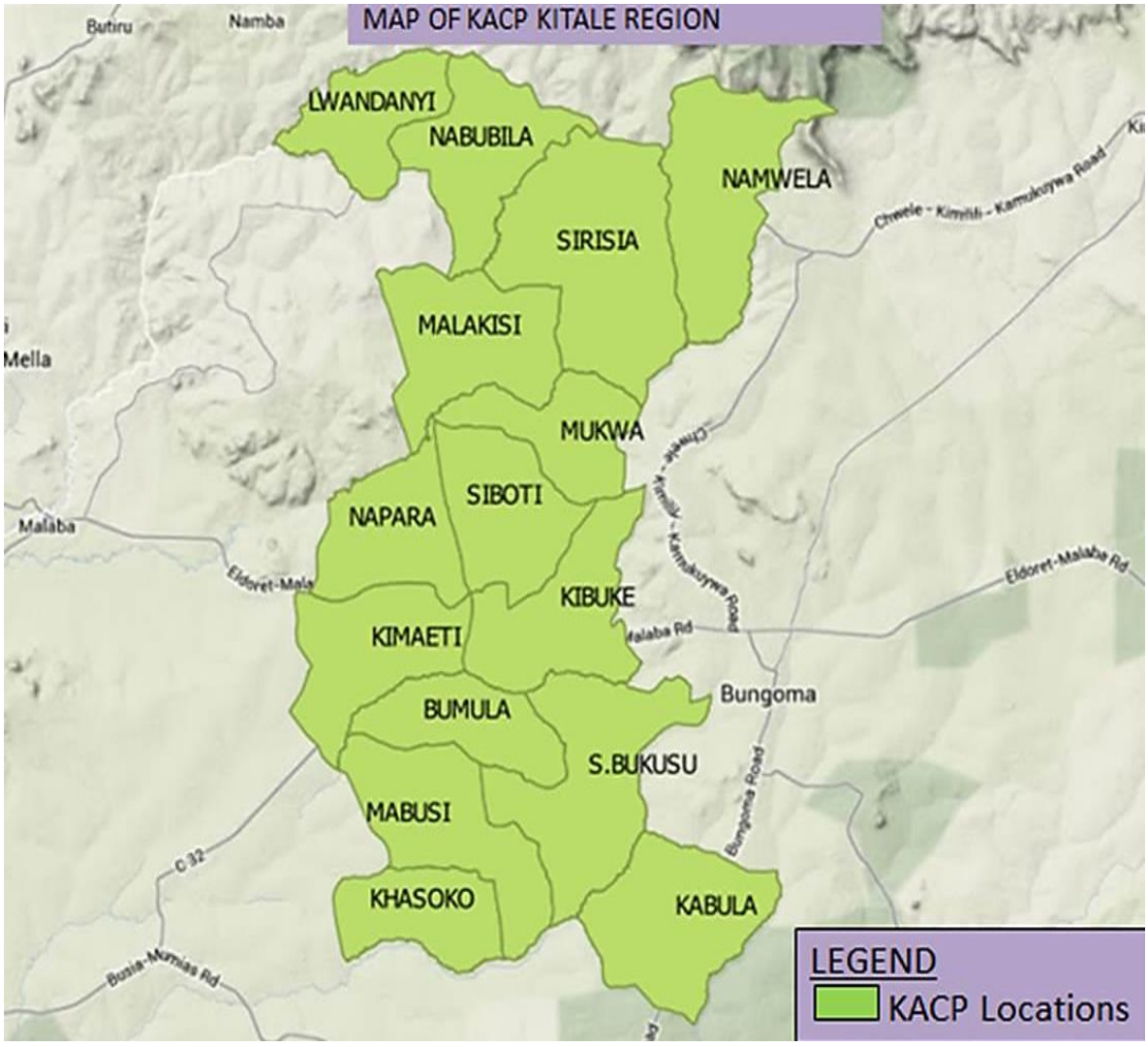


Figure 4: ***Locations/villages in the KACP project Area*** Source: (Nord 2014)

The randomized function application in Excel resulted in a sample of 16 farmer groups comprising of 6 women groups and 10 self-help-groups from 11 locations among all the 15 locations (*see Figure 4 above*) that KACP project covers in Bungoma County. Of the 16 randomly selected farmer groups, 8 were from Bumula division and 4 each from Malakisi and Sirisia divisions. From each of these groups, a non-probability snowball sampling selection of 5 household heads was applied to whom a household survey questionnaire was administered to. This was done with the help of a community facilitator who identified one active village member of a farmer group to be administered with a questionnaire then he/she referred the researcher to other active members as well as non-members. This exercise resulted in 80 household heads being administered with the survey questionnaire.

The qualitative part of the study used purposive sampling; a non-probability sampling approach where the researcher makes a judgment on whom to include in the sample based on a prior knowledge of the typical characteristic of the target population (Scheyvens & Storey 2003). According to (Gray et al. 2007), this sampling approach purposely selects certain groups or individuals for their relevance to the issue being studied. As such, 3 Focus Group Discussions (FGDs) were purposely organized according to their proactivity in KACP thereby targeting the most active in each of the three sub-counties. These were done with the help of KACP's Zonal Officers (ZOs) and Community Facilitators (CFs) who convened the FGD participants using their communication networks. Therefore, three FGD's were successfully conducted in N'goli, Tulienge and Maeni villages situated in KACP focal areas namely Bumula, Malakisi and Sirisia respectively. Three key informants (KACP officers) from ViA's Bungoma office were purposely and conveniently selected for interviews.

Overview of sample frequencies by Sub-counties, Gender and Membership in KACP

Approximately 51% (*see table 2*) of the household survey sampled respondents were from Bumula division which is geographically the nearest focal area to the KACP Bungoma Office and comprises of 10 locations in total (*see figure 4*). The study covered 6 locations of these 10 locations from Bumula focal area. 25% and approximately 24% of the respondents were from Malakisi and Sirisia divisions respectively as the two other KACP focal areas in addition to Bumula. The sampling procedure yielded a bigger proportion of the respondents from Bumula division owing to the greater number of locations it is comprised of. As such, Bumula division comprised of a greater number of sample farmer groups while Malakisi and Sirisia comprised of the rest of the sample hence lesser proportion of farmer groups. This scenario was fairly convenient for the study's ease of access to respondents considering the vastness of the project area. 25% (*see table 2*) of the respondents were male and the rest were women owing to their presence and availability during the day in the homesteads as they are culturally regarded as domestic home-keepers.

Table 2: ***Sub-counties/Divisions, Gender and KACP Membership, Bungoma, Kenya, 2014***

		Frequency	Valid Percent	Cumulative Percent
Sub-county of Household				
Valid	Bumula	41	51.3	51.3
	Malakisi	20	25.0	76.3
	Sirisia	19	23.8	100.0
Gender of HH				
Valid	Male	20	25.0	25.0
	Female	60	75.0	100.0
Membership in KACP				
Valid	Yes	57	71.3	71.3
	No	23	28.8	100.0
	Total	**80**	**100.0**	

Therefore, majority of the study respondents (75%) were women because the household survey was carried out based on daytime availability of respondents at homesteads within the study sample locations. It was reported from the FGDs conducted that men are the household heads with most capital and asset-related household decisions vested on them although women are to a large extent invisibly part and parcel of consenting and implementing such decisions.

3.4.2 Household Survey

Surveys are arguably the most common form of quantitative research technique in social sciences. They are systematic attempts to collect information, mostly from individuals, to describe and explain the beliefs, attitudes, values and behaviour of selected groups of people (Gray et al. 2007). Their common use in social researches is attributed to their ability to produce a representative distribution or cross-section of the target population. As such, they are often coupled with probability sampling techniques of which this study employed to sample the KACP household-heads who were administered with the survey questionnaires. As (Gray et al. 2007) argue, the value of a survey depends, among others, on the representativeness of the group surveyed because the sampling plan and its execution is almost as crucial to final success as is the planning and execution of the overall survey.

Surveys are however fairly rigid and structured when they are being administered. As a result, the study had to be creative in the administration of the household survey questionnaires owing to the literacy levels of the respondents. Most KACP farmers had only attained primary level education and this prompted a change in the procedure of administration as well as design of the household questionnaire. The administration of the survey questionnaires shifted from standardized self-administration to an interview survey where the researcher had to ask questions himself and fill in the questionnaires. The rigidity of a standardized survey questionnaire was in this study altered and neutralized by redesigning some of the structured questions in the questionnaire into semi-structured questions. Semi-structured questions permitted the respondents to answer them as they fit, and encouraged freer and lengthier discussions between the researcher and the respondents. Further, a pilot exercise or a pre-test; a tentative examination of a handful of subjects who are similar to those who will be the target of the survey later, is often recommended (Gray et al. 2007). It involves drawing a very small sample of subjects conducting interviews or administering a questionnaire and noting all the problems that arise for the interviewers and for the subjects. It is intended to allow the researcher to try out various possibilities before deciding which ones to adopt and often stimulate new lines of inquiry prompted by the reactions or unsolicited responses of the subjects (Gray et al. 2007).

Accordingly, the study carried out a pilot exercise on 5 respondents from within Bungoma Township and who had affiliations with KACP to test the household questionnaire prior to the

commencement of the actual fieldwork in mid-October. The exercise allowed the study to resolve ambiguities in the way questions were designed and asked; indicated changes needed for sufficient coverage of the research topics and eliminated fruitless lines of inquiry. A good example of a question that was redesigned (*see Appendix 1, Part Three [d]* which previously read: *"In your own opinion, are monetary incentives a good motivation to adopt SALMs?"* After the pre-testing exercise, a household survey was conducted in 80 households within the three KACP focal areas/divisions in Bungoma County i.e. Bumula (41 respondents), Malakisi (20 respondents) and Sirisia (19 respondents). This was carried out over a period of one month; from mid-October to mid-November 2014. The survey covered 11 locations or villages across Bungoma County (*see figure 4*) as per the random sample selected for the study. A maximum of 6, an average of 5 and a minimum of 3 household questionnaires per day were administered for 16 days within the one-month research period.

3.4.3 Focus Group Discussions

A focus group is a small (six to ten persons) collection of individuals brought together for an hour or two discussion of some issue, idea, product or program (Gray et al. 2007). In social researches, Focus Group Discussions (FGDs) comprise of participants who are purposely sampled for their special positions, expertise, experience or interest. In this study, three Focus Group Discussions (FGDs) were conducted in each of the three focal areas/administrative divisions that KACP operate in Bungoma County i.e. in Bumula, Malakisi and Sirisia divisions. With the help of Field Officers from ViA Bungoma Office and Community Facilitators on the ground (community/village levels), three Community Based Organizations (CBOs) were purposely selected from the three focal areas for the study's FGDs. FGDs are good social research tools because the nature of discussions or conversations within it can be a source of highly informed data not otherwise available in evaluation research (Gray et al. 2007). FGD's discussions are usually conducted by a convener who is most often the lead researcher in the field, who qualifies as a moderator as well as a note-taker in cases of a single researcher like in this study. A sound or video-recorder is also often used as a back-up information gatherer for later analysis of issues that note-taking did not capture. In the study, the researcher took up both of these roles of moderating and notetaking whilst keeping vigil of his audio recorder that captured more information that could not be immediately noted down.

A moderator is also expected to be as unobtrusive as possible albeit while maintaining an overall sense of control over the topics for discussion and pacing of the conversation (Gray et al. 2007). Moreover, the passive role for the moderator is preferred because of the desire to elicit interaction among the FGD participants. In the study, the researcher used an FGD research questions guideline to systematically moderate and conveniently steer the discussions in the right direction by probing only when necessary, listening more and encouraging interactions by clarifying and simplifying unclear issues that arose. The first FGD comprised of 10 participants, (8 men and 2 women) and was conducted on the 10th of November 2014 with Ng'oli CBO of Ng'oli village in Kibuke location (*see figure 4*), Bumula division. The second FGD comprised of 11 participants (6 men and 5 women) and was carried out on the 14th of November 2014 with Namubila-Tomato CBO of Tulienge village in Namubila location (*see figure 5*), Malakisi division. Lastly, the third FGD comprised of 11 participants (5 men and 6 women) and was done on the 15th of November 2014 with Change Agents CBO of Maeni village in Lwandanyi Location (*see figure 4*), Sirisia division. The FGDs took approximately 30-45 minutes each.

FGDs are important in social research as they are less time consuming and typically place less emphasis on the interviewer's views and more on the respondents (Gray et al. 2007). Further, the give-and-take among participants fosters reflections on other people's ideas, thereby eliciting more information outflow for the benefit of the researcher. The study's use of a sound and video recorder also enhanced the richness of information. It enabled the researcher to replay the recordings later thereby capturing nuances within the FGD conversations which escaped note-taking. Nonetheless, FGDs experience drawbacks as purposive sampling risks bias because selected participants are often not broadly representative of the research population. Validity of FGDs is therefore heavily dependent on the authenticity of participants' prior experience and their willingness to be frank (Gray et al. 2007).

3.4.4 Key Informant Semi-structured Interviews

Key informant semi-structured interviews are flexible qualitative in-depth dialogues between the researcher (interviewer) and key research respondents (interviewees). The researcher usually identifies key research respondents in the field then prepares a list of questions on fairly specific topics to be covered known as an interview guide (Bryman 2008). He then uses this list as a tentative guide to steer him through the interview process while the interviewee responds as

freely as possible. The key informant interviewees were three ViA's staff purposely selected as KACP's implementing persons on the ground. It included KACP's two zonal officers and the project's monitoring and evaluation coordinator. One zonal officer was in charge of Bumula division as one major focal area of KACP and the other was in charge of Malakisi and Sirisia divisions as the other focal areas in Bungoma County. The monitoring and evaluation coordinator was stationed mainly at ViAs head office in Kitale town. He was the lead-focal person for the whole project covering Bungoma and Kisumu areas. The zonal officers were important interview candidates because they had firsthand experience on KACP implementation. They were also an important bridge between KACP field officers at the project's grassroots level and the monitoring and evaluation staff at ViA's head office in Kitale. The monitoring and evaluation coordinator was the vital key informant as his position enabled him to be significantly informative about the project operationalization both in its theoretical and application fronts.

The key interviews in the study were carried out at ViA's Bungoma Office after successful completion of the household survey. The researcher qualified as the interviewer and moderator while the key informants were of course the interviewees. He firstly observed the ethical research principles by obtaining their informed consent and then assuring the interviewees of their anonymity and confidentiality in data storage and handling. Using the interview guide, the researcher did not follow the questions sequentially but asked follow-up questions as a way of probing and steering the conversations. He used an audio device to audio-record the interviews for later transcription but of course with the prior consent from the respondent. Each of the interviews took 25-35 minutes each. The unstructured nature of semi-structured interviews rendered it a very flexible technique for the researcher. It provided deeper insights into how farmers in Bungoma County perceived KACP's impacts on their livelihoods both economically and socially. Further, the use of an audio recorder averted note-taking and enabled the study to capture the complete account of the interviews for later scrutiny through transcriptions (Bryman 2008).

In as far as key informant interviews are concerned there exists a risk of biases in the selection of the key interview candidates. The choice of two zonal officers and one monitoring and evaluation coordinator may not have been as representative as may be deemed appropriate. This however was attributed to challenges faced in the field (*see section 3.5*). Another notable

drawback of key informant interviews emanate from the time-consuming task of interview transcriptions which risked misinterpretation by the researcher's own perceptions and expectations (Bryman 2008)

3.4.5 Representativeness

The KACP generally targets to have recruited 3000 farmer groups at its completion. They aim at recruiting 1500 farmers each from Kisumu and Bungoma areas. With regards to Bungoma county, it is reported that a total of approximately 918 farmer groups have been registered so far under KACP comprising of approximately 15,935 individual farmers *_pers. comm*. (KACP Monitoring and Evaluation Officer). From the total number of farmer groups, approximately 500 groups are from Bumula sub-county and approximately 200 groups come from Sirisia and Malakisi sub-counties. The quantitative part of the research encompassed choosing farmer groups from the three sub-counties to serve as representative samples for the total population of the KACP farmers in Bungoma County. A random selection of farmer groups was done from the project's total register of 918 farmer groups to produce 16 farmer groups comprising of 6 women groups and 10 self-help-groups from 11 locations of the study area Of the 16 randomly selected farmer groups, 8 were from Bumula division and 4 each from Malakisi and Sirisia divisions. From each of these groups, a non-probability snowball sampling selection of 5 household heads was applied to whom a household survey questionnaire was administered to. This exercise resulted in 80 household heads being administered with the survey questionnaire i.e. Bumula (41 respondents), Malakisi (20 respondents) and Sirisia (19 respondents). Technically, a representative sample comprises of 5% of the total sample. In this study, this would have meant that the researcher required 750 respondents. This was of course not possible due to time, resources and cost constraints. However, the random selection of the 80 households for the research survey may have been optimal and sufficient to have enabled the study obtain statistical results that are significant although not entirely representative.

3.4.6 Data collection and analyses trustworthiness

The study employed both quantitative and qualitative research (mixed methods) approaches for data collection and analyses in a bid to complement the validity and reliability of the study's results through triangulation and corroboration of reported information and figures. A household

survey questionnaire was used to collect data on the economic impacts of KACP on farmers' livelihoods after SALMs adoptions. This method addressed *Objective 1&2* (*see Section 1.5.2*) of the study by capturing income diversity (sources and levels) and SALM adoption levels, after KACP inception. During data analyses and discussions, descriptive statistics and regression models were run using SPSS and JMP softwares then presented in tables and levels of statistical significances. In the measurement of assets, income and adoption levels using the regression models, the study's assessment may have been consistent and as such reliable, but may have underestimated the true figures of income and adoption levels. This is because assets and income analyses did not include physical capital, livestock units and environmental income. Also, the estimation of average SALM adoption levels employed a proxy measure (*see Section 3.3.2*).

Therefore, the study results may bear reliability and validity problems due to the above mentioned flaws but the use of FGDs and key informant interviews may have leveraged the analysis of the findings through triangulation and corroboration of reported information and figures. The qualitative part employed three (3) key informants' interviews and three (3) Focus Group Discussions (FGDs) from each sub-county, to address *Objective 1&3* (*see section 1.5.2*). FGDs convened key community leaders and KACP farmer groups' representatives to inform the research more on farmers' experiences and perspectives on the KACP. Key informant interviews collected vital information from KACPs staff on their experiences as extensionists and on institutionalization of KACP. The information from the FGDs and key informant interviews were carefully transcribed and keenly analyzed (*see Section 3.4.3& 3.4.4*).

3.5 Ethics in the Research Field

Ethical issues arise in relations between researchers and research respondents in the research field. Ethical considerations therefore are prudent. They concern certain acts and omissions that researchers must uphold as guiding principles to ethically sound research (Bryman 2008). Researchers must strive to abide by social research ethical principles which are divided into four main areas i.e. whether there is harm to respondents, lack of informed consent, and invasion of privacy or involvement of a deception. Further, ethical research should not only "do no harm", but also have a potential "to do good" by recommendably seeking "empowerment" (Scheyvens & Storey 2003). The principle of ethical considerations implies that prospective research respondents should be given as much information to make informed decisions whether or not

they wish to participate in a research process (Bryman 2008). In view of this, the study designed the survey questionnaire with an introductory section (*see Appendix* 1) that had an informed consent clause which affirmed its voluntarity, anonymity and confidentiality in data use afterwards.

Doing research gives rise to a plethora of ethical dilemmas which relate to power gradients between the researcher and the researched (Scheyvens & Storey 2003). During the collection of data quantitatively using survey questionnaire interviews, the researcher noticed that most respondents were unsure of or contradictory in their answers. This may have been attributed to the perceived imbalance of knowledge-power relations between the researcher and the formally less-educated farmers. This misperception led to a subdued opinion-airing by the farmers whose honest views or answers might have been unclear or outright 'guesswork' especially on the estimation of various forms of income. This dilemma was abridged during the actual carrying out of the household survey, the FGDs and the key informant interviews. The researcher made sure that prior to every data collection exercise; he politely introduced himself and the aim of the research. He then affirmed it to the respondent (s) that their participation was voluntary and their personal identities would be entirely anonymous. More importantly, he assured the respondents that the eventual use of the information gathered was very confidential in that it was to be used conscientiously without resultant harm to them. During the FGDs and key informant interviews, video and audio recording devices were used only after a clear and an informed consent agreement with the research respondents.

3.6 Research Constraints and Challenges

Language barrier was a major obstacle owing to the different ethnic subdivisions of communities present in the field. This limitation was two-way in nature. First, the researcher's ability to sufficiently interpret and convey meaning of the research questions on the survey questionnaire was stifled. This is because climate change, adaptation and mitigation as technical scientific terms could not be aptly simplified into the local language (Swahili). Secondly, the respondents being on the receiving end of the questions' interpretations, found it a little difficult to understand and to appropriately answer the climate change-related experiences that they were expected to relay to the researcher.

Another key challenge during the fieldwork was the vastness of the project area in relation to access to specific areas and consequently the respondents. The researcher particularly experienced difficult mobility challenges where he had to typically depend on motorbikes for daily transport which were quite expensive and the weather was frequently unpredictable. Additionally, accessing individual respondents for the household surveys and convening FGD's participants (though with the help of Community Facilitators-CFs) proved a daunting task as many of them had expectations of incentives in return for their information conveyance. Further, the vastness of the project area meant that ViA was not the only development agency striving to promote sustainable agriculture in Bungoma County. There were a few other development agencies doing practically and conceptually almost similar initiatives notably One Acre Fund (OAF) and Integrated Poverty Action (IPA). This scenario was evidently obtrusive and obstructive as many farmer groups were affiliated to these agencies or respondents belonged to two or more farmer groups. These rendered their views and experiences on sustainable agriculture extremely overlapping.

Setbacks also occurred in relation to sampling of the survey research respondents, FGD participants and the key informant interviews. The Excel randomized function with which the KACP Monitoring and Evaluation coordinator used to sample farmer groups resulted in a relatively skewed sample with regards to regional KACP farmer groups' representation. This is because the farmer groups register had not been duly updated as some of the farmer groups that were indicated in the sample might have collapsed changed names or newer ones had been established. For the FGDs, the purposive sampling of Community Based Organizations (CBOs) might have been slightly biased owing to the researcher's dependency on the CFs personal networks in convening participants. Most FGD participants seemed more informed, active or privileged; a relevantly beneficial factor for the FGD as a research technique but slightly biased or marginalizing. Lastly, the key informant interviews failed to include the KACP field officers who are essentially the direct influential contacts between farmers and ViA. This was because the research fieldwork period unfortunately coincided with KACP's internal evaluation process which was extremely demanding for these key informants to be available for interviews. An effort to convene them for a FGD also proved futile.

As for data analyses and discussions, the analyses of non-quantifiable outcomes such as social relations, welfare improvement, livelihoods vulnerability levels and environmental sustainability change are based on the analysis of farmers' apparent perception on how KACP and SALMs have generally impacted on their livelihoods. It is a challenging task to correctly map out of peoples' perceptions most especially when the research respondents are from rural peasant societies and have attained significantly low levels of education. Therefore, in terms of validation and substantiation of causal relationship between adoption of SALMs and the apparent livelihood consequences, SALMs attribution and accreditation to the increases in income levels and perceived livelihoods changes or improvements, may be weak and are subject to some possible flaws and inconsistencies based on data collection and analyses limitations. However, the study judiciously attempted to capitalize on the statistical analyses of reported figures and triangulation of various perceptions from key informant interviews, focus group discussions and the household survey responses on livelihoods strategies trajectories before and after KACP inception.

4.0 Results, Analyses and Discussion

A look into the asset profiles and access variations by different groups of farmers as well as across wealth groups will assist the study to assess the present livelihood adaptation strategies of farmers in the KACP area. Their livelihood activities and household survival strategies influence the consequences of SALMs adoption based on social, agronomic and environmental impacts. This is in line with KACPs core objectives of implementing SALMs in partnership with farmer groups to increase incomes and attain food security from production of higher yields and fostering carbon sequestration through carbon financing. Here, I analyze the different groups of farmers' access to various capital assets. This access influence their livelihood activities and outcomes also under a changing climate. This follows the study's overall objectives of assessing the socio-economic impacts of KACP on the farmers' general livelihoods.

4.1 Assessment of the present livelihood adaptation strategies of farmers

This study explores the status and changes in different household economic assets before and after the inception of KACP. This is based on the assessment of different capital assets (natural, physical, human, financial and social capitals) through which households are able to undertake production, engage in labour markets and participate in reciprocal exchanges with other households and in local market and/or other economic structures. This section will present an overview of the socio-economic features of the sample population. It will then discuss the assets and activity diversification as well as outcome achievements that the farmers in the study area control for livelihood sustenance. In this way, the present adaptation pillars that the farmers employ to counter climatic shocks and stresses will be reviewed.

4.1.1 Assets

From *Table 3* below, the study's socio-economic variables gives a statistical overview of the farmer's capitals and asset levels. Average age, household size and years of schooling were used to discuss human capital as labour. Social capital was discussed by mapping out the farmer's social networks through membership in different community-based organizations for social reciprocity and inclusivity. Human and social capitals facilitate livelihood diversification by increasing the range of opportunities from which choices can be made by households in the face environmental shocks and stresses such as climate change (Ellis 2000). Average land access in

hectares as total land owned by households was the main unit of estimating natural capital. As for financial capital, combined average cash income and household substance (income from maize and beans) was the unit of estimation.

Table 3: ***Socio-economic variables, Bungoma, Kenya, 2014***

Socio-economic variables	N	Mean	
	Statistic	Statistic	Std. Error
Age of respondent (yrs)	80	42.71	1.138
Number of people in HH	80	7.19	.358
Number of years in School	80	8.97	.302
Annual remittance (Kshs)	80	3391.25	1507.987
Annual labour expense	80	7565.00	1172.684
Land (hectares)	80	1.421	.1296
Amount of carbon revenue received (Kshs)	80	3193.43	356.917
Annual Total Income	80	129954.98	20572.939
Valid N (listwise)	**80**		

Ellis (2000) define assets as basic building blocks which are owned, controlled, claimed and accessed by households and utilized directly or indirectly, to generate a means of survival for sustenance and achievement of material well-being. The study sought to map out the famers' stocks of different capitals as envisaged in the sustainable livelihoods framework i.e. human (labour), social, physical[1], natural and financial assets.

4.1.1.1 Labour

The average age of the household heads interviewed was approximately 42 years (*see table 3*). A majority of the household heads interviewed were women even though culturally men are considered household heads. From the FGD discussions, the household labour force in agricultural production was nevertheless reportedly exerted in equal measure between men and women although women culturally tend farms areas closest to the homestead as they are the custodians of home-keeping and domestic chores. The average household size was 7 persons

[1] *Physical capital (infrastructure such as buildings, irrigation canals, roads, tools, machines etc.) was not analysed due to missing data/information during household survey*.

with a majority being nuclear families while a few comprised also of extended family members. Such units had a substantial supply of labour and did not require hiring much labour from outside. The average number of years in school was approximately 9 years. Some of the sample respondents had no formal education at all; a majority of them had attained only primary level education (7-8years). Still, a substantial number had also attained secondary level education (9-12years) with 2.5% having attained college/tertiary education level (13-14years). Primary level education attainment does not guarantee formal employment such as teaching, nursing or administrative jobs at the local level community hence this explains the self-employment mode of most of the study's respondents who were mostly fulltime farmers.

The education levels of a population may be closely and substantively linked to labour force inputs, higher levels of technology adoption and improved livelihood adaptation strategies. Higher education levels may lead to higher rates of adoption of SALM practices and more meaningful labour appropriation; resulting in broader household diversification strategies.

Table 4: ***Hired labour, Bungoma, Kenya, 2014***

Labour		Frequency	Valid Percent	Cumulative Percent
Valid	No	22	27.5	27.5
	Yes	58	72.5	100.0
	Total	**80**	**100.0**	

Most household respondents (73%) did report that they hired farm labour in their agricultural production activities while a few (27%) reported that they only use their own labour. The average amount of hired labour expenditure by households was approximately Kshs. 7565 (USD77) (*see Table 3*). The dependence on outside labour sources may signify a limited demand on willingness to pay for household labour. This is partly a result of the youth labour force being absent during the year and often enrolled in schools. It also signifies a households' ability to afford labour when needed for its agricultural production needs. Poorer farmers will often offer their labour input as a non-farm employment prospect but it seems availability of paid farm work is rather low.

4.1.1.2 Social capital

In terms of social capital, a majority of the sample respondents reported to belong to one or several local community-based organizations or associations. From the total sample, many reported that they belonged to a self-help group (SHG); a substantial number reported that they belonged to a women group (WG) and a few belonged to a youth group (YG), a disabled or special needs group.

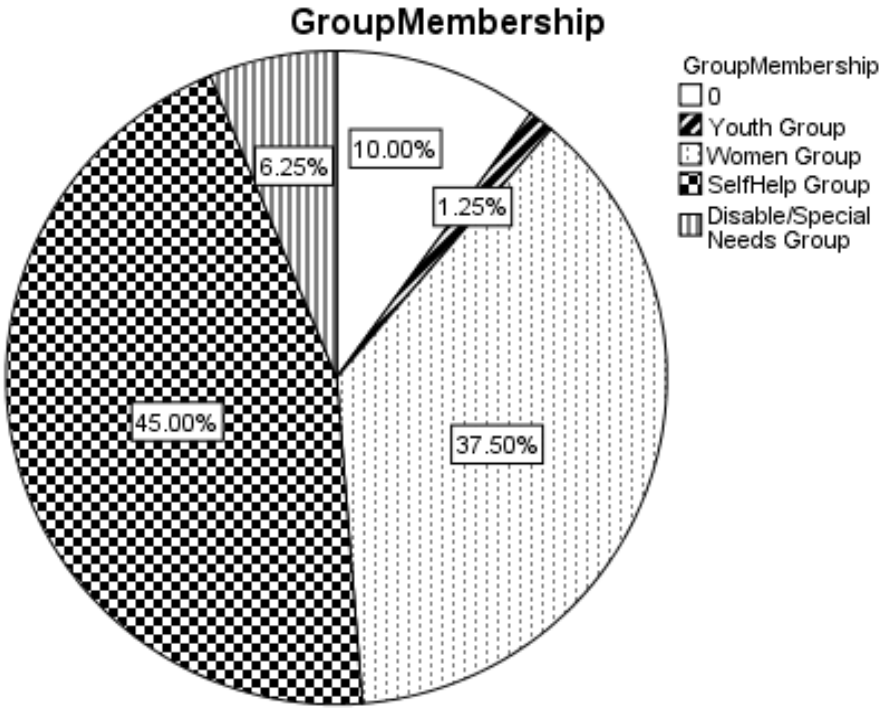


Figure 5: ***Community group membership, Bungoma, Kenya, 2014***

The large share of membership in self-help groups (45%) may signify farmers' predisposition in optimizing maximization of affiliation opportunities by belonging to more than one local CBO. A self-help group (SHG) is more inclusive than a women group, a youth group or a special needs group. There are many agricultural development agencies within the project area working on cross-cutting socio-economic and agricultural development projects ranging from health, water and sanitation and HIV/AIDS to enhancement of agricultural production, livestock management and environmental conservation. Many of these agencies give SHGs a priority in terms of partnership as it is all inclusive of more than one social group of men, women, and youth and sometimes minority groups such as the disabled or people living with HIV/AIDS. Belonging to a

community group enhances the individual farmer's inclusion in most agricultural development and extension services from where knowledge is gained and social capital is enhanced in charting sustainable agricultural pathways such as SALMs. A majority of the respondents were therefore affiliated to one or more community groups also because it enabled them to gain knowledge from agricultural extension practitioners such as the KACP field officers. This forms an important social institution that also fosters socially constructed and developed norms and rules for adaptation through interaction with other farmers in producer environments (Vedeld & Krogh 2003). Farmers did not only gain new knowledge but also interactively shared good agronomy values and norms through sustainable indigenous knowledge integration with modern techniques.

4.1.1.3 Land

The average household land size used for agriculture was approximately 0.92 hectares (*see Table 5*). This was 0.6 hectares below the sample's average total land ownership (1.42 hectares). The rest of households' land areas were used for other purposes such as housing (homesteads), woodlots, physical structures for livestock keeping and other income generating activities such as brick-making or tobacco furnaces. The maximum household access to land area for agriculture was reported to be 3.24 hectares with a minimum of 0.004 hectares for one or two households that considered themselves squatters due to unresolved inheritance conflicts.

Table 5: ***Land access for various land-uses, Bungoma, Kenya, 2014***

Land Access	N	Mean	
	Statistic	Statistic	Std. Error
Land (hectares)	80	1.421	.1296
Land access for agriculture (hectares)	80	0.919	.0749
Land access for grazing (hectares)	80	.1551	.0199
Land access for hire (hectares)	80	.0851	.0514
Land access rented (hectares)	80	.0608	.0267
Valid N (listwise)	**80**		

The average land sizes for hiring (in this study this meant short-term leasing out land for a fee) and for renting (acquiring parcels of land at a fee) were 0.085 hectares and 0.061 hectares respectively (*see Table 5*). Compared to the average households' access to total agricultural land area, the areas of these parcels of lands for hiring out to other households and renting them from other households were quite small. This indicates that most households that tended to lease out parcels of their agricultural land lacked the economic capacity to invest in the whole land area and often opted to lease some part of it as an income generating option. On the other hand, most households renting land were in need of it to boost their income diversification options through farming more food crops or cash crops. As for grazing land, the average size was approximately 0.085 hectares. Respondents who reported land for grazing reflected those households that have invested in large livestock e.g. cattle, goats and sheep requiring grazing fields for their animals.

Table 6: ***Land acquisition, Bungoma, Kenya, 2014***

Land Acquisition		Frequency	Valid Percent	Cumulative Percent
Valid	Inherited	51	63.8	63.8
	Bought	29	36.2	100.0
	Total	**80**	**100.0**	

Approximately 64% (*see table 6*) of the respondents acquired their parcels of land through inheritance while 36% of them reported that they had bought land. A few others reported that they owned partly inherited parcels of land and partly purchased portions of them. Those owning inherited land did so through customary lineages which regard only men as inheritors. Men therefore had bigger mandate to determine land use although the survey found out that women's role in land-use decision-making nowadays had increased since KACP inception. This has largely been attributed to women's higher involvement in the implementation of SALM practices as a result of their more active engagement in domestic/subsistence production through self-help groups affiliated to KACP.

4.1.1.4 Savings and Credit

Table 7: ***Lending and Loans, Bungoma, Kenya, 2014***

Lending				
		Frequency	Valid Percent	Cumulative Percent
Valid	No	70	87.5	87.5
	Yes	10	12.5	100
Loan				
Valid	No	62	77.5	77.5
	Yes	18	22.5	100.0
Total		**80**	**100**	

Regarding lending, 12.5% (*see Table 7*) of the sample respondents reported that they informally lent out money to other households in times of need and it was based on friendship, good neighbour-liness and trust. It was mostly resource-poor households that lacked diversified livelihoods to secure daily household needs the whole year around that practiced lending. 87.5% of the sample respondents reported that they did not engage in lending processes because such agreements most often resulted to prolonged debts. Prolonged debts subsequently caused conflicts between friends and neighbours. This eroded trust and social networking for collective development.

22.5% (*see Table 7*) of the sample respondents reported that they had loans from the farmers' informal village saving and lending associations (VSLAs) as well as from other formal sources such as banks, micro-finance institutions (Women Finance Trust [WFT]) and government's credit facilities (Women Enterprise Fund [WEP]).This proportion of respondents comprised of resource poor and resource-average households who borrowed small amounts of funds from VSLAs. From focus group discussions, the study gathered that VSLAs, through KACP interventions, had uplifted the famers' economic capacities in terms of saving, loaning and lending within their community groups. They could then further be able to access bank loans because groups have been empowered to come up with local business enterprises such as a tomato sauce plant in Tulienge village in Malakisi division. Relatively resource-secure households with higher than average education levels who, because of their significantly

knowledgeable predisposition, access loans more easily from formal private and public credit facilities.

77.5% of the sample respondents however reported that they did not have any loans. They could not sufficiently access them through the VSLA's or they could neither access the formal sources individually nor collectively as farmer groups. This is reportedly due to significantly complex credit application procedures that required financial management knowledge.

4.1.1.5 Assets access by location and wealth groups

Table 8: ***Assets by sub-counties, Bungoma, Kenya, 2014***

Sub-county of Household	Bumula	Malakisi	Sirisia	**Total**
Variables	Mean	Mean	Mean	**Mean**
Age(yrs)	41.56	44.80	43.00	**42.71**
HH size	6.83	8.55	6.53	**7.19**
Years in School	7.93	10.20	9.95	**8.97**
Land (hectares)	1.26	1.41	1.78	**1.42**
Labour (Kshs)	3782.93	12385.00	10652.63	**7565.00**
Lending (Kshs)	1663.41	1450.00	1578.95	**1590.00**

In terms of labour, Malakisi sub-county has higher HHH[2] mean age (44), household size (8) and years in school (10) compared to Sirisia and Bumula sub-counties that have similar household sizes (6) but different mean ages (43, 41) and mean years of schooling (9, 7) respectively (*see Table 8*). The mean amount spent on external labour for Malakisi is the highest of the three regions at Kshs. 12,385 (USD126) while in Bumula farmers spent the least at only a mean of Kshs. 3,782 (USD38). This means farmers in Malakisi region could afford more external labour than Sirisia or Bumula where it appears most farmers are economically poor and highly likely labourers (engaged in off-farm income generation) in farm holdings of a few wealthier farmers.

As for land access, farmers in Sirisia sub-county own land areas with a mean of 1.78 hectares which is relatively higher than Malakisi and Bumula divisions where farmers reportedly access

[2] House hold head interviewed in the study

means of 1.41 and 1.26 hectares of land respectively. Financially, Bumula sub-county reported a mean lending level of Kshs. 1663 (USD17) which is higher than Sirisia and Malakisi that reported means of Kshs. 1579 (USD16) and Kshs. 1450 (USD14) respectively.

Table 9: ***Assets by wealth groups, Bungoma, Kenya, 2014***

Wealth group	Low-income	Middle-income	High-income	**Total**
Variables	Mean	Mean	Mean	**Mean**
Age(yrs)	42.13	43.76	40.80	**42.71**
HH size	5.00	7.51	8.10	**7.19**
Years in School	7.20	8.98	10.30	**8.97**
Land (hectares)	0.87	1.56	1.52	**1.42**
Labour (Kshs)	1786.67	5235.56	17140.00	**7565.00**
Lending (Kshs)	600.00	1537.78	2450.00	**1590.00**

The farmers' average total mean income is Kshs.129954.98 (USD1327) (*see Table 3*). This figure was divided into three wealth groups. Those who receive one-third of it (approximately Kshs. 43,000 {USD442}) were considered low income earners (poor or very poor) while those within the two-thirds bracket (between approximately Kshs. 44, 000 {USD449} and Kshs. 86,000 {USD878}) were considered middle income earners (averagely neither poor nor rich). Those who receive annual total mean income above the two-thirds bracket (approximately Kshs. 87,000 {USD888} and above) were considered high income earners (relatively rich/wealthy).

In terms of human capital, the high income wealth group had a lower mean age (40years) but relatively higher household size (8persons) and years of schooling (10 years) compared to the middle and low income wealth groups (*see Table 9*). These latter groups (middle income and low income) reported slightly higher mean ages (43, 42 years) but lower household sizes (7, 5persons) and years of schooling (8, 7) respectively. The high income wealth group also reported higher external labour expenditure at Kshs. 17,140 (USD175) than the middle income (Kshs. 5,235/USD53) and the low income (Kshs. 1787/USD18) wealth groups. As for natural capital, the low income wealth group reported a very low mean land ownership level at 0.87hectares

compared to the middle income and high income wealth groups that reported a relatively higher but slightly similar land size (1.56 and 1.52 hectares) respectively.

4.1.1.6 Summary of assets

Farmers in Western Kenya are generally poor and the mean income per person per day is very low in the study sample (approximately USD3.6). Even the high income wealth group, which receives a mean income per person per day of approximately USD9, is quite poor by any global standard. Most farmers are averagely quite old and rely on their own labour (often unskilled characterized by low levels of education) used on very small plots of land (mean size of 1.42 hectares). On average also, Western Kenyan farmers have very low access to financial as well as physical capital. Loans and lending are confined to only VSLAs within their farmer groups and a few small and medium micro-finance institutions (*see Section 4.1.1.4*), but very few reported access through formal finance institutions such as banks. In terms of social capital (its measure restricted to community membership), farmers belonged mostly to self-help groups comprising of more women groups than any other collective rural associations (men, youth or disabled groups). The project area was deficient of well-developed physical infrastructure ranging from semi-permanent housing, lack of or marginal access to electricity (confined only in a few urban areas) and poor earth-road networks; to lack of tools, machines, irrigation canals and generally lack of improved agricultural technology.

4.1.2 Activities

The asset status of poor rural households such as in Western Kenya leads to coping livelihood strategies that generate a marginal means of household survival (Ellis 2000). Asset profiles are typically varied between households and their structure dynamic in nature to respond to differential resource access, changing climate conditions as well as unpredictable environmental shocks and stresses. The livelihood activities that farmers in the KACP project area undertook were agriculturally and economically rural-based. They comprised of a diverse portfolio of natural resource-based activities (on-farm practices) and non-natural resource-based activities (off-farm and non-farm practices) in order to sustain their resource-poor standards of living. The combined activities reflected substitutability of income sources as well as income diversification patterns. A majority of the farmers engage in different and also complimentary agricultural and economic activities that ensure household resilience under a changing climate. Substitutability is a prime consideration when thinking about livelihood diversification (Ellis2000). While assets focus on the potential to achieve sustainable livelihoods, activities focus on the realization of that potential in the shape of viable portfolio of income-generating activities. This section descriptively gives an account of activities that farmers engaged in from different regions or divisions of the KACP project area.

4.1.2.1 On-farm Activities

Food crops farming

A majority of the study sample respondents from all the three KACP focal areas i.e. Bumula, Sirisia and Malakisi divisions grew grains, tubers, plantains and legumes. This majority reflected the generally resource-poor households who famed for subsistence purposes but at the same time used crops as an income generating activity accruing from any surplus produce. However, in many cases, food-crops produce stashed away for subsistence could also be sold during periods of economic crisis due to various household-level constrains e.g. health problems or environmental shocks such as droughts. The main food crops commonly grown in all the three project areas were maize and beans which are essentially the Kenyan staple crops. They were produced on a larger scale compared to other grown food grains such millet, sorghum and upland rice which had been introduced to farmer groups by KACP in Malakisi and Sirisia areas. Maize and beans were also the major surplus agricultural produce commonly sold to diversify incomes

for households. The other food crops grown were tubers, bananas, legumes and vegetables that have traditionally been cultured from older generations as well as others that were introduced by community-based development agencies such as KACP.

As for the tubers; cassava and sweet potatoes were grown in all the three areas except for arrowroots which were mainly grown in Sirisia division and in a few riverine and swampy parts of Malakisi and Bumula divisions. Sweet bananas and East African green bananas were also grown in most parts of the KACP project area with more intensification in Malakisi focal area where KACP had introduced high-yielding bananas referred to as 'tissue-culture' as reported by the respondents. Both the tubers and the plantains were occasionally sold by the farmers to supplement household income in times of need. Groundnuts, cowpeas and soya beans were the leguminous food crops reportedly grown by farmers in all of the three project regions. Soya-bean was introduced by KACP as a way of strengthening food security to widen households' nutritional choices. As for vegetables, tomatoes and onions, they were mainly grown in Sirisia and Malakisi divisions owing to the geographically favorable micro-climate that Mt. Elgon provided. Other vegetables grown on small-scale levels were green kales, cabbages and traditional herbs that were seasonally and culturally considered vegetable dietary supplements. Fruits were also grown besides the vegetables. Fruits like avocados, mangoes, guavas, passion fruits and water melon were also grown.

Cash crops farming

Another crucial on-farm agro-economic activity that the middle-income and the relatively affluent farmers engaged in was cash crop farming. The main cash crops in the KACP project area are; sugarcane, tobacco, coffee and sunflower. Sugarcane and tobacco was grown more in Bumula division and to a lesser extent in Sirisia division where coffee was the commonly grown cash crop to the northeast; Namwela location (*see figure4*). Coffee was also grown in Malakisi division to the northwest; Lwandanyi location (*see figure4*). It was grown in northern Malakisi and Sirisia divisions because of the more fertile loamy volcanic soils and the averagely high rainfall geographically modified by Mt. Elgon agro-ecological system. These regions did not actively require SALM practices such as mulching, planting of cover crops and soil nutrient management as strategies for water and soil conservation. This is because they receive high rainfall amounts most seasons of the year and the soils are more fertile than on the lower

altitudes of Bumula. However, other forms of SALM practices such as minimum tillage, residue management and agronomic practices (agroforestry and improved livestock management) were readily and relevantly applicable and hence actively promoted by KACP for carbon sequestration.

Sugarcane and tobacco were the mainstays of Bumula and Sirisia divisions because of the clay sandy soils that were less fertile coupled with averagely low and erratic rainfall patterns. In these regions, KACP intensively fostered SALMs which were very crucial for soil nutrient management, water and soil conservation and carbon sequestration. These agronomic practices collectively improve soil fertility by conserving soil organic carbon (SOC); it also conserves soils by controlling soil erosion, minimizing soil carbon emissions and further enhances carbon sequestration by trees (agroforestry).

Livestock keeping

Chicken rearing was the most traditionally practiced livestock keeping activity in all KACP project areas by a majority of the resource poor and resource-average farmers. They rear local chicken on free-range basis where the chickens are usually left to wander around homesteads and neighbouring compounds in search of their own food. Others opted to rear theirs under SALM (improved livestock management) in semi-free-range; left on free-range sometimes and bred in open enclosures while being fed cereals most of the time. KACP encouraged this as it enabled farmers to collect manure from chicken droppings for compost production as well as closely monitor their health. Most of the chicken is reared for sale as well as for eggs as households' economic and nutritional supplements. Few of the resource endowed farmers in the project areas practice rearing of layer chickens exclusively for egg production because they can afford to establish the necessary structures and conditions for such an investment. Exclusive egg production requires access to a substantial capital that can foot the cost of maintaining structures, feed and health conditions of chicken layer production for urban supply. In a few households, ducks and pigeons were reportedly kept although mainly for subsistence and occasionally for sale.

Cattle, goats and sheep were other common livestock in KACP project focal areas. It is the averagely resource-poor households that owned most of these kinds of livestock. There were

fewer households rearing large livestock than chicken. Most of the kept cattle were low-yielding crossbreed species and of a small herd-size (approximately three to four animals) depending on the household farm size. A small herd-size ensures that farmers conserve soil (prevents erosion through overstocking) and reduces emissions of methane while minimizing the costs of maintenance (feed and veterinary check-ups). This was therefore actively encouraged by KACP under the improved livestock management SALM strategy as it further increases the productivity of livestock. Cattle were mostly reared for milk production for household consumption but in some instances for sale of any surplus production as an income generating activity. A few resource-endowed households exclusively kept dairy cattle of a substantively large herd-size on zero-grazing (animals fed within enclosures). They reared them for milk production for household consumption and for sale in the local market dairy shops. Other households also kept goats and sheep for sale and for milk production occasionally.

4.1.2.2 Off-farm Activities

Furnaces construction and brick-making

Some farmers offer 'expert' handy services to other farmers e.g. tobacco furnaces construction and brickmaking for pay. These farmers were unskilled yet experienced builders who offered their labour for lease. They carried such services as their livelihoods lifelines besides being farmers themselves. For instance, in Bumula and Sirisia divisions, many tobacco farmers require tobacco furnaces on their home compounds in order to pre-process their tobacco harvests (tobacco leaves) for sorting and grading ready for supply to factories. Therefore, some farmers in most tobacco producing villages were experienced builders of tobacco furnaces as employment opportunities for livelihood sustenance. A related activity commonly carried out by a few young famers in Bumula and Sirisia divisions is brick-making because of the geographical availability of clay soils within these regions. Young farmers from resource-poor households opted to take up brick-making as an income generating activity where they locally sold baked bricks for permanent house construction.

Rural public services

Apart from tobacco furnaces construction and brickmaking, some farmers offered other public services within the KACP project areas. For instance, in Malakisi division, a certain farmer group called Kitomaka Self-Help-Group specialized in construction of energy-saving stoves for

other farmers' households at a price. This group had received training from a non-governmental organization working in the area on how to construct traditional 'jikos' or stoves that used less fuel wood and produced less GHGs just as KACP encourages them to do. They therefore earned a substantial amount of income from constructing such stoves for other farmers who were willing and environmentally conscious of saving fuelwood and at the same time have a role of cutting down GHG's emissions. This is in line with KACPs goal of cutting down GHGs using SALM practices to enhance carbon sinks as well as conserving carbon in biomass through agroforestry.

In Northern Malakisi and Sirisia divisions, the terrains of the farmlands were quite steep. Some farmers owned bulls for ploughing the agricultural lands of other farmers in the villages for a fee hence it was a reliable income source. This is because heavy machinery such as tractors could not access some remote locations and therefore the ploughing bulls came in handy. They are normally used for ploughing during planting season as well as for trucking food crops yields from the farmlands during harvest. Contour ploughing by these bulls was therefore encouraged by KACP field officers as a conservation tillage technique under tillage and residue SALM. This technique helped reduce soil erosion by controlling run-off during heavy rains thereby conserving SOC and decreasing carbon emissions release.

In all KACP project areas, the means of transport into the interior of the study areas required the use of motorbikes or occasionally bicycles. As such, a substantial number of middle-income and resource-endowed famers i.e. those with formal employment or higher than average land ownership, possessed one or two motorbikes that they used as investments on public transport services. Some male youths from all the three KACP regions therefore were employed by the farmers who owned motorbikes as daily operators while they cashed in on the income accrued from the transport fares payable upon use of such public services.

4.1.2.3 Non-farm Activities

Rural farm-output trade

Farm-output trade involved farmers selling surplus produce from their food crops harvest to supplement the households' income when needs arose. From the focus group discussions, most participants agreed that SALM practices increased their farm yields especially food crops output. Some households sold their surplus maize, beans and other grains to other local farmers who acted as middlemen who would often resell them in other local urban areas. Therefore, SALM

practices enabled farmers to trade in buying and reselling cereals which was a common activity in most of the three KACP project areas. KACP, through its field officers and community facilitators greatly encouraged farmer groups to get involved in agri-business; where they were taught to collectively 'think business' whenever harvests were high. For instance, in Malakisi division, Tulienge village, a CBO[3] called Namubila Tomato has established a local factory project which was underway to venture into production of tomato sauce. This was a KACP intervention to curb loss of perishable surplus tomato yields that often went to waste due to lack of market channels. Within villages, the local small markets had stalls that acted as local agricultural produce exchange platform selling grains, tubers, plantains, vegetables and fruits. In Bumula division for instance, it was common to find sugar cane sold by the roadside. As for the livestock, chicken and eggs were sold in the local market for consumption or for further rearing and breeding of free-range species. Milk and meat were other farm-products from cattle and occasionally goats and sheep that were traded between farmers from different areas of the KACP project.

Rural non-farm trade

Non-farm trade involved a wide range of economic activities. A number of farmers opted to run small kiosks and canteens from their household vicinities where they sold a variety of goods across the compound boundaries or fences to the outside. They sold small household items such as pens, books , over-the-counter medicines etc. and finished or processed products such as bread, sugar, salt, kerosene and cooking oils just to mention a few. Women farmers cooked aand sold food items such as- fries/chips, sweet potatoes, cassava, fried groundnuts and homemade scones or buns (mandazi's and chapatis). Others outsource fishes from (Lake Victoria); the neighbouring Nyanza province and become local roadside village-fishmongers. Some farmers take up hawking as an income generating activity by selling small household items from house to house looking for willing buyers.

From the household interviews, other reported notable examples of rural non-farm trade that some farmers ran for other farmers consumption included; rental shops for canteens and kiosks, electronic and mobile phones charging/repair services shops, motorbikes and bicycles repair

[3] *A collective group of local community farmer groups that forms a farmer association(often more than 10 farmer groups)*

services, grains grinding mills (poshomill/maize millers), tobacco brokerage for tobacco factories and selling local brew as reported by one woman from Bumula.

4.1.2.4 Remittances and migration

14% (*see Table 10*) of the study sample respondents reported to receive remittances from their children and relatives who held formal employment positions in the other villages, small townships or urban towns and cities. These remittances were sent monthly or annually from their children and relatives who were teachers, bankers, nurses, lecturers and businessmen and women just to mention a few. This featured both poor and relatively wealthy households that had invested in their children education and luckily enabled them to secure substantively well-paying jobs thereby rendering them capable of sending money home. A large majority of the sample respondents (86%) reported that they did not receive any remittances from any sources be it children, relatives or friends. This featured the resource-poor households that had unfortunately not been able to invest in their children education due to poverty, poor health and other social constraints.

Table 10: ***Remittances and migration, Bungoma, Kenya, 2014***

Remittance		Frequency	Valid Percent	Cumulative Percent
Valid	No	69	86.2	86.2
	Yes	11	13.8	100.0
Migration				
Valid	No	62	77.5	77.5
	Yes	18	22.5	100.0
	Total	**80**	**100.0**	

23% (*see Table 10*) of the study sample respondents reported that they had migrated from their village of origin and lived somewhere else for a number of years. Most of these respondents had migrated out of their village to urban areas i.e. village trading centers, neighbouring district or provincial towns and cities in search of formal and informal employment opportunities. A majority of the study respondents (77%) however, had never migrated from their village of origin to live somewhere else. This segment of the study sample signifies that most of the farmers in the study areas were traditionally natives and had not sought alternative livelihoods diversification options outside their villages of origin. This is because they could not afford to do

so, or were not literate, skilled and ‘exposed to the outside world’ to take up formal jobs in urban areas so that they could better their resource-poor livelihoods.

4.1.2.5 Summary of Activities

Most of the activities in the project area are more on-farm-oriented compared to off-farm and non-farm activities. Most of the on-farm activities comprise of food crops farming (commonly maize and beans among others) and cash crop farming (sugarcane in Bumula, tobacco in Sirisia and coffee in Malakisi). Livestock keeping is another common on-farm activity with chicken rearing as the most practiced, followed by cattle keeping, then sheep, goats, pigs and rabbits. Off-farm activities commonly involve provision of local semi-skilled rural services ranging from construction of tobacco furnaces, energy-saving stoves and livestock pens to brick-making, public transport provision, oxen ploughing and running of machine repairs services shops. It also involves the low income earners labouring in land holdings of the middle and high income wealth groups as seasonal casual labourers. These seasonal labouring often involves ploughing, planting, weeding and harvesting of food crops and cash crops. When it comes to non-farm activities, rural farm-output trade is the most common compared to non-farm trade. On one hand, a majority of the farmers across the wealth groups, but often the middle income and the high income earners, involve themselves in local trade of surplus agricultural yields (maize, beans, eggs and milk) while the low income group traded in the daily nutritional supplements (vegetables and tubers). On the other hand, few farmers, especially within the low and medium wealth groups, involve themselves in running small shops and informal roadside stalls that sell local household commodities.

4.1.3 Outcomes

The KACP project set forth its so called win-win endeavours to address food insecurity and soil carbon emissions in the context of climate change and poverty. This means a majority of farmers in Western Kenya were persuaded and encouraged by KACP to diversify their livelihood activities to cushion risks and their vulnerability to socio-economic and environmental shocks and stresses. Such activities were meant to build their assets and expand their income sources as livelihood strategies for coping and adapting to CC as well as emancipate from poverty. In SLA, outcomes in relation to rural livelihoods context have been closely associated with increased income and well-being, improved food security, reduced vulnerability and a more sustainable use of natural resources. In this study, outcomes are presented and discussed in terms of income sources diversity (by scale of income, location, relative importance, distribution and wealth groups variations), vulnerability context and poverty, in view of relevant transforming processes (institutions, governance and labour markets) within the KACP context.

4.1.3.1 Income diversity

Table 11: ***Average household income sources, Bungoma, Kenya, 2014***

Income Sources	N		Mean	
	Statistic	%of Total Income	Statistic	Std. Error
Annual on-farm income (Kshs)	80	72.2%	93766.25	12645.592
Annual off-farm income (Kshs)	80	17.6%	22921.25	4499.599
Annual non-farm income (Kshs)	80	28.4%	36888.75	14004.679
Annual remittance (Kshs)	80	2.6%	3391.25	1507.987
Annual amount of carbon revenue per farmer group (Kshs)	80	2.5%	3193.43	356.917
Annual amount of carbon revenue per farmer (Kshs)	80	0.17%	216.23	23.651
Annual total Income (Kshs)	**80**	**100%**	**129954.98**	**20572.939**

Above (*see Table 11*) is a summary of the average annual income sources that the farmers receive. A majority of the study sample respondents receive on-farm cash incomes which are mainly products of farming Kenyan staple food crops of maize and keeping livestock such as cattle, chickens, goats, sheep, pigs and rabbits. Further, on-farm income is accrued from the sale

of small-scale food crops such as cassava, sweet potatoes, groundnuts, tomatoes, onions, vegetables and fruits. A few resource-average and resource-endowed households gained income from cash crops such as sugarcane, tobacco and coffee. The annual mean annual on-farm income was Kshs. 66,537 (USD679); a 72.2% of the annual mean total income (*see Table 11*). Other notable sources of incomes embedded in the on-farm income category included subsistence cash income (from sale and consumption of maize and beans) as well as carbon revenue from KACP through SALMs implementation. As for off-farm income, many of the resource-poor farmers reported that they receive it by labouring in other farms (of the middle-income and the high-income) as casual labourers. This was as a result of ownership of small land parcels hence they could not achieve surplus yields to enable them engage in agri-businesses. The annual mean off-farm income was Kshs. 22,921 (USD234); a 17% of the annual mean total income (*see Table 11*). Many of the sample respondents did not receive much non-farm income because inhabitants in the project area were small-scale subsistence farmers and a few traders who lacked sufficient entrepreneurial knowledge to invest in agri-business. Few of these who achieved non-farm income were primarily entrepreneurs by nature and ran small village canteens, kiosks, grinding mills and other small businesses. The annual mean non-farm income was Kshs. 36,889 (USD377); a 28% of the annual mean total income (*see Table 11*). The average annual remittance was nevertheless quite low at Kshs. 3391 (USD35).

The annual mean carbon revenue for a farmer group was Kshs 3193 (USD33); a 2.5% of the annual mean total income. This was a marginal amount considering that a farmer group consisted of an average number of 15 members; meaning that the annual mean carbon revenue per farmer per year was extremely marginal at approximately only Kshs. 216 (USD2). Overall, the annual total mean income (including carbon revenue for each farmer) was a sum of the total cash income (on-farm, off-farm, non-farm and remittances) and the marginal carbon revenue. This amounted to Kshs. 129954.98 (USD1327) per farmer per year (*see Table 11*) or Kshs. 10829.58 (USD111) per person per day.

4.1.3.2 Income Sources Variation by Locations

Below (*see Table 12*) is an overview of the mean annual income sources by sub-counties. It shows systematic differences and variation in the income sources and levels between the study locations.

Table 12: ***Income sources by sub-counties/divisions, Bungoma, Kenya, 2014***

Sub-county/ Income Sources	Bumula (N41)		Malakisi (N20)		Sirisia (N19)		**Total income (Kshs)**	
Mean / Std. Error (S.E.) / % of Total by Income Source (I.S.)	Mean (S.E.)	% of Total by I.S.	Mean (S.E.)	% of Total by I.S.	Mean (S.E.)	% of Total by I.S.	**Total Income (Kshs.)**	**% of Total by I.S.**
Annual on-farm income (Kshs)	49780.49 (8237.3)	66.7%	103700.00 (35585.8)	49.8%	63578.95 (12530.8)	41.8%	**217059.44**	**49.9%**
Annual off-farm income (Kshs)	12700.00 (3381.8)	17%	37700.00 (11237.4)	18.1%	29421.05 (12302.3)	19.4%	**79821.05**	**18.4%**
Annual non-farm income (Kshs)	12124.39 (4414.2)	16.3%	66700.00 (37956.0)	32.1%	58947.37 (42163.0)	38.8%	**137771.76**	**31.7%**
Total income (Kshs)	**74604.88**	**100%**	**208100**	**100%**	**151947.37**	**100%**	**434652.25**	**100%**

On-farm Income

On-farm income is arguably the most depended upon source of income in terms of relative importance compared to off-farm and non-farm incomes as it comprised of 50% of the total income on average (*see Table 12*). A majority of the study respondents (96%) reported that they achieve on-farm income directly from the farm agricultural outputs while a few of them (4%) reported that they did not receive any on-farm income. Agricultural outputs primarily included farming of maize and beans, other small-scale food crops (cassava, sweet potatoes, groundnuts, vegetables, bananas and other fruits) and also cash crops (sugarcane, tobacco and coffee). Sugarcane is the most commonly grown in the KACP project area generally but more intensively

in Bumula division. Tobacco was mostly grown in Sirisia and some in Malakisi division while coffee was more grown in Malakisi compared to Sirisia. Income from rearing of livestock ranged from cattle, goats and sheep-keeping to chicken, pigs and rabbits. A majority of the households reared chicken as a form of small-scale 'quick sale' investment in time of weekly or monthly household cash needs and for eggs (a domestic consumption dietary supplement). Cattle followed closely in livestock popularity reared for milk production for the household consumption and for sale of the surplus locally to other households or at shopping centers for a daily or a monthly fee. Others kept goats, sheep, pigs and rabbits for sale as an income diversification strategy for the household.

Malakisi division achieved the highest average annual amount of on-farm income at Kshs. 103,700 (USD1059) compared to Bumula division which had the least at approximately Kshs. 49,780 (USD508) (*see Table 12*). Sirisia division achieved a low average amount of Kshs. 63,579 (USD649) compared to Malikisi division.

Off-farm Income[4]

Off-farm income is the least depended upon source of income by a majority of the respondents across the wealth groups in terms of relative importance as it comprised of approximately 19% of the total income (*see Table* 12). Many respondents (74%) reported that they receive off-farm income. They were mostly farmers who offered or sold their skilled and unskilled individual labour forces. Examples of off-farm labour services included salaried formal employments as well as farm works such as tilling, planting, weeding, harvesting and manual haulage of crop yields back from the farms to the farmyards. Such services earned them a daily, weekly or monthly wages that enabled them to sustain their households' needs. Fewer of the study respondents (26%) did not receive any off-farm income. Most of these farmers who did not have sources of off-farm income were mostly resource-poor often with very small pieces of land and little skilled labour to offer public or meaningful farm work labour. Other off-farm activities that notably generated livelihoods incomes for a few farmers who were semi-skilled in different respects included construction of poultry pens, rabbit cages, energy-saving stoves and tobacco furnaces.

[4] *In this study, off-farm income referred to wage labour payments and erroneously included salary employment which technically belongs to the non-farm income category.*

Malakisi division achieved the highest average annual off-farm income at Kshs. 37,700 (USD385) compared to Bumula division which had the least at Kshs. 12,700 (USD130) (*see Table 12*). Sirisia division achieved a substantial average annual off-farm income of Kshs. 29421(USD300) compared to Malakisi division.

Non-farm Income

Non-farm income is the second most depended upon income source in terms of relative importance after on-farm income as it comprised of 32% of the total income on average. Among the wealth groups, the middle and high income wealth groups achieve non-farm income more than the low income wealth group because of the latter command comparably wider asset profiles that enables better diversification from on-farm to non-farm activities. 41% of the sample respondents reported that they achieve non-farm income from running small, medium and large scale businesses. Notable examples of non-farm income generating activities include, but are not limited to, running of village canteens, electronic shops and cereal kiosks, maize grinding mills, selling fruits and vegetables by the roadside and burning of bricks for sale. 59% of the study's sample respondents reported that they did not achieve any non-farm income since they did not engage in any small, medium or large scale business ventures in the villages.

Malakisi division in this income source category also achieved the highest annual mean non-farm income of Kshs. 66700(USD681) compared to Sirisia and Bumula divisions which achieved substantial amounts of annual mean non-farm incomes at Kshs. 58,947 (USD602) and Kshs. 42,163 (USD430) respectively (*see Table 12*).

4.1.3.3 Poverty, Income Distribution and Assets

Poverty is the inability of people to realize their potential as human beings due to lack of capability and well-being (Ellis, 2000; Sen, 1997). In most rural areas of low-income countries such as in Western Kenya, many people experience lack of capability and well-being in pursuing livelihood strategies that can enable them realize a desired level of well-being. As such, there are huge disparities in income sources and income levels resulting in social differentiations. In measuring the magnitude of poverty[5], the study sample was divided into three wealth groups (*see*

[5] *Poverty in this case refers to absolute poverty; an objective criterion following a fixed measure of income level that represents the minimum material necessities for a secure well-being (Ellis, 2000)*

Section 4.1.1.4), according to income levels. Those who receive below one-third of the annual average total income were considered low income earners (poor or very poor) while those within the two-thirds bracket were considered middle income earners (averagely neither poor nor rich). Those who receive annual total mean income above the two-thirds bracket were considered high income earners (relatively rich/wealthy). Below (*see Table 13*) is an overview of the mean annual income sources by wealth groups. It shows income distribution and systematic differences in the income sources and disparities within the three wealth groups.

Table 13: ***Income sources by wealth groups, Bungoma, Kenya, 2014***

Wealth Group/Income Sources	Low Income (N15)		Middle Income (N45)		High Income (N20)		**Total Income (Kshs) (N80)**	
Mean / Std. Error (S.E.) / % of Total by Income Source (I.S.)	Mean (S.E.)	% of Total by I.S.	Mean (S.E.)	% of Total by I.S.	Mean (S.E.)	% of Total by I.S.	**Total Income (Kshs)**	**% of Total by I.S.**
Annual on-farm income (Kshs)	6000.00 (2077.1)	59.7%	48511.11 (4484.9)	65.6%	152500.00 (33536.1)	46%	**207011.11**	**49.8%**
Annual off-farm income (Kshs)	2246.67 (889.6)	22.3%	14266.67 (2321.9)	19.3%	57900.00 (14766.9)	17.5 %	**74413.34**	**17.9%**
Annual non-farm income (Kshs)	1806.67 (1308.7)	18%	11200.00 (3325.7)	15.1%	121000.00 (52003.0)	36.5%	**134006.67**	**32.3%**
Total income (Kshs)	**10053.34**	**100%**	**73977.78**	**100%**	**331400**	**100%**	**415431.12**	**100%**

In terms of on-farm income, the high-income group receives a high annual average amount of Kshs. 152,500 (USD1557) compared to the middle and low-income wealth groups which receive Kshs. 48,511 (USD495) and Kshs. 6,000 (USD61) respectively (*see Table 13*). In terms of off-farm income, the high-income category similarly did achieve a high annual average income of Kshs. 57,900 (USD591) compared to the middle-income and low income groups which achieve Kshs. 14266 (USD146) and Kshs. 2,247 (USD23) respectively (*see Table 13*). As for non-farm income, the high-income wealth group achieved a very high annual average income of Kshs. 121,000 (USD1235). This is in comparison to the low-income and middle-income wealth groups

which achieve quite low annual average non-farm incomes of Kshs. 11,200 (USD114) and Kshs. 1806 (USD18) respectively (*see Table 13*).

Based on the total annual average income of Kshs. 129,995 (USD1327), the per capita income per farmer per day translates to a mere Kshs. 360 (USD3.7). For the low-income wealth group which achieves a total annual average income of only Kshs. 10053 (USD103) (*see Table 13*), the per capita income per farmer per day translates to an extremely marginal amount of Kshs 28 (USD0.29). This measly amount when compared to the per capita income per farmer per day of the high-income wealth group (Kshs. 921/USD9) shows high income inequality and unequal wealth distribution between the poor and the non-poor. Generally, therefore, most farmers in the project area are more or less poor by any global standard as they achieve a very low mean income per capita per day of less than 3.8USD. All wealth groups achieve considerably higher annual on-farm incomes than off-farm or non-farm incomes because across the project area most people are farmers hence their farm yields primarily accrue cash and subsistence income. As for off-farm and non-farm income sources, the middle income and high-income wealth groups differ significantly from the low-income group. The high-income wealth group achieves high incomes from all types of income sources but relatively more from on-farm and non-farm activities. The low-income wealth group achieves the lowest from all income sources but relatively more from on-farm income as they are dependent solely on on-farm activities

From the study figures (which experienced inconsistencies because salaried incomes were erroneously included under the off-farm income category {*see footnote5*}), the low income wealth group achieves extremely low annual incomes (*see Table 13*) compared to the middle and high-income groups. This can be attributed to their generally poor asset status (especially natural and human capitals) as they own very small plots of lands and have achieved very low formal education (only primary level) (*see Table 9*). Low levels of natural, human and social capitals translate to less livelihoods diversification due to poor farm yields, low social ties and reciprocity networks as well as low-paying unskilled labour that they often use and depend on as their off-farm and non-farm (small-scale sale of food crops) incomes. The middle income and high-income wealth groups on the other hand earn comparably higher off-farm and non-farm incomes than the low-income group. They own substantially bigger plots of land and have averagely higher levels of formal education (secondary and tertiary levels) (*see Table 9*) hence they are

able to command a wider livelihood diversity through higher farm yields, higher returns to skilled labour and better access to socio-economic opportunities (social services and trade). This correlates to numerous incomes inequality case studies which show the difference between diversification alternatives of the poor and those of the rich who are able to diversify in high wage labour markets or high return self-employment (Ellis, 2000).

4.1.3.4 Vulnerability Context and Risk Strategies

Vulnerability refers to a high degree of exposure to risk, shocks and stressors and proneness to adversity (Ellis 2000). By extension, it encompasses the capacity or incapacity to cope and adapt to risk associated with external environmental stimuli (such as climate change) to livelihood security. In the study context, vulnerability is seen to manifest itself when risk factors such as a changing climate pose threats to poor farmers' livelihoods whose resilience and coping capabilities are low. Resilience (ability to bounce back from adversity) and coping capabilities are determined by assets access, food storage, market fluctuations and support from kin or community (Ellis 2000). So, a household's asset base and the livelihoods strategies (activities) put in place to realize desired livelihood outcomes require high resilience and low sensitivity (magnitude of a system's response to external adversity). Therefore, vulnerability follows that the most secure livelihood system is one with high resilience and low sensitivity while the most vulnerable exhibits low resilience and high sensitivity. In most parts of Western Kenya, and particularly where KACP is implementing SALMs, rainfall is relatively low and unreliable and soils infertile owing to a gradual decrease of soil organic carbon in the past decade. This is attributed to a changing climate coupled with traditional agricultural practices that had over the years not adhered to principles of environmental conservation and sustainable use of natural resources such as land and forests. As such, agricultural production has been constrained by poverty, declining soil fertility, inadequate pest and disease control and consequently poor crop yields and nutrition. This scenario can be described as precarious and explains KACPs intervening predisposition and role in addressing the livelihoods vulnerability of Western Kenyan poor farmers to socio-economic and biophysical stressors and shocks. KACP, through SALMs, has strove to inculcate the culture of income diversification as a risk strategy to cushion climatic shocks and stressors such as droughts.

Risk strategies comprise forward planning to spread risk across a diverse portfolio of activities in the context of degrees of risks attached to certain sources of incomes (Ellis 2000). For instance, income diversification is often taken to imply a trade-off between a higher total income involving greater probability of income failure, and a lower total income involving smaller probability of income failure. In the previous section (*see section 4.1.3.3*), income distribution shows that all wealth groups depend on on-farm income generally but differ in various respects concerning off-farm and non-farm income sources and levels. As such, climate change is a huge risk factor for on-farm income dependence in terms of seasonal droughts, soil erosion or flooding. Diversification in this case as a risk strategy therefore means securing alternative pathways towards creating more of off-farm and non-farm income sources so that during periods of scarcity in case of droughts or floods, people can cushion their vulnerability and secure more resilient livelihoods. However, diversification patterns within the wealth groups vary extensively because the low income wealth group are disadvantaged, in terms of claiming asset profiles that can pull them out of vulnerability, compared to the middle income and high-income groups who claim better asset profiles for resilient livelihoods. Resilient livelihoods here reflect the ability to diversify from overdependence on on-farm income and shifting to higher returns off-farm and non-farm activities. As for the low income group who are deficient of assets especially land, human labour and strong social networks, the prudent way to diversify is to build assets. This can be fostered through improved agriculture such as SALMs application and utilizing rural development opportunities through community group formations and local level organizational networks to boost social capital.

4.1.3.5 Institutions, Policies and Governance

Social Relations

Socio-cultural relations as an important factor in rural livelihoods diversification draws from varying degrees of inclusivity and social ties made up of networks and relationships between individuals or organizations, and the trust and expectations which flow through them (Ellis, 2000). These networks and relationships are maintained and upheld by norms, values, customs and social relations embedded in policies, institutions and organizations that inhibit or facilitate the exercise of capabilities and choices by individuals or households. It is important to look at the mediating processes linking farmers' (of different wealth groups) livelihoods, their socio-

cultural relations and institutional arrangements (policies and governance) in relation to KACP. Socio-cultural relations such as ethnicity, age, gender and wealth groups determine social positioning of individuals and households within the society. The dominant ethnic group in Western Kenya is the Luhya tribe which comprises of many sub-tribes depending on which region of the KACP project area they reside. However, their cultural practices are very similar in many customary aspects including assets ownership and livelihood activities hence ethnicity as a social positioning factor was not fundamental in any respect. The study's average age of household heads interviewed, at 42 years, means that most respondents own land as a cultural expectation and obligation in order to support their household survival. Therefore, agriculture becomes the prime livelihood activity for most of them and its success or viability stems from how much land one accesses and claims rights of use. In rural livelihoods, natural capital access and rights of use are closely associated with gender and gender roles. From the focus group discussions, it was reported that land tenure arrangements follow customary laws of inheritance whereby men are the ones who inherit land from their family lineages whereas women do not. This was based on their marriage tradition which renders women marriageable to an outside family or community such that, where she is married, the husband is expected to have inherited land from his family lineage. As such, men are considered the household heads and are the ones expected to make 'stronger' decisions concerning assets use (especially land and financial capitals). On the other hand, women take the second charge and make 'softer' decisions by complementing men's culturally-shaped roles especially at the household subsistence level as well as within the local community level. For instance, within the KACP context, women's subsistence labour and community membership (social capital) in the women farmer groups are very significant for SALMs implementation while men's off-farm labour and local community leadership roles equally strengthen the project's endeavours. Such contextual and socially accepted rules (institutions) govern gender roles and determine access to natural resources.

Land Tenure System, Governance and Agrarian Change

An important institution in this study that ensures livelihoods survival is land inheritance. As mentioned earlier, the customary land inheritance rule in Western Kenya restricts women from inheriting land and instead favours men who are the decision makers pertaining land access and use. However, from the focus group discussions, it was reported that through community-based organizations (especially women groups), women have in the recent past been gradually but

steadily involved alongside the husband, in much of the decision making regarding land access and use at the household level. Women groups can be viewed as institutional empowerment tools that have seen women gender roles elevated to a higher level because within women groups, most improved agricultural technologies such as SALMs are instilled and they end up implementing them at their farm holdings in consultation with their husbands. Improved agricultural technologies are fostered by non-governmental organizations such as ViA and state agencies such as the Ministry of Agriculture. These organizations work with farmers on partnership basis where new technologies regarding better farming methods and improved seeds varieties are exchanged through agricultural extension services to the farmers. Working partnerships in the KACP project area prioritized farmer groups rather than individual farmers in order to build social capital through inclusive agricultural growth and communal benefits sharing pertaining carbon sequestration and revenues. In this study, self-help groups is the dominant farmer group in KACP with women groups as the most common in terms of gender grouping compared to men, youth and special needs groups. Individual farmers within these community groups were expected by KACP to own land as a criterion of registration for membership hence almost all of the study respondents reported to have access to a piece of land (average land size access at 1.42 hectares) acquired mainly through inheritance and to a lesser extent through private purchase.

Land tenure system as an institution in the KACP project area reflects Kenya's private freehold title as its legal framework for land ownership. In Western Kenya, most farmers do not own land titles as expected by the Ministry of Land because they acquire and access their parcels of lands through customary inheritance. Many respondents therefore did not require title deeds unless upon the pressure of present day land market when brothers have to split the inherited land of their old or departed father. In fact, present household heads generation who own the reported average land size of 1.42 hectares reflect land sub-division that may have happened over the past decade. This generation own inherited land from their forefathers who probably owned bigger pieces of lands because from the sample survey, most respondents reported ownership of relatively smaller pieces of lands alongside their brothers who are their neighbours. This land subdivision is partly attributed to population pressure and partly due to increased integration into an emerging land market whose transaction policies requires titling as prerequisite documentation for private property ownership under Kenya's land law. However, customary

tenure in practice prevails further away from urban centres because land adjudication framework in Kenya is still centralized within and around urban planning and management. This alienates most of the rural areas where land ownership is more or less traditionally governed by customary laws hence land transactions and any arising conflicts are done and resolved by village council of elders and other local justice systems.

Land ownership is an important factor in livelihood sustenance and survival for most, if not all farmer households in Western Kenya. Therefore, land remains the most vital capital that requires judicious management in the overall process of asset building. Households achieve this by maximizing their labour and investments on land depending on their asset profiles and economic capabilities. The intervention of KACP and other agricultural development agencies in Western Kenya regions through new agricultural technologies has of course induced agricultural change in land-use and impacted on modes of production. It has consequently resulted in livelihood changes within farmer social groups especially across wealth groups. In modelling agricultural change in rural livelihoods, Vedeld (1988) and Ellis (1987) draw up two peasant livelihood reproduction trajectories in the face of agro-economic change and livelihood adaptation spectrum/nexus. On one hand is social differentiation which follows that the nexus will cause a differentiation of farmers into two classes of wage labourers and capitalist farmers based on factors such as increased private ownership of land and adoption of improved agricultural technologies such as SALMs. On the other hand, the nexus may result in social consolidation; a scenario that will see peasant farmers resist the pressures of capitalist tendencies (profit maximization) and instead build social reciprocity by maintaining control of simple means of production on their small pieces of land (own-labour intensification/self-exploitation).

From the study findings, a look into the wealth groups reveals few low-income earners, many middle income earners and few high-income earners all of whom depend more on on-farm income than off-farm or non-farm income sources. However, the low income wealth group more often than the other wealth groups depend on seasonal wage labour as a diversification option during hardships (often in land holdings of the less poor) while the high income wealth groups depend on skilled labour in the public sector and rural trade. It is therefore possible to infer that within the agro-economic change and livelihood adaptation nexus, Western Kenyan farmers through KACP and other agricultural development agencies have substantially followed the

social consolidation trajectory although not entirely evidenced by the wide income inequalities between the poor and the non-poor. Nonetheless, a majority of them are neither profit maximizers not capital accumulators; instead they are on-farm agriculturalists who pursue simple reproduction as the main aim of production hence socially consolidated livelihoods.

Markets

It is evident from the discussions above that land ownership in the KACP project area determines farmers' livelihood strategies and links them to collective socio-cultural and agricultural development opportunities such as KACP. These development opportunities are availed to farmers on the ground by government ministries, County government structures (Kenya's current regime under devolved governance), both local and international non-governmental agencies and micro-finance institutions. Therefore, agricultural development partnerships in practice are part and parcel of the broader economy through market structures that inevitably must be integrated in most project implementation processes. For instance, KACP in its bid to realize its objectives of increased incomes, increased food security (through attainment of higher farm yields) and carbon revenue earning for farmers, had to consider farmers access to farm input markets. KACP, through ViA, intervened by subsidizing prices and providing cheaper inorganic fertilizers as well as improved seeds varieties of maize, beans and other food crops for the farmers. However, the use of inorganic fertilizers was not much encouraged because composting was one important SALM strategy that KACP vigorously promoted to curb GHGs emissions especially methane.

A majority of the study respondents relied on on-farm farming for livelihood survival amid vulnerability from climate change and inadequate natural, human and social capitals (land, labour and social networks). As such, a prudent diversification pathway implied a shift from overdependence on on-farm activities towards more of off-farm and non-farm income generating activities. This is because a change in relative prices of food crops in the local markets can be a livelihood shock for most farmers who depend on on-farm income for consumption smoothing (Ellis, 2000). However, such shocks in fluctuation of relative prices can be a good incentive in provoking adaptive livelihood responses that foster the shift from over-reliance on on-farm farming towards off-farm and non-farm activities. A shift to off-farm or non-farm activities depends on conducive labour and credit markets environments. Rural livelihoods are lacking in terms of existence of established labour market networks and lending and borrowing credit

facilities. For instance, in Western Kenya, there are lower returns to labour in agriculture because of the existence of a large unskilled pool of human labour. On one hand, the low income wealth group lack the resources and skills to claim higher returns on-farm activities and wage labour from societal institutions or the high-income wealth groups. On the other hand, societal institutions such as schools and health institutions or high-income wealth groups do not provide any mechanism to integrate the low-income wealth group because formal employment opportunities require higher attainment of education levels. Also, the provision of higher returns labour opportunities for the poor in agricultural farm holdings of the middle and high-income wealth groups seems unforthcoming due to unwillingness to pay commensurate wages for unskilled yet essential labour, leading to wide income inequalities between the poor and the non-poor. As for credit markets, Western Kenya farmers have very low access to financial resources where loans and lending are confined to village savings and lending associations within farmer groups and a few small and medium micro-finance local institutions. From the focus group discussions and key informant interviews, it was however gathered that active borrowing and lending transpired in terms of farm inputs (seeds and fertilizers) between farmers and some agricultural development agencies such as OneAcreFund (OAF) who offer such services on credit but claim a certain percentage of the harvest accruals.

4.1.3.6 Summary of Outcomes

In terms of income diversity, a majority of the study respondents generally relied on on-farm incomes compared to off-farm or non-farm incomes sources. Malakisi division had the highest income earning by percentage of the total from all of the income categories i.e. on-farm, off-farm and non-farm income sources compared to Sirisia and Bumula divisions. This scenario was mainly attributed to the higher agro-ecological potential of this region in terms of rainfall reliability and soil fertility and partly due to higher assets ownership (land) and skilled labour (higher attainment of education levels) that accrue higher returns to both skilled and unskilled wage labour across the wealth groups. In terms of poverty and income distribution, there are very wide disparities (income inequalities) between the low-income, middle and the high-income wealth groups. These differences are also attributed to the high incidences of differential asset ownership and access to natural and human capitals between the poor, less poor and the non-poor. A scenario that renders the middle income and high income earners capable of diversifying

better into off-farm and non-farm activities compared to the low income earners who own very small pieces of lands and lack the skills to diversify away from dependence on on-farm income and low returns seasonal off-farm wage labour. As a result, the low income wealth group is more vulnerable to environmental (droughts, pests and diseases and flooding) and economic shocks (fluctuations in relative prices of food crops) compared to the middle and high income earners. Asset building especially on land and human resources through investment in social capital is seen as the institutional arrangement to counteract poverty and food insecurity in Western Kenya as envisioned by KACP. Individual farmers within the farmer groups benefit from the land tenure arrangements under private ownership, even though based on customary inheritance, which is a prerequisite partnership and membership registration criterion by ViA for SALMs implementation. Land ownership is based on paternal inheritance with women culturally having less 'say' on cash crops (sugarcane, tobacco and coffee) land-use decisions but take charge of subsistence food crops decisions. Women farmer groups were reported to have had a huge impact on SALMs implementation at the community as well as the household level thereby elevating their social status in terms of decision-making alongside men.

4.2 Consequences of SALMs adoption on the livelihoods of farmers in the KACP area

Adoption concerns itself with the extent and patterns of technology uptake by adopters. For KACP, mapping out the extent and patterns of SALMs uptake is vital in informing the project implementation in the long run as well as in the overall realization of its goals. From the onset, KACP affirmed that the projected real benefits of its carbon sequestration initiative were progressively improved soil fertility; resulting in increased crop yields, increased food security, greater market access for farm produce and enhanced climate resilience by farmers and communities in Western Kenya.

In line with this, this section seeks to map out the reported consequences of SALMs adoption on farmers' livelihoods. It will firstly examine briefly the various SALM technologies being practiced by farmers and as envisaged in KACP. Secondly, it will discuss the study sample adoption rates and patterns across the three project regions and within/between wealth groups. Thereafter, it will present SALMs adoption in light of the diversified livelihood strategies, assets mobilization and building, the attainment of relatively higher incomes (compared to reportedly lower returns in the past), improved soil fertility, increased yields and the subsequent food security attainment. It will seek to elaborate on the potential decreased vulnerability to poverty and environmental shocks and stresses (climate change) on farmers' livelihoods as well as a generally reported improved environmental sustainability. Lastly, it point out the study's limitations in the accreditation of SALM adoption to the apparent livelihoods consequences.

4.2.1 An overview of the SALM practices

KACP fosters six main SALM practices in Western Kenya namely: i) soil nutrient management ii) agronomic cropping practices iii) tillage and residue management iv) soil and water management v) integrated pest management and vi) integrated livestock management. Below are brief descriptions of what each of the agricultural technologies entail in practice.

1. ***Soil nutrient management-*** This refers to practices that conserve soil moisture and improve soil fertility e.g. mulching soil surfaces using crop residues, improved fallow, fertilizer use efficiency (manure management) and composting. These practices are important because most KACP regions experience unreliable rainfall amounts and soil infertility; hence there is need to

conserve moisture and increase SOC (humus). Fertilizer management through reduced use of inorganic fertilizers and intensified compost use cuts costs of on-farm production, while maintaining high yield levels.

Figure 6: ***Crop residues from maize and beans and animal waste.*** **By:** ***Author, 2014.***

2. ***Agronomic practices*****-** This involves a range of sustainable agricultural practices that largely improve soil fertility (nutrient exchange), increase crop production and consequently enhance environmental sustainability. Good examples of agronomic practices include: i) *Use of cover crops*- ViA encouraged planting of cover crops and even provided some farmer groups with a variety of cover crops seeds e.g. pigeon peas (njahe); ii) *Intercropping*- Integration of more than one type of crop in a parcel of land improves production, enhances nutrient exchange and expands households' nutritional uptake; iii) *Contour farming/strip cropping*- Controls soil erosion and maximizes run-off water on sloppy farm lands; iv) *Crop rotation*- Planting of different crops on sub-divisions of cropland in an alternating version seasonally; e.g. use of field IDs, introduced by KACP, helps farmers partition their farms in ridges hence eventually benefits cropland from nutrient exchange as well as pest control; v) *Improved crop varieties*- Use of improved seeds e.g. KACPs 'germ-plasm' maize seeds from a multinational company called Syngenta; these seeds are reportedly short-season, early maturing, drought and pest resistant that do well in moderately moist soils; vi) *Agroforestry*- Integration of trees and crops on the same farm unit. Farmers reported extensive use of woody perennials such as Grevalia robusta,

Markhamia lutea, Calliandra, Cordia africana, Sesbania sesban and others; which are economically and environmentally beneficial for many as a source of timber, firewood and fodder crop (fodder banks) for livestock.

Figure 7: ***Woody perennials (Grevalia robusta) and napier grass for fodder on farm ridges.*** **By:** ***Author, 2014.***

Figure 8: ***Farmers in Bumula division, Ng'oli village, discussing use of cover crops.*** **By:** ***Author, 2014.***

3. ***Tillage and residue management-*** This refers to conservation tillage or minimum tillage (ploughing only when necessary e.g. during planting only) and leaving weeded or post-harvest plant residues on the soil surface to reduce soil disturbance to a bare minimum. A good example of residue management that farmers in the KACP area have extensively embraced in is called 'trashlines'- the strategic heaping of post-harvest maize stalks and beans residues along contours or between the next season crop lines instead of burning them as traditionally done in the past. Plant residues managed as trashlines mainly assist in curbing soil erosion and partly assist in composting to enhance SOC for improved soil fertility through nutrient exchange intensification, hence boosting agricultural productivity.

Figure 9: ***Trashlines of maize stalks residue in Bumula.*** **By:** ***Author, 2014.***

4. ***Soil and water management;*** comprise of practices that prevent and reduce amount of soil lost through erosion as well as related water use efficiency by minimizing losses of water from evaporation and run-off. Farmers in the KACP area reported that they dig 'diversion ditches' and erect terraces on farm slopes to reduce erosion from run-off e.g. when asked how they manage soil and water, one farmer from Bumula during the FGD said, "*tulichimba mitaro za maji"* (we dug water spillway trenches). Others reported the use of planting basins and pits (planting crops such as bananas in dug out pits to capture run-off and improve longer soil water infiltration).

Figure 10: ***Planting basins or pits containing banana seedlings in Malakisi.*** **By:** ***Author, 2014.***

5. ***Integrated pest management-*** This refers to the use of natural and cultural control of pests to prevent and suppress pests as well as minimize the use of commercial pesticides. For example, farmers in the study area reported that KACP distributed 'desmodium' seeds to farmer groups and rigorously promoted the use of 'desmodium species' to stifle invasive weeds such as the 'striker weed' which had over the recent past extensively chocked food crops especially maize. Integrated pest control reportedly increased farm productivity by reducing crop damage, promoting healthier crops and increasing cost-effectiveness.

6. ***Integrated livestock management-*** This involves the promotion of mixed farming where apart from crop farming, farmers are encouraged by KACP to also invest in sustainable livestock keeping. This means herd management by rearing of a few animals proportionate to farm size (to discourage overstocking) and using improved livestock feeding practices. It also emphasizes long-term livestock health monitoring, sustainable breeding and manure collection.

Figure 11: ***Improved livestock pens and feeding for cattle zero grazing in Bumula and Sirisia divisions*** **By:** ***Author, 2014.***

4.2.2 SALMs Adoption Levels and Patterns

4.2.2.1 Adoption Levels/Rates by Locations

Adoption can be measured in the study as the share of agents that take up different SALM practices and at what rate they utilize them in practice on their land. An approximation of adoption levels of SALMs by the farmers in Bungoma, from personal communication by *KACP Zonal Officer, Bumula,* is reportedly 65% with agroforestry as the most adopted followed closely by soil nutrient management and tillage and residue management (composting and use of trashlines). From the study results, this claim seems to be relatively true to what we find; the general total adoption rate is approximately 54% (*see Table 14*). On one hand, the adoption rates of agroforestry, soil nutrient management, tillage/residue management and soil and water management are considerably higher than average at approximately 69%, 68%, 64% and 63% respectively. On the other hand, the adoption rates of integrated pest management and improved livestock management are considerably lower than average at 20% and 39% (*see Table 14*) respectively. Adoption of agricultural technologies depends on a range of social, cultural and economic factors within assets and institutions especially asset profiles, income levels, awareness level as well as the characteristics of the technology itself (Pannell et al. 2006).

Table 14: ***SALMs adoption levels by locations, Bungoma, Kenya, 2014***

		Adoption levels by location					
Subcounty of Household/ SALMs		Bumula (N41)	Malakisi (N20)	Sirisia (N19)	Frequency	General Adoption Rates %	Level of significance R^2 & (p-value)
Tillage residue management	No	37%	15%	58%	29	36.2	0.1005 (0.0035*)
	Yes	63%	85%	42%	51	63.8	
Soil nutrient management	No	39%	15%	37%	26	32.5	0.0420 (0.1395)
	Yes	61%	85%	63%	54	67.5	
Soil and water management	No	49%	15%	37%	30	37.5	0.0657 (0.0285*)
	Yes	51%	85%	63%	50	62.5	
Agroforestry	No	39%	10%	37%	25	31.2	0.0451 (0.1147)
	Yes	61%	90%	63%	55	68.8	
Improved livestock management	No	66%	40%	74%	49	61.2	0.0471 (0.1008)
	Yes	34%	60%	26%	31	38.8	
Integrated pest management	No	88%	70%	74%	64	80.0	0.0498 (0.0842)
	Yes	12%	30%	26%	16	20.0	
Total Adoption Levels		**47%**	**72.5%**	**47%**	**80**	**53.6%**	**0.0022 (0.5516)**

Regionally, the average adoption rate of SALMs in Malakisi division was significantly higher (72.5%) compared to Bumula and Sirisia divisions (47% each). The average adoption rates of tillage residue management and soil and water management are significantly different between the locations (p-values of 0.0035 and 0.0285). The rest of the SALMs are however not significantly different between locations including the average total adoption rate (p-value of 0.5516) (*see Table 14*). These insignificant trends in differences of some SALMs adoption rates between the locations maybe attributed to variation in triability of the technologies themselves rendering the less complex more equally adopted across the locations than the complex ones. Malakisi division scored higher in adoption of all SALM practices and most especially the resource intensive and technical technologies i.e. livestock and pest management (*see Table 14*). This may be attributed to Malakisi division's generally higher scores on asset levels and subsequent wider commands on sets of livelihood diversification strategies compared to Sirisia and Bumula divisions. Malakisi division has a higher human capital level characterized by higher

education levels and more skilled labour pools (*see Section 4.1.1.4*) suggesting that they have a significant relative advantage technically (skill-wise) and economically over Sirisia and Bumula divisions in terms of SALMs adoption. It has often been concluded that beneficial innovations tend to be adopted more by landholders with higher levels of education as a catalyzing adoption mechanism based on faster acquisition of knowledge and awareness (Pannell et al. 2006). Contrary to this, though, the study findings do not show statistical significance (p-value of 0.7681) between average adoption rates and years of schooling (*see Table 15 below*).

Table 15: ***Total adoption rates against socio-economic variables, Bungoma, Kenya, 2014***

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Subcounty	2	2	0,500686	0,9502	0,3917
AgeRspndt	1	1	0,033181	0,1259	0,7238
GenderRspnt	1	1	1,110532	4,2151	0,0439*
HH_Total	1	1	0,374930	1,4231	0,2370
KACP_Membershp	1	1	12,864113	48,8262	<,0001*
Yrs_School	1	1	0,023086	0,0876	0,7681
GroupBelonging	1	1	1,777303	6,7458	0,0115*
LandOwned	1	1	0,034750	0,1319	0,7176
TotalIncome	1	1	0,004331	0,0164	0,8984

RSquare	*0,652641*	***Mean Square***	***F Ratio***
RSquare Adj	*0,601559*	*3,36614*	*12,7763*
Root Mean Square Error	*0,513291*	*0,26347*	***Prob > F***
Observations (or Sum Wgts)	*79*		*<,0001**

Land access and ownership in Western Kenyan farmers' livelihoods is also a significant factor that often determines the claiming or commanding of other important assets such as skilled labour (improved education attainments), higher income earnings and strong social capital (social ties and networks based on unity and reciprocity) and has often, but not always been related to new technologies adoption. Adoption in itself is a complex process that essentially requires a pool of skills, broad knowledge and appropriate assets, both individually and collectively, mediated by institutional contexts to establish a favourable or unfavourable take-up platform for farmers. In Western Kenya, livelihoods activities and outcomes vary according to farmers' land access and ownership which differed in different respects between and within the project regions. However, the study figures show that location (regions), land ownership and other socio-economic variables (except gender and social capital), are not statistically significant

to the average rate of SALMs adoptions by farmers (*see Table 15 above*). This may be attributed to general drawbacks and limitations of the data (*as discussed in section 4.2.8*).

In terms of technology characteristics, farmers adopt new agricultural practices when they perceive that these practices will advance their livelihoods goals particularly those with a high relative economic advantage (profit-wise) and are readily trialable with observable results (Pannel, Marshall et al. 2006). However, adoption is often not an instant decision but a continuous process that occurs in a gradual stepwise manner or sometimes ends in partial adoption. Most SALM practices in Western Kenya were generally embraced and accepted at the onset by farmers because KACP vigorously promoted its goals and objectives of facilitating farmers' capability of attaining higher agricultural yields and incomes, securing food security and accruing carbon revenue. KACPs initial and progressive campaigns greatly influenced the acceptance of the SALMs 'package' by farmer groups implying the relative economic advantage predisposition of individual farmers. It subsequently found out later through project monitoring and evaluation that the rate of implementation of SALM practices depended on the trialability (the simplicity or complexity of implementation) of particular practices (*as captured in the discussion below*)

4.2.2.2 Adoption Patterns by Wealth Groups

There are generally significant differences within the three wealth groups identified in the study i.e. the poor (low-income), the less poor (medium-income) and the non-poor (high-income). These disparities in wealth groups may cause differential adoption patterns (variance in use or implementations) of SALMs as adoption depends on farmers' asset profiles and levels as well as particular characteristics of the technologies. Conservation agriculture studies suggest that technologies which are perceived economically beneficial (profitable), technically simpler, readily trialable, require few assets to implement, have a lower risk profile and are less costly, have higher chances of being adopted by small scale farmers. On the other hand, technologies that are perceived 'far-fetched' profit-wise, not readily trialable (technically complex), require more assets to effect (more costly) and have a higher risk profile, have less chances of being taken up by small scale farmers. In Western Kenya for example, the study found out that tillage and residue management, soil nutrient management, soil and water management as well as agroforestry (first set of SALMs) had been averagely adopted fairly well (67%) across all wealth

groups (*see Table 16*) compared to improved livestock management and integrated pest management (second set of SALMs) which had been averagely adopted poorly (31%). A logical explanation for this follows that, the former group of SALMs that pertain to residue, nutrient, soil and water management require low investment of assets (economic and human) to implement with short-term observable economic benefits (higher on-farm yields and subsequent proceeds from earning more income). Conversely, the latter set of SALMs that pertain to livestock and pest management essentially require higher investments technically and economically and possess long-term observable economic benefits (e.g. proceeds from chicken, dairy, beef, mutton or bacon farming) hence are generally less adopted, especially by the low-income wealth group.

Table 16: ***SALMs adoptions pattern across wealth groups, Bungoma, Kenya, 2014***

		Adoption Pattern by wealth groups							
Wealth Groups/ SALMs		Low-income (N15) Average SALMS adoption rate		Middle-income (N45) Average SALM adoption rate		High-income (N20) Average SALM adoption rate		General Adoption Rate By SALM sets	Level of Significance R^2 (p-value)
Tillage residue management	No	40%	57%	42%	61%	20%	83%	1st Set SALMS **67%**	0.0374 (0.2079)
	Yes	60%		58%		80%			
Soil nutrient management	No	47%		36%		15%			0.0353 (0.2343)
	Yes	53%		64%		85%			
Soil and water management	No	47%		44%		15%			0.0519 (0.0853)
	Yes	53%		56%		85%			
Agroforestry	No	40%		33%		20%			0.0367 (0.2162)
	Yes	60%		67%		80%			
Improved livestock management	No	73%	14%	67%	25%	40%	53%	2nd Set SALMS **31%**	0.0368 (0.2154)
	Yes	27%		33%		60%			
Integrated pest management	No	100%		84%		55%			0.0905 (0.0065*)
	Yes	0%		16%		45%			
Total Adoption Level		42%		49%		73%			0.0325 (0.0792)

A closer scrutiny into the study figures pertaining adoption patterns within the wealth groups reveals that the first set of SALMs (residue, nutrient, soil and water management and agroforestry) have been adopted more by the high income wealth group on an average adoption rate of 83% in comparison to the average adoption rates by the middle and low-income wealth groups at 61% and 57% respectively. As for the second set of SALMs (improved livestock management and integrated pest management), the high-income wealth group again scores a significantly higher average adoption rate of 53% compared to the middle and low-income wealth groups that scored 25% and 14% respectively (*see Table 16*). The adoption rate of integrated pest management stood out as the most significantly different across the wealth groups (p-value 0.0065*) partly due to its applicability limitations (not readily triable) hence the high income wealth group could at least adopt it more while the low income could not at all. The adoption rate of the rest of the SALMs were however not significantly different across the wealth groups possibly because they are relatively applicable (readily trialable) hence equally adoptable generally by all wealth groups.

From the comparison of adoption rates across wealth groups above, it is possible to infer that generally, the high income wealth group are strategically dispositioned in terms of adopting fairly well (73%) both the 'less-investment and less-technical' SALMs (the first set) as well as the 'more-investment and more-technical' SALMs (the second set) because of their stronger claims and commands of assets (land, labour, finance and social networks). On the other hand, the middle income and low income wealth groups are fairly dispositioned in terms of general adoption rates (49% and 42% respectively), but they both tend to adopt the first set of SALMs more than the second set of SALMs. The middle income wealth group has an access and ownership of assets that enables them to implement the 'less-investment and less-technical' SALMs substantially more than the 'more-investment and more-technical' SALMs. The low income wealth group has a significantly lower access and ownership of assets compared to the high and middle income groups hence substantially adopt the first set of SALMs that are 'less-investment and less-technical', but markedly fall short of adopting the second set of SALMs that are 'more-investment and more-technical' oriented.

4.2.2.3 Social Capital, Adoption and Non-Adoption of SALMs

As discussed earlier in the study (*see Section 4.1.1.2*), the large share of KACP farmers' membership in self-help groups signified their predisposition in optimizing maximization of affiliation opportunities by belonging to more than one local CBO. Many development agencies including ViA give SHGs a higher priority in terms of partnership as it includes more than one social group of men, women, and youth. Belonging to a community group enhances the individual farmer's inclusion in most agricultural development and extension services (producer environments) from where knowledge is generated, assessed and exchanged thereby enhancing joint labour and social capital in collectively embracing sustainable and adaptive agricultural livelihoods such as through adoption of SALMs. Farmers do not only gain new knowledge but also interactively share good agronomy values and norms through communal integration of traditional indigenous knowledge with SALM practices (Vedeld & Krogh 2003). Therefore, the institutionalization of SALMs in Western Kenya by KACP through member farmers is seen as a communal social process rather than individual farmer decisions towards attainment of collectively secure livelihoods through higher yield levels and incomes, sustainable resource utilization, faster adoption rates of new technologies as well as acquisition of a sense of belonging and prestige.

A sense of belonging and prestige is acquired when farmers' interaction is based on enjoyment of equal social statuses in terms of agricultural production prowess reflected in high farm yields and income accruals for efficient and diversified rural livelihoods. For KACP, this is centered on functioning social networks (social capital) that enhance reciprocity and collective efforts geared towards achievement of better standards of living as a common goal through SALMs. The adoption of SALMs in Western Kenya therefore may be partly attributed to the social networks that KACP has facilitated since its inception with the sole goal of improving agricultural production, bettering on-farm income accruals and diversifying livelihoods towards non-farm activities. However, as the study found out, there were a substantial number of farmers who did not adopt SALMs. Non-adoption of SALMs in Western Kenya partly appears to stem from individual farmer's personal choices not to be part of Common Interest Groups (CIGs). A likely explanation generally for most farmers that had partially or not adopted SALMs completely, was poverty. Poor farmers lacked community awareness and access as well as sufficient assets (land,

labour and community groups' membership) to meaningfully engage in KACPs facilitation of SALMs implementation. Also, from the key informant interviews, it was reported that many of the non-adopters seem to have obtained external information through local social networks which reportedly insinuated that SALMs promotion by KACP were a replica of Conservation Agriculture (CA) practices that the Ministry of Agriculture had been promoting over few decades back. This appears to be a 'dis-adoption' scenario as Pannell et' al (2006) put it; that if external information or local trial results of new technologies are not sufficiently encouraging economically (i.e. there is a chance that a farmer's production goals will not be advanced by the innovation), then the technology (ies) will be rejected. Further, if it was initially adopted but a newer or perceived superior replacement or practice becomes available (a scenario the study gathered as having took place when another American development agency called One Acre Fund (OAF) reportedly started operating in Western Kenya a few years back) then SALMs implementation may have partially and progressively been scaled down and eventually discontinued by the non-adopters.

4.2.2.4 Summary on Adoption

Generally, the adoption rate of the first set of SALMs that the study considered 'less technical-less investment' (residue, tillage, water and agroforestry management) type was significantly higher than the second set of SALMs that were considered 'more technical-higher investment' (livestock and pest management) type. This was mainly attributed to the economic advantage relativity (the need to attain higher income) and triability (simplicity or complexity of operationalization) of the SALM practices and partly, to the farmers' predisposition in terms of asset profiles and ownership which considerably determined the degree of adoption levels. Communally, adoption here is not only seen as an individual process related to assets and personal abilities, but also a collective social process based on common goals to secure livelihoods through higher yield levels and incomes, sustainable resource utilization, as well as acquisition of a sense of belonging and prestige. Regionally, Malakisi division reported wider asset profiles and higher asset levels hence higher adoption rates compared to Sirisia and Bumula divisions even though the study findings show weak statistical significance of the differential adoption rates by location. In terms of adoption patterns across the wealth groups, findings show that the high income wealth group scores significantly higher adoption rates than the middle and

low income wealth groups owing to their stronger claims and commands on assets (land, labour, finance and social networks). However, the study results here also do not show strong statistical significances between average adoption rates and the socio-economic variables (assets) owing to data limitations. Also, numerous cases of non-adoption were reported based on lack of assets for the low income earners and personal choices by the middle and high income earners who were affiliated to other agricultural development agencies similar to ViA such as OAF.

4.2.3 Improved Soil Fertility, Farm Yields and Food Security

4.2.3.1 Soil fertility improvement and conservation

Soil fertility improvement is a perceived and non-verifiable outcome from the study's findings on farmers' reported implementation of soil related SALM management practices and the subsequent increases in farm yields. KACP as a project is targeting the Western Kenya region because of its agricultural potential given sustainable management of agricultural soils. However, these soils are prone to degradation from both traditional practices and climate change. Therefore, several SALM practices (*see section 4.2.*1) were geared towards reclamation of degraded soils through fertility enhancement and improved water management.

Under soil nutrient management, approximately 68% of the sample respondents had adopted mulching, composting and improved fertilizer use. These practices reduce soil erosion, increase soil organic matter and enhance mineralization hence improving the quantity and quality of soil humus. Around 32% of the respondents however had not adopted any of these practices owing to lack of incentives, commitment and responsibility to implement them. Approximately 64% of them reported to have adopted tillage and residue management by using trash-lines and practicing minimum conservation tillage which leaves soils undisturbed thereby increasing soil carbon in the upper layers while around 36% had not adopted it. As for soil and water management, approximately 63% of the respondents reported that they implement water use efficiency by planting cover crops, using terraces and ploughing along the contours on slopy farmlands to control soil erosion. Around 37% of them however reported to have not adopted soil moisture conservation due to labour constraints and inadequate knowledge and skills of implementing the recommended soil-related SALM practices.

4.2.3.2 Increased Yields and Food Security Attainment

One of the major objectives of KACP is to progressively increase food security among the rural poor farmers of Western Kenya by boosting farm yields. A measure of food security increases in the study area was the change in reported yields levels and the number of food-secure months per year. This was based on the reported number of bags of maize and beans (staple food crops) as well as the number of food-secure months per year that the farmers experienced before and after joining KACP or any other agricultural development agency for the non-KACP members. Food security attainment may therefore be said to be a perceived and limitedly verifiable KACP outcome in terms of substantiation. However, based on the study findings, on-farm yield levels have considerably increased and farmers have diversified food crops farming (planting other crops besides the staples-maize and beans) thereby broadening their nutritional dietary supplements. Consequently, the study found out that majority of the farmers interviewed concur that their farm yields had substantially increased since they joined KACP and practiced SALM activities on their parcels of land.

From the key informant interviews, KACP staff on the ground in the project focal areas reported that initially farmers had only one or rarely two planting seasons, but presently based on KACPs interventions, farmers now manage three crops seasons per year; maize (January to May), beans (June to September) and vegetable and groundnuts (October to December) _pers. Comm. (*Zonal Officer, Sirisia and Malakisi focal areas, Oct. 2014*). They agreed that from their work experiences and engagements in the field interacting with KACP farmers, they can attest that food security has substantially increased. Other good examples of improved food security indicators that they cited apart from increased annual planting seasons was the farmers' reported number of meals per day and the number of food secure months per year. They reported that initially, before or at the onset of KACP, farmers used to have two meals a day but these days they have at least three meals a day and that there has been an increase in the number of months that the farmers have food; "*Some are sufficient for only 5months, others 8 months and other 10-12 months"* _pers. Comm. (*KACP Monitoring and Evaluation Officer, October 2014*).

Approximately 91% of the KACP members' respondents reported increased agricultural yields since joining KACP. They attributed this increment in harvests to the adoption of soil and water-related SALM activities which have boosted soil fertility and imparted to them 'climate-smart'

knowledge and technologies in a changing climate. Around 9% of the sample respondents however, reported that their agricultural yields had not increased. They cited the lack of sufficient inputs coupled with environmental shocks such as droughts, soil erosion and floods as the limitations to attainment of higher crop yields. As an indicator of food security and sufficiency, the study mapped out the approximate average number of bags of the staple food crops (maize and beans) that the farmers yielded per hectare before and after KACP inception *(see Table 17 below).*

Table 18: ***Maize and beans yields per hectare and food-secure months per year before and after KACP inception, Bungoma, Kenya, 2014***

No. of bags of Staple food crops/ No. of Food-secure months	N	Mean	Std. Error of Mean	Change in Mean	Level of Significance R^2 (p-value)
Maize per hectare before KACP/AoAP inception	80	4	.325	9	0.1319 (0.0010*)
Maize per hectare after KACP/AoAP inception	80	13	.796		
Beans per hectare before KACP/AoAP inception	80	1	.087	2	0.1078 (0.0031*)
Beans per hectare after KACP/AoAP inception	80	3	.324		
Months of sufficient food for family before KACP/AoAP inception	80	5	.312	4	0.0940 (0.0060*)
Months of sufficient food for family after KACP/AoAP inception	80	9	.318		
Valid N (listwise)	80				

The average number of bags of maize was reportedly 4 bags per hectare prior to KACP inception but after, it is said to have increased to approximately 13 bags per hectare (*see Table 17*). As for the beans, prior to KACP project, the farmers reported that they harvested an average of one bag per hectare but after KACP promoted SALM practices, the number of bags increased to approximately 3 bags per hectare. This means that the reported maize and beans yield markedly increased by 9 bags and 2 bags respectively; quite high percentages in yield changes (by 125% and 200% respectively) and shows statistical significances based on the reported figures (*see*

Table 17). It appears that the reported figures may be unsubstantiated approximations hence might have been slightly exaggerated by the farmers because it is reported by KACP staff that their agricultural input-output record keeping is very poor. Also, the reported number of months that the households felt food-secure prior to KACP project was approximately 5 months on average but reportedly increased to averagely 9 months after KACP's intervention; quite a reasonable change that shows a strong statistical significance (*see Table 17*) but lacking in substantiation as they are basically unverifiable estimations. However, the study assumed that these reported changes in yields and number of food-secure months could be regarded as proxies for a considerable boost in nutrition as well as for a possible increase in food security level. The farmers' associated these changes to significantly more diversified income sources that enabled them to afford other tradable nutritional supplements for the household from the local markets.

Additionally, the study gathered from the focus group discussions that the farmers perceived that their adoption of SALMs had enabled them to diversify the kinds of food crops they usually plant. They reported that the KACP had promoted food crops intensification and thereby enabling them to cultivate other crops other than maize, beans and the common cash crops (sugarcane, tobacco and coffee). Notable examples of new food crops were: improved green bananas species, pigeon peas, soya beans as well as traditional ones such as cowpeas, sweet potatoes, cassavas, millet and sorghum. Such crop diversity is said to have considerably expanded farmers' nutritional choices and increased their dietary supplements for healthier livelihoods. Generally still, the study experienced a limitation in establishing a concrete measure of yield changes and food security increase owing to the lack of a baseline data or reference project documentation to substantiate the reported changes in maize and beans and the subsequent changes in food-secure months.

4.2.3.3 Summary on Improved Soil Fertility, Farm Yields and Food Security

Generally, the improvement of soil fertility, farm yields and food security level are perceived outcomes and only proxies based on the study's reported findings. The study lacks baseline project documentations to verify the quantification of the changes in soil fertility, yield increases and the subsequent attainment of a substantially improved food security level. In terms of soil fertility improvement, many of the study respondents reported that since they joined KACP, they have adopted residue, water and soil nutrient management practices (trash-lines, mulching,

composting and improved fertilizer use) that have significantly boosted the productivity of their lands (soil fertility). Substantial yield increases of the staple food crops of maize and beans were also unanimously reported by many farmers; a change they attribute to increased soil fertility due to their efforts towards implementation of SALMs. Increased food crops diversification apart from the staples had also reportedly impacted positively on household nutritional dietary supplements. As for food security improvement, the study found out that the number of food secure months per year had increased by 5 months. Statistical correlation between adoption of SALM and changes in yields of staple food crops as well as food-secure months showed strong statistical significances.

4.2.4 SALMs and Improved Living Standards

Improved living standards in the study area are closely and substantially linked to improved incomes for the farmers generally stemming from increased livelihood diversification activities from on-farm to off-farm and non-farm activities. Prior to KACP, most food crops in the project area were cultivated solely for subsistence but nowadays, through SALMs, the yields have increased and the surplus produce is sold to earn money by engaging in rural trade and local farm produce market structures. A linear regression model of SALM adoption rates against the farmers' annual average agricultural incomes from maize and beans show statistical significances (*see Table 19 below*).

Table 19: ***SALM adoption rates against agricultural incomes, Bungoma, Kenya, 2014***

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	0,7469694	0,180152	4,15	<,0001*
MaizeIncome	1,8181e-5	9,132e-6	1,99	0,0501
BeanIncome	1,8619e-5	1,035e-5	1,80	0,0759

RSquare	*0,144748*	***Mean Square***	***F Ratio***
RSquare Adj	*0,122242*	*3,73286*	*6,4314*
Root Mean Square Error	*0,761849*	*0,58041*	***Prob > F***
Observations (or Sum Wgts)	*79*		*0,0026**

It is possible to infer that SALM adoption may have an indirect 'knock-on' effect whereby increased on-farm yields (maize and beans) enables good SALM implementers to diversify their activities from on-farm to off-farm and non-farm activities that increase the households income earning in the long-run. However, the almost unanimous attestations from KACP farmers that their adoption of SALM had substantially impacted on their income levels cannot be fully substantiated by the study findings based on data limitations. It was reported in the key informant interviews that farmers' estimation of farm yields often discounted seasonal mid-harvests of green maize, beans and other food crops resulting in underestimation of actual production and consumption figures.

Regionally, SALM practices reportedly impacted more on farm yields in Malakisi region than in Bumula and Sirisia regions where also rainfall patterns are more erratic, lower and the soils more infertile. The latter project areas require more intensified SALM practices for them to have a substantial productivity impact on farm yields and consequently increase on-farm income. The agro-ecological context of Malakisi region had a more favourable climatic condition (substantial rainfall and fertile volcanic soils) as compared to Bumula and Sirisia divisions. The higher average on-farm and off-farm incomes for Malakisi division (*see section 4.1.3.2*) compared to Sirisia and Bumula can be attributed to the regions' higher agricultural potential for coffee and tobacco cash crops farming. However, KACPs project design for SALM implementation as a first 'climate smart' agricultural carbon project in Africa might have been poorly executed because 'blueprint project approaches' across agro-ecological zones tend to turn out unsuccessful in realizing set project goals.

From the FGDs and key informant interviews, most of the study respondents reported that living standards had substantially improved. A basic example is the improvement of housing units by some individual KACP farmers. It was reported that in the recent past before KACP intervention, many houses were mostly grass-thatched and mud-walled but nowadays, more households own better shelters with iron sheets roofs and bricked walls than before.

Figure 12: ***Improved housing unit in Bumula made of bricks.*** **Photo:** ***Author, 2014***

KACP strove to facilitate farmers' livelihoods diversification activities to feature a shift from on-farm income dependence (based on food crops and cash crops) to investment and pursuit of environmental incomes. For example, many of the study respondents practice agroforestry, which KACP has continually endorsed over the years within the project areas. These farmers benefit from selling off mature trees as poles and timber for building both at village level and far off in townships. Occasionally, they discriminately cut down mature trees and sell them off as fuel-wood to schools and other local institutions. In other instances, it was reported that some households offered timber and poles to schools in exchange for exemption from paying school fees hence this was a form of reciprocal modern barter exchange.

To sum up, SALM adoption by the farmers have reportedly enabled them to expand their income diversity by enhancing their livelihood strategies against poverty and environmental shocks such as droughts and floods brought about by a changing climate. Regionally, Malakisi division has consistently scored higher in terms of livelihoods activities diversification and expanded income sources and earning compared to Bumula and Sirisia divisions. Improved livelihoods based on a more diversified livelihood portfolio may have been a distinctive factor in singling out Malakisi division as more resilient and less vulnerable to poverty and climate change; an attribution to better profiles, claims and commands on asset portfolios. In terms of wealth groups, the high income group commanded stronger asset portfolios for improved livelihoods through increased

diversification compared to the middle and low income wealth groups. The low income wealth group lacked the necessary asset profiles, especially land and skilled labour, which could considerably enable them to diversify their livelihoods activities and lift them from overdependence on miniscule on-farm production hence achieving a marginal level of livelihoods improvement generally.

4.2.5 SALMs and Improved Social Relations

KACP through SALMs seems to have improved the social fabric of Western Kenyan farmers' livelihoods in terms of social capital. As discussed in the FGDs, the requirement that individual farmers had to be members of farmer groups to be enrolled in KACP greatly influenced local farmers' unity and common commitment towards collective livelihoods improvement goal. The enrolment of self-help groups, women groups, youth groups and other minority groups positively impacted on farmers' inter-relationships on the community level as well as at the household level. From the key informant interviews, it was reported that gender participation in decision-making and community development has significantly improved. Approximately 75% of KACP participants are women and that they are reportedly better SALM adopters than men because they have taken up the role of SALM implementers at the household level more than men have done _pers. Comm. (*Zonal Officer Bumula focal area*). Women have been empowered to take up decision-making roles in a lot of farming activities as reported by another KACP staff who said, *"Mamas are on the frontline these days. At the moment it is the mamas who are doing it"*-(deciding on land use)'_pers. Comm. (*Zonal Officer Sirisia and Malakisi focal areas*). However, the key informants and many FGD participants reiterated that men still take the bigger role in household decisions even though women roles at consulting on the same decisions has been elevated. Also, women are said to have acquired better land access and land-use decisions nowadays on the farm-level as to which types of crops to plant and where in the farm SALM practices require appropriate application.

From the Focus Group Discussions, it was reported that the collective voice of farmers has been elevated because of collective SALM use. For instance, prior to KACP involvement, most farmers reportedly used to do farming as individuals separate from the rest of their neighbours but nowadays, through KACP engagement and facilitation, farmers have come together and formed farmer groups, Common Interest Groups (CIGs) and Community Based Organizations

(CBOs). Through such farmer social groups, exchange of goods and services and communal labour may have been enabled resulting in both reciprocal support and a sense of security and belonging for most KACP farmers at the community level (Vedeld and Krogh, 2003). Further, it is reported that these social groups have enabled farmers to interact and form local village savings and lending association (VSLAs) structures that have apparently enhanced farmers' involvement in agribusiness, collective marketing and promoted access to credit facilities. Therefore, the reportedly commendable levels of adoption of SALMs may have strengthened community networks and consequently improved efforts towards income growth individually and collectively. This scenario in terms of agricultural change and shifts in mode of production for rural livelihoods adaptation (*see Section 4.1.3.*5) can be said to have created a social consolidation effect. Farmers in Western Kenya have significantly built social reciprocity by maintaining control of simple means of production albeit a reportedly creditable level of livelihoods diversification (more off-farm and non-farm activities).

However, the study findings on income distribution (*see Section 4.1.3.*3) reveal that there are also features of income differentiation (*see Section 4.1.3.*5) when we look at the income inequality between the highest income earners (a few entrepreneurial capitalist farmers) and the lowest income earners (a few poor and almost landless farmers; owing to unresolved kin inheritance conflicts that result in considerable land differentiation). These low income earners fall within the 'dis-adopters' category of the study respondents who took up SALMs at the onset but later may have abandoned them due to the intensive nature of implementation. For them, some SALMs were too capital-demanding, based on their weak asset profiles that renders them less resilient to socio-economic and environmental shocks and stresses alike. SALMs therefore may have exacerbated inequality by enabling a few middle income group of farmers and most high income group farmers to diversify better than the low income group thereby creating an income 'rift' between the wealth groups. Such a scenario renders the low income earners vulnerable to poverty and the changing climate resulting in precarious livelihood trajectories based on overdependence on off-farm and marginal on-farm activities; typically toiling as seasonal low-wage casual labourers in the farm holdings of the more well-off and minimally producing only food crops on their small portions of land.

At the household level, it was reported that improved income levels may have positively impacted on the ability of household heads to pay school fees for their children. Although this is neither statistically verifiable nor subject to substantiation by the study due to data collection limitations, some farmers' convincingly reported that their children's school attendance has improved nowadays because the children reportedly attend schools considerably more consistently (decreased absenteeism). It is reported that some farmers have managed to negotiate payment of school fees 'in kind'; i.e. a few farmers reported that they occasionally harvest mature trees (timber and poles from their farms) in exchange for non-payment of school fees in cash _pers. Comm. (*Zonal Officer Bumula focal area*).

4.2.6 SALMs and Decreased Livelihood Vulnerability

Western farmers' reported decreased livelihoods vulnerability in the study areas may be seen on two related fronts. Firstly, there is their reportedly improved livelihood strategies based on progressively diversified agricultural activities that have apparently substantially improved their income diversity in terms of sources and levels (*see Section 4.1.3.*1). This may be inferred as a significant shift from poorer livelihoods (poverty) to considerably less poor conditions. Secondly, their diversified livelihood activities that feature a shift from on-farm activities dependence to off-farm and non-farm activities that may indicate improved adaptation pathways towards more CC resilient livelihoods in the face of climatic shocks and stressors such as droughts and floods. Decreased livelihoods vulnerability in this case is therefore a function of poverty and environmental shocks resilience.

A majority of the study respondents were subsistence farmers and on-farm income is therefore the vital income source of sustaining livelihoods. As such, poverty and climate change do still pose a threat to their livelihood strategies. KACPs incorporation of SALMs involved facilitating the adoption of viable and eco-friendly agricultural production as risk management strategies that are deliberate household mechanisms to maintain a spread of activities for generation of both cash and subsistence incomes. The mean annual agricultural income (on-farm income) comprised of approximately 72% (Kshs. 66,500) of the annual mean total income (approximately Kshs. 130, 000) per household. The mean annual off-farm and non-farm incomes comprised of approximately 17% (Kshs. 22,900) and 28% (Kshs. 36,800) respectively, of the annual mean total income (*see Section 4.1.3.1*). The study findings show that these different shares of

incomes from different sources varied between locations and wealth groups hence also signifying different degrees of resilience and vulnerability regionally and socially. Generally, many farmers depended on on-farm incomes but it is reported that KACP and SALMs have significantly impacted on their diversification towards non-farm income. The reportedly surplus farm produce from increased yields is said to have enabled them to engage in agribusiness besides subsistence farming thereby boosting their livelihoods resilience and apparently decreasing their vulnerability against CC. SALMs implementation may therefore be seen as a climate change coping mechanism for unanticipated environmental stressors such as droughts which are common and seasonally persistent especially in Bumula division among the three project regions. Coping measures are reactive or responsive short-term livelihood strategies to stave off adversity as opposed to adaptation strategies which are long-term continuous processes of changing to livelihood strategies that either enhance existing assets or try to reduce vulnerability and poverty (Ellis 2000).

Following the study's earlier discussion (*see Section 4.1.3.3*), on KACP farmers' income distribution and assets across social groups (wealth groups), SALMs may have had differential impacts on livelihood strategies of different wealth groups of farmers. A notable positive vulnerability-related effect is the reportedly enhanced productivity of their land soils that may have resulted in substantially higher agricultural yields hence subsequently translating to higher income levels and enhanced food security. The reported attainment of higher yields, income levels and food security than in the past may imply enhanced adaptation to climate change, boosted coping mechanism in the wake of environmental adversity and consequently strengthened resilience to poverty and vulnerable livelihood survival strategies. Nevertheless, as far as social groups and improved vulnerability levels are concerned, there appears to be a few instances of increased vulnerability within the low income wealth group. As discussed earlier, adoption of SALMs may have also resulted to social differentiation among the low income factions of Western Kenya farmers. This group seems to have found SALM implementation a daunting task given the adoption practices costs that appeared more capital-demanding amid their precarious circumstances asset-wise.

4.2.7 SALMs and Improved Environmental Sustainability

Sustainability attempts to convey long term continuity in the capacity of a system to reproduce itself or expand over time without depleting its resources (Ellis, 2000). Agriculturally, it may be viewed as any farming system that principally achieves steadier yield productivity over time without adverse impacts on soil fertility. Therefore, a sustainable agricultural system is one that upholds resource conservation within soils, water and other natural environmental resources. In line with this, KACP's third objective envisioned an environmentally conscious agricultural society in Western Kenya whose carbon footprint is reduced to a minimum. As such, SALMs adoption can be said to be a yardstick that may generally indicate a sustainably managed agricultural landscape as well as sound climate-friendly practices. Farmer groups were expected by KACP to embrace 'climate smart' technologies which featured environmental conservation practices ranging from soil, water and crops residue management to livestock, agro-forestry and crops management. Among the outcomes, they envisioned environmental management and sustainability to encompass natural asset building as well as human and financial capital resources enhancement. This scenario has been ascribed to increased crop yields, secured food sufficiency and eventual reduction of greenhouse gases emissions from soils within the project area.

Among the SALM practices, agro-forestry and residue management appear to stand out as the practices that farmers perceived to have improved their environment. In this case, environment from farmers' 'laymen' perception is narrowly confined to their definition of basically the immediate surroundings they interact with everyday comprising of trees, rivers, water points, farmlands, homesteads and air (the surrounding atmosphere). From the FGDs, many respondents pointed out that their agro-forestry implementation efforts had really paid off in terms of maintaining 'fresh air' and substantially 'attracting more rainfall'. Many of them unanimously attributed the considerably more consistent rainfall patterns (the previous three years to the present compared to the past) to their rigorous efforts in tree planting of both indigenous and a few exotic tree species around and within their farm holdings (woody perennials integrated with food crops). They reported to have creditably fostered agro-forestry with engagement and facilitation by KACP which resourcefully provide them with tree seedlings of different indigenous trees such as Grevalia robusta, Markhamia lutea, Croton megalocarpus, Calliandra,

Cordia Africana and Sesbania sesban. Some tree species however, such as the Croton megalocarpus reportedly experienced rejection due to a Luhya traditional taboo; as it is regarded as a 'bad luck omen' to the household often related to sickness and death . As for residue management, it enabled farmers to shift from the traditional burning of plant residues to recycling them as mulch or trash-lines that are left to naturally decompose and be ploughed into the soil or used as composting materials. Many farmers' reported that the shift from burning has 'saved' the environment from 'dirty air' (carbon) that comes from burning thereby rendering their atmosphere cleaner and smoke-free (carbon-free).

Therefore, as far as the intricacies of environmental sustainability vis-à-vis SALM adoption are concerned, it appears that there may be a wide knowledge disconnection between farmers' understanding of their environment, their livelihood activities (SALM practices included) and the larger institutionalization of KACP around poverty and global climate change interaction (*see Section4.3.1*). Given the role of traditional knowledge in environmental sustainability without downplaying its relevance, it is prudent to say that the study did not establish much on it but rather purposely concentrated on investigating farmers' understanding of the importance of SALM implementation on their livelihoods as well as on the ecological balances of nature (e.g. carbon cycle). The study gathered that KACP had strove to simplify the science of GHGs and the changing climate vis-à-vis SALM implementation, into easily understandable everyday interconnectedness of rural peasant livelihoods strategies and the immediate environment i.e. soil protection, water use (including rainwater capture), waste disposal, livestock management, tree planting and conservation etc. For instance, when asked whether they think that since they started adopting SALMs their environment had improved in any way, many respondents pointed out that they were taught by KACP that the more they planted trees, the better their weather patterns will change especially rainfall availability and temperature reduction. Many farmers therefore positively reported that the rainfall patterns had substantially improved in the recent years from erratic patterns in the past to considerably more consistency in the present. Others said that the weather nowadays is 'cooler' and the air dust-free and 'fresher' owing to the apparently increased tree cover from mainly the more extensive agro-forestry practice by farmers generally and partly due to better residue management that involves non-air polluting practices.

Nonetheless, just like a number of the study findings and analyses as discussed earlier, the correlation of SALM adoption levels and improvement in environmental sustainability can be said to be a perceived and unsubstantiated outcome based on reported experiences of farmers in Western Kenya. From a researcher's point of view, most of the examples of the apparent changes were honestly readily observable (*see 4.2.*1) such as tree cover and residue management but they are not subject to verification owing to lack of project baseline documentation on the preceding state of the environment in KACP project area.

4.2.8 Limitation of findings and analyses on the consequences of SALM adoption

As deliberated in the above sections of the study preceding this, the consequences of SALM adoptions on livelihoods of farmers in Western Kenya are based on reported estimation of figures, numbers and experiences of the study respondents. Apart from the analyses of reported income levels and yields statistics based on regression analyses, the analyses of non-quantifiable outcomes such as social relations, welfare improvement, livelihoods vulnerability levels and environmental sustainability change are based on the analysis of farmers' apparent perception on how KACP and SALMs have generally impacted on their livelihoods. This means that it is a challenging task to correctly map out of peoples' perceptions most especially when the research respondents are from rural peasant societies and have attained significantly low levels of education.

Therefore, in terms of validation and substantiation of causal relationship between adoption of SALMs and the apparent livelihood consequences, SALMs attribution and accreditation to the increases in income levels and perceived livelihoods changes or improvements, may be weak and are subject to some possible flaws and inconsistencies based on data collection and analyses limitations. However, the study judiciously attempted to capitalize on the statistical analyses of reported figures and triangulation of various perceptions from key informant interviews, focus group discussions and the household survey responses on livelihoods strategies trajectories before and after KACP inception.

4.2.9. Summary on consequences of SALM adoption on farmers' livelihoods

Overall, the adoption rate of the 'less technical-less investment' SALMs (residue, tillage, water and agroforestry management) was significantly higher than the 'more technical-higher investment' SALMs (livestock and pest management) type. This is an attribution to the relative economic advantage and triability of the SALM practices as well as to the farmers' predisposition in terms of asset profiles and ownership. Regionally, Malakisi division score higher adoption rates compared to Sirisia and Bumula divisions owing to farmers' stronger claims and commands on assets (especially human labour); even though the study findings show very weak statistical significance of the differential adoption rates by location. In terms of adoption patterns across the wealth groups, the high income wealth group scores significantly higher on adoption rates than the middle and low income wealth groups owing to their stronger claims and commands on assets and more diversified livelihood activities. However, instances of non-adoption were also reported based on lack of assets for the low income earners and personal choices by the middle and high income earners who were affiliated to other agricultural development agencies working alongside farmers in the project area. To sum up, the effect of SALM adoption on farmers' livelihoods was generally perceived as positive and 'livelihoods-enhancing'. This was reported in terms of apparent improvement of living standards and food security (an attribution to increased income levels through attainment of higher yields), improved resilience to poverty and climate change (reduced vulnerability) and improved environmental sustainability. A scenario which if maintained, through progressive implementation of SALMs, may translate to long-term adaptation to climate change. Socially, adoption of SALMs may have to a large extent resulted to social consolidation (social reciprocity and equality among farmers in Western Kenya) and to a less extent to social differentiation (capitalism and wide income differences between few rich farmers and majority poor casual labourers). Generally however, the causal relationship between adoption of SALMs and the apparent positive or negative livelihood consequences still appear weak and are subject to some errors and inconsistencies of the study's data collection and analyses.

4.3 Evaluation of the farmers' understanding of carbon financing and marketing concept

The backbone or the ultimate development outcome of the KACP project is the eventual achievement of resilient and adaptive agricultural societies in Western Kenya and that can be considered low-carbon societies. Its future goal therefore stems from the belief that Western Kenyan farmer groups could be part and parcel of the global society combating carbon emissions through 'climate-smart agriculture'. As such, the study found out that the farmers' perception on adoption of SALM practices as taught, recommended and facilitated by KACP, was to reduce 'bad air' (greenhouse gases) in the atmosphere to a minimum level. This is envisioned as soil carbon sequestration using SALMs on their farms to not only serve as carbon reduction technologies, but also as livelihood improvement pathways towards food and economic sufficiency. Technically, carbon sequestration is a prime target outcome of KACP project whose measurement or quantification is beyond the scope of this thesis. This section seeks to illuminate on the extent of farmer's understanding and internalization of carbon financing and marketing concept of which they are part of under KACP. First, it presents the farmers' general knowledge and perceptions on soil carbon sequestration and financing and the essence of KACP's SALM facilitation and implementation through them. Second, it discusses what the farmers ought to internalize in principle about SALMs and soil carbon sequestration processes. Third, it expounds on the challenges facing KACP extension services to the farmers as reported by the key informants in the study. Lastly, I offer some key criticisms on the project in totality and deliberate on the institutionalization of KACP in a development context in Western Kenya.

4.3.1 Farmers knowledge and perception on SALMs and carbon revenue

Farmers' understanding of carbon financing and marketing appear limited to an extent that the study repeatedly had to elaborate on its third objective to 'set the pace' for meaningful dialogues when conducting the survey and during facilitation of the focus group discussions. When asked what they knew about the agricultural carbon market, many reported that they did not really understand it or gave out very simple and basic explanatory responses. On one hand, a majority of the respondents who thought they had an idea of what carbon sequestration was would associate it with agroforestry and composting practices. One said; *"Planting of trees harvests the 'bad air' (carbon) from the atmosphere and puts it in the ground".* Another said; *"The more we*

plant trees, the better the environment becomes and the rains come". Yet another one said; *"Burning of plant residues produces 'bad air' and planting of trees cleans it up"*. From a researcher's point of view, it is possible to infer that these basic ideas of what carbon sequestration pertains to stems from ViA's extension services through KACP, which have over the years attempted to simplify environmental knowledge and education to farmers. With regard to SALMs, agroforestry and composting stood out as good examples for KACP to try and educate or explain, to the lowly educated Western Kenyan farmers, the ecological functioning of trees and decomposition processes in the carbon cycle. On the other hand, many farmers closely linked the amount of 'bonus' they achieved to SALMs. They would associate KACPs carbon monitoring and verification processes, such as the assessment of acreage, total number of trees and tree species, types of crops and use of fertilizers, to their understanding of agricultural carbon market. One said; *"The more trees someone plants, the more bonus the group gets"*. Others reported that KACP discouraged them from cutting trees and instead encouraged tree planting practice that do not affect the development of their crops (woody nitrogen-fixing perennial species) as well as organic farming. This way, the study established that KACP farmers were lacking a broader understanding of the interrelationship between soil carbon emissions, SALMs implementation and global climate change, but that they could appreciate the practical economic value of carbon sequestration through tree planting.

Pertaining to carbon revenue, it is reported that at the onset, KACP clarified in many preliminary project processes of community entry that the carbon revenue was not meant to be the key motivation behind SALM promotion. This was reaffirmed by one of the KACP staff who said, "*Bonus is very little money and that will not help a farmer…it is something very small to appreciate and that is it…'*_pers. Comm. (*Zonal Officer Sirisia and Malakisi focal areas*). He also reported a widespread misperception at the onset that WB was going to give out 'bonus' leading to a high expectation by the farmers that is yet to be met, as far as carbon revenue is concerned. KACP however clearly denounced it to all partner farmer groups while insisting that the focus should be on productivity from the land areas they own with strong emphasis on SALM intensification. The clarification of carbon revenue as only a co-benefit to farmers and not the chief motivation of the project is said to have made them conscious and aware of the main goals of SALM implementation by KACP.

i) Livelihoods improvement and food security attainment through achievement of higher farm yields and consequently accruing higher incomes.

ii) Promoting soil carbon sequestration that enables the farmers to accrue carbon revenue.

Therefore, KACP field officers and community facilitators endeavored to make all farmers understand that they needed to work extra hard to implement SALMs in order to benefit from both productivity increase and carbon revenue.

From the key informants' interviews, the study gathered that farmer groups received the first tranche[6] of carbon revenue in 2011 and were expecting the second tranche earlier this year. There was a delay of payment to the farmers (who were expecting the carbon revenue earlier between 2013 and 2014) attributed to drawbacks in carbon accounting between KACPs internal and external monitoring and verification protocols and processes (*as elaborated more in section 4.3.4 below*). From the study findings, the annual mean carbon revenue for a farmer group was Kshs. 3193 (USD33) which translates to a very marginal amount per farmer per year (only Kshs. 216{USD2}), considering that a farmer group consisted of an average number of 15 members. This carbon revenue amount compared to the annual income per farmer per year of Kshs. 129954.98 (USD1327) is thus extremely peripheral as an incentive for SALMs adoption. This view was repeatedly expressed in the focus group discussions where many respondents reported great disappointments as per their initial 'bonus' expectations despite KACPs objective clarifications at the project's onset. However, many of them at the same time confirmed that KACP had attempted to 'clear the air' during most of their engagements with farmer groups that the carbon revenue was 'just a bonus' and a motivation to appreciate their efforts of implementing SALMs. They reported considerable contentment with the increases in farm yields and consequently income increases that had enabled them to achieve significantly diversified livelihoods.

[6] *A portion of the total carbon revenue payment to be paid to farmers by KACP at completion of project*

4.3.2 What farmers 'ought to know' and understand about SALMs, KACP and carbon financing?

Conventional agricultural practices such as maximum tillage or shifting cultivation disrupt soil structures thereby enhancing gaseous exchange between the soil and the atmosphere. It also encourages the incorporation of plant material into the soil where it is subject to decay (decomposition) that is both beneficial (addition of SOC for nutrient exchange) and harmful (GHGs emissions that cause global warming). SALMs are adopted in Western Kenya to promote soil carbon sequestration through the reduction or elimination of soil disturbance to maximize the return of soil organic matter, hence transform farming systems from being carbon emitters to carbon sinks. As such, Western Kenyan farmers' understanding and knowledge of SALMs, carbon sequestration and financing ought to encompass firstly, the relationship between agricultural practices and GHGs emissions and secondly, the basis of KACP institutionalization i.e. SALM implementation vis-a-vis carbon revenue earning. The institutionalization of KACP mainly hinges on the concept of carbon offsets emerging from the Kyoto Protocol and partly anchors on an environmental development concept referred to as Payment for Ecosystem Services (PES).

The backbone of KACP is anchored on the concept of carbon offsets emerging from the Kyoto Protocol's 'flexible mechanisms' which allow industrialized countries to meet their emission-reduction targets by purchasing emission reductions through funding climate change-related projects in developing countries. The Protocol's flexible mechanisms stem from a market logic that carbon offsets create a demand for and a supply of carbon reductions that can be priced and exchanged within the international climate regimes (Bumpus & Liverman 2008). As such, KACPs institutionalization follows this logic under voluntary carbon offsets (VSOs) where the World Bank, through its Bio-Carbon Fund acts as the voluntary market and through ViA partnership, funds farmer groups to adopt and implement SALM practices which are considered effective carbon sinks. There appears to exist a wide disconnect between this logic and KACP practitioners on the ground who comprise of the zonal officers, field officers, community facilitators and farmers (SALMs implementers). The study comprehended that the 'politics' behind carbon offsets and institutionalization of KACP alongside WB was quite 'far-fetched', particularly with regards to carbon financing and marketing which directly links to carbon

revenue earning by farmers. However, from the key informant interviews, the study established that KACP staff had strove to expand farmers understanding of the importance of SALMs to farm yields increment, improved livelihoods and the 'bonus' (carbon revenue) receipt. It can be argued that on one front, farmers' knowledge on the complex intricacies of international markets and Kyoto's Protocol functioning is not necessarily very vital for their understanding of the importance of SALMs implementation; an attribution to their low literacy levels generally and particularly on the technical science behind carbon sequestration and the institutionalization of carbon offsets at the international and national levels. However, on another front, how SALM implementation translates to carbon revenue accrual is quite vital for the farmers' understanding and knowledge of the importance of upholding sustainable agricultural practices amidst poverty and global climate change.

As discussed before in the study (*see Section 2.3.3*), KACP may also be seen as a PES scheme that compensates land users for the environmental services a given land use(s) e.g. SALMs provide. Many studies hail PES as a creative innovation option that rewards communities (either through payments, compensation or exchange between a willing buyer and a willing seller) for ecosystems services or land-use that sustains such service. This is seen in the study when the extent of adoption of SALMs, among other parameters (land size, number of tree species and types of crops cultured), by individual farmers determine the amount of compensation that the farmer groups collectively receive after carbon accounting is determined through activity monitoring and verification. Basically, farmer groups are compensated in monetary terms for the carbon they sequester based on the estimated quantities of carbon sequestered by each farmer. This payment is viewed as a form of opportunity cost cover (incentives) for the adoption of more environmentally sound land-use services (SALMs). Paying land users who adopt recommended practices like SALMs for the biodiversity and carbon sequestration services they generate may tip the balance towards adoption (Pagiola et al. 2004). KACPs institutionalization therefore has PES attributes although primarily it has continually emphasized the vitality of using SALMs as a tool for livelihoods improvement by expanding farmers' income diversification strategies through agribusiness. This aids poor and vulnerable communities in increasing their resilience to environmental shocks socially and economically in a changing climate. Poverty alleviation may not often be the main objective of PES schemes but it has increasingly been recognized as an

important positive side-effect of the environmental market paradigm just like the institutionalization of KACP (Van Hecken & Bastiaensen 2010).

4.3.3 What KACP reported as challenges facing their extension services to farmers?

As mentioned in earlier discussions of the study, farmers' expectations about carbon revenue were quite high since the on-set of KACP despite the project's continuous emphasis on exerting more focus and efforts towards boosting agricultural yields and improving food security. Even though these clarifications have consistently been made clear, it is reported that farmers' expectations on carbon revenue amount, to be specific, had not been met yet and that they still expressed disappointment upon receipt of the delayed first tranche of carbon revenue payment. It is said that many farmers expected substantially higher amounts of payments than what the groups received collectively because many complains surrounded the fact that individual efforts towards implementing SALMs varied extensively. Some farmers were performing extremely good while others very poorly, and yet, the payment had to be shared. This issue was often raised by individual farmers during the household surveys when asked what they perceive of the carbon revenue-many of them reiterated that it really fell short of their initial as well as present expectations. Therefore extension staff (field officers and community facilitators reportedly experienced difficulties addressing such arising issues of equity and fairness within some farmer groups that had received carbon payments, but were dissatisfied by the amount they got. A few farmers reported that their groups had not received any of these payments owing to record-keeping failures of a few farmers within their groups.

From the key informant interviews, it was found that KACP occasionally experiences difficulties as they work with few staff on the ground, not least considering the vastness of the project area and the intensity of the carbon accounting and verification processes. It is reported that there have been incidences of carbon accounting over-reporting based on internal and external verification cross-checks especially during project validations (final carbon evaluation exercises before a tranche of carbon payment is made to the farmers). These incidences of over-reporting have been attributed to CF's occasional deliberate 'fixing of figures' and eventual complacency in their verification of farmers' record keeping due to pressure and work overload pertaining to carbon accounting and verification. The field officers claim that a substantial number of farmers at the on-set of the project over-reported the size of their farmlands and the biomass size (number

of indigenous trees and crop types) that they had on their farm holdings. This is reportedly because they had received 'rumours going around' that speculated that the bigger the size of one's farm and the higher the amount of biomass, the better and higher compensation in terms of carbon revenue one will receive from KACP. Therefore, CF's reportedly experienced 'hard times' during field verification exercises to confirm the validity of farmers' records also bearing in mind that some project areas covered several villages e.g. Bumula division. In other instances, some farmers' outrightly refused to let them measure their farms for verification purposes claiming that they were skeptical of KACP staff actual motives hence were mistrustful and fearful of losing their farms to strangers or 'swindlers'.

As for monitoring and verification system overall, which involved farmer-based and staff-based community facilitators and field officers, KACP staff on the ground expressed concerns on the complexity of the monitoring, reporting and verification methodology and lamented on the need to shift to a simpler carbon monitoring tool yet accurate. KACP staff at the management level further expressed the need to intensify training for farmers and CFs because they conceded that farmers' record-keeping is very poor owing to their low literacy levels. It was noted that inaccuracy of carbon accounting stems from inconsistences in reported figures such as the total acreage yields due to unaccounted mid-harvests of green maize and beans as well as over-reporting of acreage and total number of trees species as confirmed by internal verification. A slight shift from activity baseline management survey (ABMS) to permanent farmer monitoring system (PFMS) (*see Section 4.3.4*) appears to have generally eased verification of group carbon monitoring and accounting for validation purposes. As reported by one of the KACPs zonal officers, two notable changes that has reduced the CF's field workload is the introduction of GPS gadgets and simplification of farmers' summary forms[7]. He reported that previously CFs used to pace up and down around farmers' plots to measure acreage but nowadays they use GPSs which greatly improves monitoring, reporting and verification exercises in terms of accuracy and efficiency of land size measurements. Also, that the original summary form; had to be reviewed to create another simplified version (*see Appendix…*) to make it easier for CFs and a few learned farmers to carry out appropriate carbon accounting, verification and reporting.

[7] *It is a farmer-based carbon-accounting or information-gathering tool that captures statistical figures of acreage, number of trees species and crop types that a farmer owns.*

4.3.4 What KACP is critiqued on as an agricultural carbon project?

Various studies and researches works show that the real socio-economic impacts of agricultural carbon sequestration projects being implemented in developing countries are intangible and difficult to substantiate. Some claim that there is a divergence between scientific-donor narratives and those of the reported perceptions on the ground of smallholder farmers enrolled in such programmes and funds aimed at transforming their livelihoods options into diversified ones (Atela 2012). As for KACP, the study established that in a long-term perspective, many farmers strongly testify that their farm yields have substantially increased hence subsequently impacting positively also on their income levels. The preceding discussions on the study's outcomes has shed light on the projects impacts on the ground as reported by farmers and KACP staff and has been crucial in efforts of reconciling the perceived divergent narratives of project implementers and the project's beneficiaries.

On the local level, other studies have expressed skepticism based on reported uncertainties in accuracy of carbon accounting methodology(ies), high institutional management costs and intangible social and environmental impacts. However, from available project documentations and key informant interviews, the study gathered that there is no direct measurement of carbon but instead farm yields and other on-farm biomass are modelled from group carbon monitoring based on permanent farm monitoring process. It is reported that KACP project design underwent a slight shift from the project's initial dependence on activity baseline management survey methodology (ABMS)[8] to incorporation of permanent farmer monitoring system methodology (PFMS)[9]. It is said that ABMS involves group monitoring with all stakeholders included in information flow and quality control; a process that the study deemed quite complex and tedious in terms of carbon quantification as CFs have to cover vast project areas and manually carry out individual farms measurement procedures that often experiences inconsistencies in data collection. It involves farmers filling individual farmer commitment forms, CFs then verify these and record in farmer groups records, KACP field officers in turn verify group records then monitoring and verification is summarily done at the project evaluation level where quality

[8] *Community facilitators (CFs) record all practices undertaken by farmers in all of the farmers' crop fields.*
[9] *A sample of 200 farms based on agro-ecological zones permanently registered and monitored as a group monitoring tool.*

check, verification, analysis and report writing is done. PFM introduction therefore emerged as a slightly simpler and complementary methodology carried out by KACP staff (field officers) based on 200 permanent representative sample farms used to establish the total KACP baseline conditions in terms of ex-ante actual GHGs emissions and sequestration of the project (Tennigkeit et al. 2012). As for high institutional management costs which was allegedly attributed to higher project expenditure on consultants, project staff and generally project running costs instead of revenue to farmers, the study gathered from key informant interviews that these were false allegations. As reported by KACP monitoring and evaluation officer, the project expenditure as far as KACP is concerned is claimed to have adhered to the project roll-out plan and that 60% of the carbon revenue goes to farmer groups directly, 35% goes to project implementation (field officers' allowances, transport and fuel costs, trainings and other office logistics with salaries to KACP staff being paid by ViA) while 5% goes to marketing and negotiations at the Stockholm office in Sweden.

On the international level, the World Bank (WB) has established itself as a carbon broker through the BioCarbon Fund, and has actively promoted carbon markets by supporting agricultural carbon sequestration projects in developing countries (Sharma & Suppan 2011). KACP as one example has been hailed as the first blueprint agricultural carbon project in Africa flagged as the trailblazer in soil carbon sequestration and poverty reduction through 'climate-smart agriculture'. However, the coining of SALMs as climate smart agriculture has received considerably vehement criticism on the alleged uncertainty of socio-environmental benefits at the local level based on intangible livelihoods changes and statistical proof limitations on actual quantification of agricultural soil carbon sequestration. The KACPs projected amount of carbon sequestration estimated at a total of 1.2 million metric tons of carbon is considered very uncertain and unverifiable owing to a reportedly 60% carbon reduction discounting that is attributed to soil GHGs impermanence (Tennigkeit et al. 2012). Further, as far as WB's role as a carbon credits broker is concerned, it appears there is a wide disconnect between its mandate as a soil carbon credits marketer for KACP and the viability of actually penetrating the international carbon market. This is because there is no compliant voluntary carbon market that accepts soil carbon credits, at least not yet, according to Kyoto Protocol mechanisms. It is reported that the voluntary carbon market that exists amount to a very minuscule percentage of the compliance markets following unpredictable and fluctuating carbon offsets credits prices that have shrunk

and weakened demand for the same (Sharma & Suppan 2011). From the key informant interviews, the study established that KACP's staffs on the ground are also skeptical about the carbon prices in the international market based on what they gather from research information by their affiliate development agencies and partners. They nevertheless do express positive attitudes on the long-term project outcomes (farmers' improved livelihoods from sustainable agricultural production) that hold ViA'S relevancy as KACP implementing agency. As a WB pilot project therefore, the study perceives that KACP has fallen short of establishing a firm foundation for possible replication of other agricultural soils carbon projects across developing countries owing to the aforementioned critiques.

4.3.5 KACPs institutionalization in development realm

Institutionally, a more critical lens into the institutionalization of KACP through ViA, WB and other international partners (SIDA and Syngenta) partnership implies a 'business as usual' scenario in policy and practice discourses. It seems KACPs promotion of 'climate smart agriculture' is similar to many development interventions that studies have shown to be 'old wine in new bottles'. This is a replication of older agricultural technologies into seemingly newer technologies to serve 'the whims of today's hot development topic(s)'-e.g. climate change. For instance, the study gathered that a number of the SALM practices such as soil and water management (terracing and contour ploughing) are a replication of what the Ministry of Agriculture and other agricultural development agencies, including ViA, have been promoting through its extension services a few decades in the past to address soil degradation. The study found out that many international and national development agencies, such as KACPs key partners the WB and ViA, have failed to uphold the principle of development ethics[10] where on closer scrutiny, policy and practice are deceptively 'worlds apart' regarding common but, differentiated responsibilities (CBDR) in climate change adaptation and mitigation burden-sharing (Ringius et al. 2002)

It is claimed that WB was meant to be a carbon credits broker and not a buyer per se' as is the state of affairs currently. One KACP staff at the management level reported that there is a

[10] *It refers to upholding the principle of fairness and distributive justice in sustainable development and across international relations and engagements e.g. states' conscientious take-up of responsibilities in climate change adaptation and mitigation burden-sharing (Ringius et al. 2002).*

rampant misperception by researchers and critics alike, on KACPs financial responsibilities especially moderation of carbon revenue and various financial flows which involve other ViAs projects implementation processes besides SALM. In fact, he insisted that researchers and critics should strive to understand that ViAs mandate as KACP implementing agency obligated it to be the project's pre-financer and not the implementer in its entirety (including carbon revenue intricacies and deliberations). He went on to recommend that 'World Bank should assist ViA in implementing KACP on the ground'. This suggests that the project may be facing implementation challenges within its mandate but there seems to be a 'silent' power relations strife between ViA and WB owing to their differential stakes in the KACP. As such, the issues of development ethics and the divergence between policy and practice sharply emerge as major drawbacks when KACP institutionalization is closely examined and more so regarded as 'climate smart agriculture'. From earlier discussions, contrary to the study findings that established substantial changes in farmers' rural livelihoods generally, KACP has been critiqued on the uncertainty of actual socio-environmental impacts which are allegedly not readily tangible. To this end, some propositions about policy and practice as envisioned and elaborated by Mosse (2005) puts forward the study's key criticism on the institutionalization of KACP.

First, *policy primarily functions to mobilize and maintain political support*- This is seen in the legitimization of practice rather than its presupposed transformative orientation. WB has endeavored to remain relevant in today's 'climate change politics' by not only pushing for efficacy in CC adaptation and mitigation projects through voluntary carbon markets creation for forests (REDD) but also for agricultural soils carbon sequestration projects (such as financing KACP's carbon revenue). This scenario, Mosse asserts, '…inspires allegiance, conceals ideological differences…thereby generating political legitimacy…' that often successfully enrolls different interests that are necessary to bring a new project, such as KACP, into existence.

Second, *development interventions are not driven by policy but by exigencies of organizations and the need to maintain relationships*- Here, it is observed that project designs are technically expressed but politically shaped based on vested interests and priorities of international development agencies, national governments, implementing agencies, collaborating NGOs, research institutions and donor advisors (Mosse 2005). KACP overall operationalization comprises of closely knitted network of public and private development politics 'big wigs'. As

Mosse claims, such a project (KACP) design and operationalization as run and deliberated by WB and ViA alongside SIDA and Syngenta[11], is an 'art' of making a convincing argument (climate smart agriculture). It develops a causal model that relates inputs, outputs and impacts i.e. agricultural soils carbon sequestration for climate change adaptation and mitigation, higher agricultural yields and food security attainment. This is oriented to justify the allocation of resources (carbon revenue from BioCarbon-Fund) by validating higher policy goals in the expansion and legitimization of the voluntary soil carbon markets under international climate policies.

Third, *development projects work to maintain themselves as coherent policy ideas and operational systems*. The coining of KACP as 'climate smart agriculture' purports a generalized model of misrepresentation that consciously campaigns to stabilize authoritative interpretation of blueprint project models such as KACP as the first agricultural carbon sequestration project in Africa (Mosse 2005). He claims that such models conceal contradictions and weak causal connections[12] between project activities (SALM implementation) and claimed outcomes (increased farm yields, improved incomes and food security attainment). He further points out that model projects such as KACP 'reveal and conceal, explain, justify, label and give meaning' to dominant interpretations (climate change adaptation and mitigation) where 'success' and 'failure' are policy-oriented judgements that obscure actual project impacts on the ground. Summarily, the study establishes that KACP has not generated SALM practices as new agricultural practices to address climate change but rather, has sustained them as replicas of older agricultural practices to justify international climate policies. Nevertheless, WB and ViA need to uphold the principles of development ethics by conscientiously promoting SALM implementation more, rather than too much institutional emphasis on agricultural carbon credits financing and marketing.

[11] *It is a multi-national seed manufacturing company that collaborates with KACP to provide improved seeds variety as well as different fertilizer brands.*

[12] *Where old agricultural practices for soil degradation are replicated as 'new' SALM technologies for CC change adaptation and mitigation through soil carbon sequestration- an unclear argument in its entirety because soil carbon emissions and sequestration are allegedly subject to impermanence.*

4.3.6 Summary on farmers' understanding of carbon financing and marketing concept

First, farmers' knowledge and perception of carbon financing and marketing concept within KACPs institutionalization appears very limited as they relate more to SALM practices and their implementation than the content of carbon sequestration and its interrelationship with the larger international carbon market. This is because the sciences behind carbon sequestrations as well as international carbon market structures are considerably 'far-reaching' for the farmers based on their low levels of education generally. Second, KACP and its PES carbon revenue element has little or no meaningful value for individual farmers based on its marginal importance as an income source of the average total income earnings for households compared to other sources of incomes such as from on-farm, off-farm and non-farm activities. It was however understood and positively accepted by many farmers as a symbol of appreciation for their SALM implementation efforts that mainly focused on livelihoods improvement through enhanced agricultural yields and consequently increased income earning levels. Third, it appears that the KACP invests a lot of resources in the implementation of SALMs through its extension services compared to what the Kenyan government has progressively done through agricultural extension services by the Ministry of Agriculture's as a public responsibility. Therefore, as a pilot project, it seems infeasible for replication in other climate change prone areas owing to the financial commitments and the complexity of ascertaining the real livelihood impacts of 'climate-smart agriculture' for agricultural soils carbon sequestration. Lastly, SALM activities are seen as most likely 'old wines in new bottles' owing to the replication of SALM practices from previous development agencies but only coined differently as 'climate-smart agriculture for political and vested interest gains by KACP project partners.

5.0 Conclusion and Recommendations

The broad aim of this study was to assess the socio-economic impacts of the KACP on the livelihoods of poor small-scale farmers in Western Kenya in light of poverty reduction. The study's specific objectives were; the assessment of farmers' present livelihood adaptation strategies, determination of the consequences of SALMs adoption on farmers' livelihoods and an evaluation of farmers' understanding of carbon financing and marketing concept.

5.1 Assessment of farmers' present adaptation

In the *assessment of farmers' present adaptation strategies*, the study mapped out the farmers' asset profiles, livelihood activities and outcomes. The study findings reveal that farmers in Western Kenya are generally both asset-poor and cash-poor. In terms of activities, most livelihood activities in the project area are on-farm-oriented (50%) compared to off-farm (18%) and non-farm (32%) activities. On-farm activities feature food crops farming, cash crop farming and livestock keeping while off-farm and non-farm activities feature tradable manual employment and payable rural services such as brick-making, tobacco furnaces construction, rural farm-produce trade, and seasonal farm wage-labour. Regionally, Malakisi division reported wider asset profiles and higher asset levels hence higher SALM adoption rates compared to Sirisia and Bumula divisions. Across the wealth groups, the high income wealth group scores significantly higher SALM adoption rates than the middle and low income wealth groups owing to their stronger claims and commands on assets and more diversified livelihood activities.

As for the outcomes, the study findings show that in all the project areas, on-farm income is the most depended upon source of income (50% of the total income on average) in terms of relative importance followed by non-farm income (32% of the total income on average) then off-farm income which is the least depended upon source of income (18% of the total income on average). In terms of income distribution, the findings show high income inequality and unequal wealth distribution between the poor and the non-poor. Diversification patterns show that the low income wealth group is more vulnerable to economic and environmental shocks compared to the middle income and high-income groups who claim better asset profiles for resilient livelihoods. Socially, men are considered the household heads in the project area and are the ones expected to make 'stronger' decisions concerning assets use (especially land and financial capitals). Women make 'softer' decisions by complementing men's culturally-shaped roles especially at the household subsistence level as well as within the local community level.

5.2 Consequences of SALMs adoption

In the *determination of the consequences of SALMs adoption on farmers' livelihoods*, the study presented reported improvement in assets building, diversified livelihood strategies, higher yields and incomes, increased food security and generally improved living standards; all of which are attributed to SALM adoption.

Substantial yield increases of the staple food crops of maize and beans as well as increased food crops diversification were unanimously reported by many farmers; a change they attribute to increased soil fertility due to their efforts towards implementation of SALMs. The reported maize and beans yield markedly increased by 9 bags and 2 bags respectively; quite high percentages in yield changes (by 125% and 200% respectively). These reported figures may be unsubstantiated approximations hence might have been slightly exaggerated by the farmers owing to poor agricultural input-output record keeping. Also, food security had apparently been boosted as the number of food-secure months per year had reportedly increased by 5 months. SALMs adoption had enabled them to diversify the kinds of food crops they usually plant resulting in considerably expanded nutritional choices and increased dietary supplements for healthier livelihoods.

The impacts of SALM adoption on farmers' livelihoods was generally perceived as positive in terms of apparent improvement of living standards and food security. This is attributed to the progressive implementation of SALMs that have possibly translated to long-term adaptation to climate change. SALM adoption is seen to have expanded farmers' income diversity by enhancing their livelihood strategies against poverty and environmental shocks such as droughts and floods brought about by a changing climate. Regionally, Malakisi division consistently scored higher in terms of livelihoods activities diversification and expanded income sources and earning compared to Bumula and Sirisia divisions owing to better profiles, claims and commands on asset portfolios. Communally, the high income group commanded stronger asset portfolios for improved livelihoods through increased diversification compared to the middle and low income wealth groups. The low income wealth group lacks the necessary asset profiles, especially land and skilled labour that can considerably enable them to diversify their livelihoods activities and lift them from overdependence on miniscule on-farm production hence achieving a marginal level of livelihoods improvement generally.

Socially, adoption of SALMs may have to a large extent resulted to social consolidation and to a less extent, to social differentiation. The reportedly commendable levels of adoption of SALMs may have strengthened community networks and consequently improved efforts towards income growth individually and collectively. In terms of gender, approximately 75% of KACP participants are women and that they are reportedly better SALM adopters than men because they have taken up the role of SALM implementers at the household level more than men have done. As for environmental sustainability, the study reveals a wide knowledge disconnection between farmers' understanding of their environment and their livelihood activities. However, the KACP has simplified the science of GHGs and the changing climate vis-à-vis SALM implementation, into easily understandable everyday interconnectedness of rural peasant livelihoods strategies and the immediate environment i.e. soil protection, water use (including rainwater capture), waste disposal, livestock management, tree planting and conservation etc. Generally however, the causal relationship between adoption of SALMs and the apparent positive or negative livelihood consequences appear weak and are subject to some errors and inconsistencies of the study's data collection and analyses.

5.3 Farmers' understanding of carbon financing and marketing concept

In the *evaluation of farmers' understanding of carbon financing and marketing concept*, farmers' knowledge and perception of carbon financing and marketing concept seem very limited as they relate more to SALM practices than the real science of soil carbon sequestration based on their low levels of education generally. They lack a broader understanding of the interrelationship between soil carbon emissions, SALMs implementation and global climate change. Nevertheless, they appreciate the practical economic value of carbon revenue earning through tree planting. Many farmers associated SALMs with agroforestry and composting because the KACP has over the years attempted to simplify environmental knowledge and education to farmers. Also, many farmers closely linked the amount of 'bonus' they achieved to SALMs hence they associated KACPs carbon monitoring and verification processes, such as the assessment of acreage, total number of trees and tree species, types of crops and use of fertilizers, to their understanding of agricultural carbon market. Others reported that KACP discouraged them from cutting trees and instead encouraged tree planting practice of woody nitrogen-fixing perennial species that do not affect the development of their crops.

The study findings reveal that the annual mean carbon revenue for a farmer group is Kshs. 3193 (USD33) which translates to a very marginal amount per farmer per year (only Kshs. 216{USD2}). This carbon revenue amount compared to the annual income per farmer per year of Kshs. 129954.98 (USD1327) is thus extremely peripheral as an incentive for SALMs adoption. Therefore, the study concluded that the carbon revenue element has little or no meaningful value for individual farmers based on its marginal importance as an income source. It was however understood and positively accepted by many farmers as a symbol of appreciation for their SALM implementation efforts. The KACP and its operationalization is seen as a PES scheme where the carbon revenue payment is viewed as a form of opportunity cost cover (incentives) for the adoption of SALMs for the biodiversity and carbon sequestration services they generate.

As for institutionalization the KACP, it has been critiqued from a number of fronts including uncertainties in accuracy of carbon accounting methodology (ies), high institutional management costs. Its social and environmental impacts are considered not readily tangible (intangible). The study's main critique stemmed from KACPs operationalization that reflects a disconnection between policy and practice and failure by project implementers and key partners from upholding development ethics. Some prepositions on divergence between policy and practice suggest that the KACP institutionalization first, *primarily functions to mobilize and maintain political support* in the legitimization of practice rather than its presupposed transformative orientation. Second, *its intervention is not driven by policy but by exigencies of organizations and the need to maintain relationships* that are politically shaped, based on vested interests and priorities of international development agencies, national governments, implementing agencies, collaborating NGOs, research institutions and donor advisors. Third, KACP *works to maintain itself as a coherent policy idea and operational system* especially when coined as 'climate smart agriculture'. It is seen as a generalized model of misrepresentation that consciously campaigns to stabilize authoritative interpretation of blueprint project models. Generally, SALM practices are seen as most likely 'old wines in new bottles' owing to the replication of SALM practices from previous development agencies but only coined differently as 'climate-smart agriculture' for political and vested interest gains by KACP project partners.

5.4 Recommendations

From the study's main critique on KACPs operationalization, there is need to abridge the disconnection between policy and practice. The key project initiators/implementers (ViA and WB) and other partners need to focus more on SALMs implementation rather than carbon accounting processes. The KACP needs to conscientiously legitimize transformative development for Western Kenyan farmers rather than focusing on international climate policy by channeling more technical and monetary resources towards SALM intensification. KACPs extension services need to foster rigorous SALMs educational campaigns for farmers that emphasizes more on livelihoods transformation through sustainable agriculture rather than carbon sequestration and revenue accrual goals. Of course the carbon sequestration factor cannot be entirely left out but re-focusing farmer's efforts towards increasing farm yields, securing food security and bettering their living standards. This may reduce their prior high carbon revenue expectations and motivate them to work hard individually and collectively towards attainment of improved adaptive capacities (secure and more resilient livelihoods) in a changing climate.

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7.0 Appendices

Appendix 1: HOUSEHOLD SURVEY QUESTIONNAIRE

Introduction:

I am a student at the Norwegian University of Life Sciences (NMBU) in Norway who wishes to conduct a research study for my Masters' Degree Thesis. The research is about the socio-economic impacts of the Kenya Agricultural Carbon Project (KACP) in Western Kenya. I wish to request you to help me answer this questionnaire. Your participation is exclusively voluntary. The information you give herein will be anonymous and confidential and will only be used for my research thesis at NMBU NORAGRIC department. Feel free to decline to answer any question that you feel intrudes your privacy as well as to withdraw from the interview if you deem it necessary.

A: General information

Date of Interview: ..... Name of Interviewer: .....

Name of respondent (optional) .....Age: .....Sex: .....

County/Location/Village: .....Residence in Village (No. of yrs): .....

No. of people in household: .....Occupation: .....

Group membership in KACP: Member: ..... Non-member: .....

Interview duration: From; .....To: .....

Education level; .....

B: Life History

a. Where did you come from originally? 1. Born here? ……. 2. From elsewhere? ….....

b. Have you ever emigrated from the village? 1. No..... 2. Yes.....

If yes, why? Any agronomic experiences from outside?

…….....

……

c. What economic activity (ies) are you engaged in? How has it/have they changed over time?

……..

……..

d. Are you a member of any organization or institution in your village?

1. No..... 2. Yes.....

If yes what kind of organization? ……

e. How do you describe your status in your village?

1. Membership in Village Council.....2. Elder of the clan.....

3. Trustee position..... 4. Village member.....

C: Household income and expenditure

a. Do you receive income from agricultural activities that you are engaged in?

1. No.....2. Yes.....

If yes, which kind(s) of on-farm income? .....

.....

and how much per year in Kshs? ..... (Last year)

b. Do you receive any off-farm income?

1. No.....2. Yes.....

If yes, which kind(s) of off-farm income? .....

.....

and how much per year in Kshs? ..... (Last year)

c. Do you receive any non-farm income?

1. No.....2. Yes.....

If yes, which kind(s) of non-farm income? .....

.....

and how much per year in Kshs? ..... (Last year)

d. Do you receive any money from family members/ friends away from home?

1. No ..... 2. Yes.....

If yes, how much per year in Kshs? ……. (Last year)

e. Do you lend out money? 1. No ..... 2. Yes.....

If yes, how much per year in Kshs? …… (Last year)

f. Do you have any existing loans? 1. No .....2. Yes.....

If yes how much interests do you pay in Kshs? ……..... (Last year)

g. Did you hire any labor last year? 1. No .....2. Yes.....

If yes, what was the approximate total cost of the labour in Kshs? ..... (Last year)

D: A. Land Use, Access and Tenure

a. How much land area does your household own in acres? .....

b. How was this land acquired? ..... (Inherited/Bought/Others?)

c. Access to agricultural land area in acres? ..... How is this access gained or not?

……

d. How much land area is set aside for grazing/forest etc. in acres? …….....

e. How much of the land is hired/rented? ……...
If hired/rented, hiring rent paid in Kshs ……. (Last year)

E. Socio-economic impacts of KACP

Part One: ***Adaptation levels of farmers***

What constitutes past and present adaptation and diversification pillars among different groups of farmers in the KACP area? What is the difference between past and present adaptation and diversification pillars among the different groups of farmers in the KACP area?

a. Is your group involved in KACP? 1. No..... 2. Yes.....
i) If yes, in terms of agriculture, how has KACP enabled you personally to cope up with agricultural challenges related to climate change?
.....
.....
.....
ii) If no, as a farmer, how do you personally cope up with agricultural challenges related to climate change?
.....
.....
b. How can you describe your current agricultural practice compared to three years ago?
.....
.....
.....
.....
c. As a member of KACP, have you adopted SALMs? 1. No ..... 2. Yes.....
i) If yes, which SALM practices have you adopted?

SALMs	1=No, 2=Yes	Effect on yield 1=Low, 2=High	Effect on income 1=Low, 2=High	Effect on food security 1=Low, 2=High
Tillage &residue management				
Soil nutrient management				
Improved livestock management				
Soil &water management				
Integrated pest management				
Agroforestry				
Agronomic practices				

ii) If no, why? .....
.....
d. As a non-member of KACP, have you adopted any sustainable agricultural practices?
1. No..... 2. Yes.....
i) If yes, what practices are these? .....
.....
.....

Part Two: ***Consequences of adaptation on livelihoods of different groups of farmers***

What are the economic consequences of adaptation on farmers' livelihoods (i.e. share of income from adoption of SALMs or other sustainable agricultural practices)?

a. How has your involvement in KACP/any other agricultural project contributed to your income status? Has your income increased? 1. No..... 2. Yes.....
i) If yes, how much income in Kshs. per year were you receiving from your farm before and after KACP/any other agricultural project inception? 1. Before ..... 2. After .....
ii) If no, why do you think so? .....
.....

What are the agronomic and environmental consequences of adaptation on farmers' livelihoods (i.e. impacts on food security, local climate and the environment)?

a. Has your agricultural yield increased since KACP/any other agricultural project inception?
1. No..... 2 Yes .....
i) If yes, how many bags of maize and beans per acre did you harvest before and after KACP/any other agricultural project inception?
1. Before: Maize..... Beans..... 2. After: Maize.....Beans.....
ii) If no, why do you think so? .....
.....
iii) How many months in a year were/are you able to feed your family before and after KACP/any other agricultural project inception? 1. Before..... 2 After.....

iv) In terms of nutrition, which other types of crops do you cultivate in order to supplement the staples (maize and beans)? .....
.....

b. Has the local weather pattern and environmental landscape improved since KACP/any other agricultural project inception? 1. No..... 2. Yes .....
If yes or no, how? Please explain .....
.....
.....

What are the socio-cultural consequences of adaptation on farmers' livelihoods (i.e. impacts on gender relations and rights to resources)?

a. Has KACP/any other agricultural project improved the participation of men and women in sustainable agricultural practices? 1. No..... 2. Yes .....
If yes or no, how? Please explain.....
.....
.....

b. Has ownership and access to land changed in any way since KACP/any other agricultural project inception?
1. No..... 2. Yes.....
If yes or no, how? Please explain.....
.....
.....

<u>Part Three:</u> ***Evaluation of KACP's third objective: carbon financing and marketing for farmers***

<u>What has been the significance of KACP on carbon financing and marketing for farmers?</u>

a. What do you know about agricultural carbon market? .....
.....
.....

b. Has your group received any agricultural carbon credits money since the group got involved in KACP? 1. No.....2. Yes.....
i) If yes, how much in Kshs? .....And how did the group use this money?
.....
.....
.....
ii) If no, why?.....
.....

c. Do you personally employ carbon accounting and reporting system?
1. No.....2. Yes.....
If yes, Please explain how .....
.....
.....
.....

d. In your own opinion, what motivates you to adopt SALMs?
.....
.....
.....
e. In what aspects has KACP improved your livelihood generally?.....
.....
.....
.....
.....

Appendix 2: AGENDA AND TOPICS OF DISCUSSION FOR FOCUS GROUP DISCUSSION

Date_____ Venue_____ Moderator _____

Subcounty/Village represented_____

Participants/Discussants present

No.	Name	Address	Occupation/Group	Age	Sex
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Agenda

No	**Particular**	**Responsible people**	**Duration**
1	Introduction; covers objectives of the gathering, main topics and guidelines	Moderators	5-10 minutes
2	Self-introduction	All members	5- 10 minutes
3	Begin discussion (topic in order)	Moderators and members	45 minutes
4	Any contribution related to topic	All members	5-10 minutes
5	Conclusion and setup of the upcoming meeting if any	Moderators	5-10 minutes

Main topics of discussion

1: Adaptation levels of farmers

- To what extent do you think farmers have been able to adapt to climate change owing to KACP intervention?
- To what extent do you think farmers have been able to adopt SALM practices?

2: Consequences of adaptation on livelihoods of farmers

- What are your comments on; -KACP and poverty alleviation
  -KACP and food security
  -KACP and livelihoods diversification

3: Evaluation of KACP's third objective i.e. carbon financing and marketing for farmers

- What are your comments on; -KACP and agricultural carbon financing for farmers
  -KACP and agricultural carbon financing and marketing on the global scene

Appendix 3: INTERVIEW GUIDE FOR THE KEY INFORMANTS

1: Adaptation levels of farmers

- To what extent do you think farmers have been able to adapt to climate change owing to KACP intervention?
- To what extent do you think farmers have been able to adopt SALM practices?

2: Consequences of adaptation on livelihoods of farmers

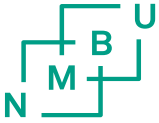
- What are your comments on; -KACP and poverty alleviation
  -KACP and food security
  -KACP and livelihoods diversification

3: Evaluation of KACP's third objective i.e. agricultural carbon financing and marketing for farmers

- What are your comments on; -KACP and agricultural carbon financing for farmers
  -KACP and agricultural carbon financing and marketing on the global scene

Follow-up questions:

- What are the socio-cultural consequences of adaptation on farmers' livelihoods *(i.e. impacts on gender relations and rights to resources)?*
- Are monetary incentives by KACP a sufficient motivation to adopt SALMs? *If not, what do you think should be the best motivation?*
- Are farmers well equipped to use carbon accounting and reporting system in relation to adoption of SALMs? *If not, how have you dealt with this challenge?*



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