



Poverty Reduction Through Sustainable NRM



**ASSESSING THE IMPACTS OF TECHNOLOGY ADOPTION ON RURAL
LIVELIHOOD ACTIVITIES IN THE UPPER TANA CATCHMENT OF KENYA: A
CASE STUDY OF EMBU AND KIRINYAGA COUNTIES.**

FINAL DRAFT REPORT

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ABBREVIATIONS AND ACRONYMS

- ❖ FDA – Focal Development Areas
- ❖ IFAD – International Fund for Agricultural Development
- ❖ PCT – Project Coordinating Team
- ❖ UTaNRMP - Upper Tana Natural Resources Management Project
- ❖ CIG – Common Interest Group
- ❖ SSA – Sub Sahara Africa
- ❖ ASALs – Arid and Semi-Arid Lands
- ❖ GOK- Government of Kenya
- ❖ KALRO – Kenya Agricultural and livestock research organization
- ❖ GDP – Gross Domestic Product
- ❖ SDGs – Sustainable Development Goals
- ❖ PLWD – People Living with Disability
- ❖ SLF – Sustainable Livelihood framework

EXECUTIVE SUMMARY

The Upper Tana Natural resource management project goal is to “contribute to reduction of rural poverty in the Upper Tana river catchment. This goal is pursued via two development objectives which reflect the poverty-environment nexus: Increased sustainable food production and incomes for poor rural households living in the project area; and Sustainable management of natural resources for provision of environmental services. The focus of this study was to assess the impacts of technology adoption on rural livelihood activities in Embu and Kirinyaga counties via the following objectives; assess the level of adoption of technologies introduced in the project study area, assess the improvement in livelihood of the people due to project interventions and assess the improvement of acquisition of resources in the study area.

The study was carried out in two (2) of the UTaNRMP six (6) counties, Embu and Kirinyaga; and covered four (4) River Basins: Rupingazi and Thuci (Embu County), Nyamindi and Thiba (Kirinyaga County). This survey utilized quantitative and qualitative research methodologies which includes: individual household (HH) interviews; Focus Group Discussions (FGDs); Key Informant Interviews and observation and informed judgment. A total of 421 Individual Household Interviews were carried out.

From the findings of the study, it can be said that adoption of improved crop technologies has contributed to increase in yield of crops, food availability, soil fertility, time saving, sustainable management of land resources as some indicated that it had help them reduce soil erosion drastically and overall increasing income of the household in the two counties. Thiba and Rupingazi have the highest rate of adoption of crop technologies. Improved livestock technologies such as silage making, farm feed formulation, agroforestry, tumbukiza and fodder production were introduced and Silage making had an adoption rate of 48.2%, farm feed formulation had 71.83%, agroforestry had 83.45 %, tumbukiza had 34.68 % and fodder production had 49.33%. Belonging to a CIG was also found to be a positive determinant in adoption of technology whereas age, farmland size and educational level were not.

Various training methodologies were employed to disseminate the technologies to the farmers These methodologies include: Farmer Field School, Study tours, Demonstration plots and On-farm trials. Effectiveness of these approaches was assessed based on the adoption of technologies introduced. Rupingazi had the highest adoption rate for technologies introduced through farmer’s

field school which was at 100%, followed by Thiba at 96.3%. Nyamindi and Thiba had the highest rate of adoption of technologies introduced through On-farm trails, both at 100% (58.8% fully and 41.2% partially) and 95.5% (56.8% fully and 38.6% partially) respectively. Overall, FFS and On-farm trials very effective in technology introduction as the rate of adoption for the two methodologies were higher than that of study tour and demonstration plots.

Improvement in livelihood of the household was observed as adoption of livestock technologies contributed enormously to improvement in nutrition, increase in income and more savings. The average yield of milk increased from 5.8 L/cow/day baseline report to 6.18L/cow/day for cattle while goat milk yield increased from 0.25L/goat/day to 1.49L/goat/day. Proportion of farmers owning improved cattle breeds was: Fresian (27.63%); Arshyre (5.95%); Guersey(8.18%); and Jersey (13.05%). The ownership of improved goat varieties was Kenya Alpine (24.23%); and Toggenburg (14.9%), while ownership of improved pig varieties was: Large White (3.03%); Landrace (0.28%); Hampshire (0.5%); and Duroc (0.13%). owning Improved rabbit breeds were: Chinchila (2.73%); New Zealand White (1.2%); and California (6.58%). improved poultry breeds were: Kari Kienyeji (52%); Kenbro (4.8%); Rainbow (5.33%). New Bee hives was: KTBH (1.5%); and Langstroth (5.65%), while fish species was Cat fish (0.75%), Tilapia (0.425%).

The percentage of people living below the \$1.25 poverty line in Kirinyaga was estimated to be 8.1% while those in Embu was 10.4% using the progress out of poverty index PPI. poverty incidences across the two counties reduced also compared to the baseline situation, Embu reduced from 35% to 28% and Kirinyaga reduced from 26% to 20 %. This can be attributed to increase in income generating activities of the population of the counties.

The number of households reported as having savings improved from 70% at baseline to 93% and this households saves mainly through also revealed that 40.1% of the HHs made savings mainly through saving SACCOs (35%); Saving Groups/Chamas (30.03%); Commercial banks 19.67% and Mobile money (16.20%). 57.9% of the house hold attempted accessing loan and 95.6% of them got the loan. 57.63% have benefitted from grant while 42.38% have not benefitted. Thuci had the highest proportion of farmers who have benefitted at 77.3% followed by Thiba 71.7%. Rupingazi and Nyamindi had 43.3% and 38.2% respectively.

Therefore, Improved technology adoption is an actual tool in improving the livelihoods of the rural as demonstrated by UTaNRMP in Embu and Kirinyaga counties. Improved crop

technologies, livestock technologies and seed multiplication has contributed immensely to food availability, improved income generation, improved seed availability and affordability and better nutrition in the two counties. Recommendations for the project are: youth groups and people living with disability (PLWD) should be encouraged to apply and given top priority, agricultural trade fairs should be organized and supported by the project to encourage rapid replication of the technologies by farmers who are not beneficiaries and lastly more small livestock technologies like bee hives and improved rabbit breeds should be introduced.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Technological improvements in the agriculture sector are believed to be the most important pathway for reducing rural poverty in many agrarian economies such as those in Sub-Saharan Africa (SSA) (Bourdillon et al., 2002; Mendola, 2007; Kijima et al., 2008; Kassie et al., 2011). In most African countries, agricultural sector provides the leading source of employment and contributes large fractions of national income. An average of 54 percent of the working population are gainfully employed in the sector. In Burundi, Burkina Faso and Madagascar, more 80 percent of the labour force works in agriculture. Still there are a few outliers – such as Angola, South Africa, and Mauritius, where the agricultural sector only employs 5.1, 4.6, and 7.8 percent of the population, respectively (Mariama Sow, 2017). However, adoption rates of improved agricultural technologies in many SSA countries remain comparatively low (Tripp and Rohrbach, 2001).

Country Economic Background

Kenya occupies a total land area of 582,646 km² with varied topography. In 2018, Kenya has an estimated population of 50.95 million, which ranks 29th in the world, with an annual growth rate of about 2.6% and an average population density of 79.2 persons per km². In 2018 Kenya had a per capita GDP of USD 1143. The real GDP growth rate for 2016 was 5.8%, and is forecast to reach 6% by 2017.

The agricultural sector remains the backbone of the economy, providing about 65% of export earnings, although its share in the GDP has declined from nearly 40% in the 1970s to about 28% in 2009. It also accounts for 19% of formal employment. However, in recent years' agricultural sector growth has been constrained by drought conditions, whilst there is an on-going boom in telecommunications, financial services, and construction. Overall economic growth is constrained by infrastructure bottlenecks, skill shortages, political uncertainty and corruption.

About 70% of the population lives in medium-high potential areas in the center and west of the country, where the population density can be more than ten times the national average. The Arid and Semi-Arid Lands (ASALs) make up more than 80% of the country's land mass, and are

home to 35% of the population (GOK, 2012: Vision 2030), 50% of its livestock, and 75% of wildlife (Shisanya, C.A, 2011). As one of the most advanced of the East African economies, Kenya plays a key role in economic development and maintaining stability in the Horn of Africa. Agriculture is very critical to Kenya 's economy. It contributes to rural employment, food production, foreign exchange earnings and rural incomes. The sector contributes 26 per cent of Kenya 's Gross Domestic Product (GDP) and 27 per cent indirectly through linkages with manufacturing, distribution and other service related sectors. Agriculture is also critical in realization of Kenya 's Vision 2030 and sustainable Development Goals (SDGs), of No poverty and Zero Hunger.

Project Background

The Upper Tana Natural Resource Management Project (UTaNRMP) covers 6 counties namely Murang'a, Nyeri, Kirinyaga, Embu, Tharaka, and Meru. The total population in the six counties according to the 2009 Kenya Population Census results was 4, 402,036 people (KNBS, 2010). It was however estimated that the population had grown to 5.2 million people at project design. The project area has an average of 250 people per square kilometer compared to an average of 66 people per square kilometer in the country. This ranges from 138 people per square kilometre in Tharaka Nithi County to 368 people per square kilometer in Murang'a County.

The main economic activities in the counties are dominated by agriculture, i.e. Cash and food crop farming. In the upper zones in Muranga, Nyeri, Kirinyaga, Tharaka Nithi, Embu and Meru counties cash crop grown consists of tea, whereas the middle zones are coffee. Food crop is mainly grown in the middle zone i.e. Maize, beans, and bananas. In the middle zone farmers also engage in livestock farming (zero grazing), and Aquaculture (trout and tilapia fish). The lower zones are characterized by livestock (free range) fruit tree farming (especially mangoes), cereals, and Apiary.

The Upper Tana Natural Resources Management Project is an eight-year project (2012-2020) funded by Government of Kenya, International Fund for Agricultural Development (IFAD), Spanish Trust Fund and the Local community. The goal of the project is to "contribute to reduction of rural poverty in the Upper Tana river catchment".

The goal of the project is pursued via two development objectives which reflect the poverty-environment nexus namely

- (i) Increased sustainable food production and incomes for poor rural households living in the project area; and
- (ii) Sustainable management of natural resources for provision of environmental services.

1.2 Problem Statement

According to 2005 – 2006 poverty survey of the Kenya national bureau of statistics, nearly half (48%) of the rural population of the country is classified as living below the poverty line or unable to meet their daily nutritional requirements. More than 75 percent of the world's poor live in rural areas and a majority of the poor will continue to live in rural areas well into the 21st century. Agriculture is the key to alleviating rural poverty. Agriculture employs more than half of the total labour force in developing countries and almost three quarters in lower-income developing countries. Most of the world's extreme poor depend on agriculture for their livelihoods. (R. Pearce and J. Morrison 2001). The eastern region and central region where the upper tana catchment natural resource management project is located has 45.6% people who live below the poverty line.

The recently released Kenya Integrated household budget survey 2015/16 revealed significant improvements with overall headcount poverty recording more than 10%-point drop. The overall national poverty headcount rate (proportion of poor individuals) dropped from 46.6 % in 2005/06 to 36.1% in 2015/16 though a few geographical areas with high pockets of population living below the poverty line still remains. The findings also show that the total population of poor individuals declined from 16.6 million in 2005/06 to 16.4 million in 2015/16 even though the country's population increased by approximately 10 million over the two periods.

Factors that affect rural poverty are more likely to be associated with agriculture since most rural residents engage in agricultural activities. The rural economy depends mainly on smallholder subsistence agriculture, which produces 75% of total agricultural output. Most Kenyans live in areas that have good potential for agriculture, which comprise about 18 percent of the country's territory and are located in the Centre and West (UTaNRMP 2012). The high prevalence of rural poverty contributes to environmental degradation which in turn reduces sustainable livelihood

opportunities. One reason for this is the rapid population growth rate of Kenya which has increased pressure on the country's resources and another is the inequality gap between the rich and the poor of which New world wealth 2014 reported that an estimated 62% of the country's wealth is owned by 8000 people (Beegle et al. 2016). Its reported inequality is worse in rural areas in that that the richest 20% of the rural and urban populations earn 62% and 51% of incomes, respectively, while the bottom 20 % earns 3.5% of rural income and 5.4% of urban income (SID. 2004).

The Rural Livelihoods component of the Upper Tana Catchment Natural Resource Management Project aims to bridge this gap using interventions that are beneficial to the management of the natural resource base. This component outputs include;

1. Agricultural packages adapted to various agro-ecological and socio-economic contexts
2. CIGs successfully adopt or improve farm and/or non-farm income generating activities (IGAs).

The above outputs are achieved through the following sub-components:

1. **Adaptive research and demonstrations led by KARI** -This includes On-farm trials and demonstrations, Soil fertility enhancement; and Seed multiplication and distribution. The Kenya Plant Health Inspection Services (KEPHIS) is responsible for regulatory oversight of seed multiplication and distribution while relevant government departments and service-providers are collaborators
2. **Adoption of IGAs through CIG's-** This is implemented by providing matching grants (30% by CIG and 70% by beneficiaries). The FFS extension approach have been used mainly to ensure the success of the IGA's over and above the other methods of demonstration plots, study tours and farmer-to-farmer training.

Thus, this study seeks to answer the following research question:

1. What is the level of adoption of the technologies introduced?
2. To what extent as the various technology transfer methods contributed to farmers yield and productivity
3. To what extent is the community matching grants implementation approach effective in achieving household poverty reduction

4. To what extent has seed bulking activity contributed to the affordability, adoption of new crop varieties and its contribution to crop production and household income

1.3 Justification of the Study

The Upper Tana Natural Resources Management Project (UTaNRMP) has the potential of not only to improve the management of natural resources but also to improve the living conditions of the beneficiaries of the project hence the result of this study will give an in-depth information on how the UTaNRMP has improved the livelihoods of the beneficiaries and what can be done to achieve more.

1.4 Objectives of the Study

The main aim of this proposed research is to assess the contribution of the Upper Tana Catchment Resources Management Project (UTaNRMP) to poverty reduction of the beneficiaries. The specific objectives are to:

- i. To assess the level of adoption of technologies introduced in the project study area
- ii. To assess the improvement in livelihood of the people due to project interventions
- iii. To assess the improvement of acquisition of resources in the study area

1.5.1 Analysis of the objectives of the study

	Research objectives	Type of variables	Indicator	Measuring of indicator	Data collection method	Level of scale	Tools of analysis	Type of analysis
I	Adoption of technology	independent	Types of technologies introduced	No and type of technologies introduced	Questionnaire	Ordinal	Mean	Descriptive
			Accessibility of technology	Distance to nearest inputs	Focus group discussion	Ratio	Percentage	Content correlation
			Training	Availability of labour	Key informant interview			
				Affordability of inputs	Questionnaire			
			Effectiveness of farmers training approach	No and types of training approach	Key informant interview			
				type and no of technologies adopted	Questionnaire			

	Improved livelihood	Dependent	<p>Increase in quantity of quality livestock produced</p> <p>Increase in quantity of livestock products produced</p> <p>Increase in quality crop varieties</p> <p>Increase in crop yield</p> <p>Increase in come</p> <p>Increased food security</p> <p>Increased in nutritional value of the food</p>	<p>Number of quality livestock produced</p> <p>Quantity of eggs (crates) produced</p> <p>Quantity of milk (litre) produced/day</p> <p>Quantity of honey produced(Kg)</p> <p>Quantity of beef produced</p> <p>Crop varieties</p> <p>Crop yield per ha</p> <p>Socioeconomic characteristics</p>	<p>Questionnaire</p> <p>Focus group discussion</p> <p>Key informant interview</p>	<p>Ordinal</p> <p>Ratio</p>	<p>Mean, percentage</p>	<p>Descriptive Content</p>
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3	<p>Improved access to resources</p> <p>Savings</p> <p>Loans</p> <p>grant</p>	Independent	<p>Increase in savings</p> <p>Access to loan facility</p> <p>Access to grants</p>	<p>Number of households with savings</p> <p>Numbers of households with access to loans</p> <p>Number of households with access to grants</p>	<p>Questionnaire</p> <p>Focus group discussion</p> <p>Key informant interview</p>	Ordinal Ratio	Mean, percentage	Descriptive content
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1.6 Research hypothesis

The researcher expects a variance in the livelihood levels of beneficiaries in the study river basins this could be depending on yield, nutritional status, income and expenditure, access to farm inputs and also in relation to their different socio-demographic characteristics. The researcher also expects that the activities of the Common Interest Groups (CIGs) will be key in improving the livelihood of the people in the study area.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical review

2.1.1 Technology Adoption

Technology has been defined in different ways, Oxford Dictionary 2013 define technology as the application of scientific knowledge for practical purposes, especially in industry. Loevinsohn et al., 2013 define technology as the means and methods of producing goods and services, including methods of organization as well as physical technique. According to these authors new technology is new to a particular place or group of farmers, or represents a new use of technology that is already in use within a particular place or amongst a group of farmers. Technology itself is aimed at improving a given situation or changing the status quo to a more desirable level. It assists the applicant to do work easier than he would have in the absence of the technology hence it helps save time and labor (Bonabana-Wabbi 2002). It can also help in increasing output per unit area.

Beethika Khan, 2002 defined technology adoption as the choice to acquire and use a new invention or innovation. It can also be defined as a Process that begins with awareness of the technology and progresses through a series of steps that end in appropriate and effective usage (*Bridges 2005*) Loevinsohn et al., 2013 defines adoption as the integration of a new technology into existing practice and is usually proceeded by a period of 'trying' and some degree of adaptation.

Technology varies with the technology being adopted. For instance, the study by Doss (2003) showed that adoption of improved seed in a survey done by CIMMYT classified farmers as adopters if they were using seeds that had been recycled for several generations from hybrid ancestors. In other studies adoption was identified with following the extension service recommendations of using only new certified seed (Doss, 2003; Bisanda 1998; Ouma 2002).

The world's population is projected to reach 8.5 billion by 2030, 9.7 billion by 2050 and exceed 11 billion in 2100, (UN report 2015) Increasing agricultural productivity is critical to achieve the Sustainable development Goal 2; zero hunger and meet expected rising demand. Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output (Jain et al., 2009). According to Loevinsohn et al. (2013) the most common

areas of technology development and promotion for crops include new varieties and management regimes; soil as well as soil fertility management; weed and pest management; irrigation and water management. By virtue of improved input/output relationships, new technology tends to raise output and reduces average cost of production which in turn results in substantial gains in farm income (Challa, 2013). Adopters of improved technologies increase their productions, leading to constant socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers (Kasirye, 2010).

2.1.2 Determinants of agricultural technology adoption

According to Loevinsohn et al. (2013), farmers' decisions about whether and how to adopt new technology are conditioned by the dynamic interaction between characteristics of the technology itself and the array of conditions and circumstances. Different factors determine the adoption of different agricultural innovations and technologies. Much empirical adoption literature focuses on farm size as the first and probably the most important determinant. (Doss and Morris, 2001; and Daku, 2002). This is because farm size can affect and in turn be affected by the other factors influencing adoption.

Social inclusion is also another determinant, Bandiera and Rasul (2002) looked at social networks and technology adoption in Northern Mozambique and found that the probability of adoption is higher amongst farmers who reported discussing agriculture with others. Similarly, Conley and Udry (2002), looking at pineapple cultivation in Ghana, analyze whether an individual farmer's fertilizer use responds to changes in information about the fertilizer productivity of his neighbor. They found that a farmer increases (decreases) his fertilizer use when a neighbor experienced higher than expected profits using more (less) fertilizer than he did, indicating the importance of social learning. Belonging to a social group enhances social capital allowing trust, idea and information exchange (Mignouna et al., 2011). Farmers within a social group learn from each other the benefits and usage of a new technology. Uaiene et al. (2009) suggests that social network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other.

Gender issues in agricultural technology adoption have been investigated for a long time and most studies have reported mixed evidence regarding the different roles men and women play in technology adoption (BonabanaWabbi 2002). In the analysis of the impact of gender on technology adoption, Morris and Doss (1999) had found no significant association between gender and probability to adopt improved maize in Ghana. They concluded that technology adoption decisions depend primarily on access to resources, rather than on gender. Another study by Obisesan (2014) on adoption of technology found that, gender had a significant and positive influence on adoption of improved cassava production in Nigeria. His result corresponds with that of Lavison (2013) which indicated male farmers were more likely to adopt organic fertilizer unlike their female counterparts. Gender will have significant association with technology adoption where decision relies on the head of the household since statistics prove that there are more male headed household than female. Other key aspects include factors of production (land, labor, capital, scale of the technology etc.)

2.1.3 Sustainable rural livelihood

Livelihood is defined as a set of activities, involving securing water, food, fodder, medicine, shelter, clothing and the capacity to acquire above necessities working either individually or as a group by using endowments (both human and material) for meeting the requirements of the self and his/her household on a sustainable basis with dignity. Ellis 1998 defined it as the activities, the assets and the access that jointly determine the living gained by an individual or household. Approximately 90 % of rural households are involved in farming activities (Davis et al. 2010a, b). In Africa, 70 % of the household income in rural areas is from farming activities, while in Asia and Latin America, 50 % of the income is from farming activities (Davis et al. 2010a,b).

Ian Scoones 1998 highlighted five key elements of the definition, the first three focus on livelihoods, linking concerns over work and employment with poverty reduction and a broader issue of adequacy, security, well-being and capability. The last two elements added the sustainability dimension, looking, in turn, at the resilience of livelihoods and the natural resource base on which, in part, they depend.

Poverty Reduction – The poverty level is a key criterion in the assessment of livelihoods. Various measures can be used to develop an absolute ‘poverty line’ measure based on income or

consumption levels (Ravallion 1992; Baulch 1996). Alternatively, relative poverty and inequality can be assessed using Gini coefficient measures. There are a range of pros and cons for each measure, as well as some major measurement challenges (Greeley 1994). However, such quantitative assessments of poverty can be used in combination with more qualitative indicators of livelihoods (Jodha, 1988; Schaffer 1996). This study use the Progress out of poverty index to measure the poverty rate in the two counties.

The Progress out of Poverty Indicator

PPIs have already been developed for more than 50 developing countries. Their development is always based on de tailed household-level data such as captured by the Living Standards Measurement Surveys of the World Bank or national household surveys and the methodology is standardized (Schreiner, 2010b). First, out of the household level variables in the survey, a pre - selection of 100 indicators in the area of family composition, education, housing, and durable goods is made. Out of these, ten are selected that have a high correlation with poverty measured by the uncertainty coefficient (Goodman & Kruskal, 197), are inexpensive to collect, easy to answer quickly, simple to verify, and liable to change over time as poverty status changes (Schreiner, 2010b). These ten items are given weights using logistic regression, such that final scores on the index range from 0 to 100. A scorecard is produced which allows users to calculate scores on the spot (figure 1). Using look-up tables, these scores can subsequently be converted into the likelihood that a household is below any one of a number of poverty lines. In general tables are provided for 50%, 100% and 150% of the national poverty line, the food poverty line and an international poverty line such as the \$1.25 (per person/day) line. Finally, the goodness of- fit is assessed without- of – sample calibration and standard errors for the likelihood of living below the poverty line given a PPI-score are obtained with bootstrapping. Country- specific details are provided in documentation available at the website of the Grameen Foundation.

The latest version of the PPI for Kenya was created in March 2011 by Mark Schreiner of Microfinance Risk Management, L.L.C. Indicators in the PPI for Kenya are based on data from the 2005/6 Integrated Household Budget Survey. The PPI for Kenya presents a single scorecard whose indicators and points are derived from household expenditure data and Kenya’s national (absolute) poverty line. Scores from this one scorecard are calibrated to poverty likelihoods for six poverty lines. The scorecard is constructed and calibrated using half of the data from the 2005/6KIHBS, and its accuracy is validated on the other half of the data. While all three scoring

estimators are unbiased (that is, they match the true value on average in repeated samples when applied to the same population from which the scorecard was built), they are—like all predictive models—biased to some extent when applied to a different population. (Tarozzi and Deaton, 2007).

2.2 Analytical Framework

The DFID sustainable livelihood framework consists of five major components that are related through sequential relationships and feedback. These include:

Vulnerability context: this describes the external factors that influence peoples’ assets and livelihood opportunities. They are broadly classified as shocks, trends and seasonality.

Livelihood assets: this is outlined in five categories necessary to produce positive livelihood outcome namely;

1. *Human capital* (i.e. the amount and quality of knowledge and labor available in a household)
2. *Natural capital* (i.e. the quality and quantity of natural resources, ranging from fisheries to air quality)
3. *Financial capital* (i.e. savings and regular inflows of money)
4. *Physical capital* (i.e. the infrastructure, tools, and equipment used for increasing productivity)
5. *Social capital* (i.e. social resources, including networks for cooperation, mutual trust, and support)

Transforming structures and processes: structures here refer to the organizations that create and enforce legislation, provide the necessary requirements for acquiring and capitalizing upon assets (e.g. private suppliers of materials for building shelters), manage natural resources, and provide other services crucial for gaining access to assets, exchanging them, and benefiting from their use. Meanwhile, “processes” determine the interactions between the structures and individuals. Examples of processes include policies, legislation, power relations, norms, market stability, and general rule of law. (M. Kollmair 2002)

Livelihood strategies: this involves individual’s available and implemented options for pursuing livelihood goals. The greater the diversity of livelihood strategies, the higher the

household's resilience to the shocks, trends, and seasonality conditions within the vulnerability context.

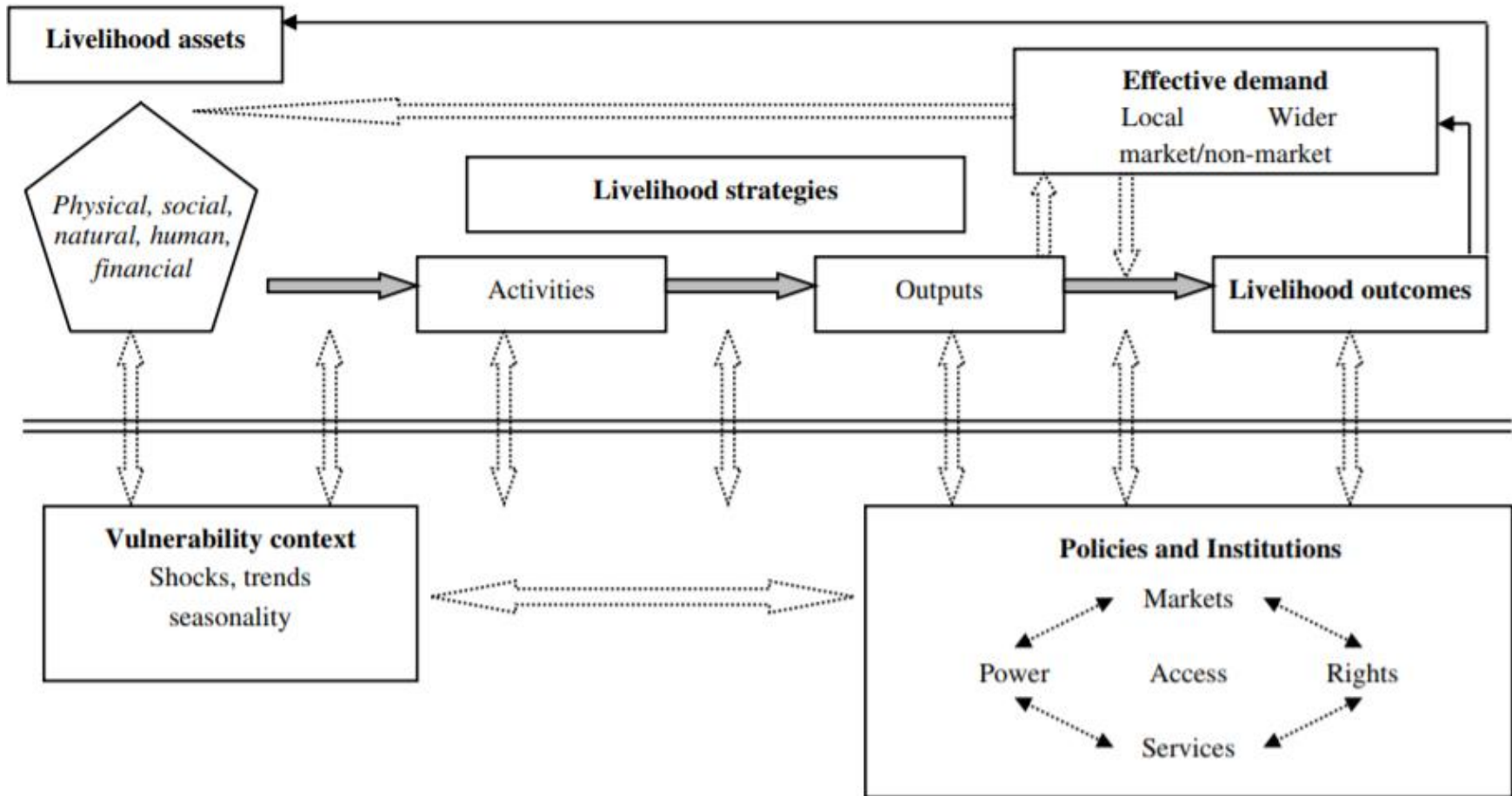
Livelihood outcomes: Livelihood outcomes refer to the outputs of livelihood strategies. Achievements may include higher income, greater well-being (e.g. self-esteem, physical security, political empowerment), reduced vulnerability, greater food security, and/or improved environmental sustainability.

Dorward et al 2001 introduced three main innovations into the 'classical' sustainable livelihood framework, to give a "modified sustainable livelihood framework", these includes;

1. Placing demand for livelihood outputs at the centre of processes and livelihood development. They assert that the nature and extent of the demand of livelihood outputs is critical in determining the impacts and sustainability (immediate and longer term) of development of livelihood activities.
2. The location and content of the 'policies and institution box in the modified SLF emphasizes its interaction with the vulnerability context and the way that policies, institutions and the vulnerability context affect all livelihood components. They may affect access to any livelihood component for example, access to demand, access to different assets and access to technologies.
3. Technology is largely ignored in the classical SLF, but institutional and technological changes have together been the drivers and facilitators of most economic and social development.

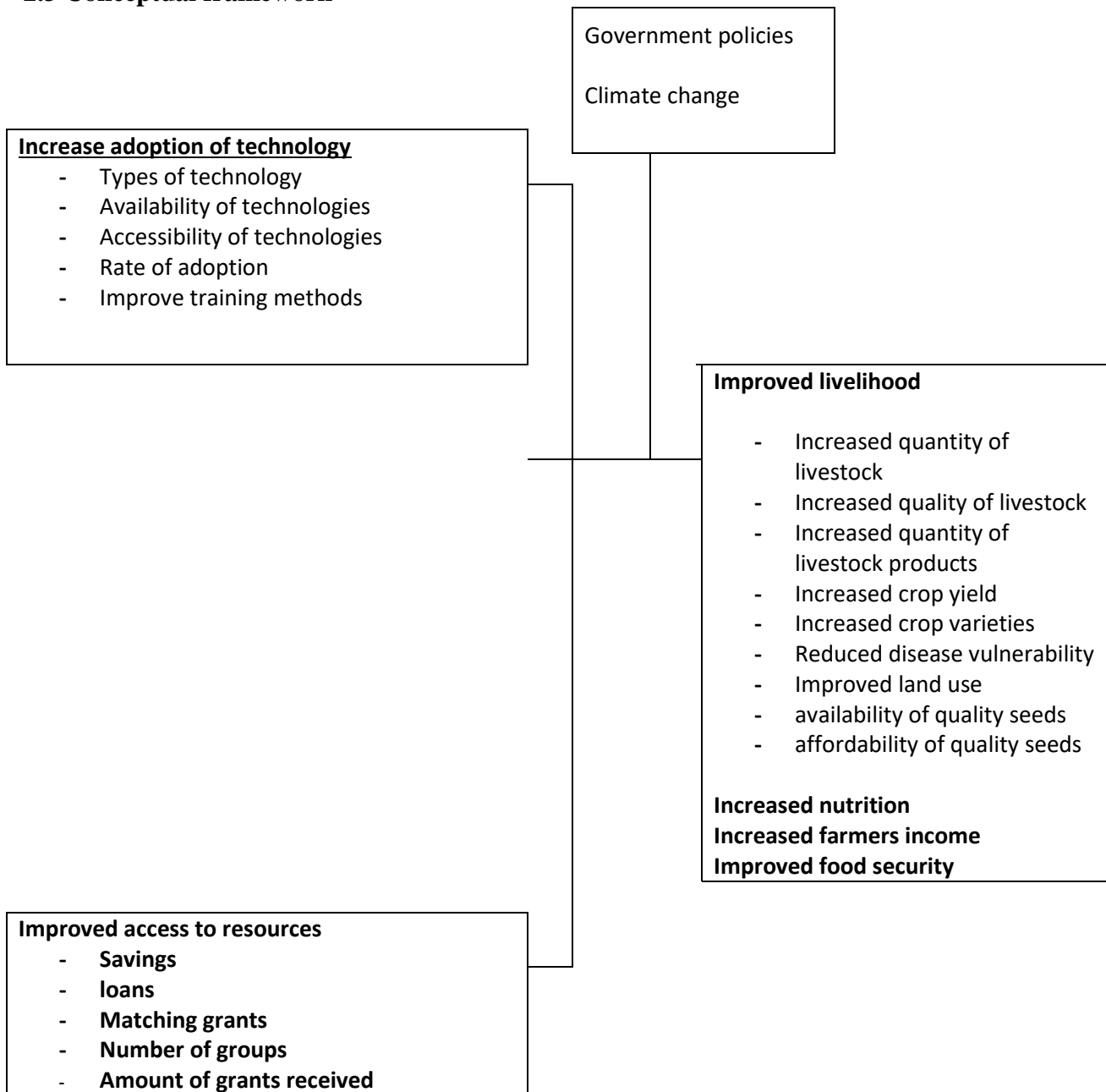
It has been greatly demonstrated that technology uptake is a major contributory factor to increased agricultural productivity (Semana, (1999); Doss and Morris (2001); Neupane, et al., 2002; Marenya and Barrett, (2006); Kiptot, et al., (2007). Therefore, assessment studies of technology adoption provide evidence-based information that is useful in decision making as well as in designing effective intervention programmes and projects in agriculture.

Figure 1: Modified sustainable livelihood framework



Source: Dorward 2001b

2.3 Conceptual framework



CHAPTER THREE – METHODOLOGY

3.1 Study Area

Although the Upper Tana Natural Resources Management Project area covers six Counties namely: **Murang’a, Nyeri, Kirinyaga, Embu, Meru** and **Tharaka** Nithi; the area which also includes the Mt. Kenya and Aberdares National Parks and surrounding Forest Reserves, only two (2) counties; Embu and Kirinyaga was selected for this research.

These were selected because of the extent off the activities of UTaNRMP carried out in the counties, closeness to project head office, and time constraint.

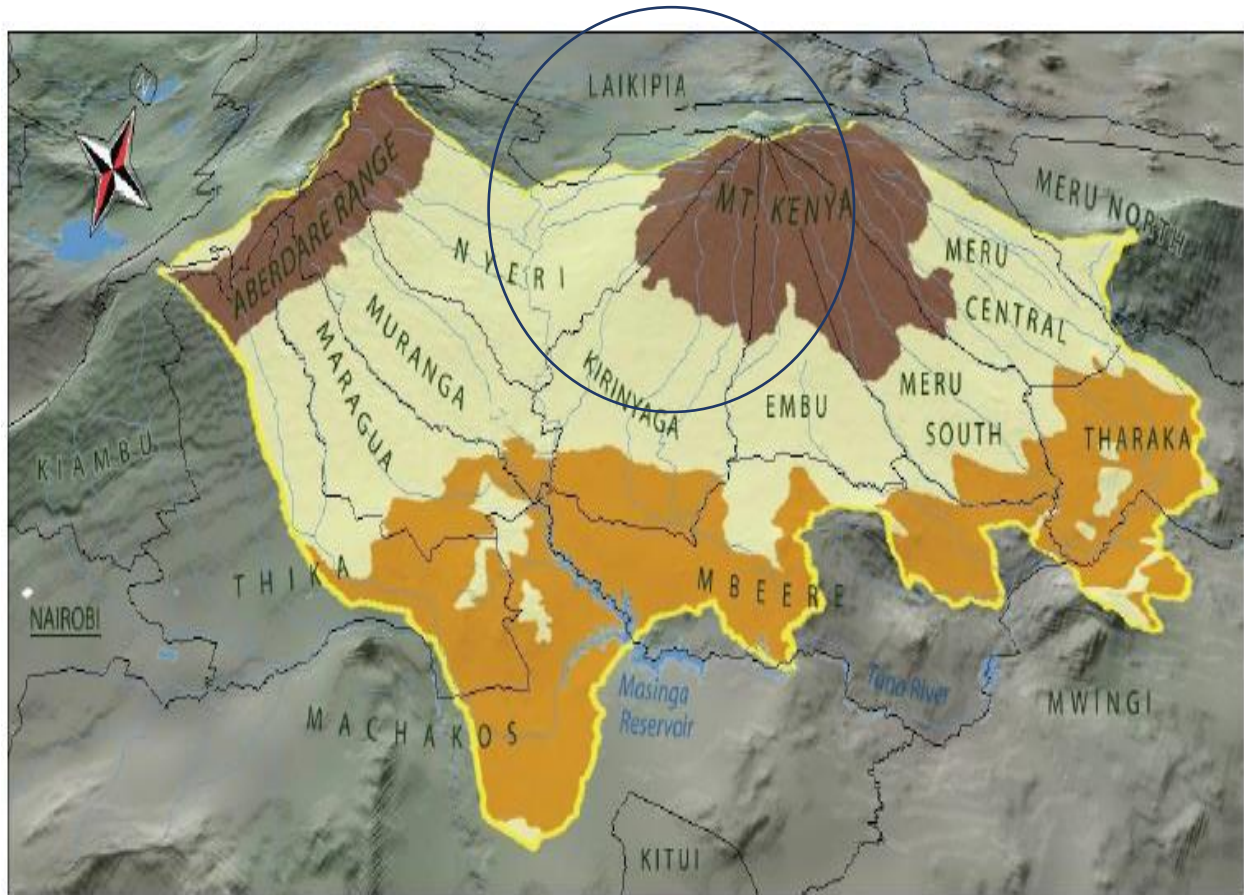
3.1.1 Embu County

Embu County is situated at the centre of the former Eastern Province and covers 2,818 square kilometers with a population of 516,212 persons. The County is inhabited by the Embu, Mbeere, Kamba and Kikuyu communities and hence presents a cosmopolitan complexion. The river basins in the county are: Rupingazi, Kablingazi, Mutonga/Thuci, Thura, Rwanjoga, Gangara, Itimbogo, Itabua/Rupingazi.

3.1.2 Kirinyaga County

Kirinyaga County is situated in Central Kenya. It measures 1,479 square kilometers with a population of 528,054. The County is dominated by the Ndia and Gichugu sub tribes, though with minority Kamba, Embu, Meru, Mbeere and other communities residing mainly in the Mwea rice settlement scheme. The river basins in the county are: Kirwara, Kiwe, Rwamuthabmi, Thiba, Nyamindi, Mugaka

Figure 2: Map showing the two counties for the research



However, for the purpose of this research, the following river basins have been purposively selected for the study based on cost limitation and time limitation of study.

Table 1: River basins for the research

S/No.	County	River Basin
1	Embu	1. Ruringazi
		2. Thuci
2	Kirinyaga	3. Nyamindi
		4. Thiba

3.2 Nature and Sources of Data Collection

In order to achieve the objectives of this research, the survey approach applied a number of techniques including: desk review of relevant documents, Quantitative Research consisting of Individual Household Interviews, Qualitative Research consisting of Key Informant Interviews (KIIs), Focus Group Discussions (FGDs) with community groups- CIGs, and observation combined with use of informed judgment through field visits.

Quantitative Research: Quantitative research was used to establish metrics of the established indicators through use of a statistical sample. Individual structured questionnaires were then administered and this methodology generated numerical data, provided uniformity in data-collection.

Qualitative Research: Qualitative participatory research was used to explore and understand people's beliefs, experiences, attitudes, behavior and interactions. This method generated non-numerical data and consisted of Key Informant Interviews (KIIs), Focus Groups Discussions (FGDs) and Observation/Informed Judgment. Three CIGs per county were selected for the FGDs and three agricultural officials which include the livestock officer, agricultural officer and the fishery officer in each county.

3.2.1 Target population

The target population were members of households and CIGs in the chosen river basins in the study area (Embu and Kirinyaga Counties) of the UTaNRMP area. Purposive sampling was used to select participants for the Focused Group Discussions (FGD) and Key Informant Interview (KII) depending on the study objectives.

3.2.2 Sampling size

The representative sample for household interview was determined scientifically. The sample size was determined using Cochran (1963:75) formula for calculating sample size.

$$SS = \frac{Z^2 \times (p) \times (1-p)}{E^2}$$

Where:

SS = Sample Size;

Z = Z value (e.g. 1.96 for 95% confidence level);

p = p is the estimated proportion of an attribute that is present in the population;

E = margin of error, expressed as decimal (e.g., .05 = ±5)

Taking into consideration a confidence level of 95% (1.96) and a 3% margin of error, the total sample size of 385 was derived.

Stratified random sampling was employed to select the households to be interviewed.

3.2.3 Determination of sample size

The target population of the project area (Embu and Kirinyaga) will be initially stratified along the river basins chosen (based on distance and extent of activities carried out) in the area constituting the first stratum.

Each river basin (first tier stratum) will then be divided into three sub-strata representing the upper, middle and lower sections of the river basin (second tier stratum). Since population along the river basin was not equally distributed, and taking into consideration that the upper and lower zones of the river basins were normally less densely populated than the middle zones of the river

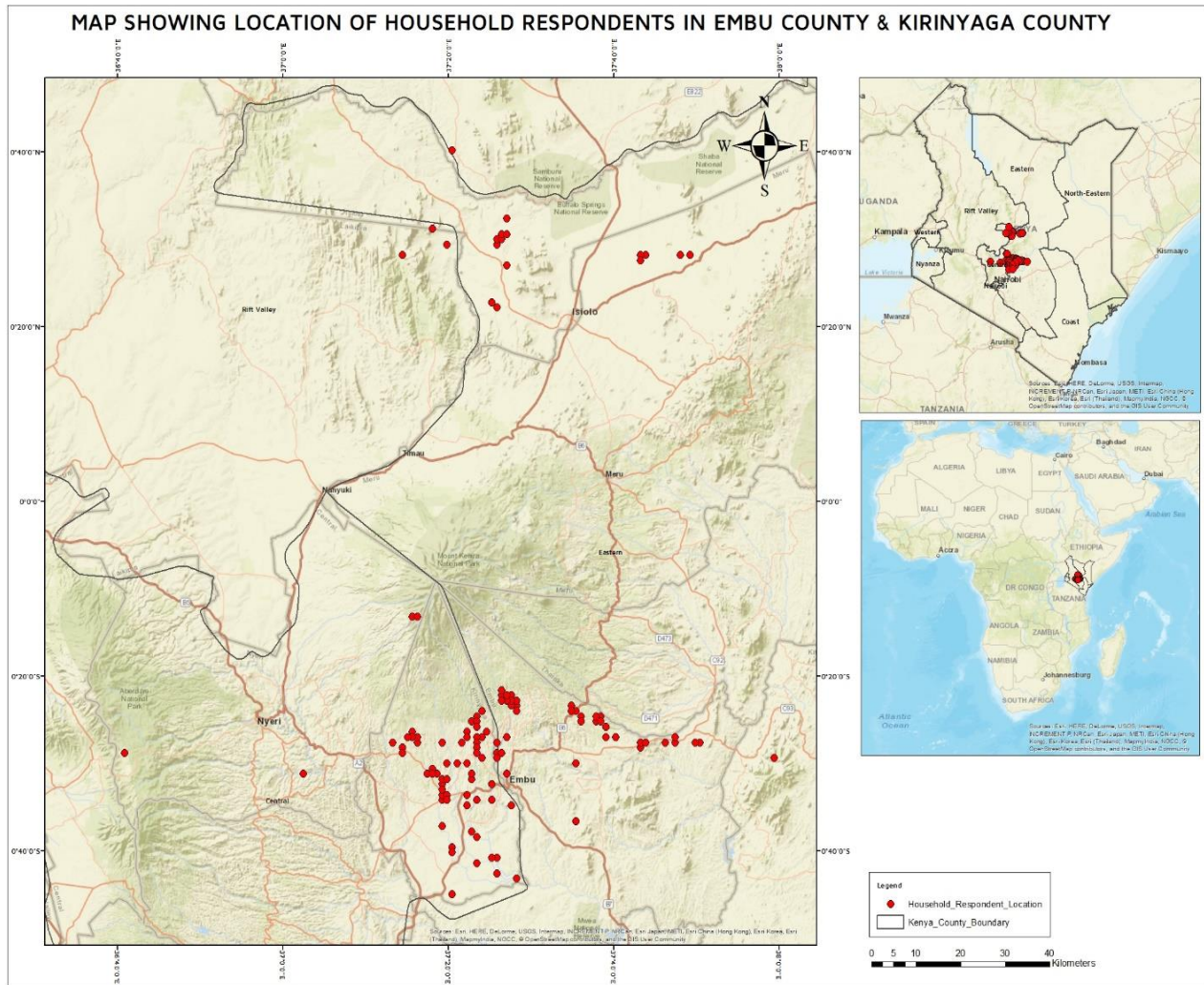
basin, the sample of each river was then divided in the ratio of 1:2:1 for the upper, middle and lower sections respectively (UTaNRMP IAE Report, 2017).

The sample size per river basin was then determined proportionately depending on the number of FDAs per river basin. Since Embu had fewer river basins than Kirinyaga, an adjusted sample size was derived by adding 4 households per FDA.

Table 2: Sample size determination across the river basins

S/No.	County	River Basins	Length (Km)	Size	Total No. of FDAs	Proportionate Sample size	Adjusted Sample size
1	EMBU 516,212 183 sq km	Rupingazi		354	4	44	60
		Thuci		152	5	55	75
2	KIRINYAGA 537,054 357 sq km	Nyamindi	78	453	10	110	110
		Thiba	78	715	16	176	176
TOTAL					36	385	421

Figure 3: Map showing location of household respondents



Source: field survey 2018

3.3 Data validity, reliability and credibility

Validity involves how accurately the data obtained represents the variables of study while reliability refers to the degree to which a research instrument yields consistent results or data after repeated trials (Saunders, *et. al.*; 2003). Validity of the instruments was established by the researcher. To ensure reliability, the questionnaires were pre-tested on a pilot scale through selected respondents outside the study area. The objectives of pre-testing allowed for modification of various questions in order to either rephrase, clarify or clear up any shortcomings in the questionnaires before administering them to the actual respondents.

4.0 RESULTS AND DISCUSSION

4.1 DEMOGRAPHIC & SOCIOECONOMIC CHARACTERISTICS OF RESPONDENTS

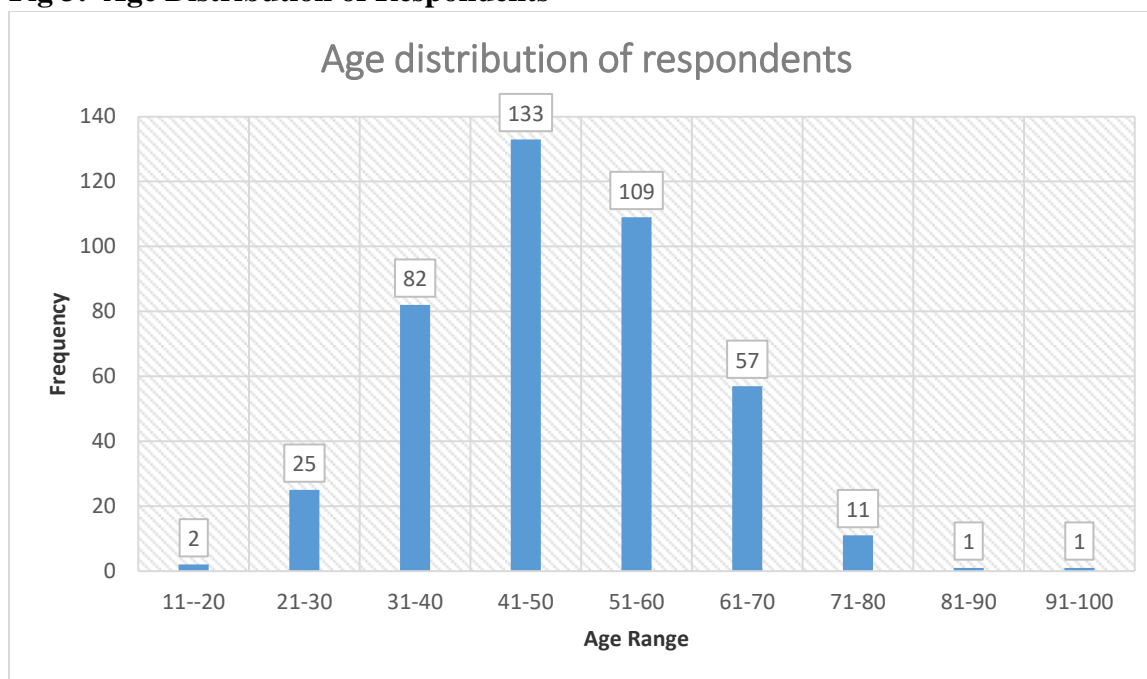
4.1.1 Age Distribution of Respondents

Table 3 and Fig 4.1.1 shows that the ages of the respondent range between 20 and 95 years and the mean age is 49.1 years. This indicates that the respondents are within the working age population and are therefore energetic and active for on farm and off activities raising their likelihood of moving out of poverty and food insecurity.

Table 3: The Mean Age of Respondents

	N	Minimum	Maximum	Mean
Age of Respondents	421	20	95	49.1

Fig 3: Age Distribution of Respondents



Source: Field Survey, 2018

4.1.2 Gender Distribution of Respondents

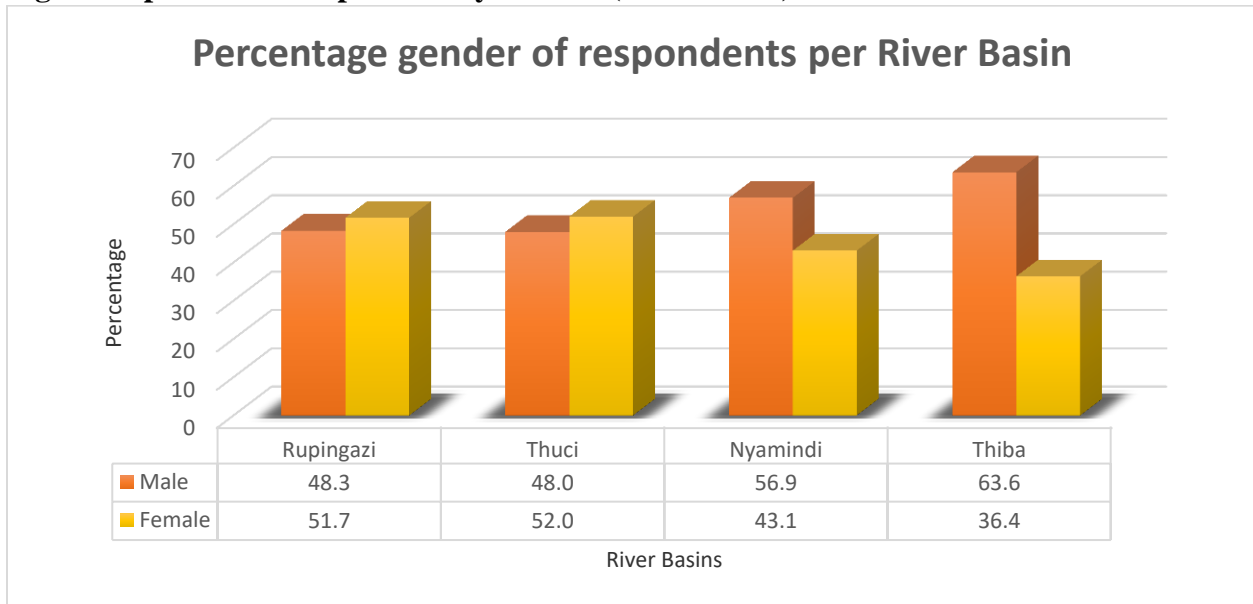
Table 4 shows that 57% of the respondents were male and 43% of the respondents were female. According to the Kenyan Population and Housing Census report of 2009, women accounted for 50.3% of the population while men accounted for 49.7% of the population. This was however only consistent in Rupingazi (48.3% male, 51.7% female) and Thuci (48% male, 52% female) river basins both in Embu County as shown in Figure 4 which therefore suggest that the UTaNRM project is female gender inclusive.

Table 4: Distribution of Respondent by Gender

Gender	Frequency	Percentage
Male	240	57
Female	181	43
Total	421	100

Source: Field Survey, 2018

Fig 4: Proportion of Respondent by Gender (River Basin)



Source: Field Survey, 2018

4.1.3 Size of Household

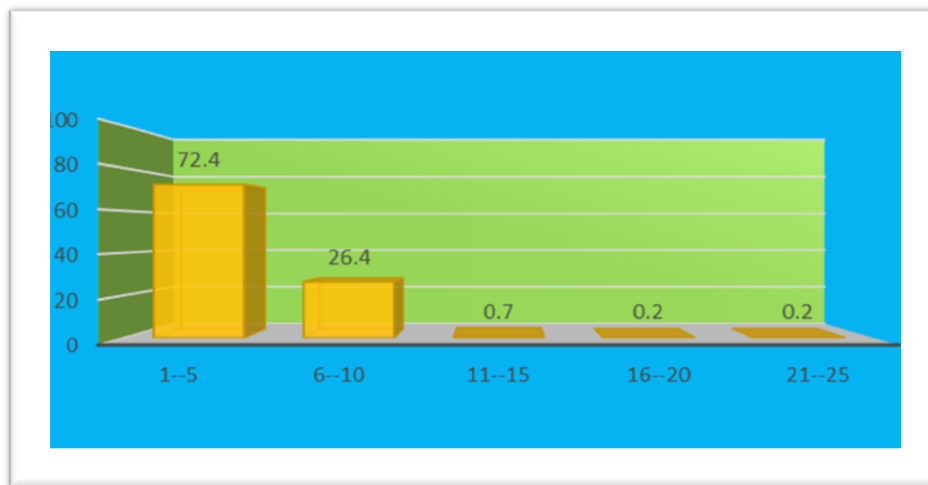
Table 5 and Fig 5 shows information on the average size of households. This data was important since it informed decisions on HH consumption, production (labour for agriculture), savings and capital mobilization amongst other factors therefore directly influencing rural household livelihood. It was established the mean size of household in the project area is 4.86.

Table 5 **Size of the Household**

	N	Mean	Std. Deviation
Household size	421	4.8622	2.17453

Source: Field Survey, 2018

Fig 5 Household Size



Source: Field Survey, 2018

4.1.3 Head of households

Table 6 shows that 12.6 % of the household were headed by female and this correspond to the UTaNRMP gender baseline survey 2014 which revealed that 20% of the homes across the project area are headed by female. These finding are also consistent with the national statistics carried out which provided that less than 29% of households are female headed (KDHS, 2010). Reason could be that majority of the men migrate from the rural areas to urban areas in search of better economic opportunities and at times these men absconded their responsibilities of providing for their families, therefore making women to be the sole bread winners for their

households just like one of the respondent who is a female head said “look at him (pointing to the husband), he does nothing. I am the one taking care of the responsibilities of the house. Dominique 2015, asserts that female headed household are contributing appreciably to the overall decline in poverty and enhancing food security. And this is encouraging given that they are a minority (less than 20%).

Table 6: Head of households

Description	Frequency	Percentage
Male	360	85.5
Female	53	12.6
Male youth	5	1.2
Female youth	3	0.7

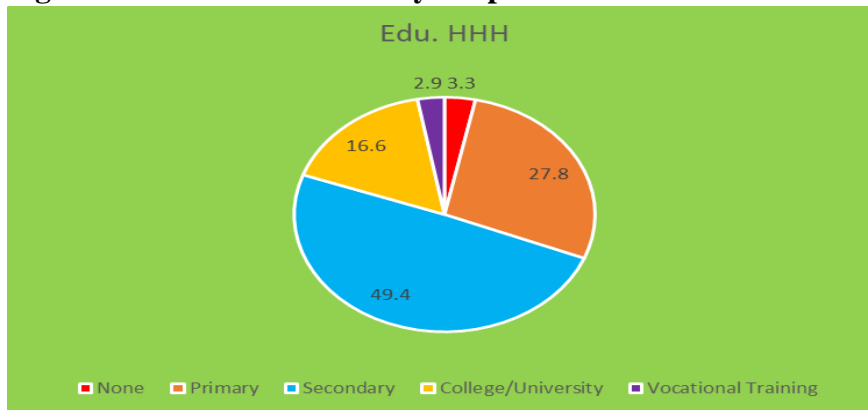
Source: Field Survey, 2018

4.1.4 Education Attainment by Respondents

The findings in figure 6 indicate that above 50% of the respondents had attained secondary education and above while 3.3% were illiterate. These findings are an improvement from baseline data which indicated that at project inception 45.3% of respondents had achieved primary level education.

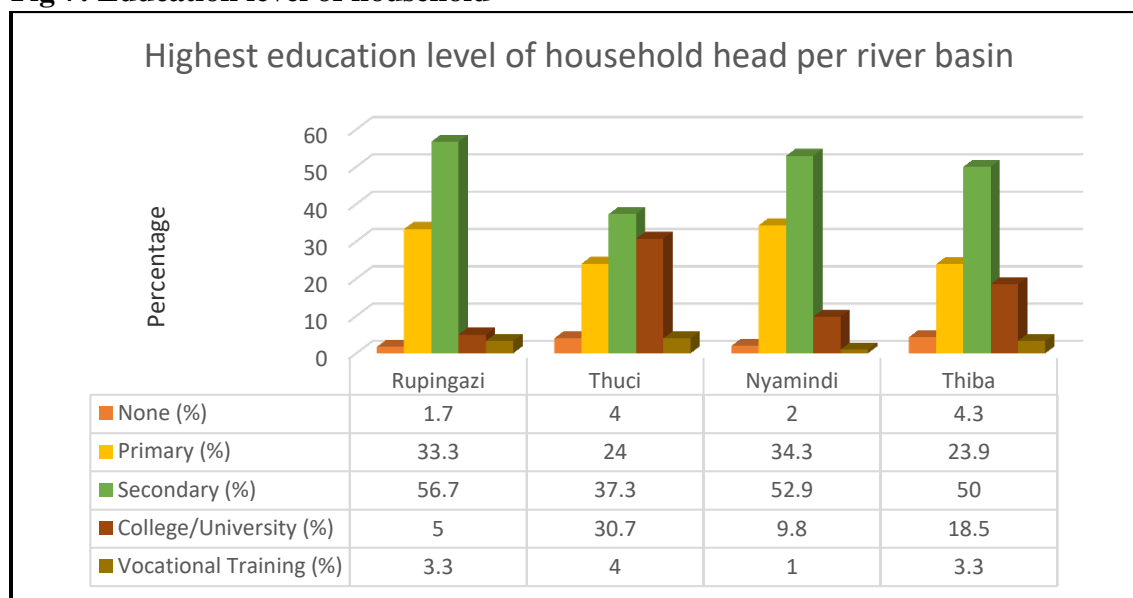
The highest level of education of household head was determined across the river basins in the study area. The findings showed that Thiba (4.3%) had the highest number of household heads with no form of education while Thuci had 30.7% household heads with college/university education. This was the highest across the river basins as shown in fig 7

Fig 6 Education Attainment by Respondents



Source: Field Survey, 2018

Fig 7: Education level of household



Source: Field Survey, 2018

4.1.5 Land ownership by respondents

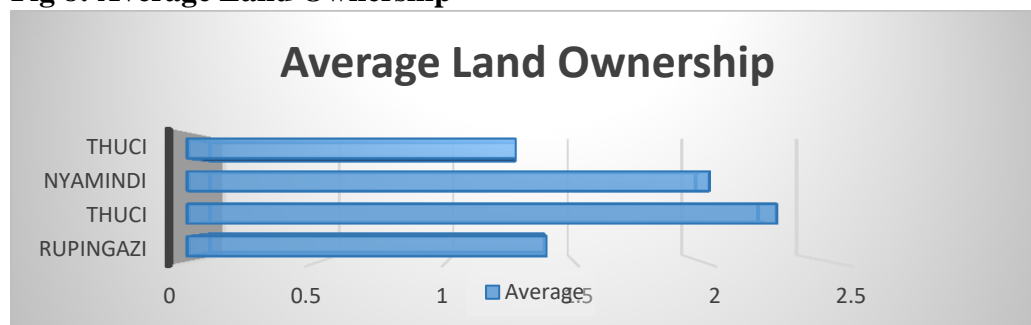
The average size of land owned by the household of the respondent was 1.65 acre however the average land owned by river basin is in the range of 1.2 -2.28 acres of land with lowest average land size being in Thiba river basin at about 1.27 acres while the highest was in Thuci river basin at about 2.28 acres as presented in the figure 8 below. This data validates the targeting mechanism for the project and is indicative that majority of the targeted beneficiaries are smallholder producers with small land holdings.

Table 7 Average Land Owned by Household (Acre)

Average Land Owned by Household	1.65 acre
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Source: Field Survey, 2018

Fig 8: Average Land Ownership



Source: Field Survey, 2018

4.2 ADOPTION OF TECHNOLOGY

4.2.1 Proportion of farmers adopting improved crop technologies

The project various crop technologies such as improved crop varieties, crop rotation, integrated pest management, conservation agriculture, intercropping, weed control and kitchen garden. This research sought to establish the proportion of farmers who have adopted the crop technologies and the findings are revealed in the Table 8 and table 9 below.

The findings from table 8 and 9 showed that Thiba had the highest adoption rate in new crop varieties with 97.6 percent (46.3 % fully, 51.3% partially) of those introduced to the technology adopting it while Thuci had the lowest adoption rate with 80.6% (29% fully, 51.6 partially). Crop rotation technology has 89.78 % adoption, conservation agriculture has 82.48 adoption rates and IPM has 75.71% adoption rate.

Table 8: Proportion of Farmers Adopting Improved Crop Technologies by River Basin

County	River Basin	N	New crop Varieties				Crop Rotation				Integrated Pest Management			
			Introduced (%)	Fully (%)	Partially (%)	None (%)	Introduced (%)	Fully (%)	Partially (%)	None (%)	Introduced (%)	Fully (%)	Partially (%)	None (%)
Embu	Rupingazi	60	45	48.1	44.4	7.4	63.3	68.4	26.3	5.3	40	70.8	29.2	0
	Thuci	75	41.3	29	51.6	19.4	56.0	59.5	33.3	7.1	29.3	50.0	36.4	13.6
Kirinyaga	Nyamindi	102	5.9	33.3	50	16.7	34.3	28.6	51.4	20	17.6	16.7	5.6	77.8
	Thiba	184	46.3	46.3	51.2	2.4	45.1	44.6	47.0	8.4	27.7	51	43.1	5.9
Total/average		421	27.7	39.2	49.3	11.48	39.74	50.3	39.5	10.2	22.9	47.1	28.6	24.3

Source: Field Survey, 2018

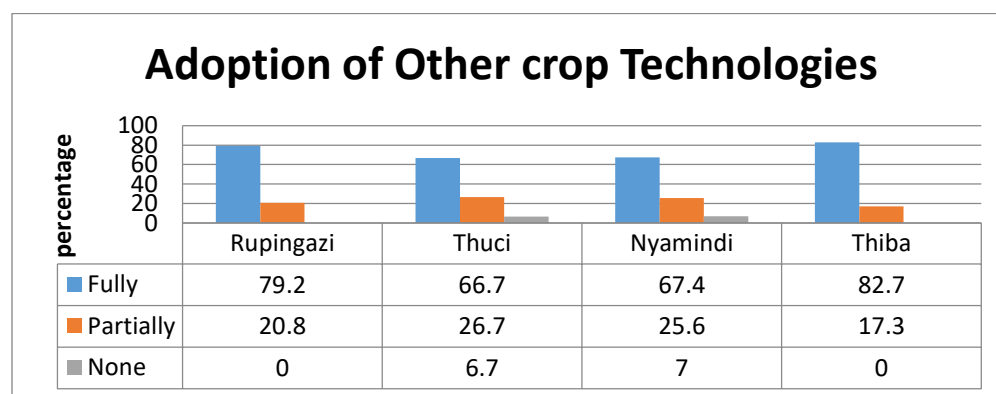
Table 9 proportion of farmers adopting improved crop technologies by River Basin

County	River basin	No	Other Crop Technologies Introduced			Conservation Agriculture			
			Intercropping	Kitchen garden	Weed control	Introduced	Adoption		
							Fully	Partially	None
Embu	Rupingazi	60	21.7	11.7	6.7	45	55.6	37.0	7.4
	Thuci	75	38.7	8.0	13.3	38.7	34.5	48.3	17.2
Kirinyaga	Nyamindi	102	19.6	18.6	3.9	29.4	6.7	60	33.3
	Thiba	184	13.6	20.7	19.0	26.6	38.8	49	12.2
Total/average		421	18.72	11.8	8.58	27.94	33.9	48.58	17.53

Source: field survey 2018

Figure 9 revealed the adoption of other crop technologies which includes intercropping, kitchen garden, and weed control. Rupingazi had 100% adoption and Nyamindi had 93% adoption.

Fig 9: Adoption of Other Crop Technologies

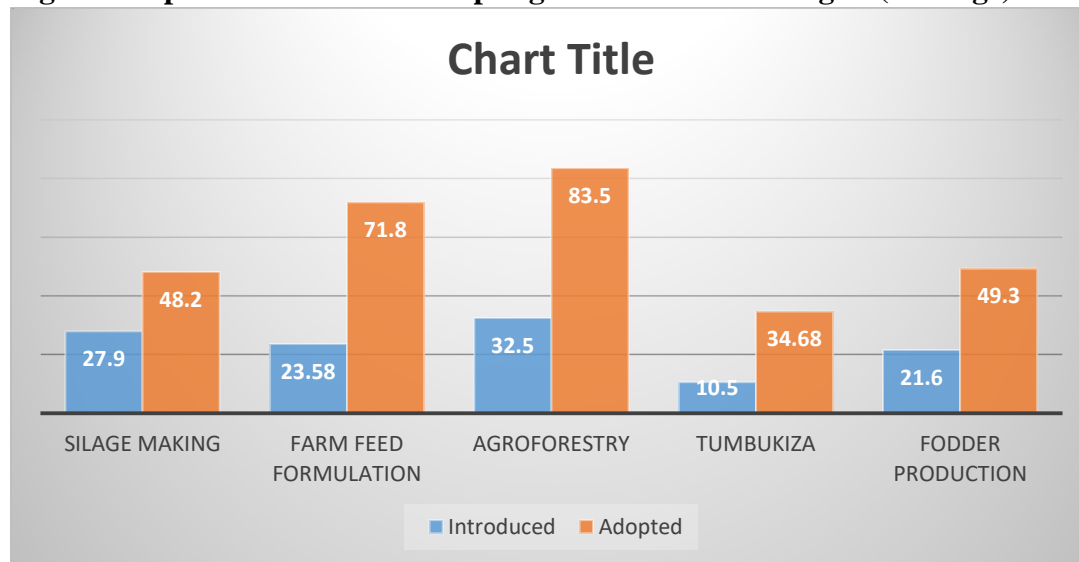


Source: field survey 2018

4.2.2 ASSESSMENT OF THE PROPORTION OF FARMERS ADOPTING IMPROVED LIVESTOCK TECHNOLOGIES AND THEIR IMPACTS

Improved livestock technologies such as silage making, farm feed formulation, agroforestry, tumbukiza and fodder production were introduced. Silage making had an adoption rate of 48.2%, farm feed formulation had 71.83%, agroforestry had 83.45 %, tumbukiza had 34.68 % and fodder production had 49.33%.

Fig 10: Proportion of farmers adopting Livestock Technologies (Average)



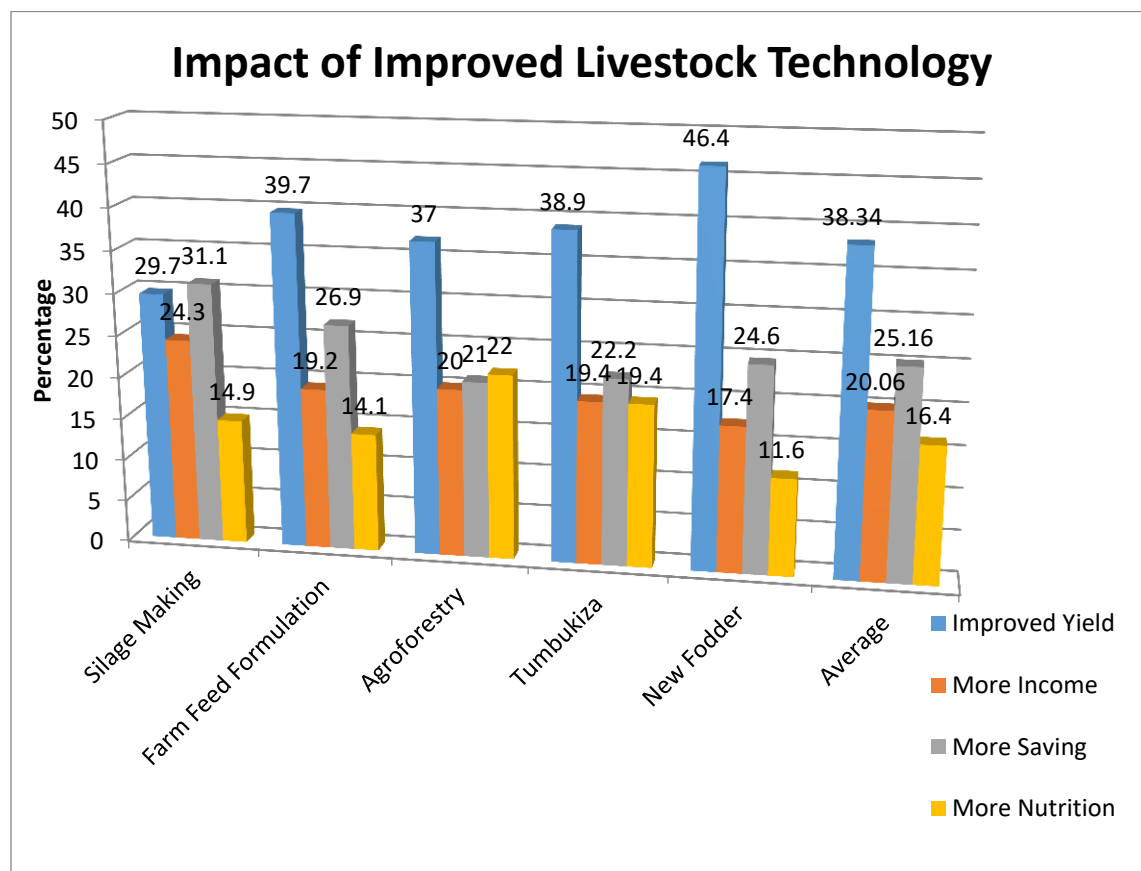
Source: field survey 2018

4.2.3 IMPACTS OF IMPROVED LIVESTOCK TECHNOLOGY

Findings show that 46.4 % of the respondents indicated that the yield of their livestock had improved, 24.3% indicated that the improved livestock technologies had helped them to earn more income, 31.1 % indicated that it had help them to save more and 22% indicated that it had contributed much more to the nutrition of their animals and their family at large since they also consume the products.

Mr. Christopher Muturi, a member of the 3k farmer’s Self-Help group said silage making and fodder crops production has help him and members of the group to have proper maintenance for their dairy cattle and has also allowed the availability of food all year round. Mrs. Esther, another member of the group also said the improve technologies has enabled the milk output per day increased from an average of 3L to 12-14L/day.

Fig 11: IMPACTS OF IMPROVED LIVESTOCK TECHNOLOGY



Source: field survey 2018

4.2.4 Assessment of Effectiveness of Training Approaches

Various training methodologies were employed to disseminate the technologies to the farmers in order to resolve key agricultural productivity issue including low crop and livestock yields. These methodologies include: Farmer Field School, Study tours, Demonstration plots and On-farm trials. Key technologies transferred using these methods includes use of certified seeds, silage making, farm feed formulation, fodder management, fertilizer mixing and soil conservation. Effectiveness of these approaches was assessed based on the adoption of technologies introduced.

Findings from table 10 and 11 revealed that 94 % had adopted technologies introduced to them via FFS and On-farm trials and about 91% had adopted technologies introduced to them via study tours and Demo plots. 97% indicated that the trainings were helpful and less than 3% indicated that these trainings were not helpful. Reasons given were that no significant difference

was observed as a result of the training. Rupingazi had the highest adoption rate for technologies introduced through farmer’s field school which was at 100%, followed by Thiba at 96.3%. Nyamindi and Thiba had the highest rate of adoption of technologies introduced through On-farm trails, both at 100% (58.8% fully and 41.2% partially) and 95.5%(56.8% fully and 38,6% partially) respectively. Overall, FFS and On-farm trials very effective in technology introduction as the rate of adoption for the two methodologies were higher than that of study tour and demonstration plots.

Table 10 Proportion of Household Who Adopted Technologies Introduced Through FFS and On- Farm Trials

River basin	N	Farmer Field School							On farm trials						
		Adoption				Performance rating			Adoption				Performance rating		
		Introduced	Fully	Partially	none	Very helpful	Helpful	Not helpful	introduced	Fully	Partially	none	Very helpful	Helpful	Not helpful
Rupinga zi	60	63.3	68.4	31.6	0	60.5	34.2	5.3	28.3	61.1	33.3	5.6	61.1	27.8	11.1
Thuci	75	41.3	53.1	37.5	9.4	51.7	48.3	0	24.0	55.6	33.3	11.1	52.9	47.1	0
Nyamin di	102	42.2	34.1	56.8	9.1	45.0	55.0	0	8.8	58.8	41.2	0	25.0	75.0	0
Thiba	184	47.3	55.6	41.1	3.3	50.6	49.4	0	21.7	56.8	38.6	4.5	69.0	31.0	0
Total /average	421	38.8	52.8	41.8	5.5	51.9	46.7	1.3	16.6	58.1	36.6	5.3	52	45.2	2.8

Source: field survey 2018

4.2.5 Factors that Influences Adoption

A cross tabulation of the

Table 11: Proportion of Household Who Adopted Technologies Introduced Through Study tour and Demo plots

River basin	Study Tour							Demonstration plots						
	Adoption				Performance rating			Adoption				Performance rating		
	Introduced	Fully	Partially	None	Very helpful	Helpful	Not helpful	Introduced	Fully	Partially	none	Very helpful	Helpful	Not helpful
Rupingazi	40.0	73.1	19.2	7.7	64.0	36.0	0	33.3	80.0	15.0	5.0	84.2	15.8	0
Thuci	26.7	50.0	45.0	5.0	42.1	52.0	0	36.0	40.7	44.4	14.8	43.5	52.2	4.3
Nyamindi	11.8	45.5	45.5	9.1	50.0	50.0	0	35.3	33.3	58.3	8.3	29.4	67.6	2.9
Thiba	31.5	43.9	43.9	12.3	44.0	56.0	0	36.4	49.3	43.3	7.5	53.2	45.2	1.6
Total/average	22	53.1	38.4	8.5	50.0	48.5	0	28.2	50.8	40.2	8.9	52.6	45.2	2.2

Source: field survey 2018

4.2.5 Factors that Influences Adoption

Technologies adopted were cross tabulated with different perceived factors that can influence adoption of technology such as Age, Education level of Household head, farm size and belonging to a common interest group.

Findings from table 12 shows that the technologies introduced (both crop and livestock) were adopted more by farmers who belong to a CIG than those who do not belong. Farm size, age and educational level of household head did not have influence on adoption.

Table 12: Factors that Influences Adoption

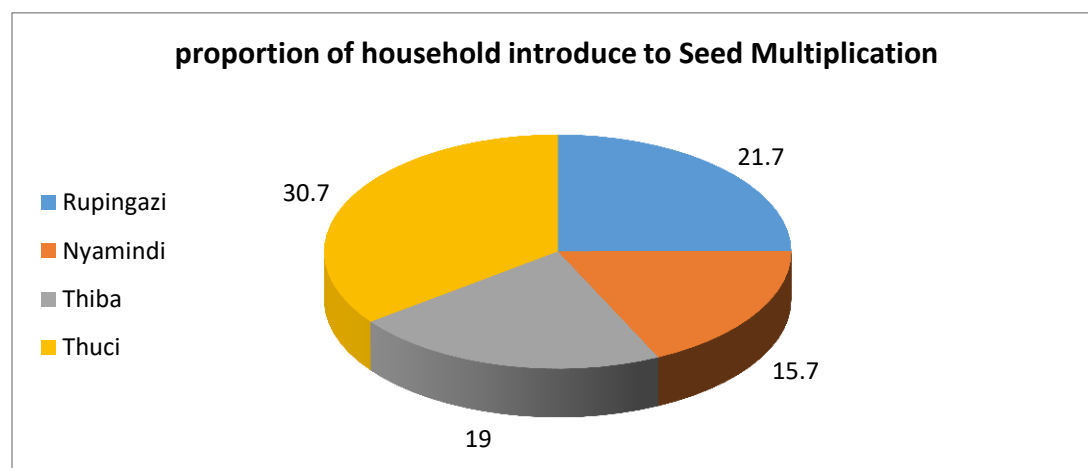
Description	Adoption of Technologies introduced (percentage)									
		New crop variety	Crop rotation	Integrated pest management	Conservation agriculture	Silage making	Farm feed formulation	Agroforestry	Tumbukiza	New fodder production
Age of respondents	11-20	100	0	-	100	100	100	0	20	-
	21-30	62.5	92.3	60	75	33.3	75	87.5	50	40
	31-40	96	91.2	91.7	79.3	55.2	82.4	76.2	21.4	40.9
	41-50	95.7	93.7	87.5	88.4	54.8	78.1	88.9	34.5	458.1
	51-60	96.3	90.2	79.4	81.8	53.1	78.6	84.4	66.7	41.5
	61-70	83.3	83.3	84.6	84.2	55	69.2	83.3	0	78.9
	71- 80	66.7	100	50	50	100	100	100	37.1	50
	81-90	-	-	-	-	-	-	-	-	-
	91-100	-	-	--	-	-	-	-	-	-
Belong to CIG	Yes	97	94.1	88.7	88.1	62.6	82.4	87.1	34.4	54.4
	No	78.9	84.8	72.7	74.5	37.8	68.8	79.6	42.4	47.6
Educational level of HH	None	100	100	75	50	50	100	100	66.7	75
	Primary	87.5	89.8	77.8	87.1	54.2	72	91.7	40.7	48
	Secondary	89.7	90	84.7	82.1	53.4	81.8	78.4	42.2	52
	College	100	88.9	85.7	86.2	60.6	78.6	79.2	19.0	53
	vocational	50	100	75	75	25	0	100	0	50
Total land owned(Acres)	Less than 1	95.2	94.3	88.4	77.1	62.2	88.9	84.4	51.7	59.5
	1-2	88.4	85.4	78.8	83.1	50.0	75	81.1	38	55.7
	3-4	84.6	91.7	63.6	95	54.5	66.7	87.5	7.7	36.8
	More than 4	85.7	100	100	87.5	42.9	62.5	100	20.6	30

4.2.5 ASSESSMENT OF SEED MULTIPLICATION/BULKING TECHNOLOGY ON IMPROVED LIVELIHOOD

The project partnered with KALRO to train Farmers on seed production protocols so that they could sustain themselves in terms of seed. These trained farmers were given seeds to share with other farmers in their groups and establish community-based seed production and they are to give back to KALRO double the amount that was given to them and then multiply the rest of the seeds or sell to other farmers.

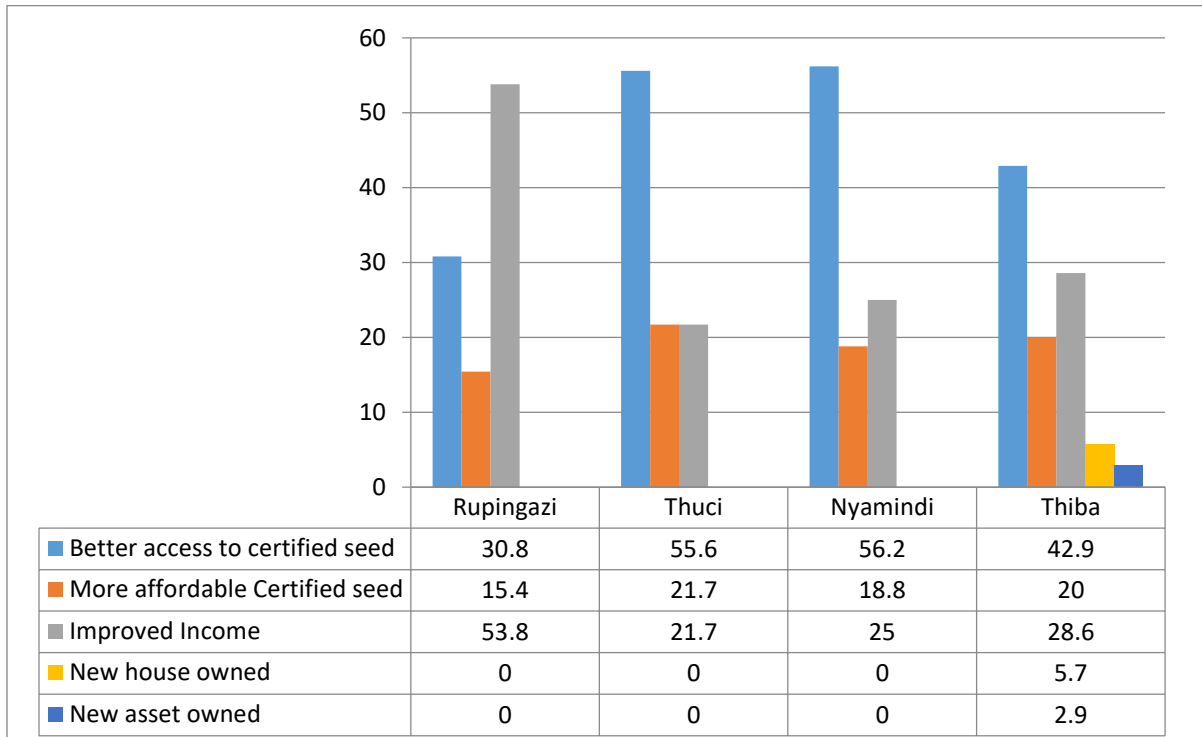
Findings from figure 12 revealed that 30% of household surveyed in Thuci, 21.7 % in Rupingazi, 19% in Thiba and 15.7% in Nyamindi are engaged in seed multiplication. Impact survey in fig 13 revealed that 46% indicated better access to certified seeds, 19% indicated more affordable certified seeds, 32% indicated increase in income and less than 2% have bought new asset and build new houses from the proceeds of the enterprise.

FIG 12: PROPORTION OF HOUSEHOLD INTRODUCE TO SEED MULTIPLICATION



Source: field survey 2018

Fig 13: Impact of seed multiplication on household livelihood



4.3 ASSESMENT OF LEVEL OF IMPROVEMENT IN LIVELIHOOD EXPERIENCED BY THE BENEFICIARIES

4.3.1 Ownership of Improved Livestock Breeds

From Table 13, proportion of farmers owning improved cattle breeds was: Fresian (27.63%); Arshyre (5.95%); Guersey(8.18%); and Jersey (13.05%). The improved cattle breed owned mostly by farmers was the Fresian breed and this was most preferred because this breed had highest production potential, its milk had the lowest butter fat content (2.5-3.6%) compared to the other breeds and the calves had a fast growth rate hence guaranteeing the farmers quicker returns. The ownership of improved goat varieties was Kenya Alpine (24.23%); and Toggenburg (14.9%), while ownership of improved pig varieties was: Large White (3.03%); Landrace (0.28%); Hampshire (0.5%); and Duroc (0.13%).

It was also established in table 13 that the proportion of farmers owning Improved rabbit breeds was: Chinchila (2.73%); New Zealand White (1,2%); and California (6.58%). improved poultry breeds was: Kari Kienyeji (52%); Kenbro (4.8%); Rainbow (5.33%). New Bee hives was: KTBH (1.5%); and Langstroth (5.65%), while fish species was Cat fish (0.75%), Tilapia (0.425%).

Nicholsen et al 2004 found out that ownership of improved dairy cows increased household-level intakes of dairy products as well as cash incomes in Kenya. By cross-tabbing the consumption quintiles which distinguish the population into 5 quintile ranks from the poorest 20% to the richest 20%, with ownership of Improved cattle breed in table 15. It was discovered that 87.2% of people who have improved breed of cattle belongs to the first quintile (poorest 20%) while 94.7% of people who does not have improved breed of cattle fall within the first quintile. 0.5% of people with improved cattle breed fall within the 5th quintile while none of the respondent with no improved cattle breed falls within the 5th quintile. This implies that proportion of household who owned improved cattle breed have access to more income than those without improved breed cattle.

Table 13: Proportion of farmers owning improved livestock breeds (cattle, Goats, Pigs)

River Basin	No	Improved cattle breed						Improved Goat breed		Improved pig breed			
		Jersey	Guersey	Fresian	Arshyre	Sahiwal	Boran	Togenburg	German/Ken	van Albhine	Large white	Landrace	Hampshire
Rupingazi	60	23.4	6.7	35.0	11.7	0	0	15.0	21.7	1.7	0	0	0
Thuci	75	4.0	8.0	32.0	4.0	2.6	0	20.0	30.7	1.3	0	0	0
Nyamindi	102	11.8	4.9	24.5	4.9	3.0	1.0	13.7	25.5	2.0	0	2.0	0
Thiba	184	13.0	13.1	19.0	3.2	0.5	0	10.9	19.0	7.1	1.1	0	0.5
Total/ Average	421	13.05	8.18	27.63	5.95	1.53	0.25	14.9	24.23	3.03	0.28	0.5	0.13

Source: field survey 2018

Table 14 Proportion of farmers owning improved livestock breeds (rabbit, poultry, bee fish)

River Basin	No	Improved Rabbit Breed			Improved Poultry Breed		Improved Bee		Fish		
		California white	New Zealand	Chinchila	Kari Kienyegi	Rainbow	Kenbro	Langstroth	KTBH	Cat fish	Tilapia
Rupingazi	60	10.7	1.7	6.7	65.0	3.3	5.5	3.3	1.7	1.7	1.7
Thuci	75	2.7	0	2.7	53.3	4.0	2.7	10.7	0	1.3	0
Nyamindi	102	6.9	2.0	1.0	45.1	6.9	3.9	5.9	2.9	0	0
Thiba	184	6.0	1.1	0.5	44.6	7.1	7.1	2.7	1.6	0	0
Total average	421	6.6	1.2	2.7	52	5.3	4.8	5.7	1.6	0.8	0.4

Source: field survey 2018

Table 15: CONSUMPTION EXPENDITURE SHARE PER QUINTILE (%)

Owned	1st	2nd	3rd	4th	5th
Improved Dairy cow breed	less than 49310 KSH	49311 - 98620 KSH	98621 - 147930 KSH	147931 – 197240 KSH	Above 197240 KSH
Yes	87.2	10.2	2.0	-	0.5
No	94.7	4.4	0.9	-	0

Source field survey 2018

4.3.2 Average Yield of Livestock

The findings in table 16 revealed that average cow milk yield is 6.18L/cow/day with a minimum of 3L/cow/day and maximum of 15L/cow/day. This show a little improvement on the baseline average which was at 5.8L/cow/day. Goat milk increased from an average of a quarter litre (0.25l/goat/day) to 1.49L/goat/day. Average honey harvested was 24.90kg and average crates of eggs sold per year is 52 crates. The increase in average yield of livestock products is due to the adoption of improved livestock technologies such as improved breed, silage making, Agroforestry and farm feed formulation.

Table 16: Average yield of livestock products

Livestock product	Cow milk(litres)	Goat milk(litres)	Honey(kg)	Eggs (crates)
Average yield	6.18	1.49	24.90	52

4.3.3 IMPACT OF IMPROVED LIVESTOCK BREED ON LIVELIHOOD

Farmers reported increased milk production as a result of adopting the improved cattle and goat breeds, which also contributed to improve incomes.

Case survey: FGD with Mbuguru Dairy cooperative in Embu

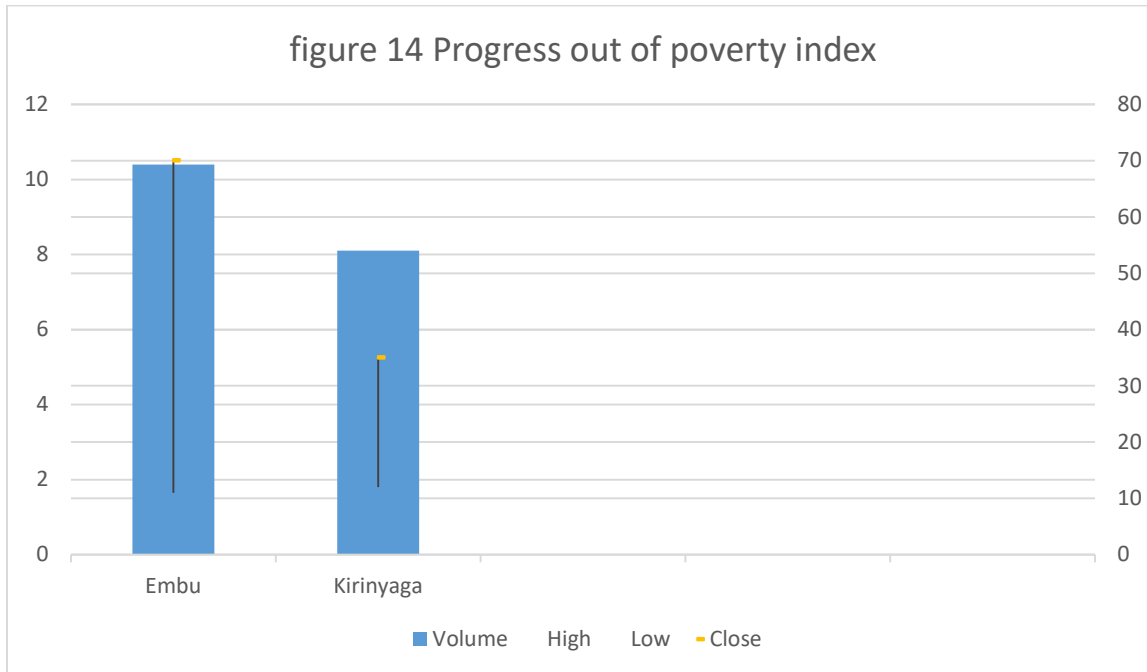
Mbuguru Dairy cooperative started in 2011 as a self-help group through the initiative of nine (9) farmers who were experiencing challenges with marketing their milk. By 2013 they members had grown to about 400 and they registered as a cooperative. Their milk collection at 2011 was 34L/day but by 2013 it had increased to 3000L/day. Presently they collect an average of 7000L/day.

Mr samuel Njeru, the chairman of the cooperative attributed the increase in milk collection to the introduction of improved cattle breed in the area and he gave an example of a self-help group (Jikaze SHG) whose members belongs to their cooperative and was funded by UTaNRMP. Before they were funded they were producing 200L of milk per day but now they produce 400L of milk per day. He further stated that individual farmer milk production had improved from an average of 3-4 L/cow/day to 5-6L/cow/day though they are still far from their target which is 15L/cow/day.

Mr kennedy the accountant of the cooperative said there is also improvement in the livelihood of their members, some who have motorbikes (Bodaboda) before have upgraded to motor cars and it has also helped them to start the production of yoghurt which is a value added product.

4.3.4 Poverty Rate by County based on the Progress out of Poverty Index® (PPI):

the rate of poverty in a group of households surveyed with the PPI is estimated by converting each household's PPI score to a poverty likelihood value using the PPI look-up table. Then, all of the likelihood values are added together and divided by the number of households surveyed. The number obtained is the percent of households in that group that live below the poverty line. The PPI by county for the household surveyed was estimated and 10.4% of the household in Embu were found to be living below the \$1.25 level while 8.1% of the household surveyed in Kirinyaga were found to be living below the \$1.25 as shown in figure 14

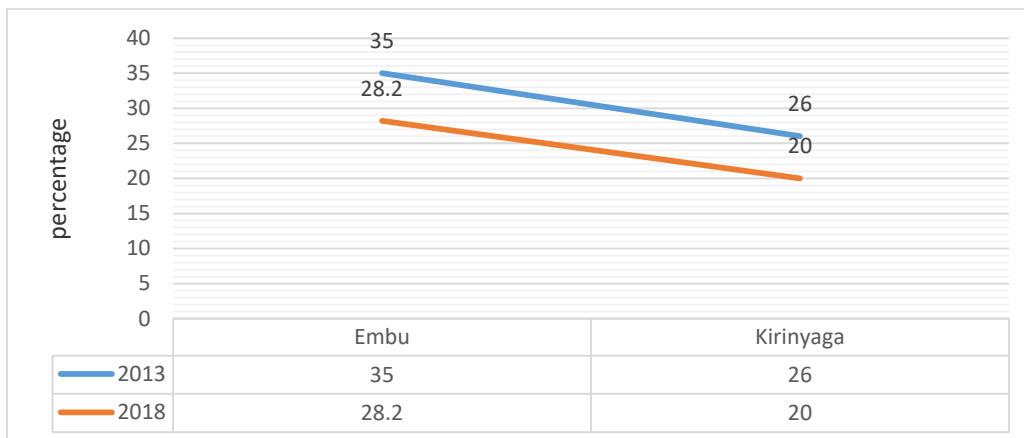


Source: field survey 2018

4.3.5 POVERTY INCIDENCE BY COUNTY

The survey also established that there was a reduction in poverty incidences (people living below the poverty line) across the two counties compared to the baseline situation, Embu reduced from 35% to 28% and Kirinyaga reduced from 26% to 20% as shown in fig 4.3.4 above. This can be attributed to increase in income of the population of the counties.

Fig 15: Comparison of poverty incidence 2013 and 2018



Source: KNBS, 2013 and KHIBS, 2018

4.3.6 Proportion of children under five years, who are chronically malnourished (height for Age), Acute malnourished (weight for height) and underweight (weight for age)

Nutrition status of children below five years of age was determined using the recent released KIHBS 2015-2016 basic report.

➤ Wasting (weight-for-height)

Wasting (low weight- for- height) is a manifestation of failure to receive adequate nutrition in the period just before the survey and mostly occurs due to recent illness, drought or insufficient food supply. Children with Z-scores below minus two standard deviations (-2 SD) are considered wasted and are acutely malnourished. The average prevalence of wasting among children in the two counties was 2.1percent, a good improvement from 3.3 percent at baseline and an improvement from the national prevalence of 13% percent (KIHBS 2018).

➤ Stunting (height-for-age)

Stunting (short for age) occurs due to failure to receive adequate nutrition over an extended period of time. Children with Z-scores below minus two standard deviations (-2 SD) are considered stunted and are chronically malnourished. The prevalence of stunting among children in the two counties 30.65%. This was a slight improvement from figures reported in KDHS (2014) where 32.9% of children under five were stunted and a little bit higher than the national prevalence for stunting in 2018 which was 29,9%. (KIHBS 2018).

➤ Underweight (weight for age)

Underweight is a measure of both acute and chronic malnutrition. Children with Z-scores below minus two standard deviations (-2 SD) are considered underweight. The prevalence of underweight among children in the two counties was 11.95%. This was higher than 10.8% reported in the KDHS (2014) and the national prevalence of 6.7% percent (KIHBS 2018).

Fig 16: Nutrition status of children below five years of age

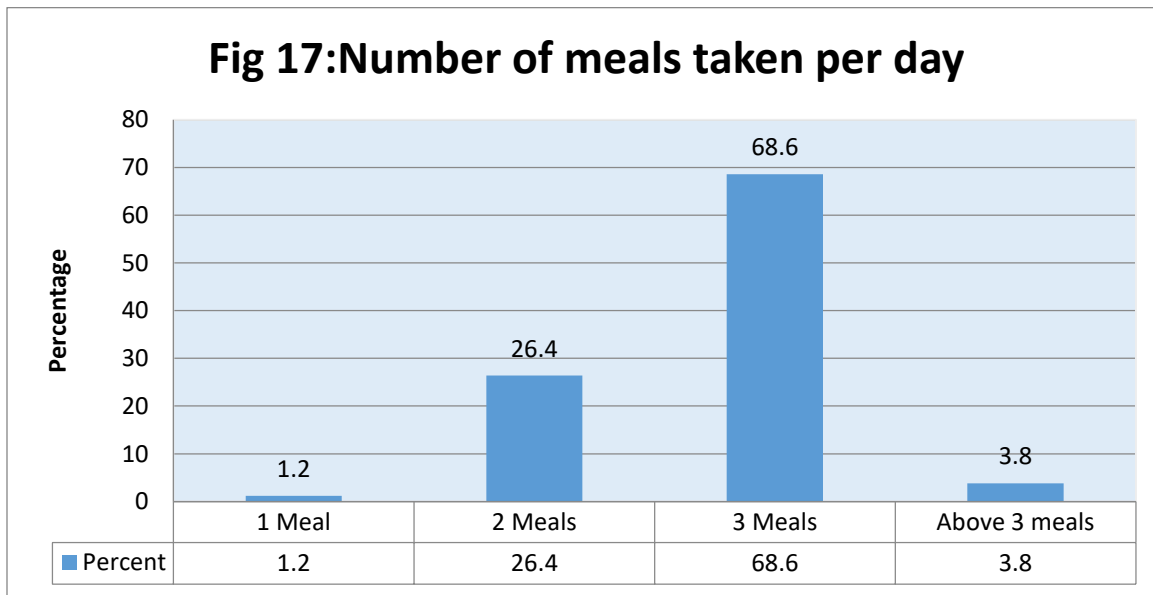
County	Wasting (weight-for-height) (%)	Stunting (height-for-age) (%)	Underweight (weight-for-age) (%)
Embu	3.5	33	16.8
Kirinyaga	0.7	28.3	7.1
Average	2.1	30.65	11.95

Source: UTaNRMP IAS 2017

4.3.7 Food Availability

The findings in Fig 17 reveal that most of the respondents (68.6%) reported that their households had three meals per day. About 3.8% of respondents reported to have more than three meals per day. On average, the number of meals taken during peak season was 3 meals.

The UTaNRMP 2017 assessment report also that 51.4% had three meals per day during low food availability season and 37.4% had two meals. The average number of meals taken during low season was 3 meals.



4.3.7.2 Dietary Diversity

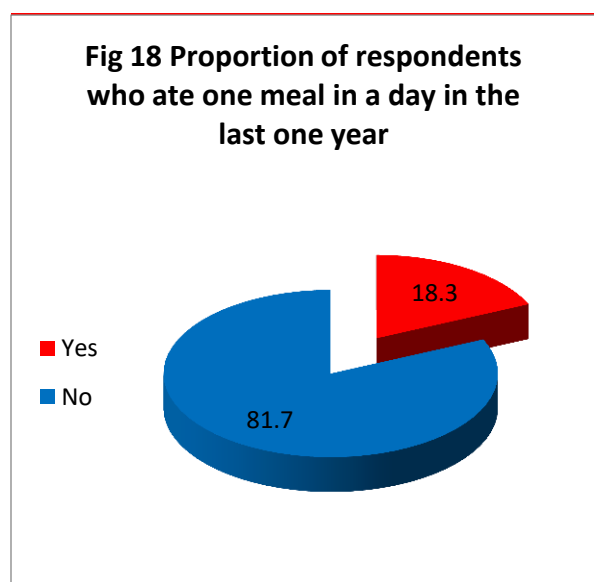
The UTaNRMP 2017 assessment computed Dietary diversity scores through a simple count of food groups consumed by the household from a list of seven food groups recommended by FAO (FAO, 2010) for assessing household dietary diversity. The seven food groups used were: 1) cereals/roots/tubers; 2) meat/poultry/fish; 3) dairy; 4) eggs; 5) vitamin A rich fruit and vegetables; 6) legumes; 7) other fruit and vegetables.

The mean dietary diversity was 4 food groups, with a minimum of 2 and a maximum of 6 food groups. This is medium dietary diversity meaning that majority of the households had a higher access to a variety of food groups. The most commonly consumed food groups in all the river basins were cereals, roots and tubers (98%), legumes (78 percent), vegetables (88%), and fruits (35%).

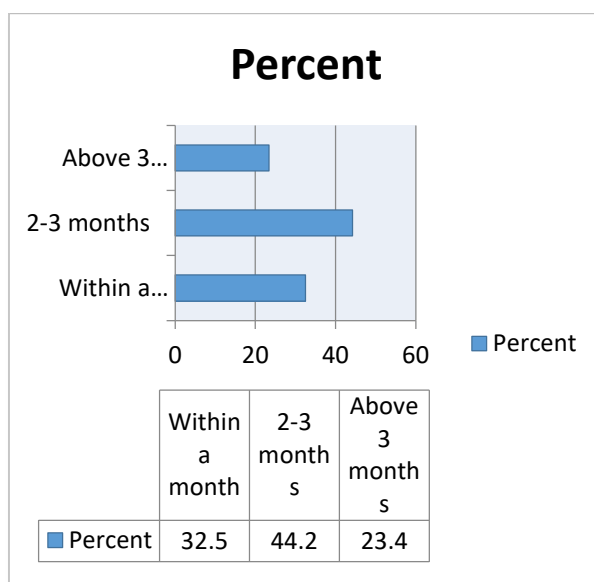
4.3.7.3 Incidence of hunger in the past one year

The respondents were asked if any member of the family had gone hungry in the past one year due to lack of food and results indicate that only 18.3% had experienced hunger in that time frame.

The frequency of hunger was further classified into three categories; within a month, 2-3 months and above 3 months. The survey realized that 44.2 % reported to have experienced hunger within 2-3 months, 32.5% experienced it within a month and 23.4% were hungry for more than 3 months. fig 18 shows proportion of households that reported hunger in the last one.



Source: field survey 2018



source field survey 2018

4.3.8 Asset ownership

This survey sought to know the proportion of farmers having Agricultural machines, tools and implements and household asset and compare with the baseline so as to track changes. Increase in assets can be as a result of increase in income of the households.

Tractors were used by just 0.125 percent of the respondents, sprays by 35 percent, Oxen plough by 5.33% and irrigation pumps by 11.65 percent of the respondents. Tractors were only found in Thiba as mentioned by 0.5%. Sprays were more common in Nyamindi as reported by 43.1% of the respondents while irrigation pumps were more common in Thiba as reported by 11.9% of the

respondents. Kirinyaga county has more agricultural machines than Embu county as 0.3% of the respondent have tractor, 8.7% have oxen plough and 14% have irrigation pump against that of Embu 0% for tractors, 3% for Oxen plough and 8.1% for Irrigation pump.

Table 17 Agricultural Machines and Power Tools Owned by Households by River Basin (percentage)

River basin	Tractor	Spray pump	Oxen plough	Irrigation pump
Rupingazi	0	41.7	0	11.7
Thuci	0	24	5.3	5.3
Nyamindi	0	43.1	7.8	17.7
Thiba	0.5	33.7	8.2	11.9
Average	0.125	35.625	5.325	11.65

Source: field survey 2018

Survey findings revealed that Motor bikes, cars, TVs, Radios, bicycles, mobile phones gas cookers, and computer were some of the assets which people owned across the river basins. Mobile phones led in the list of most common assets as mentioned by 96.95 percent of the respondents and was more than the baseline (82%). This was followed by the radio mentioned by 80% percent of the respondents while the baseline stood at 73%. Television sets were mentioned by 73% percent compared to baseline of 42 percent, while bicycles were mentioned by 38 percent of the respondents slightly higher than the baseline of 36%. Others were motorbikes (26 percent), motor vehicles 11.5%. and gas cooker 50.3% compared to 11% at baseline.

Table 18 shows that panga is own by 96.48% of the respondents, jembe and jembe fork followed with 84.53%, and 75.9% respectively. Fishing gear has the lowest percentage with 1.87%, and this shows that fishing activities is not yet being exploit to the fullest in the two counties.

Embu county leads in household asset as 76.3% owns TV, 98.5% owns phones, 13.3% owns cars while in Kirinyaga, 71.3% owns TV, 95.1% owns phones and 9.4 owns cars.

Table 18: Agricultural tools and Implements owned by household by River Basin

River basin	Panga	Jembe	Jembe fork	Sickle	Secateurs	Rake	Knapsacks	Watering can	Wheel barrow	Milking can	Fishing gear
Rupingazi	96.7	78.3	81.7	14.5	40.0	31.7	46.7	41.7	56.7	73.3	3.4
Thuci	97.3	96.0	82.7	13.3	17.7	26.7	38.7	30.7	65.3	45.3	2.6
Nyamindi	99.0	86.1	74.5	23.5	30.4	48	62.7	57.8	52.9	48.0	1.0
Thiba	92.9	77.7	64.7	16.8	30.4	42.4	54.9	59.2	51.1	46.7	0.5
Average	96.48	84.53	75.9	17.025	29.625	37.2	50.75	47.35	56.5	53.33	1.87

Source: field survey 2018

Table 19: Household Assets owned by river basin

River basin	Television	Phones	Motor vehicle	Fridge	Gas cooker	computer	Bicycle	Radio	motorcycle
Rupingazi	85	98.3	15	13.3	45	10.0	28.3	80	26.7
Thuci	63.4	98.7	12	12	50.7	11.4	41.3	77.3	24.0
Nyamindi	68.7	96.2	9.8	8.8	44.1	8.8	42.2	80.4	29.4
Thiba	75.5	94.6	9.2	8.7	61.4	9.3	40.8	82.6	24.4
Average	73.15	96.95	11.5	10.7	50.3	9.875	38.15	80.075	26.125

Source: field survey 2018

4.3.8 Housing types

Housing types were assessed along three categories, namely permanent, semi-permanent and temporary. In the survey, permanent houses were seen as those whose main material was stones. Semi-permanent houses were defined as those whose main material was timber, while temporary houses were defined as those made of mud, iron sheets, or other material other than stones and wood.

Households with temporary housing was 11% at baseline, findings from table 20, shows that it has improved to 8.1% even surpassing the midterm target which was 9%. the distinction between permanent and temporary housing is made based on the durability of materials used for roofing, wall and floor for dwellings.

Table 20: Proportion of Housing Types Owned by the Households

HH Structures	Minimum	Maximum	Mean	Semi-Perm	Permanent	Temporary
Number of Residential House	1	6	1.5416	43.7%	48.2%	8.1%
Number of Grain Store Owned	0	3	0.3634	7.4%	19.5%	6.9%
Number of Equipment Store Owned	0	2	0.5416	26.2%	57.1%	16.7%
Number of Toilet Facility Owned	0	3	1.0641	34.4%	49.6%	14.0%

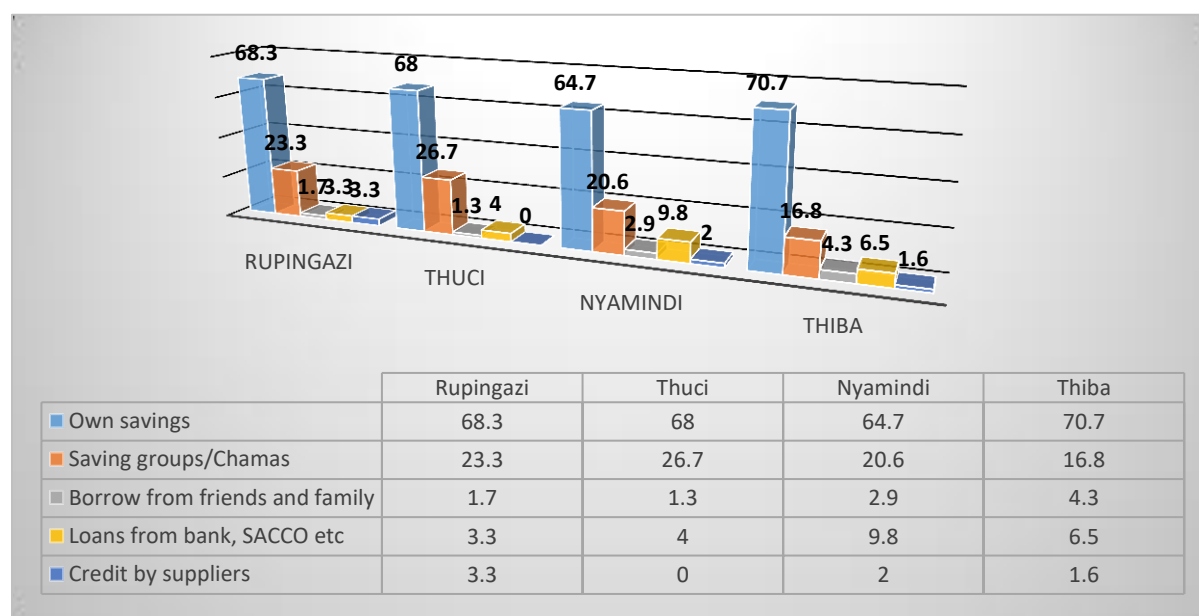
Source: Field Survey, 2018

4.4 Assessment of the level of improved access to resources of the target group

4.4.1 Main source of finance for funding enterprise and ownership of bank account

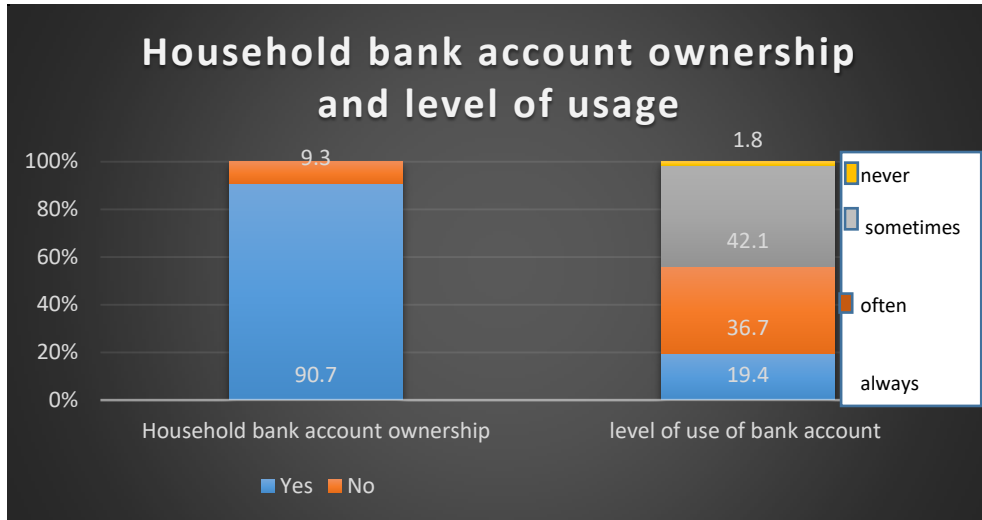
In regards to the source of finance for farming enterprise, the findings in fig 18 revealed that 68% of the respondents across all the basins used their own savings to set up their farming business while 22% sourced financing from savings groups and chamas /table banking groups. Regarding ownership of bank accounts, 90.7% of HHs reported to have bank accounts which was higher than the baseline figure of 58%. Fig 19 also reveals 19.4% of the people always use the account, 36.7 often use it, 42.1% sometimes use it and 1.8% never used it.

Fig 18: Main source of finance for funding enterprise



Source: field survey 2018

Fig 19 Household bank account ownership and level of usage



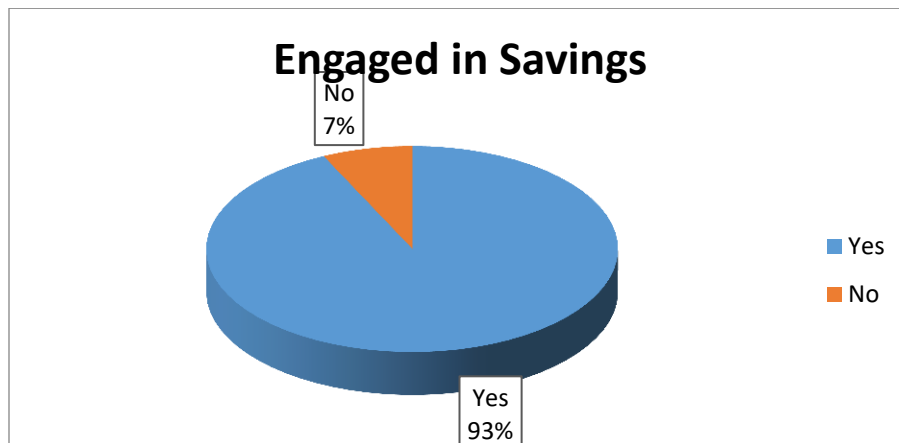
source: field survey 2018

4.4.2 ASSESSMENT OF LEVEL OF INCREASE IN SAVINGS

From the findings in fig 20, the number of HHs reported as having savings improved from 70% at baseline to 93% and this could be attributable to the trainings on financial literacy conducted by the project.

Findings from fig 21 also revealed that 40.1% of the HHs made savings mainly through saving SACCOs (35%); groups/chamas (30.03%); saccos (35%); commercial banks 19.67% and mobile money (16.20%)

Figure 20 Engaged in savings



Source: field survey 2018

Fig 21 Engagement in savings by River basin

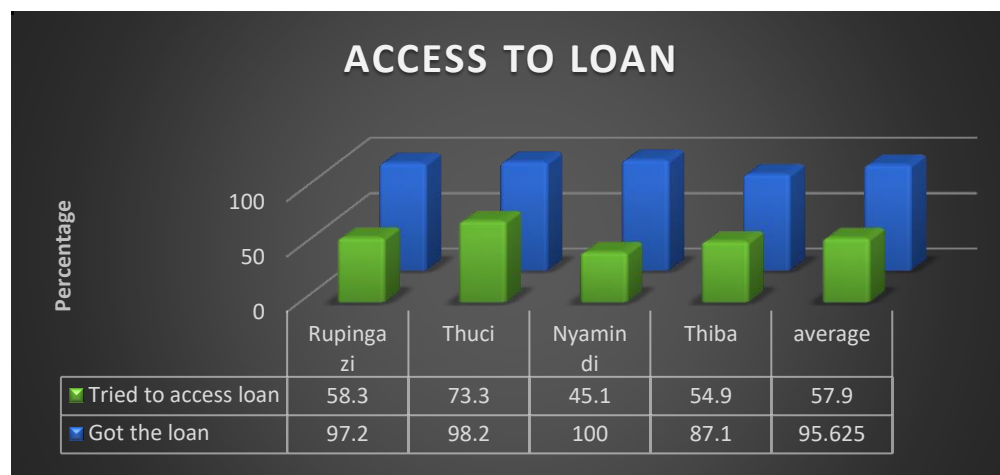
River basin	Engagement in savings		Years saving began		Place of saving					
	Yes	No	Before 2012	After 2012	Commercial bank	Microfinance bank	SACCO	Social group	Mobile money	others
Rupingazi	93.3	6.7	41.1	58.9	10.7	8.9	48.2	26.8	54.0	0
Thuci	97.3	2.7	27.4	72.5	23.9	4.2	39.4	29.6	2.8	0
Nyamindi	87.3	12.7	20.2	79.8	11.2	6.7	42.7	36.0	3.4	0
Thiba	94.6	6.0	16.8	83.2	32.9	3.5	30.1	27.7	4.6	1.2
Average	93.1	7.13	26.3	73.6	19.67	5.83	40.10	30.0	16.20	0.30

Source: field survey 2018

4.4.3 Assessment of level of access to loan

From the findings in fig 22, on the average 57.9% attempted to access loan and 95.6% got the loan. Thuci leads in proportion of farmers who tried to access loan with 73.3%, Rupingazi had 58.3%, Thiba 54.9% and Nyamindi with 45.1%. Reasons were given by farmers on why they did not attempt to access loan and most indicated that they are not interested in accessing loan as they are ok with their savings, few indicated that they have no idea about the procedures and also, they have no collateral. The improvement of those who have accessed loan in this survey from the baseline (80%) can be attributed to the financial trainings introduced by the project.

Fig 22 Access to loan by river basin



Source: field survey 2018

4.4.4 Assessment of level of Acquisition of grants

The project has implemented matching grants to fund CIGs to implement Income Generating Activities. The following tables show the donor/ community contributions towards the projects funded under the income generating activities in the two counties.

Table 21 **First Call 2014/2015**

County	No. Projects	Donor Budget	Achieved community contribution
Embu	30	13,007,760	4,825,390
Kirinyaga	41	14,942,021	3,797,558
TOTAL	71	27,949,781	5,622,951

Source: UTaNRMP IAS 2017

Table 22 **SECOND Call 2015/2016**

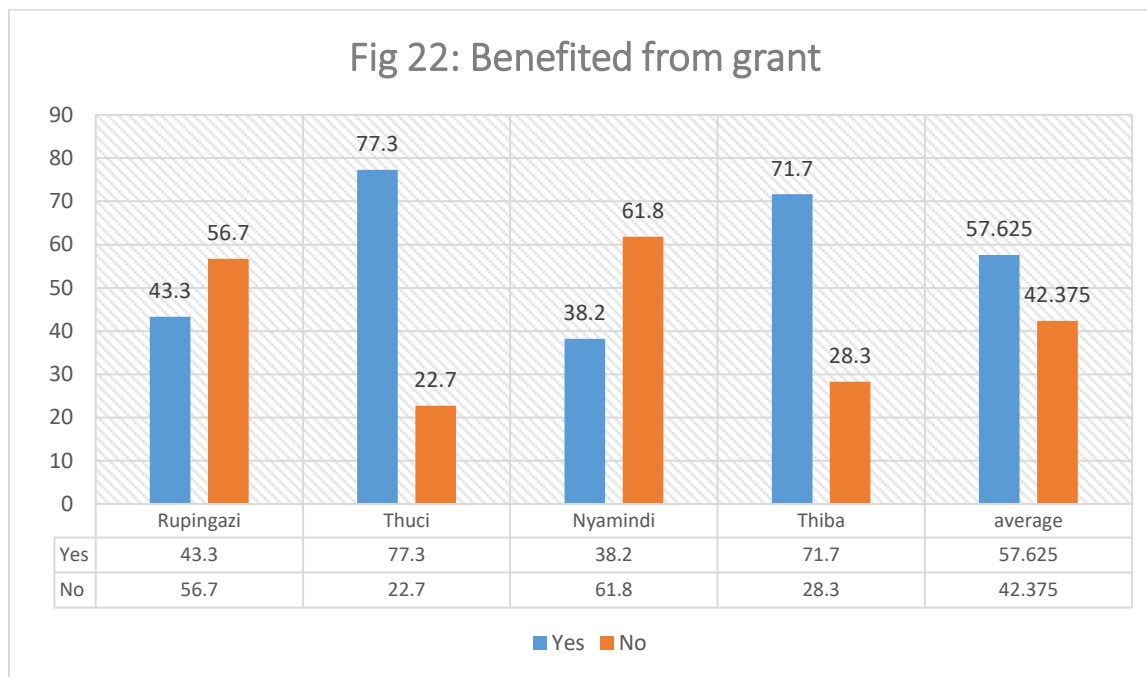
County	No. of CIGs	Achieved Community Contribution (Ksh)	Donor Budget CIGs(Ksh)
Embu	72	14,561,697	38,689,580
Kirinyaga	128	19,589,223	58,778,536
TOTAL	200	34,150,920	97,468,116

Source: UTaNRMP IAS 2017

4.4.5 Benefited from grant

From the findings in figure 22 57.63% have benefitted from grant while 42.38% have not benefitted. Thuci had the highest proportion of farmers who have benefitted at 77.3% followed by Thiba 71.7%. Rupingazi and Nyamindi had 43.3% and 38.2% respectively.

KII with the desk officer (livestock) Mrs Bridget Wangiru also revealed the 25% of the CIGs who applied under the livestock section received the grants in the first call, 28% for the second call and 44% had been approved in the third call. This shows a progressive improvement in the procedure for accessing the grants.



Source: field survey 2018

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 SUMMARY

The focus of this study was to assess the impacts of technology adoption and access to resources on rural livelihood activities in Embu and Kirinyaga counties. From the result findings, it can be said that adoption of improved crop technologies has contributed to increase in yield of crops, food availability, soil fertility, time saving, sustainable management of land resources as some indicated that it had help them reduce soil erosion drastically and overall increasing income of the household in the two counties. Thiba and Rupingazi have the highest rate of adoption of crop technologies. Improved livestock technologies such as silage making, farm feed formulation, agroforestry, tumbukiza and fodder production were introduced and Silage making had an adoption rate of 48.2%, farm feed formulation had 71.83%, agroforestry had 83.45 %, tumbukiza had 34.68 % and fodder production had 49.33%. Belonging to a CIG was also found to be a positive determinant in adoption of technology whereas age, farmland size and educational level were not.

Various training methodologies were employed to disseminate the technologies to the farmers. These methodologies include: Farmer Field School, Study tours, Demonstration plots and On-farm trials. Effectiveness of these approaches was assessed based on the adoption of technologies introduced. Rupingazi had the highest adoption rate for technologies introduced through farmer's field school which was at 100%, followed by Thiba at 96.3%. Nyamindi and Thiba had the highest rate of adoption of technologies introduced through On-farm trails, both at 100% (58.8% fully and 41.2% partially) and 95.5% (56.8% fully and 38,6% partially) respectively. Overall, FFS and On-farm trials very effective in technology introduction as the rate of adoption for the two methodologies were higher than that of study tour and demonstration plots.

Improvement in livelihood of the household was observed as adoption of livestock technologies contributed enormously to improvement in nutrition, increase in income and more savings. The average yield of milk increased from 5.8 L/cow/day baseline report to 6.18L/cow/day for cattle while goat milk yield increased from 0.25L/goat/day to 1.49L/goat/day. Proportion of farmers owning improved cattle breeds was: Fresian (27.63%); Arshyre (5.95%); Guersey(8.18%); and Jersey (13.05%). The ownership of improved goat varieties was Kenya Alpine (24.23%); and

Toggenburg (14.9%), while ownership of improved pig varieties was: Large White (3.03%); Landrace (0.28%); Hampshire (0.5%); and Duroc (0.13%). owning Improved rabbit breeds were: Chinchila (2.73%); New Zealand White (1,2%); and California (6.58%). improved poultry breeds were: Kari Kienyeji (52%); Kenbro (4.8%); Rainbow (5.33%). New Bee hives was: KTBH (1.5%); and Langstroth (5.65%), while fish species was Cat fish (0.75%), Tilapia (0.425%).

The percentage of people living below the \$1.25 poverty line in Kirinyaga was estimated to be 8.1% while those in Embu was 10.4% using the progress out of poverty index PPI. poverty incidences across the two counties reduced also compared to the baseline situation, Embu reduced from 35% to 28% and Kirinyaga reduced from 26% to 20 %. This can be attributed to increase in income generating activities of the population of the counties.

The number of households reported as having savings improved from 70% at baseline to 93% and this households saves mainly through also revealed that 40.1% of the HHs made savings mainly through saving SACCOs (35%); Saving Groups/Chamas (30.03%); Commercial banks 19.67% and Mobile money (16.20%). 57.9% of the house hold attempted accessing loan and 95.6% of them got the loan. 57.63% have benefitted from grant while 42.38% have not benefitted. Thuci had the highest proportion of farmers who have benefitted at 77.3% followed by Thiba 71.7%. Rupingazi and Nyamindi had 43.3% and 38.2% respectively.

5.1 CONCLUSION

Improved technology adoption is an actual tool in improving the livelihoods of the rural as demonstrated by UTaNRMP in Embu and Kirinyaga counties. Improved crop technologies, livestock technologies and seed multiplication has contributed immensely to food availability, improved income generation, improved seed availability and affordability and better nutrition in the two counties. Out of the two counties Rupingazi and Thiba river basins stood out in the rate of technology adoption. Percentage of people living below the \$1.25 poverty line is 10.4% in Embu and 8.1% in Kirinyaga and poverty incidence has reduced from 35% to 28% in Embu and 26% to 20% in Kirinyaga.

5.2 Recommendations

The following are my recommendations:

- The proposal process for funds should be inclusive, youth and people living with disability should be given encouraged and given top priority
- Agricultural trade fair, Field days, demonstrations and exchange tours proved to be approaches for transferring knowledge, skills and viable technologies to farmers. This will encourage a rapid replication of the technologies by farmers who are not beneficiaries. The project should enhance support for these activities and also emphasize integration and knowledge sharing within the CIGs at the FDA level and River basin levels.
- More small stock livestock technologies like Bee hives, improved rabbit breeds, poultry and dairy goat should be encouraged as they require less land and less capital especially in areas with land deficit.

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Appendices 1:

Plan of Study

S/N	Activity	Week											
		March				April				May			
		1	2	3	4	1	2	3	4	1	2	3	4
1	Review of baseline study and formulation of research questionnaire and interview guide.												
2	Conduct a pretest of the survey instrument												
3	Data gathering exercise with various stakeholders												
4	Revisit the field for clarification												
5	Coding and entry of data												
6	Data Analysis												
7	Write up of the report												

Data collection tools

ASSESSMENT OF THE UPPER TANA NATURAL RESOURCE MANAGEMENT PROJECT (UTaNRMP)

Please tick (v) where necessary and provide suggestions where required. Thank you.

Name of respondent: Date: S/No.:

County of Residence: Name of Sub-County:

Name of River Basin: River Basin: Upper (Tea) [] Middle (Coffee) [] Lower (Cotton) []

Name of FDA/CFA/WRUA/CIG: Position held

Name of Enumerator: GPS Coordinates: Longitude:..... Latitude: Altitude:

SECTION A: SOCIO ECONOMIC CHARACTERISTICS OF HOUSEHOLDS

1. Gender of Respondent Male [] Female [] 2. Age of Respondent? (Years)

3. How long have you lived in this area? (Years) 4a. Are your household members aware of any community group? Yes [] No []

4b. Which group are they engaged in? FDA [] CFA [] WRUA [] CIG [] Other [] specify

5. Do you belong to a social group? [] Yes, please specify

[] No, give reason

6. Who is the head of your household? Man [] Woman [] Male Youth [] Female Youth []

7a. Household Size.....? 7b. Number of household members working? 7c. Number of household members not working

8. What is the highest level of education?

9. Highest Education Level	None	Primary	Secondary	College/ University	Vocational Training
Household Head					
Household Spouse					
Children					

10a. Main occupation of household head? Farming [] Off-Farm [] Employment [] Other (Please specify):

10b. Main occupation of spouse of household head? Farming [] Off-Farm [] Employment [] Other (Please specify):

11. Other occupation of household? Farming [] Off-Farm [] Employment [] Other (Please specify):

12. What is the total land area owned by household? (Acres)

13. What is the land ownership status in (Q12) above? Private with titles [] Private with no titles []
Communal land [] Other (please specify): 14. Is the land mentioned in Q 12 above accessible to every member of the family? Yes [] No []

15. What are your Main sources of income?

Crop Farming []: Crops sold:

.....

Livestock []: Sale of animals/animal products:

Sale of seeds []: Types of seeds

.....

Sale of Trees/Charcoal []: Tree Species: Indigenous [] Exotic []

Business []: Type of Business:

Employment: Temporary [] Permanent [] Remittance [] Others []:

16. Household Income and Expenditure in the past one (1) month:

INCOME			EXPENDITURE		
S/No.	Particulars	Amount (KShs)	S/No.	Particulars	Amount (KShs)
a.	Livestock sales		a.	Transport (boda boda, matatu)	
b.	Livestock products (eggs, milk, meat honey)		b.	Buying food	
C	Business/ Entrepreneurship		c	Buying of Fuel Wood	
D	Unearned income(interest, dividend, royalties, capital gains)		d	Building houses	
e	Sale of horticultural produce		e	Communication (airtime)	
F	Sale of food crop		f	Belongings(Tv, Shoes, Clothing)	
g	Sale of seeds		g	Leisure (bar, sports, movies)	
H	Petty trade (hawking)		h	Investment in business (non-agriculture)	
I	Leasing out agricultural equipment		i	Water bill	
J	Formal employment		j	Electricity bill	
K	Sales of wood/tree/charcoal		k	Medical expenses	
L	Land lease		l	School Fees/College	
M	Casual employment		m	Insurance	
N	Land sale		n	Merry go round	
O	Other income (please specify)		o	Other expenditure (specify)	

17. Assets owned (number owned = 1, year it was bought = 2 note: insert numbers and dates)

Farm mach.	1	2	House hold	1	2	HH.	1	2	Agric. Tools	1	2	Agric. tools	1	2
Tractor			Tv			Computer			Panga			Knapsacks		
Oxen plough			Phone			Bicycle			Jembe			Watering can		
Spray pump			Car			radio			Jembe fork			Wheelbarrow		
Irrigation pump			Fridge			Motorcycle			Sickle			Milking can		
Other			Gas cooker			others			Secateurs			Fishing gear		
			Motor Bikes						Rake			others		

18. Structures on farm (type: Permanent = 1, Semi permanent = 2, temporary =3)

S/No	Structures	Numbers	type
a.	Residential house		
b.	Granary (grain store)		
c.	Equipment store		
d.	Toilet Facility		
e.	Other		

19a. Have your family members eaten one meal per day in the last one year? Yes [] No []

19b. If yes Q 19a above, how long was it? Within a month [] 2-3 months [] Above 3 months []

20. How many meals do you normally take per day? 1 meal [] 2 meals [] 3 meals [] above three meals []

21. What is the composition of your meals (tick as much as possible)? Maize [] Rice [] Wheat products [] Meat/Fish [] Legumes [] Fruits [] Vegetables []

22. Does the household head own a bank account? Yes [] No []

23. If Yes in Q22 above, how often is the account used? Always [] Often [] Sometimes [] Never []

24. What is the marital Status of Household head? Single [] Married [] Divorced [] Widow [] Widower []

Section B: Rural livelihoods

1. What food crops do you grow on your land? Maize [] Beans [] Green grams [] sweet Potatoes [] Bananas [] Arrow roots [] Others (specify) _____

2. What are the average crop yields per unit area for each of the crop? 3. What is the average production for livestock products?

Food crop	Area covered(acres)	Crop yields (last year)(kg)
Maize		
Beans		
Green grams		
Sweet potatoes		
Bananas		
Others		

<u>Livestock</u>	<u>Products yield</u>
Cows-Average milk per cow/per day? (litres)	
Goats – Average milk per goat/per day? (litres)	
Chicken-Live birds sold in year (number)	
Trays of eggs sold per year (number)	
Bee products- litres of Honey sold per season	
Fish- Kgs of fish per harvest	

4. Livestock ownership

Category of livestock

Livestock	Number	Improved breed (name)	Indigenous breed (name)
a) Dairy Cattle	a)	a) Jersey [] Guensey [] Fresian [] Zebu [] Aryshire [] Sahiwal [] Boran []	a)
b) beef cattle	b)	b) Jersey [] Guensey [] Fresian [] Zebu [] Aryshire [] Sahiwal [] Boran []	b)
c) Goats	c)	c) Togenburg [] German/Kenyan alpine []	c)
d) Pigs	d)	d)	d)
e) Rabbits	e)	e)	e)
f) poultry	f)	f) (Kari Kienyeji [], rainbow [], kenbro []	f)
g) Oxen	g)	g)	g)
h)Bee (Hives)	h)	h)	h)
i) Fish/	i)	I cat fish [] Tilapia [] others (pls specify)	i)

5. Which of the following crop production technologies have you been introduced to? Which ones have you adopted and for which crops have you adopted? (note: have you been introduced = HYBI, level of adoption = LOA)

Crop Technologies	HYBI (Yes =1 No = 2)	LOA (Fully =1 Partially =2 None =3)	Impacts on household livelihood
New Crop Varieties: Beans –KAT B1 [] KAT [],X56 [], cow Peas-K80 [], M66 [], Green Grams-N 26			
Crop rotation			
Integrated Pest Technologies (IPM)			
Conservation Agriculture			
Others: (Intercropping; Weed Control ad Kitchen Gardens)			

6. Which of the following livestock production technologies have you been introduced to? Which ones have you adopted and for which livestock have you adopted?

Livestock Production Technologies	Have been Introduced to		Adopted		Livestock Adopted for? (cows, goats, chicken, rabbits etc)	Impacts on household livelihood (improved yield, more income, more nutrition, more savings, etc)
	Yes	No	Yes	No		
Silage Making						
Farm Feed Formulation						
Agro-Forestry						
Tumbukiza						
New fodder						
Others						

7. Have you been introduced to seed multiplication/bulking? Yes [] No []

8. What has been the impact of seed multiplication/bulking? Better access to certified seeds []; More affordable certified seeds []; Improved income [], New house owned [], New assets owned [], Others [] **please specify:**.....

Participation in training and Adoption of technology introduced

9. Did you participate in any of the following activities? You can tick more than one
Farmer Field School (FFS) [] On Farm Trials [] Study tours [] Demonstration plots [] other _____

10. What technology were you trained on using the above methods and level of adoption (level of adoption =LOA)

Methods	Technologies learnt	LOA, fully =1 partially = 2 Not adopted =3	Rate the performance of the training Very helpful = 1, helpful = 2 not helpful =3
FFS			
On farm trials			
Study tours (learning point)			
Demonstration plots			
Others (please specify)			

11. Have you benefitted from matching grants from the Project? Yes [] No []

12. If yes which enterprise was funded, quantity and amount?

Enterprise list them	Quantity benefitted	Amount benefitted (KSH)	Products from enterprise (list them)	Quantity of prod. produced
Livestock				
Fisheries				
Crop				
Poultry birds				
Value addition				
Others (specify)				

13. What are the impacts of these grants on your household livelihood?

14. What is your main source of finance for funding your farming enterprise? Own savings [], savings groups/chamas [], Borrow from family/friends [], Obtain loans from bank, SACCO or MFI [], Credit by suppliers [], Other(specify): _____

15. Do you make savings? Yes [], No []; 16. If yes for how long?.....(yrs),

17. If yes where do you save your money? Commercial bank [] MFI [], SACCO [], Savings groups/Chaamas [], Mobile Money [] Others (Specify)....., 18. How much approximately do you save in a year?

19. In the last one year have you tried to borrow money to finance your activities? 1) Yes [] 2) No []

20. If No, why have you never tried to borrow finances?

21. If YES, where did you try to borrow from? 1) Bank [] 2) Micro-finance Institution (MFI) [] 3) SACCO []

4) Money Lender / Shylock [] 5) your Savings group [] 6) Family and Friends [] 7) Other (specify) _____

22. Did you get the loan 1) Yes [] 2) No []

23. If Yes, which of these statements is true? I got More than I requested for [], exactly what I requested for [], less than []

24. If Yes, which household or agricultural activity did you finance/ how did you use the loan?

25. If you were denied the loan, why were you denied/ what reasons were you given?

26. How many rooms does your household occupy in its main dwelling (excluding bathrooms, toilets, storerooms)?

27. The floor of the main house is predominantly made of what material? Wood [], cement [], tiles [], others

KEY INFORMANT: COUNTY AGRICULTURAL OFFICERS /LIVESTOCK PRODUCTION OFFICER

Fisheries Officer

1. A brief history about fish farming in this county

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.....

2. How many CIGs have been funded on Fisheries?

.....

.....

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.....
3. What inputs are use in the fish production
.....
.....
.....
 4. How easy is it for the farmers, CIGs to access these inputs?
.....
.....
 5. Are the farmers giving training on fish production
.....
 6. If yes tell lets know little about it,(topics covered, No of people trained, adoption level, outputs and effects etc)
.....
.....
.....
 7. What areas do you think the project need to improve for the groups to
 - (a) Access the grants effectively
 - (b) Impact their neighboring groups not part of the project on technologies introduced

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Agricultural Officer

1. A brief history about crop farming in this county (crops grown, varieties, average land size/HH, average productions etc)

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2. What are the various new crop technologies introduced?

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3. How many CIGs have been funded on these Crop technologies?

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4. What are the inputs used?

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5. How easy is it for the farmers, CIGs to access and afford these inputs?

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6. What are the various technology transfer methods used?

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7. What are the effects of these transfer methods on adoption level and improvement in livelihood activities

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9. What areas do you think the project need to improve for the groups to

(c) Access the grants effectively

(d) Impact their neighboring groups not part of the project on technologies introduced

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Seed Multiplication

1. What are the varieties introduced?

2. Number of farmers trained?

3. Number of Farmers who have adopted the technology

4. What are the challenges faced and possible solutions?

On farm Trials

What are the technologies demonstrated

What is the adoption level of the technologies demonstrated?

What the challenges faced and possible solutions?

Livestock officer

1. A brief history about livestock farming in this county (key livestock types breeds, yields)

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2. How many CIGs have been funded on livestock production?

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3. What are the new technologies introduced

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4. What is the level of adoption of this technologies and impacts on improve livelihood of the farmers

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5. What inputs are use in the livestock production

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.....
.....

6. How easy is it for the farmers, CIGs to access these inputs?

.....
.....
.....

7. What areas do you think the project need to improve for the groups to

- (e) Access the grants effectively
- (f) Impact their neighboring groups not part of the project on technologies introduced

.....
.....

FGD Guiding Questions	Responses from FGD participants
1) <u>Contact Details CIGs:</u> Name of contact person: Position of the contact person: Phone Number of contact person	
2 <u>Group Details:</u>	
2a) Name of the CIG:	
2b) Name of the River Basin:	
2c) Location of the CIG (county, sub – county, ward):	
2d) Membership details-Number of members- Men, Women, Young Men, Young Women, PLWD):	
2e) Brief history of the CIG, when started, why started:	
2f) Is your group registered? Do you have a group constitution?	
2g) Does your group have an Executive Committee? What are the roles of this committee? What is the composition of this committee (Men, Women, Young Men, Young Women, and PLWD)? Do you have other sub-committees? What are their roles?	
2h) What are the core activities of the group?	
2i) How are women, youth and PLWD involved in your group’s activities?	
3a) What crops do you grow in this river basin? What activities have you participated to improve your agricultural productivity?	

	<p><i>(FFS, Farm trials and demonstrations, soil fertility, soil and water conservation demonstrations etc)</i></p> <p><i>Describe the on- farm trials and Demonstration that have been done in your area?</i></p> <p><i>Which one have adopted</i></p> <p>How has your crop yield changed as a result of this support?</p>	
3b)	<p>What improved crop technologies have you been introduced to (crop varieties, Integrated Crop Management System, Conservation Agriculture)?</p> <p>Which technologies have you adopted?</p> <p>For which crops have you adopted these technologies?</p> <p>What are the impacts of adopting these technologies?</p>	
3c)	<p>What improved livestock breeds have you been introduced to?</p> <p>Which ones have you adopted?</p> <p>What are the impacts of adopting these improved livestock breeds?</p>	
3d)	<p>What technologies have you learnt from the FFS?</p> <p>Which technologies did you adopt?</p> <p>What have been the impacts?</p>	
3e)	<p>Have you been involved in seed multiplication activities? Yes /no</p> <p>How has community seed multiplication contributed to seed availability and affordability and your household</p>	
3f)	<p>Describe the soil fertility enhancement demonstrations carried out in your area</p>	

	<p>Which ones have you adopted?</p> <p>What was the impact of these demonstrations on your agricultural productivity?</p>	
3g)	<p>Which marketing channel do you use to sell your produce?</p> <p>How effective are these new channels?</p>	
3h)	<p>How many of your members were trained on financial literacy?</p> <p>How did this training benefit your group?</p> <p>Have you been linked to financial institutions?</p> <p>How have this linkages benefited you: which financial services do you get:</p>	
3j)		
3k)	<p>What kind of activities have you been involved with (KALRO) (KARI)?</p> <p>How has this support impacted on your group's activities?</p>	
3l)	<p>Which activity have you been funded on? How much?</p> <p>What was the impact of these grants to the members?</p>	
	<p>What is your future plans for the next five years (Vision)</p>	
	<p>How do you intend to sustain your group</p>	

PPI scorecard look up

Poverty Probability Index (PPI®) for Kenya 2005



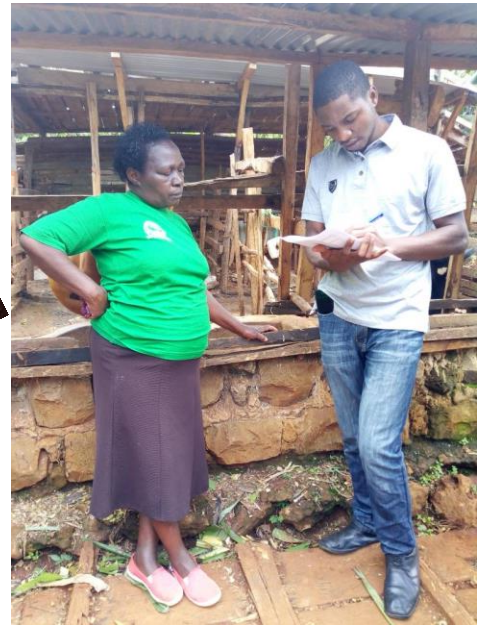
Look-up Tables

The following look-up tables are used to convert PPI scores to poverty likelihoods: International 2005 PPP Lines

PPI Score	2005 PPP Poverty Lines			
	\$1.25/day 2005 PPP	\$2.50/day 2005 PPP	\$4.00/day 2005 PPP	\$8.44/day 2005 PPP
0 - 4	100.0	100.0	100.0	100.0
5 - 9	97.5	100.0	100.0	100.0
10 - 14	86.2	99.6	100.0	100.0
15 - 19	86.0	99.3	99.7	100.0
20 - 24	81.9	99.0	99.5	100.0
25 - 29	70.1	96.2	99.4	100.0
30 - 34	63.1	95.4	98.6	99.9
35 - 39	49.0	91.8	98.2	99.9
40 - 44	35.1	82.0	95.5	99.8
45 - 49	24.9	75.3	93.8	99.5
50 - 54	9.6	61.1	88.5	98.7
55 - 59	6.8	44.4	75.5	95.6
60 - 64	1.4	29.0	63.2	94.6
65 - 69	0.8	20.3	47.4	87.5
70 - 74	0.1	8.9	31.7	78.7
75 - 79	0.1	5.4	21.1	70.6
80 - 84	0.1	3.0	10.8	60.0
85 - 89	0.0	1.2	4.7	43.3
90 - 94	0.0	0.0	0.0	24.3
95 - 100	0.0	0.0	0.0	0.0

Poverty likelihoods here for \$1.25 and \$2.50/day 2005 PPP differ slightly from Schreiner (2011). They have been adjusted to ensure that poverty likelihoods never increase as scores increase. This preserves unbiasedness and has little other effect.

This PPI was created in March 2011 using data from Kenya's 2005/06 Integrated Household Budget Survey by Mark Schreiner of Microfinance Risk Management, L.L.C. For more information, please visit www.povertyindex.org.



Data capturing



Focus Group Discussion



SDG Advocacy in School